

***The influence of dog-owner parenting styles on the attachment, owner-directed info-sharing altruism and the dogs' quality of life***



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## Table of contents

1. Introduction .....	2
2. Material and Methods .....	6
2.1 Strange situation test .....	7
2.2 Altruism test .....	8
2.3 Statistical analysis.....	9
3. Results .....	10
3.1 Participants .....	10
3.1.1 Interrelationships with parenting style scores .....	10
3.2 Dog to owner attachment .....	11
3.3 Dog directed parenting styles and dog to owner attachment .....	14
3.3 Information sharing behaviour in dogs .....	16
4. Discussion .....	18
Acknowledgements .....	23
References.....	24
Appendix II, Ethograms .....	47
Appendix III STAI questionnaire .....	53
Appendix IV, Survey .....	55

## Abstract

Parenting styles influence the wellbeing of children and due to similarities in the relationships of parent-child and owner-dog, I wondered if dog-directed parenting styles could have effects also on dogs. Four parenting styles were scored on a Cartesian coordinate system with demandingness and responsiveness as dimensions. Attachment and altruistic behaviour in dogs could mirror the strength of the owner dog relationship and I checked if the dogs' behaviours in an Ainsworth Strange Situation Test (ASST,  $n = 35$ ), and their willingness to share information ( $n = 40$ ), related to the owners' dog-directed parenting styles. A total of 2,201 dog owners participated in a survey that contained the Parenting Style Dimensions Questionnaire (PSDQ) and the Canine Behavioural Assessment and Research Questionnaire (C-BARQ), which measured respectively dog-directed parenting and dog misbehaviours on a 5-point Likert scale. Altruism was measured as dogs signalling the location of the owner's coat, which had been hidden in the dogs' view, both following a request for help by the owner (test) or not (control). Linear mixed model analyses of 5 informing behaviours revealed significant treatment effects (the owner requesting help, or not) for looking at box zone ( $p = 0.027$ ) and approaching the box zone ( $p = 0.045$ ). Informing behaviours in dogs were not related to dog-directed parenting styles. Linear mixed model analyses on associations between dog-directed parenting styles and ASST behaviours, as response variates, showed how permissive dog-directed parenting related directly to vocalization in the ASST, both for barking ( $p < 0.001$ ) and whining ( $p < 0.001$ ). A principal component analysis of questionnaire records detected how anxious and/or avoidant owners had low dog-directed parenting demandingness and tended to own dogs with separation anxiety. Dog-directed parenting styles relate to aspects of the owner dog relationship, at least to dog to owner attachment. Low dog-directed parenting demandingness may strengthen dog to owner attachment, but may facilitate the development of insecure attachment and such dogs experience relatively strong distress when the owner is gone. Thus, owners parenting along a permissive style are at increased risk of owning dogs that are susceptible to social stress and may suffer from it. Dogs showed information sharing behaviour towards their owner, but whether this represented true altruistic behaviour should be validated. This research contributes to increasing the quality of life in dogs, by proving knowledge on improving their attachment bond with their owners.

## 1. Introduction

Dogs are prominent in Western societies, inciting public interest in the human-dog relationship (Prato-Previde, 2003). A person's relationship with a dog can be impactful, for instance obese children who reported low perceived social support attached strongly to their dog, indicating that pet dogs may substitute part of a child's social support network. Similar findings resulted from a cross-sectional study, with the study households including a dog and children between 8 and 13 years old (Linder et al., 2017). Overweight children had a higher attachment score to their dogs and less perceived social support compared to non-overweight children (Linder et al., 2017). Also, dogs serve as a replacement for their owners' support network, especially when these adults ( $n = 75$ ) had less perceived peer social support (Stephens et al., 2012). In general, pet ownership or being close to a companion animal can have a positive impact on mental, social and physiological health (Friedmann and Son, 2009; Sable, 2016; White et al., 2017). However, if owners have a troubled relationship with their dog, this may lead to frustration and abandonment of the dog. Unwanted behaviours of dogs and high perceived costs of dog ownership are examples of reasons for dogs being relinquished to a shelter. Approximately thirty seven percent of dog owners ( $n = 2,045$ ) relinquished their dog to the shelter for reasons of behavioural problems, in a study in the United States (Scarlett et al., 1999). Dog behaviour and the owner dog relationship may in part be dependent on the owner's dog-directed parenting style. In humans, the relationship between caretaker (parent) and dependent (child) is in part determined by the style of parenting, which affects the child's social development and functioning. There is reason to assume that similar parenting styles exist in the owner to dog relationship (Herwijnen van et al., 2018) and here I wanted to investigate if dog-directed parenting styles influence the owner dog relationship and thus the quality of life of the dog, focusing on attachment and altruism.

Parenting styles are typologies that reflect variation in the dimensions responsiveness and demandingness of parents towards their children (Baumrind, 1971; Spera, 2005). Originally, three parenting styles were conceptualized, namely authoritative, authoritarian and permissive (Baumrind, 1971). These three parenting styles were also found in later research when analysing 133 questions answered by 1,251 parents (Robinson et al., 1995). Authoritarian parents are demanding but not responsive to their children. Permissive parents are responsive, but low in demandingness, whereas authoritative parents are both demanding and responsive (Spera, 2005). When viewing this in a Cartesian coordinate system (see Figure 1) there should be a fourth parenting style, which has been identified as an uninvolved parenting style of low responsiveness and low demandingness (Maccoby and Martin, 1983; German, 2015). Parenting styles affect children's behaviour and well-being in different ways (Frontini et al., 2015). When comparing parenting styles of parents with healthy weight children and overweight children, mothers of adolescents who were obese tended to use a more permissive parenting style. This associated with a higher level of parenting stress and a lower quality of life for the children. Authoritative parenting has been associated with girls being independent and conscious and boys being socially responsible, as compared to children raised by parents that were authoritarian or permissive (Baumrind, 1971). An authoritative parenting style protected adolescents against using drugs (Baumrind, 1991) and led to higher academic achievement, at least compared to parenting authoritarian or permissive (Spera, 2005). Clearly, parenting styles are not all explaining in this and, for example, the amount of school-specific involvement by the parents had a higher predictive value on the children's academic achievements (Pinquart, 2016). When investigating the role of parenting styles on obesity in children, it was suggested that the four parenting styles could also be applicable to pets (German, 2015). A recent survey among over five hundred Dutch dog owners where tested against four dog-directed parenting styles derived from parent-child parenting styles, where

evidence for dog-directed parenting styles were found (Herwijnen van et al., 2018). Little is known about how dog-directed parenting styles determine the owner dog relationship, and thus dog ownership satisfaction and dog welfare. In my research, the dog to owner bond is of special interest and to better understand it, the human-child relationship is reviewed for similarities.

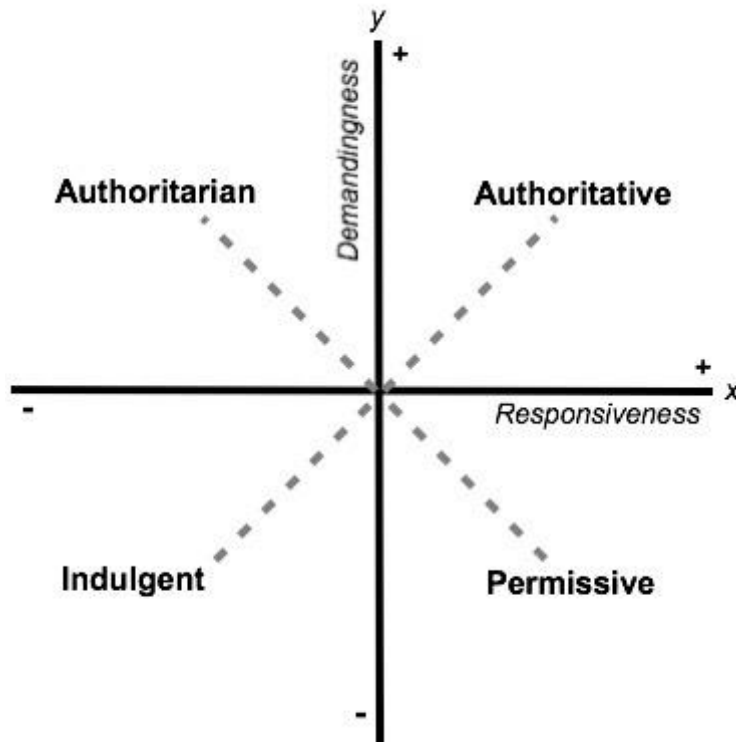


Figure 1. Parenting style dimensions according to Robinson et al. (1995). By Jager, Smit and van Woensel, 2017

In humans, a common way of assessing the parent-child relationship is measuring the attachment between parent and child with the Ainsworth Strange Situation Test (ASST, Ainsworth and Bell, 1970). A dog's relationship with its owner shares similarities with that of a mother and her infant, including attachment behaviour (Prato-Previde, 2003; Topál et al., 1998). Observing 51 dog-owner pairs in a modified version of the Ainsworth Strange Situation Test, the attachment related behaviours in dogs were comparable to that of an infant (Topál et al., 1998). Dogs are often viewed as family members, mirroring strong anthropomorphism (Charles and Davies, 2008; Gácsi et al., 2009; O'Farrell, 1997), and even as children (Berryman et al., 1985; German, 2015). In a study with fourteen thousand respondents, about ninety percent viewed their dog as a family member (Kubinyi et al., 2009). Based on the assumption that human-dog attachment is analogous to child-parent attachment (Topál et al., 1998; Siniscalchi et al., 2013) the ASST seems a valid tool to measure attachment between dogs and their owners (Topál et al., 1998). When testing 38 dog-owner pairs for ASST subtest order effects, this was not found (Palmer et al., 2008). Outcomes of ASSTs with dogs did not reveal effects of age, gender, breed and living conditions on most of the behavioural variables (Topál et al., 1998). In an ASST study with 109 dog-owner pairs, custody and apprentice dogs showed relatively relaxed reactions characterized by play whereas pet dogs reacted more anxiously with strong proximity seeking behaviour. Guide dogs were in between these two dog groups, expressing attachment to their owners but showing a more controlled emotional reaction (Fallani et al., 2006).

The ASST involves some degree of anxiety in the test subjects. In a small-scale study with 17 dogs tested in a modified Ainsworth Strange Situation Test, the changes in behaviour and heart rate were consistent with emotional stress (Palestrini et al., 2008). A strong cardiac activity response was recorded in 57 Labradors or Golden Retriever guide dogs, together with behavioural reactions, during the separation from their owners (Fallani et al., 2007). The anxiety levels during the different phases of the ASST are likely informative about the dog's attachment and physiological measurements may help to measure it. By measuring the heart rate in dogs, acute stress can be assessed and whether a dog views its environment as stressful (Beerda et al., 1998). Stress relief by safe haven effects of owner presence likely shows in heart rate (variability). A study population of 30 dogs revealed such effects of secure base and safe-haven, with increased heart rate variability during the presence of the owner (Gácsi et al., 2013). Heart rate variability seems a valid way to measure stress in dogs (Thayer et al., 2012) and a useful tool for measuring a dog's attachment to its owner.

The attachment of dogs and owners seems, to some degree, bidirectional. A correlation was found between the owners' reported attachment to their dogs and the dog to owner attachment bond assessed with the ASST (Siniscalchi et al., 2013). The ASST has been designed to measure attachment in the dependent, but also the ASST behaviour of the caretaker may be telling. Outcomes on ASSTs with 52 owners and their dogs, including the behaviour of the owner, showed that an insecure bond between owner and dog expressed by avoidance behaviour in the dogs and the owners talking much and touching their dog little. A secure bond showed as the owners talking moderately, with little touching of the dog (White et al., 2010). The bidirectional attachment of owner and dog presumably affects the quality of life of both, but little research has been done on the effect of the owner-dog attachment on quality of life (White et al., 2017). It seems obvious that owners and dogs who are bonded strongly and securely are committed to the relationship and willing to help each other. To test this, I want to associate measures of the owner dog relationship, including attachment, to owner directed altruism in dogs. For the measurement of altruism I will make use of a model of informing, which relies on dog to owner communication.

Dogs tend to willingly respond to humans and during the domestication process became increasingly skilled in cooperating and communicating with humans (Topál et al., 2005; Gácsi et al., 2009). Dogs are proficient in reading human social and communicative behaviour (Hare and Tomasello, 2005) and understand subtle signals in relative complex situations (Lakatos et al., 2009). They can interpret pointing gestures by humans and understand the referential meaning of the gesture (Soproni and Miklósi, 2002; Miklósi et al., 2005; Lakatos et al., 2009; Hegedüs et al., 2013). Dogs (n = 60) who viewed a video-projection of a demonstrator dog that gazed towards one of two plates, chose to avoid the plate that was gazed at by the demonstrator-dog. This supports the theory that responsiveness to human-given cues may not have a direct predecessor in dog-dog communication, but relies on the attention dogs give humans and might be learned responses reinforced by food rewards and positive social interaction (Bálint et al., 2015). Dogs followed human gaze more readily when the head turning of the human was preceded by the expression of communicative intent (Téglás et al., 2012). Having established that dogs readily react on communication signals by humans I assume that owners expressing a need for help will be understood by their dogs, and will use this as a basis for measuring altruism in the dogs.

Altruistic behaviour benefits another at the cost of the altruist (Davies et al., 2017). Altruism is more likely when actor and receiver are familiar (Mikulincer et al., 2005; Mikulincer and Shaver, 2005), and possibly altruistic behaviour between dog and owners is facilitated by secure attachment between them. Altruism can be split up into the three different dimensions of helping, sharing and informing

(Warneken and Tomasello, 2009). Dogs are known to show other-regarding behaviour, like the sharing of food with another dog (Quervel-Chaumette et al., 2015), at least when familiar with the other dog. In the present study the altruism of dogs is assessed by their willingness to inform, here about the location of the owner's coat that will be hidden in view of the dog but outside that of the owner.

The dog owner relationship is assessed here by dog to owner altruism and attachment, and next it is of interest how these may be influenced in a favourable way. A multitude of complex mechanisms are known to underlie the owner dog relationship, like that the personality of the owner links to attention problem in dogs (Kis et al., 2012), and that overweight owners are more likely to own overweight dogs (German, 2015). Owners who scored high for neuroticism and openness used more commands to get their dog to sit (Kis et al., 2012) and this is consistent with behavioural experts' opinion that owners may contribute to a variety of behavioural problems in their pet dogs (Konok et al., 2015). Owner characteristics influenced the dog-owner relationship more than the dog personality traits did (Meyer and Forkman, 2014), and it is important to consider the owner in the owner dog relationship and quality of life of the dog. In humans, parent-child relationships are in part defined and influenced by parenting styles and similar associations may play a role in the owner-dog relationship. The existence of dog-directed parenting styles (Herwijnen van et al., 2018) allows for testing its effects on the owner-dog relationship and dog's quality of life. The latter will be measured here by a dog's (owner reported) problem behaviours (CBARQ, Hsu & Serpell, 2003) and body condition, assuming good quality of life when dogs show little fear or aggression and are in a healthy condition. The owner dog relationship will be measured by means of bidirectional attachment, applying the ASST and MDORS questionnaire (Dwyer et al., 2006), and altruism in the dogs based on their willingness to inform the owner on the location of a missing object. My prediction is that dog owners who adopt an authoritative style of parenting have strong and secure relationships with their dogs, resulting in healthy dogs without problem behaviour.

## 2. Material and Methods

The behavioural tests performed were not identified as animal experiments by the Animal Care and Use Committee of Wageningen University and Research, August 2017. The study did not involve invasive treatments or interventions in the life of participants or their dogs, and the introduction of the online survey explained the purpose of the research. Thus, further approval by an ethics committee was not required. All participants signed an informed consent form.

An online questionnaire was constructed to assess dog-directed parenting styles, owner to dog relationships, dog problem behaviours and general characteristics of 2,201 dog owners and their dogs. From the participants of the survey, 35 dog owners were selected to participate in several behavioural tests with their dogs. A strange situation and altruism test were performed to measure the bond between the dog and the owner and two parenting style tests were done to validate the self-reported parenting style measured by the survey. The relation between the survey results and the different behaviours during the tests were analysed, excepting the results on the two parenting style validation tests.

The questionnaire consisted of a total of 158 questions (Appendix IV). The dog owners provided information about their gender, age, education, household composition and about their dog's breed, sex, age and neutered status, the age at which the dog entered their household, and the dog's body condition. The owners estimated the body condition of the dog using a body condition score chart (Royal Canin, 2017). The owners were also asked to fill in a Dutch version of the Parenting Styles Dimensions Questionnaire (PSDQ), Monash Dog Owner Relationship Scale (MDORS) (Dwyer et al. 2006) and Canine Behavioural Assessment and Research Questionnaire (CBARQ, Hsu & Serpell, 2003). Questions were typically answered on a five-point Likert scale. The PSDQ survey consisted of 20 questions. Eighteen of them were taken from the original dog directed PSDQ survey used in earlier research on dog owners (Herwijnen van et al., 2018) and 2 of the questions were taken from the original PSDQ survey for parents (Robinson et al. 1995). This original survey consists of 64 questions and has been used in multiple studies to classify the parent's use of Parenting Styles. The MDORS had 12 questions that were taken from the original 28-item scale, used to analyse the human-companion dog relationship. The CBARQ survey included a total of 71 questions, with 7 on attachment, 8 on social anxiety, 29 on aggression and 15 on fear. This questionnaire assessed (mis)behavioural traits in pet dogs. A Ten Item Personality Inventory (TIPI), being a 10-item measure of the Big-Five dimensions, was used to do a brief measure of the owner's personality (Gosling et al., 2003). A MCPQ-R (Refined Monash Canine Personality Questionnaire, Ley et al. 2009) and EAST (Emotionality Activity, Sociability Temperament, Bould et al., 2003) survey were part of the questionnaire but not used here. Finally, the owners were asked if, and when, they might be available for further behaviour tests, including heart rate measurements. The latter required that dogs were habituated to wearing a chest strap in the week prior to the behaviour test.

A selection of owners was made to ensure the participants of the behavioural tests were equally distributed across the parenting style spectrum. Participating dogs were at least 1 year old and living with the current owner since they were 15 weeks old or younger. Participating owners were the primary caregiver for the dog (50% or more of the time).

During the Strange Situation Test and the Break Test, heart rate variability (HRV) monitoring took place on randomly selected dogs. The owners of these dogs received a practice harness for the Zephyr heart rate monitor, one week prior to the moment of testing. The owner made sure the dog wore the harness for at least 8 hours. Prior to testing, the owner and dog were brought to a reception room where the dog wore the harness and was observed for 1 minute to check if it was sufficiently adapted to wearing the harness. This was done by scoring stress signals and other cues that indicated the dog is hampered by the harness (scratching, biting etc.). If 2 or more of such behaviours were scored, the heart rate measurements were cancelled. After testing in the Strange Situation Test, the



dog continued to wear the harness during the Break Test. The results on HRV are not included in this research.

## 2.1 Strange situation test

The Strange Situation Test was used to measure the dog to owner attachment, following a modified protocol as used in earlier trials done by MSc thesis students Schijndel (2012) and Dessens (2014). The protocol was adapted from the Ainsworth's Strange Situation Test (Ainsworth & Bell, 1970). In some dogs, during this test the Zephyr heart rate monitoring took place (for details see Appendix I). It was assumed that secure attachment of the dog to the owner, shows as secure base effects and that such dogs show more exploration and play behaviour and less stress behaviour in the presence of the owner. The Strange Situation Test included 8 episodes during which the dog (D) was in an unfamiliar room alone or together with the owner (O) and / or stranger (S). Episodes lasted 2 minutes, except for episode 1 which had a duration of 1 minute. See figure 2 for the test room set-up. The subsequent episodes were as follows.

*Episode 0* (O, D), O and D enter the room, O sits in chair and D is allowed to explore. O interacts only if D actively seeks attention. *Episode 1* (O, D), O attaches D to leash and O sits on chair quietly, only interacting if D seeks attention. *Episode 2* (O, D, S), S enters room and sits quietly for 1 minute, converses with O for 1 minute, and then approaches D and tries to play with D. After 1 minute, O leaves. *Episode 3* (S, D), First separation episode. S tries to play with D, after 1 minute, S sits down on chair. *Episode 4* (O,D,S), First reunion. O enters room and S leaves. O is allowed to play with and comfort D. At the end of episode, O leaves. *Episode 5* (D), Second separation. D is alone during the episode. If D becomes too distressed, episode stops. *Episode 6* (D, S), S enters room and tries to engage D in play behaviour. Halfway through episode S sits down on chair and does not interact with D. *Episode 7* (D,S,O), Second reunion. O will enter room and S leaves. O can comfort and play with D.

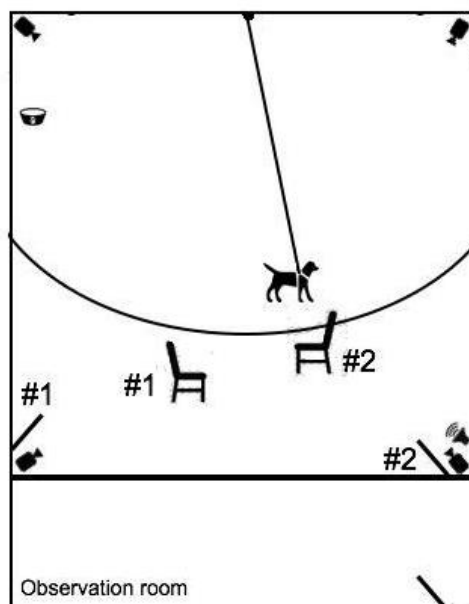


Figure 2. Experimental setup SST (Jager, Smit and Woensel van 2017); two numbered chairs and a water bowl were present, and the dog is fixed to the wall with a long leash. The dog could reach its owner but could not reach the stranger.

The behaviour of the dog was observed through a one-way screen, from the adjoining observation room. Four cameras, one in each corner of the testing room, recorded the behaviour from the dog. The owner was given instructions using a microphone from within the observation room. For the safety

of the stranger, the dog was attached with a long leash to the wall. Two chairs were placed in the observation room. Chair 1 was the chair used by the stranger. This chair was out of the reach of the dog. Chair 2 was the owner's chair, which the dog could reach. The dog had access to a water bowl.

The behaviour of the dog was observed using focal sample continuous recording following the protocol of Dessens (2014) and aided by Observer® XT 10.5 (Noldus, Wageningen, The Netherlands). Event behaviours, expressed in rate per minute, that we considered to reflect stress were panting, freezing, paw lifting, yawning, stretching, tongue flicking, shaking, scratching, sneezing, clapping teeth, barking, urogenital check, whining and jumping. Other events scored were avoid stranger, avoid owner, looking away from stranger, looking away from owner, shake, soliciting attention, pulling leash, biting leash, grooming, aggressive behaviour, sniffing environment, manipulation environment and tail wagging. The behavioural states, expressed as a percentage of the observation time, were play, locomotion, posture, being near and staring. These states were. Behaviours are further described in Appendix II (Tables 1,2 and 3). The data was analysed by two observers and inter-reliability was tested based on five dogs. Inter-observer reliability scored 60.4% average agreement and this was tested with time-based intersections of records with a 5 second tolerance in Observer XT 10.5.

## **2.2 Altruism test**

A second behaviour test was done to measure owner-directed altruistic behaviour, focussing on information sharing. The dog's informing of the owner about his/her missing coat was measured. The owner's coat was hidden in one of 3 boxes, which was done in sight of the dog and out of sight of the owner. The owner solicited help verbally ("where is my coat") and by gesturing (raising hands). The altruism test included 4 episodes. Episode 1, The owner takes off the coat, and places it over the back of the assigned chair. The dog is allowed to explore. There are four chairs and three cardboard boxes (50L) in the room and the distances between the chairs and the boxes are equal (see Figure 4). Only the middle two chairs are used for the coat. Episode 2, the owner puts the dog on the long leash and sits behind the screen with hands covering the ears while music is playing. The experimenter enters the room puts the owner's coat in the assigned box and leaves after which the owner returns to stand behind the chair. Episode 3, the owner stands behind the chair, places his/her hands on the back of the chair, makes eye contact with the dog and looks around. Next, the owner makes eye contact with the dog and asks "Where is my coat?", while looking at the dog and raising the hands. After a 5 second pause the owner repeats the request for help. Episode 4, the owner is asked to point at the box they believe the coat is in, based on signals from the dogs. The owner puts on the coat without talking to the dog. The target box was randomly assigned.

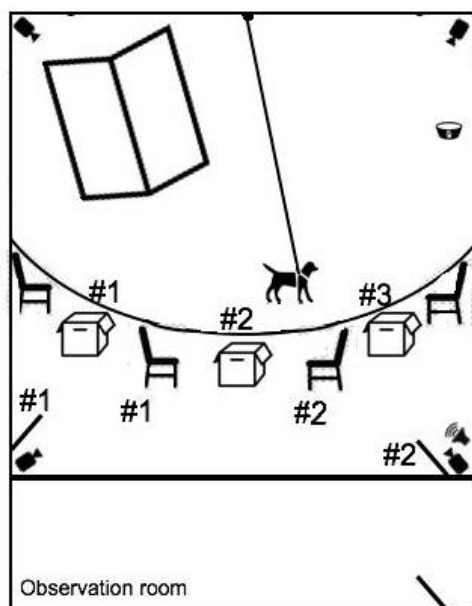


Figure 4. Experimental setup Altruism test (Jager, Smit and van Woensel, 2017); four chairs are present, of which two are numbered. Also, three numbered cardboard boxes, a water bowl and a screen are present. The dog is fixed to the wall with a long leash and can reach its owner (also when the owner is behind the screen) but can't reach the stranger.

The behaviour of the dog was observed through a one-way window, from the adjoining observation room. Four cameras, one in each corner of the testing room, were used for recording. The owners were instructed during tests by using a microphone from within the observation room (See figure 4 for the test room set up).

The behaviour of the dog was recorded following the ethogram in Appendix II (table 4), including looking at owner, looking at (box containing owner's coat), walking towards (box containing owner's coat). Assumed indicators of stress were panting, freezing, paw lifting, yawning, stretching, tongue flicking, shaking, scratching, sniffing, sneezing, barking, urogenital check, whining and yelping. The data was analysed by two observers and inter-reliability was tested based on five dogs. This was done by means of an independent t-test but no significant differences were found.

### 2.3 Statistical analysis

Statistical analyses were done using GenStat version 18.1.

The Strange Situation Test produced behaviour scores on 35 dogs, expressed in 8 repeated records (test episodes) per dog. The data was analysed by Principal Component Analyses (PCA) to detect relationships between individual behavioural parameters (Jolliffe, 1986, following procedures as described by van Herwijnen 2018). Data reduction was established by means of principal component scores, which were calculated from the individual's behaviour scores using loadings for weighing. Components which explained over 10% of variation were considered meaningful and loadings  $> |0.4|$  were considered significant. To examine the interrelationships between especially the dogs' behavioural patterns scored in the (CBARQ) survey and their owners (PSDQ) parenting styles, a Principal Component analysis (PCA) was done on 2,201 records.

Dog behaviours recorded during the Strange Situation Test were analysed for effects of the presences of the owner and / or stranger. A total of 280 records on 35 dogs were analysed with linear mixed models using Residual Maximum Likelihood (REML) and the following statistical model:

$$Y_{xyz} = u + Owner_x + Stranger_y + Owner_x \cdot Stranger_y + Dog_z + e_{xyz}$$

Where  $Y_{xyz}$  represents a behaviour score for dog  $z$  ( $n=35$ ) under condition  $x$  for owner presence (yes, no) and  $y$  for stranger presence (0,1). Thus, the presences of owner and stranger were the fixed effects in the statistical model, including the 2-way interaction, and dog made up the random component to account for repeated measurements on the same experimental unit. The  $u$  and  $e$  represent the overall predicted mean and residual, respectively.

Next, the data set described was extended with the parenting style scores and the following statistical model was ran:

$$Y_{xyzq} = u + (Owner_x * Stranger_y * Parenting_z) + Dog_q + e_{xyzq}$$

The fixed effects owner presence (yes, no), stranger presence (yes, no) and the covariate parenting style (0 to 100%) were evaluated including all possible interactions. The model was ran with one of four parenting style scores at a time.

Furthermore, REML was used to analyse the data from the altruism test, existing out of two records per dog ( $n=40$ ). In a mixed model with dog as random component and the fixed effect treatment, it was tested of dogs acted differently if owners requested help (treatment) or not (control). Possible associations with parenting styles were tested as described for the strange situation test and parenting style scores were added as a covariate, one a time, and evaluated in interaction with treatment.

$$Y_{xyz} = u + Constant_x + Trial_y + Dog_z + e_{xyz}$$

Interrelationships between the dogs' behavioural patterns in daily life, based on owner-reports in the CBARQ survey, and their owners' parenting styles (PSDQ questionnaire), a PCA was done on 2,201 survey records.

### 3. Results

Dog directed parenting styles, as assessed with the parenting styles and dimensions questionnaire (PSDQ), were tested for associations with attachment of owner to dog (assessed with the Monash dog owner relationship scale MDORS) and vice versa (Ainsworth Strange Situation Test, ASST). Similarly, associations were tested with dog (mis)behaviour (canine behavioural assessment and research questionnaire, C-BARQ), owner sociality (Experiences in close relationship scale, ECR) and dog sociality (emotional activity sociability temperament survey, EAST).

#### 3.1 Participants

A total of 2,201 dog owners filled out our questionnaire, of which 85.6% was female, 13.8% was male and 0.6% was unidentified. A subsample participated in the behaviour tests, including 88.6% female dog owners and 11.4% males. The dogs on which owners reported were 45% females, 50.4% males and for 4.6% the sex was unknown. The dogs who participated in the behaviour tests were for 48.6% female and 51.4% males. The mean descriptive scores for both dog owners and their dogs, are presented in Table 1. The authoritative parenting style (dog-directed) was used most strongly by the dog owners, with a mean 74.6% of the maximum possible. In comparison, for the authoritarian style this was 24.7%, for permissive style 27.4% and for uninvolved parenting style 25.6%. The sub sample of participants of the behaviour tests scored similarly, with scores of 73.3% for authoritative, 29.1% for authoritarian, 29.3% for permissive and 28.5% for uninvolved.

##### 3.1.1 Interrelationships with parenting style scores

To examine the interrelationships between especially the dogs' behavioural patterns scored in the (CBARQ) survey and their owners (PSDQ) parenting styles, a Principal Component analysis (PCA) was done on 2,201 records. The findings are summarized in table 1 and for a complete overview see Table 9 Appendix V.

Table 1. Loadings from a PCA analysis on the parenting style questionnaire filled in by 2,201 dog owners (18 read-out parameters). Parameters included in the analysis were acquired through the questionnaire. The variance explained by the associations between parameters (second row) indicates the importance of the components.

Column 2 presents the arithmetic mean ( $\pm$  standard deviation) expressed as percentages of the maximum score possible (further details are in Table 9 Appendix V).

	mean	$\pm$	sd	Components		
				1	2	3
variation (%)				17.1	11.6	10.7
<i>Parameters</i>						
<i>Authoritative</i> <sup>1</sup>	74.57	$\pm$	0.24	0.02	0.25	<b>0.56</b>
<i>Authoritarian</i> <sup>1</sup>	24.69	$\pm$	0.28	0.31	-0.17	<b>-0.65</b>
<i>Permissive</i> <sup>1</sup>	27.42	$\pm$	0.29	<b>0.55</b>	-0.05	-0.15
<i>Uninvolved</i> <sup>1</sup>	25.57	$\pm$	0.20	<b>0.55</b>	-0.17	<b>-0.57</b>
<i>Perceived closeness</i> <sup>2</sup>	76.06	$\pm$	0.35	0.23	<b>0.40</b>	0.29
<i>Anxious Avoidant</i> <sup>4</sup>	41.72	$\pm$	0.29	<b>0.74</b>	<b>0.51</b>	0.06
<i>Avoidant</i> <sup>4</sup>	42.86	$\pm$	0.34	<b>0.58</b>	<b>0.43</b>	0.07
<i>Anxious</i> <sup>4</sup>	40.59	$\pm$	0.37	<b>0.66</b>	<b>0.43</b>	0.04
<i>Separation Anxiety Score</i> <sup>3</sup>	7.84	$\pm$	0.30	<b>0.40</b>	-0.16	-0.04
<i>Stranger Directed Aggression Score</i> <sup>3</sup>	11.50	$\pm$	0.36	0.38	<b>-0.52</b>	0.32
<i>Dog Directed Aggression Score</i> <sup>3</sup>	19.28	$\pm$	0.46	0.35	<b>-0.51</b>	0.30
<i>Social Fear Score</i> <sup>3</sup>	9.05	$\pm$	0.36	0.39	-0.39	<b>0.45</b>

Numbers in bold are significant ( $>|0.4|$ ); 1) Parenting styles and dimensions questionnaire (PSDQ); 2) Monash dog owner relationship scale (MDORS); 3) Canine behavioural assessment and research questionnaire (C-BARQ); 4) Experiences in close relationship scale (ECR)

The PCA on the dog owners' parenting styles and sociality and their dogs (mis)behaviour and sociality produced 3 main loading patterns. However, in the second component loadings partly contradicted those in the first, so only the first component is considered meaningful. The parameters that were included in the PCA came from four parts of the survey and comprised of the parenting styles (PSDQ), perceived cost of dog ownership (MDORS), owner directed aggression and dog directed fear score (CBARQ) and adult attachment (ECR). The main component grouped 6 parameters and explained 17% of the variation in the dataset. The loading pattern shows that anxious (0.66), avoidant (0.58) and anxious avoidant behaviour (0.74) in owners associates with permissive (0.55) and an uninvolved parenting style (0.55). This in turn associates with dogs scoring relatively high for separation anxiety (0.40). Permissive and uninvolved parenting styles have in common that they demand little from their dog so anxious and avoidant owners demand little and this associates with separation anxiety in dogs.

### 3.2 Dog to owner attachment

Thirty-five dogs were tested for their attachment to their owners, using the ASST, based on 40 different behaviours. Across the 8 test phases of the ASST, dogs were alone or together with the owner and / or stranger and linear mixed models were used to determine the effects of the presence and/or absence of the stranger and the owner and the interaction between these two. Table 2 shows the p-values for the fixed effects and further details on the significant effects are in Tables 3, 4 and 5 (full presentations are in Tables 11,12 and 13 in Appendix V).

Table 2. Dogs (n = 35) were tested for attachment to their owner in an Ainsworth Strange Situation Test (ASST). Effects (p-values) of the presence of the stranger, the owner and the interaction between them on 40 different behaviour scores during the ASST were examined with linear mixed models. Column 2 presents the predicted means ( $\pm$  standard error) generated by the statistical model, columns 3-5 show the p-values. See Table 10 Appendix V for full table.

<i>Behaviour</i>	<i>Constant</i>			<i>Stranger present</i>	<i>Owner present</i>	<i>Stranger.Owne r present</i>
	mean	$\pm$	se	p-value	p-value	p-value
<i>shaking</i> <sup>1</sup>	0.06	$\pm$	0.02	<b>&lt;0.001</b>	<b>0.004</b>	0.078
<i>panting</i> <sup>1</sup>	2.57	$\pm$	0.54	0.404	0.468	<b>0.016</b>
<i>tongue flicking</i> <sup>1</sup>	0.80	$\pm$	0.16	<b>&lt;0.001</b>	0.07	0.354
<i>sniffing</i> <sup>1</sup>	0.09	$\pm$	0.02	0.349	<b>0.035</b>	0.103
<i>barking</i> <sup>1</sup>	0.72	$\pm$	0.30	0.236	<b>0.025</b>	0.279
<i>whining</i> <sup>1</sup>	3.00	$\pm$	0.66	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.005</b>
<i>growling</i> <sup>1</sup>	0.10	$\pm$	0.06	0.879	0.804	<b>0.042</b>
<i>avoid stranger</i> <sup>1</sup>	0.02	$\pm$	0.01	<b>&lt;0.001</b>	0.066	<b>0.044</b>
<i>looking away from stranger</i> <sup>1</sup>	0.06	$\pm$	0.03	<b>&lt;0.001</b>	<b>0.022</b>	<b>0.012</b>
<i>tail wagging</i> <sup>1</sup>	0.42	$\pm$	0.51	<b>0.004</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>

<i>sniffing environment</i> <sup>1</sup>	1.23	±	0.19	<b>&lt;0.001</b>	<b>&lt;0.001</b>	0.061
<i>soliciting attention</i> <sup>1</sup>	0.20	±	0.06	0.06	<b>&lt;0.001</b>	0.85
<i>pulling leash</i> <sup>1</sup>	0.57	±	0.10	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.013</b>
<i>social play stranger</i> <sup>2</sup>	3.63	±	0.98	<b>&lt;0.001</b>	0.605	0.533
<i>no playing</i> <sup>2</sup>	82.39	±	3.05	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
<i>non-social play</i> <sup>2</sup>	0.29	±	0.20	<b>0.019</b>	0.137	0.121
<i>social play owner</i> <sup>2</sup>	4.78	±	1.47	<b>&lt;0.001</b>	<b>0.019</b>	<b>0.017</b>
<i>petting owner</i> <sup>2</sup>	8.92	±	2.28	<b>&lt;0.001</b>	<b>&lt;0.001</b>	0.085
<i>standing</i> <sup>2</sup>	46.16	±	3.20	<b>0.002</b>	0.595	0.224
<i>lying</i> <sup>2</sup>	19.03	±	2.67	<b>&lt;0.001</b>	<b>&lt;0.001</b>	0.327
<i>sitting</i> <sup>2</sup>	11.20	±	2.21	0.286	<b>&lt;0.001</b>	0.266
<i>moving</i> <sup>2</sup>	23.61	±	1.98	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
<i>not being near</i> <sup>2</sup>	23.47	±	2.37	<b>&lt;0.001</b>	0.608	0.736
<i>near owner</i> <sup>2</sup>	32.12	±	2.20	<b>&lt;0.001</b>	<b>&lt;0.001</b>	0.238
<i>near owner chair</i> <sup>2</sup>	29.82	±	2.02	<b>&lt;0.001</b>	<b>&lt;0.001</b>	0.908
<i>near stranger</i> <sup>2</sup>	13.03	±	1.48	<b>&lt;0.001</b>	0.142	0.222
<i>near stranger chair</i> <sup>2</sup>	1.56	±	0.44	0.111	<b>&lt;0.001</b>	<b>0.005</b>
<i>no staring</i> <sup>2</sup>	60.56	±	2.22	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.044</b>
<i>staring door</i> <sup>2</sup>	19.23	±	1.44	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
<i>staring stranger chair</i> <sup>2</sup>	0.56	±	0.20	0.137	<b>0.014</b>	<b>0.021</b>
<i>staring owner</i> <sup>2</sup>	8.60	±	1.18	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
<i>staring stranger</i> <sup>2</sup>	10.47	±	0.64	<b>&lt;0.001</b>	0.108	0.091
<i>staring owner chair</i> <sup>2</sup>	0.59	±	0.13	<b>0.013</b>	<b>&lt;0.001</b>	0.692

<sup>1</sup> scores expressed as rate per minute, <sup>2</sup> = expressed as percentage of the observation time

Interaction effects of the presences of owner and stranger were significant for panting, growling, avoid stranger, looking away from stranger, tail wagging, pulling leash, no playing, social play owner, moving, near stranger chair, no staring, staring at door, staring at stranger chair and staring at owner (see Table 3). Evaluation of the contrasts revealed that two-way interaction effects on growling and looking away from stranger were merely trends. The dogs avoided the stranger significantly more when their owner was not present and they were alone with the stranger. There was more sitting, near stranger chair, staring at door and staring at stranger chair when the dog was left alone compared to when anybody was in the room. When only the owner was present, the dogs moved the most, typically played with their owner and stared at either their owner or nothing specific. This was accompanied with relatively high levels of panting. The dogs wagged their tails most when the owner was present, both in the situation with and without the stranger. However, they also wagged their tail more when the stranger was present compared to no one present, but this effect was less significant than when the owner was present. The dogs often pulled their leash and stared at the stranger when both the stranger and the owner were present. This indicates that they felt secure enough to explore the stranger in the presence of the owner.

Table 3 Predicted mean behaviour scores per ASST tested on the presence of the stranger and/or the owner or neither. REML output with the predicted mean and standard error of the constant and the p-values for the stranger present, owners present and the interaction between stranger and owner for 40 behaviours with 35 dogs. If the difference between two predicted means was higher than two times the standard error of differences, the p-value was ≤ 0.05 for that specific contrast, which is indicated by a different character (a, b, c or d). See Table 13 Appendix V for full table.

<i>Behaviour</i>	<i>Stranger present . Owner present</i>											
	0.0 mean	±	se	0.1 mean	±	se	1.0 mean	±	se	1.1 mean	±	se
<i>panting</i> <sup>1</sup>	2.16 <sup>a</sup>	±	0.63	<b>3.03<sup>b</sup></b>	±	0.55	2.83 <sup>ab</sup>	±	0.58	2.26 <sup>ab</sup>	±	0.63
<i>avoid stranger</i> <sup>1</sup>	0.00 <sup>a</sup>	±	0.02	0.00 <sup>a</sup>	±	0.01	<b>0.08<sup>b</sup></b>	±	0.02	0.01 <sup>a</sup>	±	0.02
<i>tail wagging</i> <sup>1</sup>	0.42 <sup>a</sup>	±	0.51	<b>4.65<sup>c</sup></b>	±	0.38	<b>2.30<sup>b</sup></b>	±	0.43	<b>4.28<sup>c</sup></b>	±	0.51
<i>pulling leash</i> <sup>1</sup>	0.11 <sup>a</sup>	±	0.16	0.35 <sup>ab</sup>	±	0.11	0.51 <sup>b</sup>	±	0.13	<b>1.31<sup>c</sup></b>	±	0.16
<i>no playing</i> <sup>2</sup>	<b>93.72<sup>b</sup></b>	±	4.89	65.91 <sup>a</sup>	±	3.27	<b>86.88<sup>b</sup></b>	±	3.89	<b>83.03<sup>b</sup></b>	±	4.89
<i>social play owner</i> <sup>2</sup>	3.42 <sup>a</sup>	±	3.17	<b>15.02<sup>b</sup></b>	±	1.71	0.66 <sup>a</sup>	±	2.30	0.00 <sup>a</sup>	±	3.17
<i>sitting</i> <sup>2</sup>	<b>17.82<sup>c</sup></b>	±	3.31	6.78 <sup>a</sup>	±	2.34	13.11 <sup>bc</sup>	±	2.70	7.10 <sup>ab</sup>	±	3.31
<i>moving</i> <sup>2</sup>	10.58 <sup>a</sup>	±	3.51	<b>44.77<sup>c</sup></b>	±	2.17	11.69 <sup>a</sup>	±	2.69	27.39 <sup>b</sup>	±	3.51

<i>near stranger chair</i> <sup>2</sup>	<b>5.42<sup>b</sup></b>	±	0.99	0.40 <sup>a</sup>	±	0.52	0.39 <sup>a</sup>	±	0.71	0.00 <sup>a</sup>	±	0.99
<i>no staring</i> <sup>2</sup>	52.49 <sup>a</sup>	±	3.55	<b>74.78<sup>c</sup></b>	±	2.38	51.44 <sup>a</sup>	±	2.82	63.51 <sup>b</sup>	±	3.55
<i>staring door</i> <sup>2</sup>	<b>43.96<sup>c</sup></b>	±	2.56	2.25 <sup>a</sup>	±	1.58	28.43 <sup>b</sup>	±	1.96	2.27 <sup>a</sup>	±	2.56
<i>staring stranger chair</i> <sup>2</sup>	<b>1.97<sup>b</sup></b>	±	0.47	0.19 <sup>a</sup>	±	0.24	0.02 <sup>a</sup>	±	0.33	0.05 <sup>a</sup>	±	0.47
<i>staring owner</i> <sup>2</sup>	0.43 <sup>a</sup>	±	2.13	<b>22.71<sup>c</sup></b>	±	1.30	0.13 <sup>a</sup>	±	1.62	11.13 <sup>b</sup>	±	2.13

<sup>1</sup> = rate per minute, <sup>2</sup> = percentage, stretching, urogenital check

The presence of the stranger was significantly affecting the behaviours, shaking, tongue flicking, whining, sniffing environment, social play stranger, non-social play, petting owner, standing, lying, not being near, near owner, near owner chair, near stranger, staring stranger and staring owner chair (for details see Table 4). Shaking, tail wagging and sniffing environment, no playing, non-social play, petting owner, lying and near owner chair were not significantly different when testing contrasts for significance and these should be considered near significant trends. Avoiding stranger and looking away from stranger were significantly higher when the stranger was present, obviously. The main findings of interest are that in the stranger's absence the dogs stared significantly more at their owner, and at the door, but stared less in general. Pulling leash was significantly higher when the stranger was present suggesting stronger approach/avoidance motivations. This could be about approaching the door, because the owner went through the door, towards the stranger or something else. The behaviour being near stranger indicates that the dog was indeed pulling the leash to get closer to the stranger. The dogs move more when the stranger was not present. They move more towards their owner, the chair from the stranger and not near anything. However, when the stranger was present they moved significantly more towards the stranger. In the absence of the stranger there was more tongue flicking and social play with the owner.

Table 4 Predicted mean behaviour scores per ASST tested on the presence of the stranger (0 = not, 1= yes). REML output with the predicted mean and standard error of the constant and the p-values for the stranger present, owners present and the interaction between stranger and owner for 40 behaviours on 35 dogs. If the difference between two predicted means was higher than two times the standard error of differences, the p-value was ≤ 0.05 for that specific contrast, which is indicated by a different character (a or b). See Table 11 Appendix V for full table.

<i>Behaviour</i>	<i>Stranger present</i>					
	0			1		
	mean	±	se	mean	±	se
<i>tongue flicking</i> <sup>1</sup>	<b>1.00<sup>b</sup></b>	±	0.17	0.60 <sup>a</sup>	±	0.17
<i>avoid stranger</i> <sup>1</sup>	0.00 <sup>a</sup>	±	0.02	<b>0.05<sup>b</sup></b>	±	0.02
<i>looking away from stranger</i> <sup>1</sup>	0.00 <sup>a</sup>	±	0.03	<b>0.13<sup>b</sup></b>	±	0.04
<i>pulling leash</i> <sup>1</sup>	0.23 <sup>a</sup>	±	0.12	<b>0.91<sup>b</sup></b>	±	0.12
<i>social play stranger</i> <sup>2</sup>	0.04 <sup>a</sup>	±	1.17	<b>7.23<sup>b</sup></b>	±	1.24
<i>social play owner</i> <sup>2</sup>	<b>9.22<sup>b</sup></b>	±	1.87	0.33 <sup>a</sup>	±	2.03
<i>standing</i> <sup>2</sup>	41.74 <sup>a</sup>	±	3.48	<b>50.58<sup>b</sup></b>	±	3.60
<i>moving</i> <sup>2</sup>	<b>27.67<sup>b</sup></b>	±	2.31	19.54 <sup>a</sup>	±	2.44
<i>not being near</i> <sup>2</sup>	<b>30.22<sup>b</sup></b>	±	2.98	16.72 <sup>a</sup>	±	3.21
<i>near owner</i> <sup>2</sup>	<b>35.77<sup>b</sup></b>	±	2.69	28.47 <sup>a</sup>	±	2.89
<i>near stranger</i> <sup>2</sup>	0.39 <sup>a</sup>	±	1.79	<b>25.67<sup>b</sup></b>	±	1.91
<i>near stranger chair</i> <sup>2</sup>	<b>2.91<sup>b</sup></b>	±	0.57	0.20 <sup>a</sup>	±	0.62
<i>no staring</i> <sup>2</sup>	<b>63.64<sup>b</sup></b>	±	2.50	57.47 <sup>a</sup>	±	2.61
<i>staring door</i> <sup>2</sup>	<b>23.11<sup>b</sup></b>	±	1.68	15.35 <sup>a</sup>	±	1.78
<i>staring owner</i> <sup>2</sup>	<b>11.57<sup>b</sup></b>	±	1.39	5.63 <sup>a</sup>	±	1.47
<i>staring stranger</i> <sup>2</sup>	0.03 <sup>a</sup>	±	0.83	<b>20.90<sup>b</sup></b>	±	0.90

<sup>1</sup> = rate per minute, <sup>2</sup> = percentage

Owner presence had significant effects on shaking, tongue flicking, sniffing, barking, whining, looking away from stranger, sniffing environment, soliciting attention, petting owner, lying, sitting, near owner, near owner chair and staring at owner chair (for details see Table 5). The main findings of interest are that the dogs shook and sniffed significantly more when the owner was present. They also did more tail wagging, sniffing environment, soliciting attention and pulling leash. The dogs played more with their owner and got petted more by their owner which was obvious and only possible in the owner's presence. The dogs performed more barking, more looking away from stranger and no playing

when the owner was not present. When the owner was present the dog was more near the owner, and when the owner was not present the dog was significantly more near to the chairs of the owner and the stranger. When the owner wasn't present the dogs stared significantly more at the door, the chair from the stranger, and the chair of the owner. When the owner was present the dogs did significantly more staring at their owner.

Table 5 Predicted mean behaviour scores per ASST tested on the presence of the owner. REML output with the predicted mean and standard error of the constant and the p-values for the stranger present, owners present and the interaction between stranger and owner for 40 behaviours with 35 dogs. If the difference between two predicted means was higher than two times the standard error of differences, the p-value was  $\leq 0.05$  for that specific contrast, which is indicated by a different character (a or b). See Table 12 Appendix V for full table.

<i>Behaviour</i>	<i>Owner present</i>					
	0 mean	$\pm$	se	1 mean	$\pm$	se
<i>shaking</i> <sup>1</sup>	0.02 <sup>a</sup>	$\pm$	0.03	<b>0.11<sup>b</sup></b>	$\pm$	0.03
<i>sniffing</i> <sup>1</sup>	0.05 <sup>a</sup>	$\pm$	0.03	<b>0.13<sup>b</sup></b>	$\pm$	0.03
<i>barking</i> <sup>1</sup>	<b>1.01<sup>b</sup></b>	$\pm$	0.33	0.43 <sup>a</sup>	$\pm$	0.32
<i>whining</i> <sup>1</sup>	<b>4.48<sup>b</sup></b>	$\pm$	0.72	1.53 <sup>a</sup>	$\pm$	0.70
<i>looking away from stranger</i> <sup>1</sup>	<b>0.12<sup>b</sup></b>	$\pm$	0.04	0.01 <sup>a</sup>	$\pm$	0.03
<i>tail wagging</i> <sup>1</sup>	1.36 <sup>a</sup>	$\pm$	0.40	<b>4.47<sup>b</sup></b>	$\pm$	0.39
<i>sniffing environment</i> <sup>1</sup>	0.36 <sup>a</sup>	$\pm$	0.28	<b>2.10<sup>b</sup></b>	$\pm$	0.25
<i>soliciting attention</i> <sup>1</sup>	0.01 <sup>a</sup>	$\pm$	0.08	<b>0.38<sup>b</sup></b>	$\pm$	0.08
<i>pulling leash</i> <sup>1</sup>	0.31 <sup>a</sup>	$\pm$	0.12	<b>0.83<sup>b</sup></b>	$\pm$	0.12
<i>no playing</i> <sup>2</sup>	<b>90.30<sup>b</sup></b>	$\pm$	3.59	74.47 <sup>a</sup>	$\pm$	3.43
<i>social play owner</i> <sup>2</sup>	2.04 <sup>a</sup>	$\pm$	2.03	<b>7.51<sup>b</sup></b>	$\pm$	1.87
<i>petting owner</i> <sup>2</sup>	3.57 <sup>a</sup>	$\pm$	2.68	<b>14.26<sup>b</sup></b>	$\pm$	2.56
<i>lying</i> <sup>2</sup>	<b>28.21<sup>b</sup></b>	$\pm$	3.16	9.86 <sup>a</sup>	$\pm$	3.02
<i>sitting</i> <sup>2</sup>	<b>15.47<sup>b</sup></b>	$\pm$	2.53	6.94 <sup>a</sup>	$\pm$	2.43
<i>moving</i> <sup>2</sup>	11.14 <sup>a</sup>	$\pm$	2.44	<b>36.08<sup>b</sup></b>	$\pm$	2.31
<i>near owner</i> <sup>2</sup>	4.58 <sup>a</sup>	$\pm$	2.89	<b>59.66<sup>b</sup></b>	$\pm$	2.69
<i>near owner chair</i> <sup>2</sup>	<b>56.68<sup>b</sup></b>	$\pm$	2.77	2.97 <sup>a</sup>	$\pm$	2.56
<i>near stranger chair</i> <sup>2</sup>	<b>2.91<sup>b</sup></b>	$\pm$	0.62	0.20 <sup>a</sup>	$\pm$	0.57
<i>no staring</i> <sup>2</sup>	51.97 <sup>a</sup>	$\pm$	2.61	<b>69.15<sup>b</sup></b>	$\pm$	2.50
<i>staring door</i> <sup>2</sup>	<b>36.20<sup>b</sup></b>	$\pm$	1.78	2.26 <sup>a</sup>	$\pm$	1.68
<i>staring stranger chair</i> <sup>2</sup>	<b>1.00<sup>b</sup></b>	$\pm$	0.29	0.12 <sup>a</sup>	$\pm$	0.26
<i>staring owner</i> <sup>2</sup>	0.28 <sup>a</sup>	$\pm$	1.47	<b>16.92<sup>b</sup></b>	$\pm$	1.39
<i>staring owner chair</i> <sup>2</sup>	<b>1.11<sup>b</sup></b>	$\pm$	0.19	0.07 <sup>a</sup>	$\pm$	0.17

<sup>1</sup> = rate per minute, <sup>2</sup> = percentage

### 3.3 Dog directed parenting styles and dog to owner attachment

To examine whether there was a relationship between the dogs' attachment behaviours in the ASST and the owners' parenting styles, a linear mixed model was used. In this analysis, 40 behaviours on 35 dogs were tested for effects of the 4 parenting styles authoritative (AUTV), authoritarian (AUTN), permissive (PERM) and uninvolved (UNIN). Eight records per dog were transformed by grouping them together on the presence of the stranger and/or the owner, which created four conditions. No-one present, only the stranger present, only the owner present and both present.

Table 6 The behaviours of the dogs during the ASST were checked for a relationship with the parenting style of the owner of the dog using a Linear Mixed Model analysis with 35 dogs, 14 behaviours and 4 parenting styles. The first column gives the behaviours, columns 2-4 give the mean and the standard error and the other columns give the p-values. The other columns represent the p-values that were given as output for the 10 parenting styles variations. If the p-value was  $\leq 0.05$ , it was printed in bold.

	mean	$\pm$	se	PS	S AUTV	O AUTV	S AUTN	O AUTN	S PERM	O PERM	S UNIN	O UNIN
<i>Looking away from owner</i> <sup>1</sup>	0.00	$\pm$	0.00	0.023 <sup>b</sup> 0.003 <sup>d</sup>							0.021	
<i>Sneezing</i> <sup>13</sup>	0.08	$\pm$	0.02							0.025		
<i>Panting</i> <sup>1</sup>	2.57	$\pm$	0.54			0.044						
<i>Yawning</i> <sup>1</sup>	0.07	$\pm$	0.02	0.023 <sup>b</sup> 0.021 <sup>d</sup>								
<i>Tongue flicking</i> <sup>1</sup>	0.80	$\pm$	0.15			0.015					0.033	



<i>Sniffing</i> <sup>1</sup>	0.09	± 0.02		0.039	0.001	0.035		
<i>Barking</i> <sup>1</sup>	0.72	± 0.29	0.018 <sup>c</sup>			0.044	0.045	<0.001
<i>Whining</i> <sup>1</sup>	3.00	± 0.59	0.002 <sup>c</sup>				0.046	<0.001
<i>Tail wagging</i> <sup>1</sup>	2.91	± 0.36					0.040	
<i>Soliciting attention</i> <sup>1</sup>	0.20	± 0.06					0.045	
<i>Pulling leash</i> <sup>1</sup>	0.57	± 0.10						0.012
<i>Social play stranger</i> <sup>2</sup>	3.63	± 0.97			0.020		0.009	
<i>No playing</i> <sup>2</sup>	82.39	± 3.08		0.019	0.027			
<i>Petting owner</i> <sup>2</sup>	8.92	± 2.29		0.014				
<i>Standing</i> <sup>2</sup>	46.16	± 3.21					0.024	0.003
<i>Lying</i> <sup>2</sup>	19.03	± 2.62			0.024			
<i>Stranger Chair</i> <sup>2</sup>	1.56	± 0.42				<0.001		

<sup>1</sup> = rate per minute, <sup>2</sup> = percentage, <sup>3</sup> = sneezing, yelping, grooming, biting, licking <sup>B</sup> = authoritarian, <sup>c</sup> = permissive, <sup>d</sup> = uninvolved

The amount of tail wagging, soliciting attention, social play with the stranger and petting by the owner are logical outcomes and not interesting for this research. 'Sneezing yelping grooming biting licking', yawning and sniffing behaviour had minimal variation and these were ignored for further analyses. Looking away from the owner was rare with mean ( $\pm$  standard error) of  $0.002 \pm 0.002$ .

The only significant interaction effect of a parenting style and presences of both the owner and stranger, was for the percentage of being near to the chair of the stranger ( $1.55 \pm 0.42$ ,  $p = 0.003$  for 3-way interaction authoritarian parenting style, owner presence and stranger presence). In figure 5 it can be seen that dogs of owners with increasing scores for authoritarian parenting were increasingly close to the chair of the stranger, i.e. when neither the owner and the stranger were present (solid line).

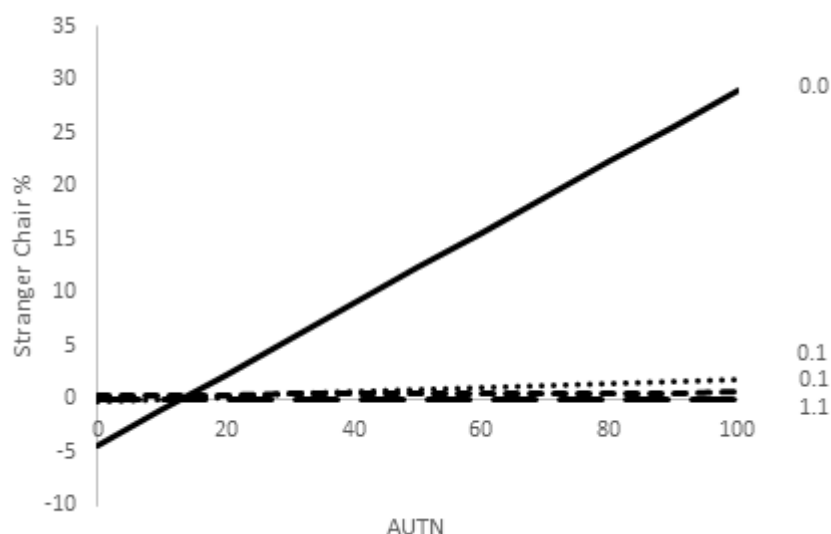


Figure 5. Scores for being near to the strangers chair (y-axis, expressed as % of the observation time) in dogs during the Ainsworth Strange Situation Test (ASST) for measuring dog to owner attachment. Shown is the effect of an authoritarian parenting style of dog owners on the amount of being near to the strangers chair behaviour that was displayed compared to stranger.owner presence with 0 meaning not present and 1 meaning was present, which led to four situations during the ASST.

Other significant findings were on vocalising behaviours such as barking and whining. Barking ( $0.72 \pm 0.28$  rate per minute) was significant for the 2-way interaction of a permissive parenting style and owner present, and also for stranger present. Barking increased with increasing scores of permissive parenting, but for when the owner was present. The same relationship with permissive parenting, as when owners were absent, was stronger when the stranger was absent than when present (figure 6).

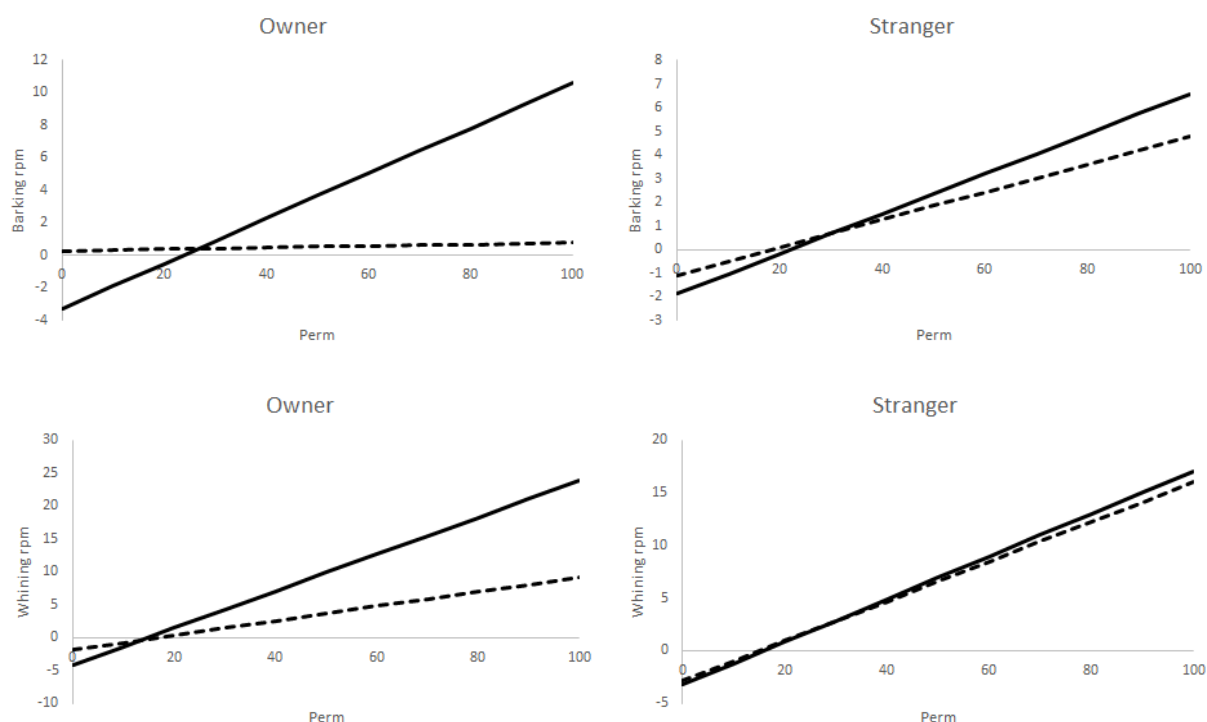


Figure 6. Scores for whining (y-axis, expressed as % of the observation time) in dogs during the Ainsworth Strange Situation Test (ASST) for measuring dog to owner attachment. Shown is the effect of an permissive parenting style of dog owners on the amount of barking or whining behaviour that was displayed compared to the presence of the owner and the stranger during the ASST with the solid line representing not present and the dashed line present.

The amount of whining ( $3.00 \pm 0.59$  rate per minute) displayed by the dogs during the ASST followed a similar pattern to barking. With an owner with a high permissive parenting style the dogs displayed a significantly higher amount of whining when the owner was not present (see figure 6) and a about half of this amount when the owner was present. Regardless of the stranger's presence or absence, the amount of whining increased with increasing scores for permissive parenting.

Panting was subject to a significant interaction effect of authoritative parenting and whether or not the owner was present during the ASST. When the owner was not present the degree of authoritativeness associated inversely with the amount of panting and when the owner was present this relationship was direct. Tongue flicking was affected by an interaction effects between authoritative and owner presence, and by uninvolved parenting and stranger presence. Tongue flicks were only weakly linked to authoritative parenting, though. For the parenting style uninvolved, the amount of tongue flicking that the dogs displayed in presence of the stranger related directly to uninvolvedness, but especially when the stranger was not present. Interaction effects on pulling on the leash indicated that leash pulling related directly to permissiveness, but especially for the ASST phases when the owner was present. The higher the parenting style scores for permissive and uninvolved parenting the more standing behaviour occurred during the ASST when the stranger was present. Lying related inversely with owner authoritativeness, with the relationship being stronger when the owner was not present.

### 3.3 Information sharing behaviour in dogs

Dogs ( $n = 40$ ) were tested twice for sharing information with their owners, as a proxy for their degree of altruism. In view of the dog but not the owner, the experimenter hid the coat of the owner inside one of 3 boxes and owners request help (not in the control trials). Restricted maximum likelihood (REML) was used to determine the effect of control trials versus test trials on the information sharing and stress behaviours of the dogs (see Tables 7 and 8 for REML predicted means and p-values). Treatment effects (the owner requesting help, or not) were significant for looking at box zone ( $p =$

0.027) and approaching the box zone ( $p = 0.045$ , Table 7). Referencing and spending time in the box zone was not influenced by whether a control or test trial occurred, and the same was true for stress signals. The fact that the owners needed something from their dogs did not give them more stress than when the owner demanded nothing from the dog.

Table 7 Effects (p-values) of the trial on information sharing behaviour scores during the Altruism test examined with a REML analysis (5 behaviours on 40 dogs). Presented are the p-values and predicted means ( $\pm$ standard error) generated by the REML analysis. If the difference between two predicted means was higher than two times the standard error of differences, the p-value was  $\leq 0.05$  for that specific contrast, which is indicated by a different character (a or b).

	<i>control</i>					<i>test</i>				
	p-value	mean	±	se	mean	±	se	mean	±	se
<i>Time in boxzone</i>	0.959	3.53	±	1.48	3.45 <sup>a</sup>	±	2.09	3.60 <sup>a</sup>	±	2.09
<i>Look at boxzone</i>	0.027	0.62	±	0.18	0.22 <sup>a</sup>	±	0.25	<b>1.03<sup>b</sup></b>	±	0.25
<i>Approach boxzone</i>	0.045	0.19	±	0.06	0.07 <sup>a</sup>	±	0.08	<b>0.30<sup>b</sup></b>	±	0.08
<i>Reference boxzone once</i>	0.074	0.13	±	0.05	0.03 <sup>a</sup>	±	0.07	0.22 <sup>a</sup>	±	0.07
<i>Stress signals</i>	0.437	19.04	±	1.85	17.06 <sup>a</sup>	±	2.61	20.49 <sup>a</sup>	±	2.61

Looking at the box zone occurred significantly more during the test trial. This indicates that when the dogs were given indicators by their owner that they had lost their coat they tried to point towards the location of the coat by visually staring in the right direction. Approaching the box zone was also significantly higher during the test thus the dogs also tried to indicate the location of the coat of the owner by physically moving towards the location.

To test whether the parenting style of the owners had a relationship with the information sharing behaviours of the dogs an ANOVA analysis (analysis of variance) was used. In this analysis 40 dogs were used with 4 parenting styles; authoritative (AUTV), authoritarian (AUTN), permissive (PERM) and uninvolved (UNIN). No significant difference was found for any of the parenting styles (Table 19 Appendix V). This indicates that the parenting style does not influence the information sharing behaviour displayed during the Altruism test.

## 4. Discussion

Dog-directed parenting styles may associate with the owner-dog bond, including a dog's attachment and altruistic information sharing behaviour towards its owner. I investigated this as knowledge on the various aspects of the owner-dog relationship may lead to tips for improving it (Meyer and Forkman, 2014) and could raise dog ownership satisfaction. Dog-directed parenting styles were related to dog to owner attachment and permissive parenting may facilitate over-attachment and strong proximity seeking behaviour. Parenting styles were not related to the likelihood of dogs helping their owners find a missing coat by signalling the hiding place.

The dog-directed parenting styles were derived from the child-directed parenting styles based on a two-dimensional scale of demandingness and responsiveness, categorizing parents as being authoritative, authoritarian, permissive and uninvolved (Baumrind, 1971; Maccoby and Martin, 1983; German, 2015). It was suggested that these child-directed parenting styles were also applicable to the dog-owner relationship (German, 2015). In a recent survey among over five hundred Dutch dog owners, three main dog-directed parenting styles could be derived from questions about parent-child parenting styles, providing evidence for dog-directed parenting styles (Herwijnen van et al., 2018). To link dog-directed parenting styles to the bidirectional bond between owner and dog, we measured the attachment of the dog to the owner via the Ainsworth Strange Situation Test (ASST). In children, it measures the attachment of a child towards its caretaker during different ASST episodes where the caretaker leaves the child either alone or with a stranger (Ainsworth et al., 1978). The ASST test has been adapted for measuring attachment from dog to owner similarly as from child to parent, and observations on 51 dog-owner pairs in a modified version of the Ainsworth Strange Situation Test supported that the attachment related behaviours in dogs were comparable to that of an infant (Topál et al., 1998). Dog behaviour during ASST represented variation in dimensions of anxiety, acceptance and attachment (Topál et al., 1998). The usefulness of the ASST for measuring the basic elements of attachment in dogs, i.e. proximity seeking and secure base effects (Topál et al., 1998; Palmer & Custance, 2008; Rehn et al., 2014), is supported by the present findings. Staring at the door, whining, barking, soliciting attention and pulling leash, were likely proximity seeking behaviour. Sniffing the environment assumingly represented exploratory behaviour indicative of secure base. The latter occurred significantly more when the owner was present and has been interpreted previously as an indicating for owners functioning as a secure base for the dog (Palmer and Custance, 2008; Prato-Previde et al., 2003). Inactivity seems the opposite of exploratory behaviour and dogs that moved little may have received little secure base from their owner (Palmer and Custance, 2008; Prato-Previde et al., 2003). In line with this, sitting and lying occurred significantly more when the owner was not present and moving occurred significantly more when the owner was present. Play is another indicator of secure base (Topál et al., 1998; Palmer & Custance, 2008; Rehn et al., 2014) and is assumed to occur when the dog feels secure enough when in the presence of the owner. However, this behaviour was not found significantly different across ASST episodes in this research.

Proximity seeking showed in several behaviours. Whining occurred typically when the owner was not present and has been identified earlier as an indicator of the attachment bond between owner and dog (Prato-Previde et al., 2003). It is a distress vocalisation, as stated by Hetts et al. (1992), and reflects separation stress. Following their owners' leave, stay and return, dogs with a separation related disorder ( $n = 25$ ) whined sooner and more of them displayed whining behaviour compared to

dogs without a separation related disorder ( $n = 20$ , Pongrácz et al., 2017). Measuring such separation stress has its risks due to the fact that not all dogs respond similarly in stressful situations (Beerda et al., 1998). Stress parameters can help to detect welfare problems in dogs (Beerda et al., 2000), but the way stress expresses differs per dog and is dependent on a dog's individual characteristics. To correct for this additional physiological indicators could be measured such as heart rate. Soliciting attention occurred especially towards the owner, rather than to the stranger, and is regarded as proximity seeking (Prato-Previde et al., 2003). Overall, these findings indicate clear attachment bonds between dogs and their owners, consistent with earlier findings (Topál et al., 1998; Prato-Previde et al., 2003).

Parents raise their children following styles that display variation in responsiveness and demandingness and such styles seem to exist also in the owner to dog relationship (van Herwijnen et al., 2018). Here, dog-directed parenting styles were measured by means of an online questionnaire based on Parenting Styles and Dimensions Questionnaire (PSDQ; Robinson et al., 1995). The PSDQ produces scores for the four parenting styles authoritative (high in both demandingness and responsiveness), authoritarian (high in demandingness and low in responsiveness), permissive (low in demandingness and high in responsiveness) and uninvolved (low in both demandingness and responsiveness). In our data set of 2,201 survey records, a principal components analysis on 2,201 owner reports showed how permissive and uninvolved parenting styles, both representing low demandingness, related directly with owners being anxious and avoidant, and with dogs showing separation anxiety. This indicates that owners who demand little from their dogs do not give their dogs a secure feeling, which could facilitate separation anxiety in the dog. In an ASST validation study with 38 dog-owner pairs, Palmer and Custance (2008) discussed how separation anxiety may ensue from suboptimal attachment and it appears that low demandingness results in less than ideal dog-directed parenting. Though, it may be questioned if the found associations based on owner reports are a valid reflection of reality. It was debated by Rehn (2013) that online questionnaires were filled in from the perspective of the dog owner, which could lead to biased results. For example, of the present participants, 86% were female, 14% was male, and such skewedness was similar in the study by Kubinyi et al. (2009) where 14,004 dog owners were analysed and 80% was female and 20% was male. Other studies with dog owners found that of the 804 participants 74% was female (Reisner and Shofer 2008), or even 90% of 731 anonymous volunteers (Duranton et al. 2018). Prato-Previde et al. (2006) pointed out that women may have stronger and more developed attachment behaviours than men and are more involved in their relationship with their dog. This could then lead to a different parenting style dynamic among females compared to men. The authoritative parenting style score was on average 75% in our study population, in comparison to an authoritarian style score of 25%, a permissive style score of 27% and an uninvolved parenting style score of 26%. This skewedness towards authoritative parenting most likely reflects that owners who are less likely to invest time in their dogs are also less likely to participate in this test. As a result, not all parenting styles will have been represented in the study as they are among the Dutch speaking population.

Authoritative parenting, which was the preferred style of parenting amongst our study subjects, facilitates appropriate raising. Lamborn et al. (1991) classified 4,100 families into four parenting style groups and concluded that an authoritative parenting style led to adolescents who were mentally stable. Authoritarian parenting led to obedient and conforming adolescents but they had lower self-esteem, indulgent (permissive) parenting led to high self-esteem but more substance

abuse and neglectful (uninvolved) parenting led to mentally unstable adolescents (Chan and Koo, 2010). Baumrind et al. (2010) found that authoritative parents led to the most competent children, meaning social and academic achievements. The effectiveness of the authoritative parenting style is thought to be in the confronting discipline and mature demands from the parents towards their child. Thus, literature on humans describes how an authoritative parenting style leads to less problem behaviours, indicating these children experience better welfare. We expect that an authoritative parenting style leads to better welfare in dogs as well.

The behaviours the dogs displayed during the ASST were checked for associations with the dog-directed parenting styles of the owners. Proximity seeking is one of the four main characteristics of an attachment bond (Payne et al., 2016), together with separation-related distress safe-haven and secure base, and it expresses in vocalizations. Dogs may vocalise to re-establish contact and during the ASST vocalization may indicate separation distress (Hetts et al. 1992), and / or protest (Prato-Previde et al. 2003). Assumingly, dogs especially want to re-establish contact when being insecure about their bond with the owner. Secure attachment implies being confident that the owner will return. A permissive parenting style in the owner related directly to proximity seeking behaviour in the dogs, in terms of vocalizing and pulling on the leash when the owner was present. Such behaviours support the presence of an attachment bond, but possibly not a secure one, because of the significant distress at the time when the owner was gone. Excessive vocalising is considered to be an indication of separation-related disorder in dogs (Pongrácz et al., 2017). Whining, for example, may indicate that the dog seeks to be close to the owner while being separated (Prato-Previde et al., 2003; Mariti et al., 2014) and barking and whining after being left by the owners may indicate separation anxiety (Palmer and Custance, 2008). Separation anxiety in dogs is more likely if owners display attachment avoidance, as was found by surveying 1,508 dog-owners (Konok et al., 2015). Attachment avoidance indicates how a person distrusts others and keeps an emotional distance and independence, as claimed by Kurdek (2008). The found permissive parenting style in relation to an over-attachment, is in alignment with what was found from the questionnaire, which indicated that a permissive parenting style associates with dogs displaying signs of separation anxiety. Uninvolved parenting related directly to tongue flicking during ASST. Tongue flicking behaviour is a stress indicator according to Beerda et al. (1998) and this could mean that a high uninvolved parenting style leads to stress.

This study supports that dog-directed parenting styles influence the bond between owner and dog. Dogs with owners with a permissive parenting style displayed significant amounts of vocalising behaviour and leash pulling, meaning proximity seeking behaviour. This indicates that the dog to owner attachment bond is not a secure bond and that the dogs are distressed when the owner is gone. This observation was in alignment with findings from the questionnaire, which related a permissive parenting style to dogs displaying behaviours of separation anxiety. Unwanted behaviour can thus occur from a non-appropriate parenting style, which in extreme could lead to dogs being relinquished to the shelter. With our research we try to establish which parenting style is best suited for dogs as to improve their welfare. One relevant aspect of the dog owner bond could be a dog's willingness to help its owner, which we labelled as altruism. Altruism was measured as the dogs' informing behaviour concerning the hiding place of the owner's coat, which had been placed in one of three boxes before the eyes of the dog. During the test trials the dog received a verbal and visible cue from their owner that they were looking for their missing coat and in control trials they did not. The results of the

altruism test on forty dogs were analysed with linear mixed models on the effect of owners asking for help and the outcomes support information sharing altruism in dogs. Effects of owners asking for help were in the expected direction (i.e. the box containing the coat) and significant for looking at the target box zone ( $p = 0.027$ ) and approaching the target box zone ( $p = 0.045$ ) were both significant. So, when dogs were verbally and visually shown that their owner looked for his/her coat, they were more likely to signal the location of the coat. This willingness to help is in line with earlier findings. It was researched whether children ( $n = 11$ ) and dogs ( $n = 11$ ) indicated the whereabouts of a hidden object to another (Virányi et al., 2006). They found that both children and dogs signalled the location of the hidden object more when the person searching for the object had not been in the room when the object was being hid compared to when the person was in the room.

Our altruism test contains aspects that may need addressing. Some of the dogs appeared to display signalling behaviour immediately after the owner reappeared from behind the screen. This was not included in the observations and thus we will have missed spontaneous and immediate altruistic behaviour. Though it could be argued that if the dog does not receive a help request from its owner, they are just showing an interest because the stranger just touched the box. Altruism, according to the encyclopedia of applied animal behaviour and welfare (Mills et al., 2010), refers to giving benefits to another individual at the cost of the benefactor. Immediate spontaneous information sharing behaviour could make the test more accurate by including this early unelicited behaviour. Dugatkin (2004) pointed out that animal personalities can have practical implications for outcomes on behaviour tests and human-animal interaction. Personality differences will in part mirror breed effects. Some dog breeds behave different in certain situations than others according to Mahut (1958), and during early socialization breed differences were found in the changes of the emotional reaction of developing dogs in response to humans (Scott et al. 2012). Genetic predispositions and life time experiences will interact to cause variation in behaviour of subjects in animal behaviour test, which affects statistical power and demands larger sample sizes.

Trivers (1971) first developed the model of reciprocal altruism, which explains altruistic behaviour in unrelated species (Szekély et al., 2010). It is argued that when an individual helps another individual that they encounter often, they are likely to receive the favour in return. It could be that the altruistic behaviour observed during this research are the result of the dog trying to help the human in the hope of getting a treat. They may have displayed information sharing behaviour because they previously learned this resulted in a treat. The signalling behaviour would then not be altruistic behaviour, but rather a reaction to commands like sit or lay down. The dependency of dogs on their owners, may actually rule out true altruistic behaviour. Against this are the findings on strong emotional bonds between dog and owner. Similar as between mothers and babies, mutual gazing between owners and their dogs associated with oxytocin levels, which is considered an indicator of emotional bonding (Nagasawa et al., 2009). The gaze of an owner increases the dog's same behaviour towards their owner, in a study with fifty-five dog-owners duos (Nagasawa et al., 2009). This could actually mean that the owners eye contact influenced the amount of altruistic behaviour the dog displayed during the newly developed altruism test. Associations between informing behaviour in the dogs and dog-directed parenting style scores were never significant. Apparently, a dog's willingness to help out its owner, by signalling the location of a missing object, is independent of the style by which they are parented.

Our study dogs displayed information sharing behaviour towards their owner by looking at the place of a lost object and by approaching the target area. There is little scientific knowledge on altruistic behaviour in dogs and altruism tests should be checked for validity and reliability (Mills et al., 2010). Altruism in dogs is of relevance, for example because Aknin et al. (2013) found that altruistic behaviour in humans lead to an increase in welfare due to the rewarding experience of helping others, as deduced from large scale surveys conducted in 136 different countries. This could mean that altruistic dogs also experience an increase in wellbeing.



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## References

- Ainsworth, M. D. S., & Bell, S. M. (1970). Attachment, exploration, and separation: Illustrated by the behavior of one-year-olds in a strange situation. *Child development*, 49-67.
- Aknin, L. B., Barrington-Leigh, C. P., Dunn, E. W., Helliwell, J. F., Burns, J., Biswas-Diener, R., ... & Norton, M. I. (2013). Prosocial spending and well-being: Cross-cultural evidence for a psychological universal. *Journal of Personality and Social Psychology*, 104(4), 635.
- Bálint, A., Faragó, T., Meike, Z., Lenkei, R., Miklósi, Á., & Pongrácz, P. (2015). "Do not choose as I do!"—Dogs avoid the food that is indicated by another dog's gaze in a two-object choice task. *Applied Animal Behaviour Science*, 170, 44-53.
- Baumrind, D. (1971). Current patterns of parental authority. *Developmental psychology*, 4(1p2), 1.
- Baumrind, D. (1991). The influence of parenting style on adolescent competence and substance use. *The Journal of Early Adolescence*, 11(1), 56-95.
- Baumrind, D., Larzelere, R. E., & Owens, E. B. (2010). Effects of preschool parents' power assertive patterns and practices on adolescent development. *Parenting: Science and Practice*, 10(3), 157-201.
- Beerda, B., Schilder, M. B., van Hooff, J. A., & de Vries, H. W. (1997). Manifestations of chronic and acute stress in dogs. *Applied Animal Behaviour Science*, 52(3-4), 307-319.
- Beerda, B., Schilder, M. B., van Hooff, J. A., de Vries, H. W., & Mol, J. A. (1998). Behavioural, saliva cortisol and heart rate responses to different types of stimuli in dogs. *Applied Animal Behaviour Science*, 58(3), 365-381.
- Beerda, B., Schilder, M. B., Van Hooff, J. A., De Vries, H. W., & Mol, J. A. (2000). Behavioural and hormonal indicators of enduring environmental stress in dogs. *ANIMAL WELFARE-POTTERS BAR-*, 9(1), 49-62.
- Berryman, J. C., Howells, K., & Lloyd-Evans, M. (1985). Pet owner attitudes to pets and people: A psychological study. *The Veterinary Record*, 117(25-26), 659-661.
- Bould, H.E., Joinson, C., Sterne, J.A.C., Araya, R. (2013) The Emotionality Activity Sociability Temperament Survey: Factor analysis and temporal stability in a longitudinal cohort. *Personality and Individual Differences* 54: 628-633.
- Chan, T. W., & Koo, A. (2010). Parenting style and youth outcomes in the UK. *European sociological review*, 27(3), 385-399.

- Charles, N., & Davies, C. A. (2008). My family and other animals: pets as kin. *Sociological Research Online*, 13(5), 1-14.
- Davies, N. B., Krebs, J. R., & Parr, J. (2017). *An introduction to behavioural ecology*. Wiley-Blackwell. pp 307.
- Dessens, D. (2014). *The influence of personality traits on the training success of service dogs*. Wageningen University.
- Doinita, N. E., & Maria, N. D. (2015). Attachment and parenting styles. *Procedia-Social and Behavioral Sciences*, 203, 199-204.
- Dugatkin, L. A. (2004). *Principles of Animal Behavior*. WW Norton & Company. P595.
- Duranton, C., Bedossa, T., & Gaunet, F. (2018). The perception of dogs' behavioural synchronization with their owners depends partially on expertise in behaviour. *Applied Animal Behaviour Science*, 199, 24-28.
- Dwyer, F., Bennett, P. C., & Coleman, G. J. (2006). Development of the Monash dog owner relationship scale (MDORS). *Anthrozoös*, 19(3), 243-256.
- Fallani, G., Previde, E. P., & Valsecchi, P. (2007). Behavioral and physiological responses of guide dogs to a situation of emotional distress. *Physiology & behavior*, 90(4), 648-655.
- Fallani, G., Previde, E. P., & Valsecchi, P. (2006). Do disrupted early attachments affect the relationship between guide dogs and blind owners?. *Applied Animal Behaviour Science*, 100(3), 241-257.
- Friedmann, E., & Son, H. (2009). The human–companion animal bond: how humans benefit. *Veterinary Clinics of North America: Small Animal Practice*, 39(2), 293-326.
- Frontini, R., Moreira, H., & Canavarro, M. C. (2016). Parenting stress and quality of life in pediatric obesity: The mediating role of parenting styles. *Journal of Child and Family Studies*, 25(3), 1011-1023.
- Gácsi, M., Gyoöri, B., Virányi, Z., Kubinyi, E., Range, F., Belényi, B., & Miklósi, Á. (2009). Explaining dog wolf differences in utilizing human pointing gestures: selection for synergistic shifts in the development of some social skills. *PLoS One*, 4(8), e6584.
- Gácsi, M., Maros, K., Sernkvist, S., Farago, T., & Miklosi, A. (2013). Human analogue safe haven effect of the owner: behavioural and heart rate response to stressful social stimuli in dogs. *PLoS One*, 8(3), e58475.

- Gácsi, M., Philip, J., & Miklósi, Á. (2009). Which way does domestication work: creating new traits or modifying timing?. *Journal of Veterinary Behavior: Clinical Applications and Research*, 4(2), 58.
- German, A. J. (2015). Style over substance: what can parenting styles tell us about ownership styles and obesity in companion animals?. *British Journal of Nutrition*, 113(S1), S72-S77.
- Gosling, S. D., Rentfrow, P. J., & Swann, W. B., Jr. (2003). A Very Brief Measure of the Big Five Personality Domains. *Journal of Research in Personality*, 37, 504-528
- Hare, B., & Tomasello, M. (2005). Human-like social skills in dogs?. *Trends in cognitive sciences*, 9(9), 439-444.
- Hegedüs, D., Bálint, A., Miklósi, Á., & Pongrácz, P. (2013). Owners fail to influence the choices of dogs in a two-choice, visual pointing task. *Behaviour*, 150(3-4), 427-443.
- Hetts, S., Clark, J. D., Calpin, J. P., Arnold, C. E., & Mateo, J. M. (1992). Influence of housing conditions on beagle behaviour. *Applied Animal Behaviour Science*, 34(1-2), 137-155.
- Hsu, Y., & Serpell, J. A. (2003). Development and validation of a questionnaire for measuring behavior and temperament traits in pet dogs. *Journal of the American Veterinary Medical Association*, 223(9), 1293-1300.
- Jolliffe. (1986). *Principal component Analysis*. Springer-Verlag, New York, NY.
- Kis, A., Turcsán, B., Miklósi, Á., & Gácsi, M. (2012). The effect of the owner's personality on the behaviour of owner-dog dyads. *Interaction Studies*, 13(3), 373-385.
- Knowles, P. A., Conner, R. L., & Panksepp, J. (1989). Opiate effects on social behavior of juvenile dogs as a function of social deprivation. *Pharmacology Biochemistry and Behavior*, 33(3), 533-537.
- 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(2), e0118375.
- Kubinyi, E., Turcsán, B., & Miklósi, Á. (2009). Dog and owner demographic characteristics and dog personality trait associations. *Behavioural Processes*, 81(3), 392-401.
- Kurdek, L. A. (2008). Pet dogs as attachment figures. *Journal of Social and Personal Relationships*, 25(2), 247-266.
- Lakatos, G., Gácsi, M., Topál, J., & Miklósi, Á. (2012). Comprehension and utilisation of pointing gestures and gazing in dog-human communication in relatively complex situations. *Animal cognition*, 15(2), 201-213.

- Lamborn, S. D., Mounts, N. S., Steinberg, L., & Dornbusch, S. M. (1991). Patterns of competence and adjustment among adolescents from authoritative, authoritarian, indulgent, and neglectful families. *Child development*, 62(5), 1049-1065.
- Ley, J.M., Bennett, P.C., Coleman, G.J. (2009) A refinement and validation of the Monash Canine Personality Questionnaire (MCPQ). *Applied Animal Behaviour Science* 116(2-4): 220-227.
- Linder, D. E., Sacheck, J. M., Noubary, F., Nelson, M. E., & Freeman, L. M. (2017). Dog attachment and perceived social support in overweight/obese and healthy weight children. *Preventive Medicine Reports*, 6, 352-354.
- Maccoby, E.E., Martin, J.A. (1983). Socialization in the context of the family: Parent-child interaction. In Mussen, P.H.; Hetherington, E.M. *Manual of child psychology*, Vol. 4: Social development. New York: John Wiley and Sons. pp. 1–101
- Mahut, H. (1958). Breed differences in the dog's emotional behaviour. *Canadian Journal of Psychology/Revue canadienne de psychologie*, 12(1), 35.
- Marinelli, L., Adamelli, S., Normando, S., & Bono, G. (2007). Quality of life of the pet dog: Influence of owner and dog's characteristics. *Applied Animal Behaviour Science*, 108(1), 143-156.
- Mariti, C., Carlone, B., Ricci, E., Sighieri, C., & Gazzano, A. (2014). Intraspecific attachment in adult domestic dogs (*Canis familiaris*): Preliminary results. *Applied animal behaviour science*, 152, 64-72.
- Mariti, C., Ricci, E., Zilocchi, M., Gazzano, A. (2013). Owners as a secure base for their dogs. *Behaviour* 150:1275-1294.
- Meyer, I., & Forkman, B. (2014). Dog and owner characteristics affecting the dog-owner relationship. *Journal of Veterinary Behavior: Clinical Applications and Research*, 9(4), 143-150.
- Mills, D. S., & Marchant-Forde, J. N. (Eds.). (2010). *The encyclopedia of applied animal behaviour and welfare*. CABI. P13.
- Miklósi, Á., Pongrácz, P., Lakatos, G., Topál, J., & Csányi, V. (2005). A comparative study of the use of visual communicative signals in interactions between dogs (*Canis familiaris*) and humans and cats (*Felis catus*) and humans. *Journal of comparative Psychology*, 119(2), 179.
- Mikulincer, M., & Shaver, P. R. (2005). Attachment security, compassion, and altruism. *Current directions in psychological science*, 14(1), 34-38.

- Mikulincer, M., Shaver, P. R., Gillath, O., & Nitzberg, R. A. (2005). Attachment, caregiving, and altruism: boosting attachment security increases compassion and helping. *Journal of personality and social psychology*, 89(5), 817.
- Nagasawa, M., Kikusui, T., Onaka, T., & Ohta, M. (2009). Dog's gaze at its owner increases owner's urinary oxytocin during social interaction. *Hormones and Behavior*, 55(3), 434-441.
- O'Farrell, V. (1997). Owner attitudes and dog behaviour problems. *Applied Animal Behaviour Science*, 52(3-4), 205-213.
- Ohkita, M., Nagasawa, M., Kazutaka, M., & Kikusui, T. (2016). Owners' direct gazes increase dogs' attention-getting behaviors. *Behavioural processes*, 125, 96-100.
- Palestrini, C., Previde, E. P., Spiezio, C., & Verga, M. (2005). Heart rate and behavioural responses of dogs in the Ainsworth's Strange Situation: a pilot study. *Applied Animal Behaviour Science*, 94(1), 75-88.
- Palmer, R., & Custance, D. (2008). A counterbalanced version of Ainsworth's Strange Situation Procedure reveals secure-base effects in dog-human relationships. *Applied animal behaviour science*, 109(2), 306-319.
- Payne, E., DeAraugo, J., Bennett, P., & McGreevy, P. (2016). Exploring the existence and potential underpinnings of dog-human and horse-human attachment bonds. *Behavioural processes*, 125, 114-121.
- Pinquart, M. (2016). Associations of parenting styles and dimensions with academic achievement in children and adolescents: A meta-analysis. *Educational Psychology Review*, 28(3), 475-493.
- Pongrácz, P., Lenkei, R., Marx, A., & Faragó, T. (2017). Should I whine or should I bark? Qualitative and quantitative differences between the vocalizations of dogs with and without separation-related symptoms. *Applied Animal Behaviour Science*, 196, 61-68.
- Prato-Previde, E., Custance, D. M., Spiezio, C., & Sabatini, F. (2003). Is the dog-human relationship an attachment bond? An observational study using Ainsworth's strange situation. *Behaviour*, 140(2), 225-254.
- Prato-Previde, E., Fallani, G., & Valsecchi, P. (2006). Gender differences in owners interacting with pet dogs: an observational study. *Ethology*, 112(1), 64-73.
- Quervel-Chaumette, M., Dale, R., Marshall-Pescini, S., & Range, F. (2015). Familiarity affects other-regarding preferences in pet dogs. *Scientific reports*, 5, srep18102.

- Rehn, T. (2013). *Best of friends? Investigating the dog-human relationship* (Vol. 2013, No. 67). p 16.
- Reisner, I. R., & Shofer, F. S. (2008). Effects of gender and parental status on knowledge and attitudes of dog owners regarding dog aggression toward children. *Journal of the American Veterinary Medical Association*, 233(9), 1412-1419.
- Robinson, C. C., Mandleco, B., Olsen, S. F., & Hart, C. H. (1995). Authoritative, authoritarian, and permissive parenting practices: Development of a new measure. *Psychological reports*, 77(3), 819-830.
- Royal Canin, Body Condition Score Charts. Retrieved from: <http://www.royalcaninhealthyweight.co.uk/pet-obesity> at 26 Oktober 2017
- Sable, P. (2016). The Pet Connection: An Attachment Perspective. *Attachment*, 10(3), 199-210.
- Scarlett, J. M., Salman, M. D., New, Jr, J. G., & Kass, P. H. (1999). Reasons for relinquishment of companion animals in US animal shelters: selected health and personal issues. *Journal of Applied Animal Welfare Science*, 2(1), 41-57.
- Schijndel, A. v. (2012). Protocol behavioural test. Predicting the quality of dog-owner relationships of service dogs by using the attachment bond and personality traits of humans and dogs. Wageningen University.
- Scott, J. P., & Fuller, J. L. (2012). *Genetics and the Social Behavior of the Dog*. University of Chicago Press.
- Siniscalchi, M., Stipo, C., & Quaranta, A. (2013). "Like Owner, Like Dog": Correlation between the Owner's Attachment Profile and the Owner-Dog Bond. *PloS one*, 8(10), e78455.
- Soproni, K., Miklósi, Á., Topál, J., & Csányi, V. (2002). Dogs'(Canis familiaris) responsiveness to human pointing gestures. *Journal of comparative psychology*, 116(1), 27.
- Spera, C. (2005). A review of the relationship among parenting practices, parenting styles, and adolescent school achievement. *Educational psychology review*, 17(2), 125-146.
- Spielberger, C. D., Gorsuch, R. L., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.
- Stephens, M. B., Wilson, C. C., Goodie, J. L., Netting, F. E., Olsen, C. H., & Byers, C. G. (2012). Health perceptions and levels of attachment: owners and pets exercising together. *The Journal of the American Board of Family Medicine*, 25(6), 923-926.

- Székely, T., Moore, A. J., & Komdeur, J. (Eds.). (2010). *Social behaviour: genes, ecology and evolution*. Cambridge University Press. P363.
- Thayer, J.F., Åhs, F., Fredrikson, M., Sollers, J.J., Wager, D. (2012) A meta-analysis of heart rate variability and neuroimaging studies: Implications for heart rate variability as a marker of stress and health. *Neuroscience & Biobehavioral Reviews* 36(2): 747-756
- Téglás, E., Gergely, A., Kupán, K., Miklósi, Á., & Topál, J. (2012). Dogs' gaze following is tuned to human communicative signals. *Current Biology*, 22(3), 209-212.
- Topál, J., Gácsi, M., Miklósi, Á., Virányi, Z., Kubinyi, E., & Csányi, V. (2005). Attachment to humans: a comparative study on hand-reared wolves and differently socialized dog puppies. *Animal behaviour*, 70(6), 1367-1375.
- Topál, J., Miklósi, Á., & Csányi, V. (1997). Dog-human relationship affects problem solving behavior in the dog. *Anthrozoös*, 10(4), 214-224.
- Topál, J., Miklósi, Á., Csányi, V., & Dóka, A. (1998). Attachment behavior in dogs (*Canis familiaris*): a new application of Ainsworth's (1969) Strange Situation Test. *Journal of comparative psychology*, 112(3), 219.
- Trivers, R. L. (1971). The evolution of reciprocal altruism. *The Quarterly review of biology*, 46(1), 35-57.
- van Herwijnen, I. R., van der Borg, J. A., Naguib, M., & Beerda, B. (2018). The existence of parenting styles in the owner-dog relationship. *PloS one*, 13(2), e0193471.
- Van Reenen, C., Engel, B., Ruis-Heutinck, L., Van der Werf, J., Buist, W., Jones, R., & Blokhuis, H. (2004). Behavioural reactivity of heifer calves in potentially alarming test situations: a multivariate and correlational analysis. *Applied Animal Behaviour Science*, 85(1), 11-30.
- Virányi, Z., Topál, J., Miklósi, Á., & Csányi, V. (2006). A nonverbal test of knowledge attribution: a comparative study on dogs and children. *Animal cognition*, 9(1), 13-26.
- Warneken, F., & Tomasello, M. (2009). Varieties of altruism in children and chimpanzees. *Trends in cognitive sciences*, 13(9), 397-402.
- White, J. M., McBride, A. E., Redhead, E. (2010). Relationship between dog owner behavior and dog attachment security in the strange situation. *Journal of Veterinary Behavior: Clinical Applications and Research*, 5(1), p47.
- White, N., Mills, D., & Hall, S. (2017). Attachment style is related to quality of life for assistance dog owners. *International journal of environmental research and public health*, 14(6), 658.



- Zilcha-Mano, S., Mikulincer, M., & Shaver, P. R. (2011). An attachment perspective on human–pet relationships: Conceptualization and assessment of pet attachment orientations. *Journal of Research in Personality*, 45(4), 345-357.

## Appendix I

### Protocol behavioural test:

### **Predicting the quality of dog-owner relationships through studying the dog to owner attachment bond and owner directed altruistic informing behaviour in dogs.**

By Lonneke Jager, Iris Smit and Odette van Woensel

Study: Bachelor Animal Science - WUR (Lonneke), Bachelor Applied Biology – HAS (Iris), Master Animal Science – WUR (Odette)

Department: BHE, Behavioural Ecology

University: WUR, Wageningen University and Research Center

### **Introduction and study information**

This protocol is used for performing behavioural tests on dogs and their owners. Information is gathered on parenting styles, attachment and altruism.

A total of 4 behavioural tests were done: Ainsworth Strange Situation Test (ASST); Intrinsic Input Test; Altruism (info-sharing) test; Parenting Style validation Test.

The behaviour tests are part of the major thesis of Bachelor and Master Animal Science students and from the Bachelor Applied Biology.

The subjects were participants in a survey with a sample size of 2201 dog owners. This survey ran on [dierenwetenschap.com](http://dierenwetenschap.com) from mid-August 2017 till the start of December 2017. Study subjects were selected by making a selection from the survey participants, based on their calculated parenting style. Participants of each parenting style were selected by supervisors to prevent biased testing. This was done to make sure the data is evenly distributed across the parenting style spectrum. The survey was filled in by Dutch and Belgian dog owners, owning at least one dog, which they owned from the dog's age of 16 weeks or younger and cared for at least 50% of the time. They were recruited via Dutch regional newspapers, social media as Facebook and the website of Wageningen University on which a news item was published.

The behavioural tests deployed were determined to not fall in the category of animal experiments by the Animal Care and Use Committee of Wageningen University August 2017. The study does not involve treatments or interventions in the life of participants or their dogs, and the online survey's introduction explained the purpose of the research and thus there was no reason for further approval by an ethics committee.

Owners are informed in correspondence on the tests as well as before commencing test procedures that they can stop the behavioural tests at any time. They are able to monitor or be with their dog before, during and after all tests.

### **Description of the behavioural tests**

This protocol consists of four behavioural tests. The first one is a strange situation test where the attachment of the dog towards the owner will be measured. After that there will be a break in which the owner-dog interaction (intrinsic input test) will be observed. Followed is an altruism test, where the information sharing behaviour of the dog towards its owner is observed. The parenting style validation test is last. This test will show if the parenting style, scored via the results given by the owner in the survey, is correct. After all the tests, the weight and height of the dog will be measured to score the body condition.

### **Protocol**

At home: *Dog owner:*

Fill in questionnaire (96 questions) containing PSDQ, MDORS, CBarq, Experiences in Close Relationships questionnaire (short) and availability for testing, via internet.

At Wageningen Carus facility

Experimenters are present at the test facility 30 minutes before the first test session starts. Experimenters prepare the room for the first test (ASST), check and test testing material and leashes, refresh the water in the bowls, water cooker and coffee machine, clean the tables, put a new bag in the garbage bin, turn on the computers, cameras and recorder, check availability of data space for recordings, prepare observer programme on computer with the correct owner ID and date, fill in the first part of excel sheet about visits of that day.

Owner and dog arrive at the parking lot of the Carus facility.

*Test leader*

Greets the owner and ask if dog is okay with giving a handshake, if so greets with a handshake, introduces herself, says something nice about the dog, but does not touch the dog and stays at leash distance from it (approximately 1 meter or further, except during handshake of owner). Brings the owner and dog into the small waiting room (room #3) and offers coffee/tea. Owner is explained that he/she can drink coffee and let dog explore the waiting room and corridor off leash if owner indicates this is safe. Both test rooms are closed. Owner is asked by the test leader how journey was (as comforting small talk) and next explained what visit will look like and then explanation text is given (see below).

As explained in the email sent to the owner, for research purposes, we will be filming the test room with four cameras. This is because the observers cannot see everything live. During the first test we will look at how the dog reacts to a new, unknown person being with him/her with you in the room or not in the room. The owner is asked to sign the consent form which states that the owner is aware of this and agrees to the use of the filmed material for research and educational purposes. The person who will be the stranger is not allowed to see either the dog or the owner before the start of the Strange Situation Test. He/she is in the observation room during entry and coffee time of the test person and dog.

### **Zephyr heart rate monitor**

After 2 minutes of exploration, the owner calls the dog and puts it on leash. Owner is asked to attach the Zephyr straps to the dog after the Zephyr device is clicked into the strap by test leader, and sufficient transmission gel is applied to the electrodes in the strap. Next, the owner holds the collar of the dog to control the dog's head and the test leader checks if the Zephyr is attached correctly, if a signal is received on the computer, and adjusts the strap if necessary. The dog is allowed to walk around off leash for 5 minutes, and is then observed for 1 minute to count the number of actions, or actions longer than 5 seconds, considered responses to the strap. Response actions are scratching at, biting at, shaking, scraping against objects/wall, increasing locomotion and increased stress signals. More than one of such response means the strap will be removed.

*Explanation text for the owner at start of test sessions:*

You can leave your belongings in the waiting room, as they might interfere with the test. Right now we are going to do a Strange Situation Test. In a moment you will enter the room through door #1. When the door is closed, you can remove the leash and let the dog explore the room. You will only give attention or praise/comfort to your dog if the dog asks for it. Further instructions will be given to you via microphone, it will all be explained inside in a short moment.

Important to know is that, as owner you are allowed to intervene at any given point during the test. If you feel uncomfortable or you feel the test is not good for your dog you may ask the test to be stopped and if relevant, go into the room where your dog is.

Also, you can always see your dog during the test, even in the observation room. In the observation room it is important that you remain very quiet because your dog will be able to hear you. Furthermore, as a side note, there might be sounds from cats or a radio from the cat room. Test leader asks if owner has any questions, has understood everything and repeats that “for now it is important to remember that once the door is closed, you and your dog can explore the room freely, and only give your dog attention when he/she asks for it”. Here the protocol from the first test starts (see below).

### **Strange Situation Test**

The test leader introduces the owner and dog (on leash) to the test room and instructs the owner as explained above. The test-leader turns on the camera and the stopwatch as soon as the owner and the dog enter the test room.

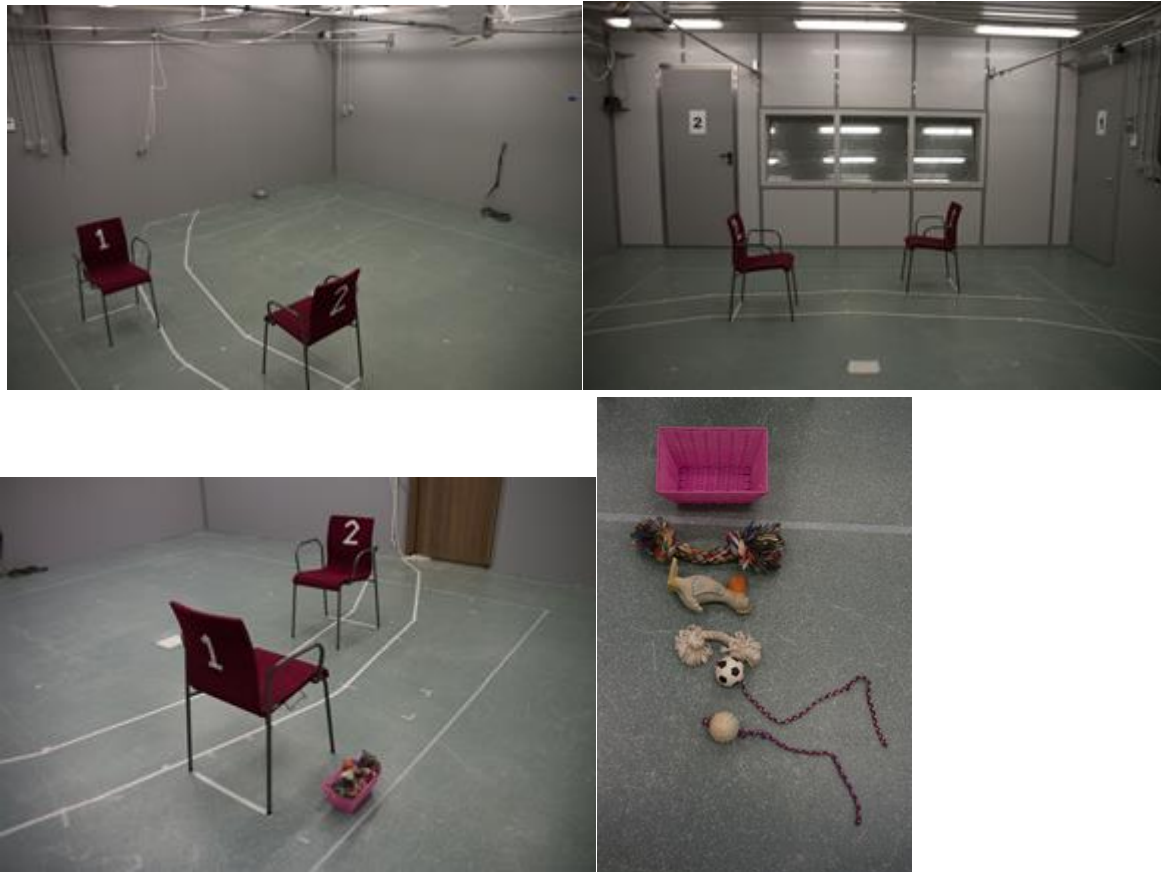


Figure 1. Experimental setup SST (Jager, Smit and Van Woensel 2017); two numbered chairs, and a water bowl are present and the dog is fixed to the wall with a long leash. The dog can reach its owner but can't reach the stranger.

Materials that are being used:

- Long leash attached to the wall (4m25)
- Two numbered chairs
- Basket with toys (2 tug-of-wars, 2 balls on a rope and a squeaky duck)
- Cameras (4)

- Microphone
- Speakers
- Observer XT 10.5
- Ethogram

#### Episode 0:

00:00 - 02:00 The test leader walks the owner to the testing area. After the test leader has left, the dog and owner are instructed via the microphone (“U mag de hond aflijnen en samen met uw hond de ruimte onderzoeken. U mag met de hond praten en naar hem kijken, maar alleen aanraken als hij bij u komt en u eerst aanraakt met bijvoorbeeld zijn neus of flank”) and allowed to explore the room off-leash for 2 minutes. At the end of these 2 minutes, the test leader instructs the owner via the microphone to attach the dog to the long leash and to sit down on chair number 2. (“Nu mag u de hond aan de lange groene lijn aan de muur bevestigen en gaan zitten op stoel nummer 2”)

#### Episode: 1 owner and dog.

02:00 - 03:00 The owner is a nonparticipant sitting on its chair (#2) while the dog explores. The owner only interacts with the dog (i.e. by petting or talking to it) if it specially asks for attention. The dog is free to explore the room. After 1 minute the stranger will come in the room and sit on the other chair.

#### Episode 2: stranger, owner, and dog.

03:00 - 03:30 The stranger enters (through door #2) and sits down on the other chair (#1). The stranger has brought 2 toys with her (ball-on-a-rope and tug-of-war) and puts the toys on the right side of chair #1 chair on the floor out of reach of the dog. The stranger says ‘Hallo, ik ben \*naam\* en zometeen krijg ik een signaal en dan ga ik de procedure uitleggen/met u praten. Tot die tijd zeg ik niks’.

03:30 - 04:30 After 30 seconds of both ignoring the owner and dog, the test leader instructs the stranger to start a conversation. (“\*Naam stranger\*, je mag gaan praten”) and the stranger starts explaining the procedure to the owner. (“Zometeen krijg ik een signaal dat ik met uw hond mag gaan spelen, u mag dan gewoon blijven zitten. Na een tijdje zal u instructies krijgen om de ruimte te verlaten via deur nummer 2. U komt dan in de observatieruimte en daar kunt u meekijken. U krijgt daar ook verdere instructies”. + Talk for the rest of the minute with the owner( for example about the weather, does the dog like to play etc.)

04:30 - 05:00 After 1 minute of talking, the test leader gives the stranger instructions to play with the dog via the microphone (speaker instructions: “\*Naam stranger\* je mag nu met \*naam hond\* gaan spelen”). The stranger stays in the playfield area indicated with white tape and approaches the dog sideways and tries to stimulate playing by playing with a ball-on-a-rope (first) or offering a tug-of-war (second) by moving these horizontally along the marked taped line and tapping it on the floor. The playing is restricted to a playfield area (marked with blue tape, 2x1m) in the room. The stranger is allowed to call the dog by its name to get its attention, but the stranger is not allowed to touch/pet the dog. The owner remains seated on his chair. At the end of this episode the test leader instructs the owner to leave the room (“\*Naam eigenaar\*, u mag nu de kamer verlaten door deur #2 en uw hond gedag zeggen zoals u thuis doet”. The owner leaves through door #2, but the dog's leash remains besides the chair.

#### Episode 3: stranger and dog. First separation episode.

05:00 - 06:00 During the first minute, the stranger is still playing with the dog or tries to interact again with the dog and keep him or her out of focusing on the door by playing (for the full minute) as described in episode 2. The stranger is allowed to call the dog by its name to get its attention but is not allowed to touch/pet the dog.

06:00 - 07:00 At the 2nd min, the stranger gets a signal (“\*Naam stranger\*, je mag gaan zitten”). The stranger stops playing, and sits down on chair #1. The stranger puts the toys on the right side of her chair on the floor. The stranger will ignore the dog at this moment. After the second minute the owner gets a (silent) signal from the test leader to enter the test room again via door #2.

#### Episode 4: owner and dog. First reunion episode.

07:00 - 09:00 The owner approaches the closed door, enters the room and closes the door behind him/her. He/she is informed that he/she may greet and comfort the dog as normal. The owner greets and comforts the dog, similar to the normal situation (e.g. coming home from shopping). Meanwhile, the stranger leaves quietly (through same door). The owner can continue to play with the dog throughout this episode with toys. After 2 min, the owner gets a signal ("\*Naam eigenaar\*, u mag de ruimte verlaten en de hond gedag zeggen zoals u dat normaal ook doet, en de deur verlaten via deur #2") and the owner leaves with a verbal farewell via door #2. The leash is left beside the chair.

Episode 5: dog alone. Second separation episode.

09:00 -11:00 The test leader, observer, stranger and the owner are in the observation room observing the dog by through an one-way screen. The owner will be asked to remain silent throughout this period, but is allowed to stop the episode if she or he believes that the dog is becoming too distressed. The owner is further instructed about the procedure. After 2 minutes the 'stranger' gets a signal to enter the room again (via door #2).

Episode 6: stranger and dog.

11:00 - 12:00 The stranger enters via door #2, closes door behind him/her. During the first minute, the stranger tries to interact with the dog again by playing with the ball-on-a-rope (first) and the tug-of-war (second),(try for the full minute). The stranger is allowed to call the dog by its name to get its attention but is not allowed to touch/pet the dog.

12:00 - 13:00 At the 2nd min, the stranger gets a signal ("\*Naam stranger\*, je mag gaan zitten"). The stranger stops playing, and sits down on chair #1. The stranger puts the toys on the right side of her chair on the floor. The stranger will ignore the dog at this moment. The stranger is not allowed to touch/pet the dog.

Episode 7: owner and dog. Second reunion episode.

13:00 - 15:00 After the 2nd minute, the owner gets a (silent) signal from the test leader to enter the test room again via door #2. The owner enters the room and closes the door behind him/her. The owner greets (and may comfort the dog), similar to a normal situation (e.g. coming home from shopping). Meanwhile, the stranger leaves quietly (through same door). The owner can continue to play with the dog throughout this episode.

When the test is completed, the owner can take the dog outside for a short break .

Time (min)	Who	Line
-0:00	Test Leader	(Standing outside the test room) U mag straks de ruimte betreden en de hond losmaken van de lijn als de deur gesloten is. U mag hierna samen met uw hond de ruimte verkennen. Het is de bedoeling dat u de hond alleen aandacht geeft als deze hierom vraagt. (Owner enters through door #1)
02:00	Test Leader	U mag ( <i>name dog</i> ) nu aan de lange groene lijn bevestigen (...) De riem achter stoel #2 leggen (...) En gaan zitten op stoel #2.
03:00	Stranger	(Enters room, with pink toy basket, through door #2 and sits on chair #1) Hallo, Ik ben ( <i>name stranger</i> ) en straks krijg ik een signaal dat ik mag gaan praten. Tot die tijd zeg ik niks.

03:30	Test Leader	( <i>name stranger</i> ), je mag gaan praten.
03:30	Stranger	<i>Explains test and starts casual conversation about the dog:</i> Zometeen krijg ik een signaal dat ik met uw hond mag gaan spelen, u mag dan gewoon blijven zitten. Na een tijdje zal u instructies krijgen om de ruimte te verlaten via deur nummer 2. U komt dan in de observatieruimte en daar kunt u meekijken. U krijgt daar ook verdere instructies
04:30	Test Leader	( <i>name stranger</i> ) je mag met ( <i>name dog</i> ) gaan spelen.
05:00	Test Leader	( <i>name owner</i> ) u mag nu de kamer verlaten via deur #2 en de hond gedag zeggen zoals u thuis doet.
06:00	Test Leader	( <i>name stranger</i> ) je mag gaan zitten op stoel #1.
07:00	Test Leader	( <i>name owner</i> ) u mag nu naar binnen en uw hond begroeten zoals u dat normaal ook doet. U mag ook met de hond gaan spelen.
07:00	Stranger	(Leaves room)
09:00	Test Leader	U mag nu de speeltjes weer in het roze mandje plaatsen (...) uw hond gedag zeggen zoals u dat normaal ook doet, en daarna de ruimte verlaten door deur #2.
11:00	Stranger	(Enters room through door #2) (Starts playing with the dog)
12:00	Test Leader	( <i>name stranger</i> ) je mag gaan zitten.
13:00	Test Leader	( <i>name owner</i> ) u mag nu naar binnen en uw hond begroeten zoals u dat normaal ook doet. U mag ook met uw hond gaan spelen.
13:00	Stranger	(Leaves room)
15:00	Test Leader	Dankuwel. Dit was het einde van de test. U mag ( <i>name dog</i> ) weer aan uw eigen lijn bevestigen en daarna de kamer verlaten via deur 1.

### Break time: Intrinsic Input test

Before the break time, the owner will have the opportunity to go for a walk with the dog. During this walk the cameras in test room #1 will be turned on. The owner will not be informed that this is a test. They will be told that the first test is completed and they can have a break in the break room, where they fill in a short questionnaire (STAI, attached below) first, and then have some coffee or tea, some cake and read a magazine if they want. The dog is allowed to be off leash in this room, and the owner



puts the dog back on the leash once the break is over and the next test will begin. The owner will not specifically be informed that they are being filmed and observed by two cameras, to see if and how they interact with their dog in a normal non-testing situation. This break will have a duration of 10 minutes. The time will be monitored using a stopwatch. After this the owner will be collected by the test leader to start the next test. This will be the first time they enter this room.

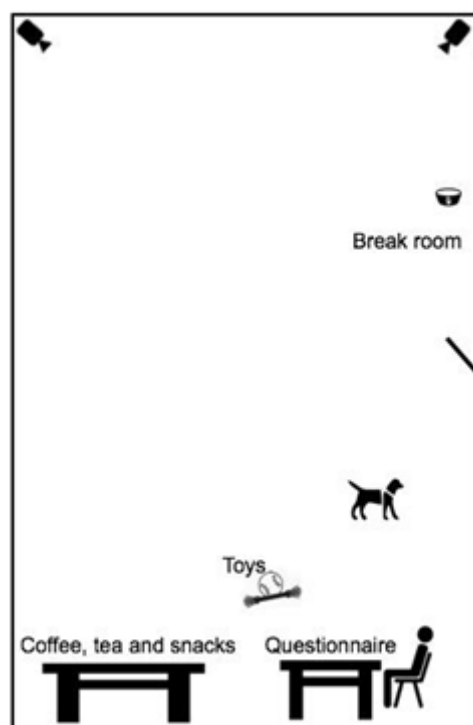


Figure 2. Experimental setup Intrinsic Input test (Jager, Smit and Van Woensel 2017); a small table for the owner and coffee table is present. The dog can walk around freely and a water bowl and toys are present.

Time(min)	Who	Line
-0:00	Test Leader	(Standing outside break room) "U en ( <i>name hond</i> ) mogen nu even pauze nemen. Zolang deze deur dicht is mag uw hond los in de ruimte zijn. Pak gerust koffie, thee of cake. Zou u als eerste kort de enquête in willen vullen die op de tafel ligt? Hierna kunt u de pauze vrij besteden. Wij zullen over 10 minuutjes weer even op het raam kloppen als de pauze voorbij is en u uw hond weer aan mag lijnen."
0:00	Owner and Dog	Enter Break Room
10:00	Test Leader	(Knocks on window of Break Room)
+/-10:20	Test Leader	(Leads owner and dog to test room for parenting style validation test)

### Altruism test

The final test is the altruism test, which tests whether the dog displays info-sharing behaviour towards its owner.

The test is conducted in the same observation room as the SST. There are two numbered chairs present (#1 and #2), and there are two not numbered chairs present. Three numbered cardboard moving boxes (small white boxes of 50L, bought at Action), are placed evenly across the tape on the floor. The numbered chairs are placed around the middle box, and the two unnumbered chairs are placed on the sides.

The dog is on the long leash of 4m25 meter tethered to the wall opposite the chairs and boxes and is able to reach the boxes, but not able to touch them. In the corner of the room is a screen behind which the owner stands while the stranger is in the room. The dog can go to the owner, and thus is aware that the owner remains present during the test. The time will be monitored using a stopwatch. The position of the screen (left: #1 and right: #2) the chair used by the owner (left: #1 and right: #2) and the box used for the owner's coat (left: #1, middle: #2 and right: #3) will be randomly picked beforehand. In each box, a neutral coat is placed beforehand. The owner is instructed beforehand how the "search action" works. An image of this will be hung inside the testing room and placed on the chair when the test is active.

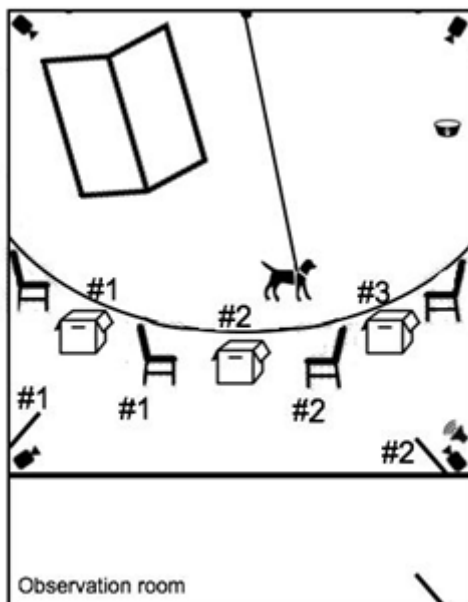


Figure 3. Experimental setup Altruism test (Jager, Smit and van Woensel 2017); four chairs are present, of which two are numbered. Also, three numbered cardboard boxes, a water bowl and a screen are present. The dog is fixed to the wall with a long leash and can reach its owner (also when the owner is behind the screen) but can't reach the stranger.

Materials that are being used:

- The owner's coat

- Two chairs
- Three identical boxes
- Long leash attached to the wall
- Observer XT 10.5
- Ethogram
- The song: Evergreen from the album Viaje Clásico Tranquilo

When the test is being done the following episodes take place:

Episode 0: Exploration

00:00 - 02:00 The owner and dog enter through door #1. After 2 min of off leash exploration and the owner visiting the space behind the screen, the owner attaches the dog on the leash and will stand behind the chair. When the dog is attentive (if not call its name), the coat is hung on the chair and the owner immediately walks behind the screen and puts on headphone for 30 sec. At the end of these 2 minutes, the test leader instructs the owner via the microphone to attach the dog to the long leash, and to sit down on a chair adjusted randomly after hanging their coat on the back of that chair and lay the leash behind it. ("Nu mag u de hond aan de lange groene lijn aan de muur bevestigen, vervolgens uw eigen riem van de halsband klippen, uw jas ophangen over de rugleuning van stoel nummer X, uw riem achter de stoel neerleggen en gaan zitten op stoel nummer X")

Episode 1: Owner on chair

02:00 - 03:00 The owner is a nonparticipant sitting on the assigned chair while the dog explores. The owner only interacts with the dog (i.e. by talking to it) if it specially asks for attention. The dog is free to explore the room. After 1 minute the test leader instructs the owner to attach the dog on the long leash and the owner to sit behind the screen. ("Nu mag u achter het scherm in de hoek gaan zitten, zometeen komt (\*naam stranger\*) binnen en dan mag u gewoon achter het scherm blijven zitten").

Episode 2: Owner behind screen, stranger enters

03:00 - 05:00 The owner is behind the screen and is non-participant. 03:30 The music will start. At 04:00 the stranger enters the room through door #2, waits until she/he has made eye contact with the dog and calls the dog by its name, and then takes the owner's coat of the chair and puts it in a randomly assigned box. After this the stranger leaves through door #2.

Episode 3: Owner searches coat 1,

05:00 - 05:30 The owner calls the dog to them. Then the owner returns to stand behind chair, (1) looks at the dog and (2) asks "Waar is mijn jas?" and (3) raises arms, owner looks around searching for 5 seconds.



Waar is mijn jas?

1. Oogcontact met je hond
2. 'Waar is mijn jas?'
3. Vragende houding (plaatje)
4. 5 sec rondkijken
5. Oogcontact met je hond
6. 'Waar is mijn jas?'
7. Vragende houding (plaatje)
8. 5 sec rondkijken
9. Klaar.

Figure 4. Instruction figure for the owner. (Jager, Smit and Van Woensel 2017); During the test the leaflet is placed on the chair of the owner as a reminder of the sequences.

Episode 4: Owner searches coat 2,

05:30 - 06:00 Repeat sequence 1,2,3 and again look around searching for 5 seconds.

Episode 5: What does the owner think

06:00 - 06:30 The test leader will ask the owner where they think the coat is based on the signals the dog is giving them. ("Denkt u te weten in welke doos uw jas zit? Wilt u dan uw duim opsteken? In welke doos denkt u dat uw jas zit als u kijkt naar de signalen van uw hond? Wilt u deze doos aanwijzen?") Then the test leader tells the owner where their coat is. ("Dank u wel, dit is het einde van de test. U mag zonder iets te zeggen uw jas uit doos nummer X halen. U mag (*naam hond*) weer aan uw eigen lijn aanlijnen en de ruimte verlaten via deur nummer 1.")

For the control of the test episode 1 and 2 will be repeated. After that the owner calls the dog to them and the owner stands behind the chair and places their hands on the back of the chair: looks at the dog, without a questioning look, looks around for 5 seconds in a neutral way, looks at the dog again and ends with looking around, modelling the previous procedure.

Time (min)	Who	Line
00:00	Test Leader	(while standing outside door #1 with the owner) U mag zometeen de ruimte betreden met uw hond en uw hond aflijnen. U mag samen met de hond de ruimte verkennen, zorg hierbij dat u ook achter het scherm loopt.
02:00	Test Leader	Nu mag u ( <i>naam hond</i> ) aan de lange groene lijn aan de muur bevestigen(...) uw jas ophangen over de rugleuning van stoel nummer X (...) uw riem achter de stoel neerleggen (...) en gaan zitten op stoel nummer X
03:00	Test Leader	Nu mag u achter het scherm in de hoek gaan zitten. Zometeen komt ( <i>name stranger</i> ) binnen, u mag achter het scherm blijven zitten.
03:30	Test Leader	Nu mag u uw handen over uw oren plaatsen. Zometeen wordt de muziek gestart, u mag dan uw handen over uw oren houden.
04:00	Stranger	(Enters room through door #2) (Get attention & make eye contact with the dog) (Get coat from chair X and put it in box X) (Leave through door #2)
05:00	Test Leader	Test: U mag uw hond bij u roepen, u mag achter stoel nummer X gaan staan (...), oogcontact maken met uw hond en 1 keer duidelijk aan uw hond vragen <i>Waar is mijn jas?</i> Control: U mag uw hond bij u roepen, u mag achter stoel nummer X gaan staan (...), en zo natuurlijk mogelijk rondkijken.
05:30	Test Leader	Test: U mag dit nog eenmaal herhalen. Control: n.a.
6:00	Test Leader	Denkt u te weten in welke doos uw jas zit? Wilt u dan uw duim opsteken?  In welke doos denkt u dat uw jas zit als u kijkt naar de signalen van uw hond? Wilt u naar deze doos wijzen?
06:30	Test Leader	Dankuwel, dit is het einde van de test. U mag zonder iets te zeggen ( <i>naam hond</i> ) weer aan uw eigen lijn aanlijnen en de ruimte verlaten via deur nummer 1.

### Parenting style validation test

The owner will enter the testing area with the test leader. The test leader will ask the owner to put the red leash on the dog. Then the test leader will explain to the owner that the goal of the task is to make sure the dog does not eat the treats or takes the ball. Using the red leash, the owner and the dog have to walk on a line that has been taped on the floor. On both sides of this line, 12 treats and 8

tennis balls have been distributed with an interval of 2 meters on both sides of this line. The path follows the walls of the room and runs from door #1 to back to door #1 (see picture). They do this three times starting from the door where they enter. When they have finished one lap, they will leave through door #1 and walk towards the entrance door, there they wait 20 seconds before walking back to door #1 and walking another lap. This will be repeated 3 times. During the time that the owner and dog are in the hallway, the test leader will replace any treats that have been taken by the dog and put the tennis balls back that have been moved. When the test is finished the dog can eat the treats and play with the balls if he wants to / is allowed by the owner.

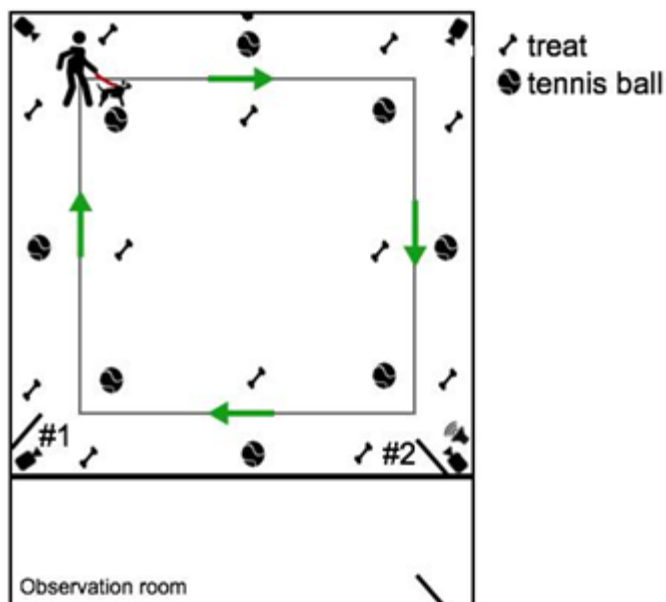


Figure 5. Experimental setup Parenting Style Validation test (Jager, Smit and van Woensel 2017); A total of 11 dog treats and 8 tennis balls are placed randomly on both sides of the square line taped on the floor. The dog is attached to a red leash.

Materials that are being used:

- Red leash (1m45)
- Treats (12 small piles of approximately 3 pieces of 1 cm, Caniland Soft Struisvogel-Snack Graanvrij)
- Tennis balls (8, Kong Squeakair)
- Cameras
- Observer XT 10.5
- Ethogram

Time (min)	Who	Line
-0:00	Test leader	(Standing outside door #1) "Het doel van deze test is dat de hond de snacks en ballen niet pakt en dat u 3 keer de gemarkeerde lijn volgt. U mag zelf bepalen hoe jullie dit doen. Na elk rondje mag u even de gang op lopen."
0:00	Owner	Walks the line 3 times with the dog from door #1 to door #1. Exits through door #1 and walks towards the entrance door, there they wait 20 seconds before walking back to door #1 and walking another lap.

+/- 5:00	Test leader	“Dankuwel, dit is het einde van de test. Uw hond heeft het goed gedaan. Uw hond mag nu de snoepjes of balletjes als u dat goed vindt. Anders mag u de ruimte verlaten via deur nummer 1. “
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### Measurements

Back in testing room 1. The owner will be asked to place the dog on the scale. After weighing the dog, the height (withers) will be measured using a measurement tape attached to the wall. The measurements will be noted in the participants excel-sheet.

### End of tests

After the tests are done the test leader will thank the owner and present them with the goodie bag as participation gift.

Travel costs will not be refunded, nor partially. This is not up for discussion and has been mentioned in the email sent to participants beforehand.

### Closing up

Clean up the test area. Prepare the area for the visit of the next day so set up for the ASST. Declutter the computer room. Charge camera's and Zephyr in break room. Call to the front desk of Zodiac to close the gate.

### Mail to owner (in Dutch):

Onderwerpregel:

Uitnodiging deelname gedrags proefjes op **XX** met uw hond - graag reactie voor **XX**

Geachte heer / mevrouw,

Naar aanleiding van de online vragenlijst over ouderschapsstijlen, waarbij u heeft aangegeven dat u bereid bent om mee te willen werken aan ons onderzoek, nemen wij contact met u op.

Graag willen wij u en uw hond uitnodigen om mee te doen aan een aantal gedrags-proefjes in Carus in Wageningen! Dit is gebouw nummer 120 en ligt aan de achterzijde van de campus. *Onderaan deze mail staat het adres en een korte routebeschrijving.* Hier is ook gelegenheid om te parkeren en uw hond nog even kort uit te laten.

Het moment waarop u welkom bent op Carus is (**dag datum**), om (**uur**). Het onderzoek zal maximaal 2 uur duren. Er is tussendoor voldoende tijd voor uw hond om uit te rusten en uitgelaten te worden, en er zal koffie en thee aanwezig zijn.

Graag vernemen we uw adres. Wij sturen u een tuigje toe, dat gebruikt wordt bij de hartslagmeting tijdens de proef. De meter wordt op de dag zelf in het tuigje geklikt. Voor de hond is het belangrijk dat hij eerder aan het tuigje went, anders kan hij afgeleid raken tijdens de proef. Wilt u hem in de week voor u naar ons toekomt de hond gedurende acht uur het tuigje laten dragen, als u bij hem bent, zodat hij er aan kan wennen? Instructies over het omdoen ervan zitten bij het tuigje.

Tijdens de tests zal er gebruik gemaakt worden van video opnames. Deze worden uitsluitend gebruikt ten behoeve van het onderzoek. Op de locatie wordt u gevraagd om een formulier te ondertekenen om aan te geven dat u hiermee akkoord gaat.

Uw medewerking aan dit onderzoek zal op vrijwillige basis zijn en wij zijn helaas niet in staat om reiskosten te vergoeden, wij vragen uw begrip hiervoor. De meeste deelnemers vinden het erg leuk om te zien hoe de gedragsproefjes lopen en hoe hun hond zich gedraagt en ze uitvoert. Bij een van de proefjes is de hond kortdurend alleen, maar u kunt de hond dan wel zien. Tijdens de testjes mag u het altijd aangeven als u wilt stoppen, als u daar reden toe zou zien.

Wilt u ons voor **XX** laten weten of we op uw aanwezigheid mogen rekenen op het genoemde moment? Wij kijken er naar uit u en uw hond te ontmoeten en zijn erg blij dat u bijdraagt aan dit onderzoek! Mocht de genoemde datum of tijd u niet schikken dan kunt u contact opnemen via dit emailadres om een andere datum af te spreken.

Met vriendelijke groeten,

Iris, Lonneke en Odette

Wageningen Universiteit & Research Centrum

#### *Routebeschrijving Carus:*

Carus heeft het gebouwnummer 120, en adres 'Bornse Weilanden 5', 6708 WG, te Wageningen. Op de campus van Wageningen zelf zullen overal bij de gebouwen ook bordjes met de gebouwnummers staan.

Als u naar Wageningen toe gereden bent zult u op de verkeersborden al 'Wageningen Campus' zien, deze borden volgt u. Na een aantal stoplichten komt u aan bij de rotonde voor de campus, deze is te herkennen aan het gebouw 'NIOO-KNAW' aan uw rechter (of linker-) hand, en een gebouw van Friesland Campina aan de andere kant van de weg.

Deze rotonde neemt u de afslag naar de campus toe, respectievelijk de 3e afslag (als u vanuit het centrum komt) of de 1e afslag (als u van de N781 komt). Dan rijdt u alsmaar rechtdoor. U komt bij een kruispunt bij het 'Axis' waar u naar rechts of rechtdoor kunt: hier gaat u rechtdoor. Vervolgens gaat u nog steeds rechtdoor, en rijdt u deze straat helemaal uit tot het dood loopt. Hier kunt u aan de rechterkant uw auto parkeren, hier is ook de ingang en daar zullen wij u en uw hond ontvangen

(Indien u met het openbaar vervoer naar het Carus wilt komen, adviseren wij u om uw reis de plannen op [9292ov.nl](http://9292ov.nl) voor het meest actuele reisadvies.)



## Appendix II, Ethograms

*Table 1: Defenition of stress behaviours during the Strange Situation test. These will be observed using Observer XT 10.5 (Dessens, 2014, Beerda et al.,1998)*

<b><i>Behaviour</i></b>	<b><i>Definition</i></b>
<b>Panting</b>	Mouth wide open with tongue protruding, often moving in and out of the mouth
<b>Freezing</b>	When all movement of the body is stopped
<b>Paw lifting</b>	A fore paw is lifted into a position of approximately 45°
<b>Yawning</b>	Inhalation of air and stretching of the eardrums, followed by an exhalation of breath
<b>Stretching</b>	Extend either forelegs or hind legs and hold for 1-2 s
<b>Tongue flicking</b>	Part of the tongue is shown and moved along the mouth
<b>Shaking</b>	Rotation of the body starting at the head and moving caudally
<b>Sniffing</b>	Nose to ground/air/object and sides of body moving rapidly in and out
<b>Sneezing</b>	Expulsion of air from the lungs through the nose and mouth
<b>Barking</b>	Head and lips forward, mouth opening, and shutting repeatedly while vocalising.
<b>Urogenital check</b>	Checking urogenital area
<b>Whining</b>	Soft, high pitched vocalisations
<b>Yelping</b>	loud (relative to whining ) high pitched vocalizations
<b>Jumping</b>	Jump up: push off with and land on hind legs, or land or forelegs

Table 2: States during the SST. These will be observed using Observer XT 10.5 (Dessens, 2014, Ley & Bennett, 2015)

<b>Behaviour</b>		<b>Description</b>
<b>Play</b>	No play	No play was shown
	Non-social play	Any energetic behaviour, usually directed toward a toy, when clearly detached from social interaction
	Social play owner	Any energetic behaviour performed when interacting with owner, often including a toy
	Petting owner	The owner is petting the dog
<b>Locomotion</b>	Social play stranger	Any energetic behaviour performed when interacting with stranger, often including a toy
	Lying	Sternum touching ground and hind limbs on either side (bent or stretched out the back) OR Side of dog touching the ground fully OR Back of dog touching the ground
	Sitting	Front legs straight, rear end lowered, and resting on "hocks" and perineum
	Moving	Dog is moving (any direction)
<b>Posture</b>	Standing	Upright on all 4 legs, no locomotion
	High	The breed-specific posture shown by dogs under neutral conditions; but in addition, the tail is positioned higher or the position of the head is elevated and the ears are pointed forward, or the animal is standing extremely erect
	Neutral	The breed posture shown by dogs under neutral conditions)
	Low	The position of the tail is lowered, the ears are positioned backward, and the legs are bent
	Half low	Two of the following features are exhibited: a lowered position of the tail (compared with the neutral posture),

<b>Being near</b>		a backward position of the ears and/or bent legs (or also tail lower than neutral or neutral p ears backward)
	Very low	Low posture, but now, the tail is curled forward between the hind legs
	Owner	The dog is near the owner (within 1 meter)
	Owner chair	The dog is near the owner's chair (within 1 meter)
	Stranger	The dog is near the stranger (within 1 meter)
	Stranger chair	The dog is near the stranger's chair (within 1 meter)
<b>Staring</b>	Not being near	The dog was not near
	No staring	No staring shown
	At stranger	Staring fixedly at stranger either in close proximity or from a distance
	At stranger chair	Staring fixedly at empty stranger chair
	At owner	Staring fixedly at owner either in close proximity or from a distance
	At owner chair	Staring fixedly at empty owner chair
	At door	Staring fixedly at the door either in close proximity or from a distance

Table 3: Events during the SST. These will be observed using Observer XT 10.5 (Beerda et al., 1998; Dessens, 2014)

<b>Event</b>	<b>Definition</b>
<b>No event</b>	Any activity not included in the event listing below
<b>Avoid stranger</b>	Obvious avoidance of interaction with stranger by moving away
<b>Avoid owner</b>	Obvious avoidance of interaction with owner by moving away
<b>Looking away from stranger</b>	Obvious avoidance of interaction with stranger by looking away
<b>Looking away from owner</b>	Obvious avoidance of interaction with owner by looking away
<b>Shake</b>	Rotation of the body starting at the head and moving caudally
<b>Soliciting attention</b>	Approach or accost the owner or stranger
<b>Pulling leash</b>	Pulling while on leash
<b>Biting leash</b>	Biting on leash
<b>Grooming</b>	Behaviours directed towards the subject's own body, like scratching, licking and biting-self
<b>Aggressive behaviour</b>	Growling, barking, baring teeth, snapping, attacking, either in a high or low posture
<b>Sniffing environment</b>	Sniffing directed toward physical environment
<b>Manipulation environment</b>	Playful or stereotyped interactions with elements from the environment
<b>Tail wagging</b>	Repetitive wagging movements of the tail

Table 4: Defenition of stress behaviours during the Altruism Test. These will be observed using Observer XT 10.5 Behaviours were scored for frequency of occurrence and expressed as rate per minute, but for the state behaviours identified by 1. These were recorded for duration and expressed as % of the observation time. (Dessens, 2014)

<b>Behaviour</b>	<b>Defenition</b>
<b>Position within the room</b>	1 Zone in which dog has its front legs
<b>Stress</b>	<p>Bark</p> <p>Yelp</p> <p>Whine</p> <p>Tongue flick</p> <p>Yawn</p> <p>Paw lift</p> <p>Shake</p> <p>Look away</p> <p>Tail wag</p> <p>Pant</p>
<b>Signalling</b>	<p>Approach</p> <p>Look at</p> <p>Reference once</p> <p>Reference multiple times</p>

Source: Dessens (2014), Beerda et al.(1998)

*Dessens, D. (2014). The influence of personality traits on the training success of service dogs. Wageningen University*

*Beerda, B., Schilder, M.B.H., van Hooff, J.A.R.A.M., de Vries, H.W., Mol, J.A. (1998) Behavioural, saliva cortisol and heart rate responses of different types of stimuli in dogs. Applied Animal Behaviour Science 58, 365-381*

*Ley, J.M., Bennett, P.C. (2015) Understanding Personality by Understanding Companion Dogs. Anthrozoös 20(2) 113-124.*

## Appendix III STAI questionnaire

Een aantal uitspraken die mensen hebben gebruikt om zichzelf te beschrijven is hieronder gegeven. Lees elke uitspraak en zet per uitspraak een streepje op de lijn om aan te geven hoe je je **nu** voelt, **op dit moment**. Er zijn geen goede of foute antwoorden. Besteed niet teveel tijd aan een beschrijving maar zet een streepje dat het best beschrijft hoe je je op dit moment voelt.

	Helemaal niet	Een beetje	Redelijk	Helemaal wel
1. Ik voel me kalm	-----	-----	-----	-----
2. Ik voel me zeker	-----	-----	-----	-----
3. Ik ben gespannen	-----	-----	-----	-----
4. Ik voel me opgejaagd	-----	-----	-----	-----
5. Ik voel me op mijn gemak	-----	-----	-----	-----
6. Ik voel me van streek	-----	-----	-----	-----
7. Ik maak me momenteel zorgen over mogelijke tegenslagen	-----	-----	-----	-----
8. Ik voel me voldaan	-----	-----	-----	-----
9. Ik voel me angstig	-----	-----	-----	-----
10. Ik voel me comfortabel	-----	-----	-----	-----
11. Ik voel me vol zelfvertrouwen	-----	-----	-----	-----
12. Ik voel me nerveus	-----	-----	-----	-----
13. Ik ben zenuwachtig	-----	-----	-----	-----
14. Ik voel me besluiteloos	-----	-----	-----	-----
15. Ik ben ontspannen	-----	-----	-----	-----
16. Ik voel me tevreden	-----	-----	-----	-----
17. Ik maak me zorgen	-----	-----	-----	-----
18. Ik voel me verward	-----	-----	-----	-----
19. Ik voel me stabiel	-----	-----	-----	-----
20. Ik voel me prettig	-----	-----	-----	-----

Een aantal uitspraken die mensen hebben gebruikt om zichzelf te beschrijven is hieronder gegeven. Lees elke uitspraak en zet per uitspraak een streepje op de lijn om aan te geven hoe je je **over het algemeen** voelt. Er zijn geen goede of foute antwoorden. Besteed niet teveel tijd aan een uitspraak maar zet een streepje dat het best beschrijft hoe je je over het algemeen voelt.

	(bijna) Nooit	Soms	Vaak	(bijna) Altijd
21. Ik voel me prettig	-----	-----	-----	-----
22. Ik voel me nerveus en rusteloos	-----	-----	-----	-----
23. Ik voel me tevreden met mezelf	-----	-----	-----	-----
24. Ik zou graag zo gelukkig willen zijn als anderen lijken	-----	-----	-----	-----
25. Ik voel me een mislukking	-----	-----	-----	-----
26. Ik voel me uitgerust	-----	-----	-----	-----
27. Ik ben kalm en evenwichtig	-----	-----	-----	-----
28. Ik heb het gevoel dat moeilijkheden zich zo opstapelen dat ik ze niet kan overwinnen	-----	-----	-----	-----
29. Ik maak me teveel zorgen over dingen die er niet echt toe doen	-----	-----	-----	-----
30. Ik ben gelukkig	-----	-----	-----	-----
31. Ik heb verontrustende gedachten	-----	-----	-----	-----
32. Ik heb een gebrek aan zelfvertrouwen	-----	-----	-----	-----
33. Ik voel me zeker	-----	-----	-----	-----
34. Ik maak beslissingen makkelijk	-----	-----	-----	-----
35. Ik voel me niet goed genoeg	-----	-----	-----	-----
36. Ik ben tevreden	-----	-----	-----	-----
37. Een onbelangrijke gedachte speelt in mijn hoofd en stoort me	-----	-----	-----	-----
38. Ik neem teleurstellingen zo serieus dat ik ze niet uit mijn hoofd kan zetten	-----	-----	-----	-----
39. Ik ben een stabiel persoon	-----	-----	-----	-----
40. Ik raak gespannen en wordt onrustig als ik nadenk over mijn recente zaken en belangen	-----	-----	-----	-----

Spielberger, C. D., Gorsuch, R. L., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). Manual for the State-Trait Anxiety Inventory. Palo Alto, CA: Consulting Psychologists Press.



## Appendix IV, Survey

### **DD-PSDQ (Herwijnen van et al., 2018)**

De volgende stellingen gaan over hoe u uw hond begeleidt en naar hondenbezit kijkt. Denk niet te lang na, ga op uw eerste gevoel af. (Er zijn geen goede of foute antwoorden.) Hoe vaak is onderstaande op u van toepassing? Nooit (1), soms (2), neutraal (ongeveer de helft van de keren, 3), meestal (4), altijd (5).

1. Ik sta toe dat mijn hond mijn besluiten beïnvloedt, bijvoorbeeld wat betreft de route tijdens de wandeling.
2. Ik houd rekening met de gevoelens en behoeften van mijn hond.
3. Ik kan in woede uitbarsten richting mijn hond als hij iets doet waarvan hij weet dat ik dat niet wil.
4. Ik buig ongewenst gedrag van mijn hond om naar meer gewenst gedrag.
5. Ik moedig mijn hond aan zijn gemoedstoestand te tonen, zo mag hij grommen bij ongemak.
6. Ik troost mijn hond als hij overstuur is.
7. Ik prijs mijn hond als hij iets goed doet.
8. Ik pak mijn hond beet als hij ongehoorzaam is.
9. Ik oefen gedrag stap voor stap met mijn hond, zodat ik zeker weet dat hij begrijpt wat ik van hem vraag.
10. Ik oefen bepaald gedrag met mijn hond, voordat ik dat gedrag vraag in een voor de hond moeilijke situatie.
11. Ik verhef mijn stem als mijn hond zijn gedrag moet verbeteren.
12. Ik scheld en heb kritiek als het gedrag van mijn hond niet voldoet aan mijn verwachtingen.
13. Ik houd voorkeuren van mijn hond in gedachten als ik plannen maak.
14. Ik houd de wensen van mijn hond in gedachten voordat ik hem vraag iets te doen.
15. Ik denk na over regels die ik mijn hond opleg.
16. Ik gebruik een corrigerende tik als mijn hond zich misdraagt.
17. Ik prik met mijn vinger, of geef een kort schopje als mijn hond zich misdraagt. Zo haal ik hem uit het gedrag.
18. Ik zet een beloning in (voer/speeltje) als mijn hond echt iets moet doen.
19. Ik gebruik fysieke (lichamelijke) correcties (bijvoorbeeld een tik of een slipketting) als een manier om het gedrag van mijn hond te verbeteren.
20. Ik roep of schreeuw als mijn hond zich misdraagt.

### **Plomin's EAS Temperament survey - social motivation, not shyness (Bould, 2013)**

In welke mate is onderstaande van toepassing op uw hond? Nooit (1), soms (2), neutraal (ongeveer de helft van de keren, 3), meestal (4), altijd (5).

1. Mijn hond is graag bij mensen.
2. Mijn hond speelt liever met anderen dan alleen.
3. Mijn hond vindt mensen leuker dan wat dan ook.
4. Mijn hond is graag op zichzelf.
5. Mijn hond voelt zich eenzaam als hij alleen is.

### **TIPI – Ten-Item Personality Inventory - Big-five brief measure - owner (Gosling, 2003)**

Hoe beschrijft u uzelf? Ik zie mezelf als... op een schaal van 1 (zeer oneens) tot 7 (zeer eens). (zeer oneens – oneens – beetje oneens – neutraal – beetje eens – eens – zeer eens)

1. extravert, enthousiast
2. kritisch, discussiebereid

3. betrouwbaar, gedisciplineerd
4. bezorgd, snel overstuur
5. open voor nieuwe ervaringen, complex
6. gereserveerd, stil
7. sympathiek, warm
8. chaotisch, nonchalant
9. kalm, emotioneel stabiel
10. conventioneel, weinig creatief

**Refined Monash Canine Personality Questionnaire, MCPQ-R – dog (Ley et al, 2009).**

Hoe goed beschrijft elk van de onderstaande woorden uw hond op een schaal van 1 (beschrijft uw hond helemaal niet) tot 6 (beschrijft uw hond helemaal)?

1. Actief
2. Energiek
3. Snel geprikkeld
4. Overactief
5. Levendig
6. Rusteloos
7. Assertief
8. Vastbesloten
9. Onafhankelijk
10. Volhardend
11. Eigenwijs
12. Oplettend
13. Bereid te doen wat wordt gevraagd
14. Intelligent
15. Gehoorzaam
16. Betrouwbaar
17. Trainbaar
18. Makkelijk in de omgang
19. Vriendelijk
20. Niet-agressief
21. Relaxed
22. Sociaal
23. Angstig
24. Nerveus
25. Onderdanig
26. Timide

**CBARQ Fear & aggression (Hsu & Serpell, 2003)**

Agressie is een normale gedragsuiting voor honden. Sommige honden vertonen dan ook soms agressie.

Typische uitingen van "gematigde agressie" zijn blaffen, grommen en ontbloten van de tanden. Meer "ernstige agressie" kenmerkt zich door happen, uitvallen, bijten of pogingen tot bijten. Wilt u, door het aanklikken van een nummer op de onderstaande 5-punts schaal, aangeven in hoeverre uw hond de afgelopen tijd de neiging had om agressief gedrag te vertonen in de genoemde omstandigheden? 0 = geen agressie, 1-3 = gematigde agressie, 4 = ernstige agressie.

1. Als uw hond direct benaderd wordt door een onbekende volwassen man tijdens het aangelijnd uitlaten.
2. Als uw hond direct benaderd wordt door een onbekende volwassen vrouw tijdens het aangelijnd uitlaten.
3. Als uw hond direct benaderd wordt door een onbekend kind tijdens het aangelijnd uitlaten.
4. Naar onbekende personen die uw hond benaderen terwijl die in uw auto zit (bijvoorbeeld op een parkeerplaats).
5. Als een onbekend persoon u of een gezinslid thuis benadert.
6. Als een onbekend persoon u of een gezinslid buitenshuis benadert.
7. Als de postbode of andere bezorger uw huis benadert.
8. Als vreemden uw huis passeren terwijl uw hond in de tuin is.
9. Als joggers, fietsers, of skaters uw huis passeren terwijl uw hond in de tuin is.
10. Tegen onbekende personen die bij u op bezoek komen.
  
11. Als uw hond verbaal gecorrigeerd of gestraft wordt (b.v. een standje geven, schreeuwen, enz.) door u of een gezinslid.
12. Als een gezinslid een speeltje, bot of ander voorwerp van uw hond afneemt.
13. Als uw hond door een gezinslid wordt geborsteld of gewassen.
14. Als uw hond direct door een gezinslid benaderd wordt terwijl hij/zij aan het eten is.
15. Als het voer van uw hond weggehaald wordt door een gezinslid.
16. Als uw hond direct aangestaard wordt door een gezinslid.
17. Als een gezinslid over uw hond heen stapt.
18. Als u of een gezinslid door uw hond gestolen eetwaar of voorwerpen terug pakt.
  
19. Als uw hond direct benaderd wordt door een onbekende reu tijdens het aangelijnd uitlaten.
20. Als uw hond direct benaderd wordt door een onbekende teef tijdens het aangelijnd uitlaten.
21. Tegen onbekende honden die bij uw thuis op bezoek komen.
22. Als uw hond direct benaderd wordt door een hond van dezelfde grootte of groter tijdens het aangelijnd uitlaten.
23. Als uw hond direct benaderd wordt door een hond die kleiner is dan uw hond tijdens het aangelijnd uitlaten.
24. Als uw hond direct benaderd wordt door een onbekende pup tijdens het aangelijnd uitlaten.
25. Als een andere (onbekende) hond naar uw hond blaft, gromt of uitvalt.
26. Tegen één van uw andere honden (Laat deze vraag open als u geen andere honden heeft).
27. Als uw hond benaderd wordt op zijn favoriete rust/slaapplaats door één van uw andere honden (Laat deze vraag open als u geen andere honden heeft).
28. Als één van uw andere honden de hond benadert terwijl hij/zij aan het eten is (Laat deze vraag open als u geen andere honden heeft).
29. Als één van uw andere honden de hond benadert terwijl hij/zij aan het spelen is met of kluift aan zijn/haar favoriete speeltje, bot, voorwerp, enz. (Laat deze vraag open als u geen andere honden heeft).

Honden vertonen soms angst bij het waarnemen van bepaalde geluiden, voorwerpen of personen, of in specifieke situaties. Typische kenmerken van gematigde (zwakke, matige en sterke) angst zijn het vermijden van oogcontact, vermijden van het voorwerp waar de hond bang voor is, kruipen of ineen duiken met een lage staart of staart tussen de poten, janken of piepen, bevriezen en trillen of beven. Extreme angst kenmerkt zich door overdreven ineen krimpen en/of heftige pogingen om te ontsnappen, terug trekken of verstoppert voor het gevreesde object, situatie of persoon.

Wilt u op de onderstaande 5-punts schaal aangeven in hoeverre uw hond de afgelopen tijd angstig reageerde in de genoemde situaties? Geen waarneembare tekenen van angst; geen angst (0), zwakke angst (1), matige angst (2), sterke angst (3), ineen krimpen, terug trekken, verstoppert, enz.; extreme angst (4).

1. Op onbekende personen die bij u op bezoek komen.

2. Als uw hond buitenshuis direct benaderd wordt door een onbekende volwassen man.
3. Als uw hond buitenshuis direct benaderd wordt door een onbekende volwassen vrouw.
4. Als uw hond buitenshuis direct benaderd wordt door een onbekend kind.
5. Op onbekende honden die bij u thuis op bezoek komen.
6. Als uw hond direct benaderd wordt door een hond van dezelfde grootte of groter tijdens het aangelijnd uitlaten.
7. Als uw hond direct benaderd wordt door een hond die kleiner is dan uw hond tijdens het aangelijnd uitlaten.
8. Als uw hond direct benaderd wordt door een onbekende reu tijdens het aangelijnd uitlaten.
9. Als uw hond direct benaderd wordt door een onbekende teef tijdens het aangelijnd uitlaten.
10. Als uw hond direct benaderd wordt door een onbekende pup tijdens het aangelijnd uitlaten.
11. Als een andere (onbekende) hond naar uw hond blaft, gromt of uitvalt.
12. Nabij één van uw andere honden (Laat deze vraag open als u geen andere honden heeft).
13. Als uw hond benaderd wordt op zijn favoriete rust/slaapplaats door één van uw andere honden (Laat deze vraag open als u geen andere honden heeft).
14. Als één van uw andere honden de hond benadert terwijl hij/zij aan het eten is (Laat deze vraag open als u geen andere honden heeft).
15. Als één van uw andere honden de hond benadert terwijl hij/zij aan het spelen is met of kluift aan zijn/haar favoriete speeltje, bot, voorwerp, enz. (Laat deze vraag open als u geen andere honden heeft).

Hoe vaak heeft uw hond de afgelopen tijd de volgende tekenen van "verlatingsangst" laten zien als hij/zij alleen gelaten werd of als u op het punt stond om hem/haar alleen te laten? Klik het juiste vakje aan. Nooit (0), zelden (1), soms (2), meestal (3), altijd (4).

1. Trillen, beven of bibberen
2. Overmatig speekselen
3. Onrust/opwinding/heen en weer lopen
4. Janken
5. Blaffen
6. Huilen
7. Knagen of krabben aan deuren, de vloer, ramen, gordijnen, enz.
8. Verlies van eetlust.

Hoe vaak heeft uw hond de afgelopen tijd het genoemde gedrag laten zien? Klik het juiste vakje aan. Nooit (0), zelden (1), soms (2), meestal (3), altijd (4).

1. Is sterk gehecht aan één bepaald gezinslid.
2. Heeft de neiging om u (of andere gezinsleden) te volgen door het hele huis, van kamer tot kamer.
3. Heeft de neiging om dicht bij u (of een ander) of tegen u aan te zitten als u zit.
4. Heeft de neiging om zachtjes tegen u of een ander aan te stoten, te besnuffelen of een pootje te geven om aandacht te vragen terwijl u of die ander zit.
5. Wordt onrustig (janken, opspringen, proberen tussenbeide te komen) als u (of anderen) genegenheid toont (tonen) voor een ander persoon.
6. Wordt onrustig (janken, opspringen, proberen tussenbeide te komen) als u (of anderen) genegenheid toont (tonen) voor een andere hond of een ander dier.

#### **ECR-Short Version (Wei et al., 2007)**

Onderstaande 12 stellingen gaan over hoe u zich over het algemeen voelt in relaties, zoals met uw eventuele partner, goede vrienden of familie. Geeft u per stelling aan in welke mate u het eens bent op een schaal van 1

(zeer oneens) tot 7 (zeer eens)? (zeer oneens – oneens - beetje oneens – neutraal – beetje eens – eens – zeer eens)

1. Ik ben bezorgd dat anderen niet zo veel om mij geven, als ik om hen.
2. Ik wil verbinding met anderen, maar blijf me terugtrekken.
3. Mijn wens om zeer verbonden te zijn, jaagt soms mensen weg.
4. Ik word nerveus wanneer iemand te dicht bij me komt.
5. Ik heb veel bevestiging nodig dat belangrijke anderen, zoals een partner, goede vrienden en/of familie, echt om me geven.
6. Ik probeer te voorkomen dat ik me te veel hecht aan anderen.
7. Ik maak me niet vaak zorgen dat een belangrijke ander me verlaat.
8. Gewoonlijk bespreek ik mijn problemen en zorgen met belangrijke anderen.
9. Ik vind of vond dat mijn (ex)-partner, niet zo veel verbinding met me zoekt, als ik zou willen.
10. Het helpt om hulp te zoeken bij anderen als ik het moeilijk heb.
11. Ik raak(te) gefrustreerd als mijn (ex-)partner er niet voor me is/was als ik hem of haar nodig heb/had.
12. Ik zoek anderen op in veel situaties, bijvoorbeeld als ik troost of bevestiging nodig heb.

### **MDORS (Dwyer et al, 2006)**

Hoe vaak zijn onderstaande stellingen van toepassing op u en uw hond? (Bijna) nooit (1), Minstens 1 keer per maand (2), 1 keer per week (3), 2 tot 3 keer per week (4), Minstens 1 keer per dag (5).

1. Hoe vaak speelt u met uw hond?
2. Hoe vaak neemt u uw hond mee op visite?
3. Hoe vaak geeft u uw hond snoepjes?
4. Hoe vaak geeft u uw hond een kusje?
5. Hoe vaak neemt u uw hond mee in de auto?
6. Hoe vaak knuffelt u met uw hond?
7. Hoe vaak koopt u “cadeautjes” voor uw hond?
8. Hoe vaak is uw hond bij u wanneer u ontspant, bijvoorbeeld tijdens televisie kijken?
9. Hoe vaak verzorgt u de vacht van uw hond?

In hoeverre zijn onderstaande stellingen van toepassing op u en uw hond? Heel erg mee oneens (1), Mee oneens (2), Neutraal (3), Mee eens (4), Heel erg mee eens (5)

10. Mijn hond helpt me door moeilijke tijden.
11. Mijn hond is er voor me wanneer ik getroost moet worden.
12. Ik zou mijn hond graag altijd bij me hebben.
13. Mijn hond biedt me altijd gezelschap.
14. Als iedereen me zou verlaten, zou mijn hond er nog voor me zijn.
15. Mijn hond geeft me een reden om 's ochtends op te staan.
16. Ik zou willen dat mijn hond en ik nooit gescheiden zouden zijn.
17. Mijn hond heeft altijd aandacht voor mij.

Hoe vaak zijn onderstaande stellingen van toepassing op u en uw hond? (Bijna) nooit (1), Minstens 1 keer per maand (2), 1 keer per week (3), 2 tot 3 keer per week (4), Minstens 1 keer per dag (5)

18. Hoe vaak vertelt u uw hond dingen die u aan niemand anders vertelt?

Wat is op u van toepassing? Helemaal niet moeilijk (1), Niet moeilijk (2), Neutraal (3), Een beetje moeilijk (4), Heel erg moeilijk (5)

19. Hoe erg zou het voor u zijn als uw hond sterft?

Hoe vaak zijn onderstaande stellingen van toepassing op u en uw hond? (Bijna) nooit (1), Minstens 1 keer per maand (2), 1 keer per week (3), 2 tot 3 keer per week (4), Minstens 1 keer per dag (5)

20. Hoe vaak heeft u het gevoel dat het verzorgen van uw hond een vervelende taak is?
21. Hoe vaak weerhoudt uw hond u ervan dingen te doen die u graag zou doen?

In hoeverre zijn onderstaande stellingen van toepassing op u en uw hond? Heel erg mee oneens (1), Mee oneens (2), Neutraal (3), Mee eens (4), Heel erg mee eens (5)

22. Het is vervelend dat ik soms plannen moet wijzigen vanwege mijn hond.

23. Het is vervelend dat mijn hond me weerhoudt van dingen die ik deed voordat ik hem/haar had.

24. Er zijn belangrijke aspecten die ik niet leuk vind aan het houden van een hond.

25. Mijn hond maakt te veel rommel.

26. Mijn hond kost te veel geld.

Wat is op u van toepassing? Helemaal niet moeilijk (1), Niet moeilijk (2), Neutraal (3), Een beetje moeilijk (4), Heel erg moeilijk (5)

27. Hoe moeilijk is het voor u om voor uw hond te zorgen?

Hoe vaak heeft u het gevoel dat het houden van een hond meer moeite kost dan dat het waard is?

- Bould, H.E., Joinson, C., Sterne, J.A.C., Araya, R. (2013) The Emotionality Activity Sociability Temperament Survey: Factor analysis and temporal stability in a longitudinal cohort. *Personality and Individual Differences* 54: 628-633.

- Dwyer, F., Bennett, P. C., & Coleman, G. J. (2006). Development of the Monash dog owner relationship scale (MDORS). *Anthrozoös*, 19(3), 243-256.

Gosling, S. D., Rentfrow, P. J., & Swann, W. B., Jr. (2003). A Very Brief Measure of the Big Five Personality Domains. *Journal of Research in Personality*, 37, 504-528

- Hsu, Y., & Serpell, J. A. (2003). Development and validation of a questionnaire for measuring behavior and temperament traits in pet dogs. *Journal of the American Veterinary Medical Association*, 223(9), 1293-1300.
- Ley, J.M., Bennett, P.C., Coleman, G.J. (2009) A refinement and validation of the Monash Canine Personality Questionnaire (MCPQ). *Applied Animal Behaviour Science* 116(2-4): 220-227.
- Van Herwijnen, I (2017) Dog Directed PSDQ Questionnaire. Unpublished work.
- Wei, M., Russell, D.W., Mallinckrodt, B., Vogel, D.L. (2007) The Experiences in Close Relationship Scale (ECR)-Short Form: Reliability, Validity, and Factor Structure. *Journal of personality assessment* 88(2): 187-204

## Appendix V

### Tables and graphs results section

Table 9. Non-transformed loading pattern outcome of the PCA on the parenting style questionnaire filled in by 2201 dog owners (2201 records of 2201 dogs, on 18 different parameters). Parameters included in the analysis were acquired through the questionnaire. The variance explained by the associations between parameters is indicated in the second row and indicates the importance of the components. Column 2 presents the arithmetic mean ( $\pm$  standard deviation) produced by excel.

	mean	$\pm$	sd	Components		
				1	2	3
variation (%)				17.13	11.61	10.66
Parameters						
Authoritative <sup>1</sup>	74.57	$\pm$	0.24	0.02	0.25	<b>0.56</b>
Authoritarian <sup>1</sup>	24.69	$\pm$	0.28	0.31	-0.17	<b>-0.65</b>
Permissive <sup>1</sup>	27.42	$\pm$	0.29	<b>0.55</b>	-0.05	-0.15
Uninvolved <sup>1</sup>	25.57	$\pm$	0.20	<b>0.55</b>	-0.17	<b>-0.57</b>
Share <sup>2</sup>	72.27	$\pm$	0.23	0.03	0.31	0.26
Close <sup>2</sup>	76.06	$\pm$	0.35	0.23	<b>0.40</b>	0.29
Cost <sup>2</sup>	86.78	$\pm$	0.25	-0.29	0.24	0.32
AnxiousAvoidant <sup>4</sup>	41.72	$\pm$	0.29	<b>0.74</b>	<b>0.51</b>	0.06
Avoidant <sup>4</sup>	42.86	$\pm$	0.34	<b>0.58</b>	<b>0.43</b>	0.07
Anxious <sup>4</sup>	40.59	$\pm$	0.37	<b>0.66</b>	<b>0.43</b>	0.04
DogSociability <sup>3</sup>	62.30	$\pm$	0.35	0.05	0.31	-0.25
AttachmentScore <sup>3</sup>	50.02	$\pm$	0.43	0.39	0.03	0.01
SeparationAnxietyScore <sup>3</sup>	7.84	$\pm$	0.30	<b>0.40</b>	-0.16	-0.04
StrangerDirectedAggressionScore <sup>3</sup>	11.50	$\pm$	0.36	0.38	<b>-0.52</b>	0.32
OwnerDirAggrScore <sup>3</sup>	2.45	$\pm$	0.16	0.31	-0.27	0.00
DogDirAggrScore <sup>3</sup>	19.28	$\pm$	0.46	0.35	<b>-0.51</b>	0.30
SocialFearScore <sup>3</sup>	9.05	$\pm$	0.36	0.39	-0.39	<b>0.45</b>
DogDirFearScore <sup>3</sup>	12.10	$\pm$	0.36	0.33	-0.38	0.33

Numbers in bold are loaded significantly ( $>|0.4|$ ); 1) Parenting styles and dimensions questionnaire (PSDQ); 2) Monash dog owner relationship scale (MDORS); 3) Canine behavioural assessment and research questionnaire (C-BARQ); 4) Experiences in close relationship scale (ECR)

Table 10. Dogs (n = 35) were tested for attachment to their owner in an Ainsworth Strange Situation Test (ASST). Effects (p-values) of the presence of the stranger, the owner and the interaction between them on 40 different behaviour scores during the ASST were examined with a REML analysis. Column 2 presents the predicted means ( $\pm$  standard error) generated by the REML analysis, columns 3-5 show the p-values.

Behaviour	Constant			Stranger present	Owner present	Stranger.Owne r present
	mean	$\pm$	se	p-value	p-value	p-value
freezing, paw lifting, biting leash <sup>1</sup>	0.009643	$\pm$	0.011051	0.348	0.311	0.744
stretching, urogenital check <sup>13</sup>	0.04479	$\pm$	0.014037	0.397	0.995	0.215
sneezing, yelping, grooming <sup>14</sup>	0.07863	$\pm$	0.018942	0.812	0.333	0.600
<b>shaking<sup>1</sup></b>	0.06452	$\pm$	0.023126	<b>&lt;0.001</b>	<b>0.004</b>	0.078
panting <sup>1</sup>	2.568	$\pm$	0.537	0.404	0.468	<b>0.016</b>
yawning <sup>1</sup>	0.07463	$\pm$	0.018603	0.402	0.061	0.856
<b>tongue flicking<sup>1</sup></b>	0.802	$\pm$	0.15987	<b>&lt;0.001</b>	<b>0.07</b>	0.354
<b>sniffing<sup>1</sup></b>	0.09145	$\pm$	0.022023	0.349	<b>0.035</b>	0.103
<b>barking<sup>1</sup></b>	0.7199	$\pm$	0.29653	0.236	<b>0.025</b>	0.279
<b>whining<sup>1</sup></b>	3.0040	$\pm$	0.6647	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.005</b>
jumping <sup>1</sup>	0.09645	$\pm$	0.052064	0.109	0.162	0.142
<b>growling<sup>1</sup></b>	0.09561	$\pm$	0.058018	0.879	0.804	<b>0.042</b>
<b>avoid stranger<sup>1</sup></b>	0.02389	$\pm$	0.012801	<b>&lt;0.001</b>	0.066	<b>0.044</b>
avoid owner <sup>1</sup>	0.007696	$\pm$	0.008323	0.058	0.252	0.296
<b>looking away from stranger<sup>1</sup></b>	0.06325	$\pm$	0.02831	<b>&lt;0.001</b>	<b>0.022</b>	<b>0.012</b>
looking away from owner <sup>1</sup>	0.0015	$\pm$	0.002488	0.274	0.509	0.547
<b>tail wagging<sup>1</sup></b>	0.4217	$\pm$	0.51036	<b>0.004</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
<b>sniffing environment<sup>1</sup></b>	1.231	$\pm$	0.186	<b>&lt;0.001</b>	<b>&lt;0.001</b>	0.061
<b>soliciting attention<sup>1</sup></b>	0.1954	$\pm$	0.06452	0.06	<b>&lt;0.001</b>	0.85
<b>pulling leash<sup>1</sup></b>	0.5683	$\pm$	0.10416	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.013</b>
<b>social play stranger<sup>2</sup></b>	3.633	$\pm$	0.9841	<b>&lt;0.001</b>	0.605	0.533
<b>no playing<sup>2</sup></b>	82.39	$\pm$	3.049	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>

<i>non-social play</i> <sup>2</sup>	0.2876	±	0.19735	<b>0.019</b>	0.137	0.121
<i>social play owner</i> <sup>2</sup>	4.777	±	1.474	<b>&lt;0.001</b>	<b>0.019</b>	<b>0.017</b>
<i>petting owner</i> <sup>2</sup>	8.916	±	2.2838	<b>&lt;0.001</b>	<b>&lt;0.001</b>	0.085
<i>standing</i> <sup>2</sup>	46.16	±	3.204	<b>0.002</b>	0.595	0.224
<i>lying</i> <sup>2</sup>	19.03	±	2.668	<b>&lt;0.001</b>	<b>&lt;0.001</b>	0.327
<i>sitting</i> <sup>2</sup>	11.2	±	2.21	0.286	<b>&lt;0.001</b>	0.266
<i>moving</i> <sup>2</sup>	23.61	±	1.975	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
<i>not being near</i> <sup>2</sup>	23.47	±	2.367	<b>&lt;0.001</b>	0.608	0.736
<i>near owner</i> <sup>2</sup>	32.12	±	2.198	<b>&lt;0.001</b>	<b>&lt;0.001</b>	0.238
<i>near owner chair</i> <sup>2</sup>	29.82	±	2.019	<b>&lt;0.001</b>	<b>&lt;0.001</b>	0.908
<i>near stranger</i> <sup>2</sup>	13.03	±	1.483	<b>&lt;0.001</b>	0.142	0.222
<i>near stranger chair</i> <sup>2</sup>	1.555	±	0.4364	<b>0.111</b>	<b>&lt;0.001</b>	<b>0.005</b>
<i>no staring</i> <sup>2</sup>	60.56	±	2.224	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.044</b>
<i>staring door</i> <sup>2</sup>	19.23	±	1.442	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
<i>staring stranger chair</i> <sup>2</sup>	0.5593	±	0.19505	0.137	<b>0.014</b>	<b>0.021</b>
<i>staring owner</i> <sup>2</sup>	8.6	±	1.177	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
<i>staring stranger</i> <sup>2</sup>	10.47	±	0.639	<b>&lt;0.001</b>	0.108	0.091
<i>staring owner chair</i> <sup>2</sup>	0.5914	±	0.13067	<b>0.013</b>	<b>&lt;0.001</b>	0.692

<sup>1</sup> = rate per minute, <sup>2</sup> = percentage, stretching, urogenital check <sup>3</sup> = includes manipulating environment, sneezing, yelping, grooming <sup>4</sup> = grooming includes biting and licking

Table 11. Predicted mean behaviour scores per ASST tested on the presence of the stranger. REML output with the predicted mean and standard error of the constant and the p-values for the stranger present, owners present and the interaction between stranger and owner for 40 behaviours on 35 dogs. If the difference between two predicted means was higher than two times the standard error of differences, the p-value was  $\leq 0.05$  for that specific contrast, which is indicated by a different character (a or b).

<i>Behaviour</i>	<i>Stranger</i>					
	0 mean	±	se	1 mean	±	se
<i>freezing, paw lifting, biting leash</i> <sup>1</sup>	0.01 <sup>a</sup>	±	0.01	0.01 <sup>a</sup>	±	0.02
<i>stretching, urogenital check</i> <sup>13</sup>	0.06 <sup>a</sup>	±	0.02	0.03 <sup>a</sup>	±	0.02
<i>sneezing, yelping, grooming</i> <sup>14</sup>	0.07 <sup>a</sup>	±	0.03	0.08 <sup>a</sup>	±	0.03
<i>shaking</i> <sup>1</sup>	0.10 <sup>a</sup>	±	0.03	0.03 <sup>a</sup>	±	0.03
<i>panting</i> <sup>1</sup>	2.60 <sup>a</sup>	±	0.55	2.54 <sup>a</sup>	±	0.56
<i>yawning</i> <sup>1</sup>	0.05 <sup>a</sup>	±	0.02	0.10 <sup>a</sup>	±	0.03
<i>tongue flicking</i> <sup>1</sup>	1.00 <sup>b</sup>	±	0.17	0.60 <sup>a</sup>	±	0.17
<i>sniffing</i> <sup>1</sup>	0.06 <sup>a</sup>	±	0.03	0.12 <sup>a</sup>	±	0.03
<i>barking</i> <sup>1</sup>	0.73 <sup>a</sup>	±	0.32	0.71 <sup>a</sup>	±	0.33
<i>whining</i> <sup>1</sup>	3.04 <sup>a</sup>	±	0.70	2.97 <sup>a</sup>	±	0.72
<i>jumping</i> <sup>1</sup>	0.12 <sup>a</sup>	±	0.06	0.07 <sup>a</sup>	±	0.07
<i>growling</i> <sup>1</sup>	0.08 <sup>a</sup>	±	0.07	0.11 <sup>a</sup>	±	0.07
<i>avoid stranger</i> <sup>1</sup>	0.00 <sup>a</sup>	±	0.02	0.05 <sup>b</sup>	±	0.02
<i>avoid owner</i> <sup>1</sup>	0.02 <sup>a</sup>	±	0.01	0.00 <sup>a</sup>	±	0.01
<i>looking away from stranger</i> <sup>1</sup>	0.00 <sup>a</sup>	±	0.03	0.13 <sup>b</sup>	±	0.04
<i>looking away from owner</i> <sup>1</sup>	0.00 <sup>a</sup>	±	0.00	0.00 <sup>a</sup>	±	0.00
<i>tail wagging</i> <sup>1</sup>	2.54 <sup>a</sup>	±	0.39	3.29 <sup>a</sup>	±	0.40
<i>sniffing environment</i> <sup>1</sup>	1.56 <sup>a</sup>	±	0.25	0.91 <sup>a</sup>	±	0.28
<i>soliciting attention</i> <sup>1</sup>	0.18 <sup>a</sup>	±	0.08	0.21 <sup>a</sup>	±	0.08
<i>pulling leash</i> <sup>1</sup>	0.23 <sup>a</sup>	±	0.12	0.91 <sup>b</sup>	±	0.12
<i>social play stranger</i> <sup>2</sup>	0.04 <sup>a</sup>	±	1.17	7.23 <sup>b</sup>	±	1.24
<i>no playing</i> <sup>2</sup>	79.81 <sup>a</sup>	±	3.43	84.96 <sup>a</sup>	±	3.59
<i>non-social play</i> <sup>2</sup>	0.51 <sup>a</sup>	±	0.25	0.07 <sup>a</sup>	±	0.27
<i>social play owner</i> <sup>2</sup>	9.22 <sup>b</sup>	±	1.87	0.33 <sup>a</sup>	±	2.03
<i>petting owner</i> <sup>2</sup>	10.42 <sup>a</sup>	±	2.56	7.41 <sup>a</sup>	±	2.68
<i>standing</i> <sup>2</sup>	41.74 <sup>a</sup>	±	3.48	50.58 <sup>b</sup>	±	3.60
<i>lying</i> <sup>2</sup>	18.29 <sup>a</sup>	±	3.02	19.78 <sup>a</sup>	±	3.16
<i>sitting</i> <sup>2</sup>	12.30 <sup>a</sup>	±	2.43	10.11 <sup>a</sup>	±	2.53
<i>moving</i> <sup>2</sup>	27.67 <sup>b</sup>	±	2.31	19.54 <sup>a</sup>	±	2.44
<i>not being near</i> <sup>2</sup>	30.22 <sup>b</sup>	±	2.98	16.72 <sup>a</sup>	±	3.21
<i>near owner</i> <sup>2</sup>	35.77 <sup>b</sup>	±	2.69	28.47 <sup>a</sup>	±	2.89



<i>near owner chair</i> <sup>2</sup>	30.70 <sup>a</sup>	±	2.56	28.95 <sup>a</sup>	±	2.77
<i>near stranger</i> <sup>2</sup>	0.39 <sup>a</sup>	±	1.79	25.67 <sup>b</sup>	±	1.91
<i>near stranger chair</i> <sup>2</sup>	2.91 <sup>b</sup>	±	0.57	0.20 <sup>a</sup>	±	0.62
<i>no staring</i> <sup>2</sup>	63.64 <sup>b</sup>	±	2.50	57.47 <sup>a</sup>	±	2.61
<i>staring door</i> <sup>2</sup>	23.11 <sup>b</sup>	±	1.68	15.35 <sup>a</sup>	±	1.78
<i>staring stranger chair</i> <sup>2</sup>	1.08 <sup>b</sup>	±	0.26	0.04 <sup>a</sup>	±	0.29
<i>staring owner</i> <sup>2</sup>	11.57 <sup>b</sup>	±	1.39	5.63 <sup>a</sup>	±	1.47
<i>staring stranger</i> <sup>2</sup>	0.03 <sup>a</sup>	±	0.83	20.90 <sup>b</sup>	±	0.90
<i>staring owner chair</i> <sup>2</sup>	0.57 <sup>a</sup>	±	0.17	0.61 <sup>a</sup>	±	0.19

<sup>1</sup> = rate per minute, <sup>2</sup> = percentage, stretching, urogenital check <sup>3</sup> = includes manipulating environment, sneezing, yelping, grooming <sup>4</sup> = grooming includes biting and licking

Table 12 Predicted mean behaviour scores per ASST tested on the presence of the owner. REML output with the predicted mean and standard error of the constant and the p-values for the stranger present, owners present and the interaction between stranger and owner for 40 behaviours on 35 dogs. If the difference between two predicted means was higher than two times the standard error of differences, the p-value was  $\leq 0.05$  for that specific contrast, which is indicated by a different character (a or b).

<i>Behaviour</i>	<i>Owner</i>					
	0			1		
	mean	±	se	mean	±	se
<i>freezing, paw lifting, biting leash</i> <sup>1</sup>	0.00 <sup>a</sup>	±	0.02	0.02 <sup>a</sup>	±	0.01
<i>stretching, urogenital check</i> <sup>13</sup>	0.04 <sup>a</sup>	±	0.02	0.05 <sup>a</sup>	±	0.02
<i>sneezing, yelping, grooming</i> <sup>14</sup>	0.06 <sup>a</sup>	±	0.03	0.10 <sup>a</sup>	±	0.03
<i>shaking</i> <sup>1</sup>	0.02 <sup>a</sup>	±	0.03	0.11 <sup>b</sup>	±	0.03
<i>panting</i> <sup>1</sup>	2.49 <sup>a</sup>	±	0.56	2.64 <sup>a</sup>	±	0.55
<i>yawning</i> <sup>1</sup>	0.04 <sup>a</sup>	±	0.03	0.11 <sup>a</sup>	±	0.02
<i>tongue flicking</i> <sup>1</sup>	0.69 <sup>a</sup>	±	0.17	0.91 <sup>a</sup>	±	0.17
<i>sniffing</i> <sup>1</sup>	0.05 <sup>a</sup>	±	0.03	0.13 <sup>b</sup>	±	0.03
<i>barking</i> <sup>1</sup>	1.01 <sup>b</sup>	±	0.33	0.43 <sup>a</sup>	±	0.32
<i>whining</i> <sup>1</sup>	4.48 <sup>b</sup>	±	0.72	1.53 <sup>a</sup>	±	0.70
<i>jumping</i> <sup>1</sup>	0.05 <sup>a</sup>	±	0.07	0.14 <sup>a</sup>	±	0.06
<i>growling</i> <sup>1</sup>	0.09 <sup>a</sup>	±	0.07	0.10 <sup>a</sup>	±	0.07
<i>avoid stranger</i> <sup>1</sup>	0.04 <sup>b</sup>	±	0.02	0.01 <sup>a</sup>	±	0.02
<i>avoid owner</i> <sup>1</sup>	0.00 <sup>a</sup>	±	0.01	0.02 <sup>a</sup>	±	0.01
<i>looking away from stranger</i> <sup>1</sup>	0.12 <sup>b</sup>	±	0.04	0.01 <sup>a</sup>	±	0.03
<i>looking away from owner</i> <sup>1</sup>	0.00 <sup>a</sup>	±	0.00	0.00 <sup>a</sup>	±	0.00
<i>tail wagging</i> <sup>1</sup>	1.36 <sup>a</sup>	±	0.40	4.47 <sup>b</sup>	±	0.39
<i>sniffing environment</i> <sup>1</sup>	0.36 <sup>a</sup>	±	0.28	2.10 <sup>b</sup>	±	0.25
<i>soliciting attention</i> <sup>1</sup>	0.01 <sup>a</sup>	±	0.08	0.38 <sup>b</sup>	±	0.08
<i>pulling leash</i> <sup>1</sup>	0.31 <sup>a</sup>	±	0.12	0.83 <sup>b</sup>	±	0.12
<i>social play stranger</i> <sup>2</sup>	4.03 <sup>a</sup>	±	1.24	3.24 <sup>a</sup>	±	1.17
<i>no playing</i> <sup>2</sup>	90.30 <sup>b</sup>	±	3.59	74.47 <sup>a</sup>	±	3.43
<i>non-social play</i> <sup>2</sup>	0.05 <sup>a</sup>	±	0.27	0.52 <sup>a</sup>	±	0.25
<i>social play owner</i> <sup>2</sup>	2.04 <sup>a</sup>	±	2.03	7.51 <sup>b</sup>	±	1.87
<i>petting owner</i> <sup>2</sup>	3.57 <sup>a</sup>	±	2.68	14.26 <sup>b</sup>	±	2.56
<i>standing</i> <sup>2</sup>	45.19 <sup>a</sup>	±	3.60	47.12 <sup>a</sup>	±	3.48
<i>lying</i> <sup>2</sup>	28.21 <sup>b</sup>	±	3.16	9.86 <sup>a</sup>	±	3.02
<i>sitting</i> <sup>2</sup>	15.47 <sup>b</sup>	±	2.53	6.94 <sup>a</sup>	±	2.43
<i>moving</i> <sup>2</sup>	11.14 <sup>a</sup>	±	2.44	36.08 <sup>b</sup>	±	2.31
<i>not being near</i> <sup>2</sup>	24.55 <sup>a</sup>	±	3.21	22.39 <sup>a</sup>	±	2.98
<i>near owner</i> <sup>2</sup>	4.58 <sup>a</sup>	±	2.89	59.66 <sup>b</sup>	±	2.69
<i>near owner chair</i> <sup>2</sup>	56.68 <sup>b</sup>	±	2.77	2.97 <sup>a</sup>	±	2.56
<i>near stranger</i> <sup>2</sup>	11.28 <sup>a</sup>	±	1.91	14.78 <sup>a</sup>	±	1.79
<i>near stranger chair</i> <sup>2</sup>	2.91 <sup>b</sup>	±	0.62	0.20 <sup>a</sup>	±	0.57
<i>no staring</i> <sup>2</sup>	51.97 <sup>a</sup>	±	2.61	69.15 <sup>b</sup>	±	2.50
<i>staring door</i> <sup>2</sup>	36.20 <sup>b</sup>	±	1.78	2.26 <sup>a</sup>	±	1.68
<i>staring stranger chair</i> <sup>2</sup>	1.00 <sup>b</sup>	±	0.29	0.12 <sup>a</sup>	±	0.26
<i>staring owner</i> <sup>2</sup>	0.28 <sup>a</sup>	±	1.47	16.92 <sup>b</sup>	±	1.39
<i>staring stranger</i> <sup>2</sup>	9.45 <sup>a</sup>	±	0.90	11.49 <sup>a</sup>	±	0.83
<i>staring owner chair</i> <sup>2</sup>	1.11 <sup>b</sup>	±	0.19	0.07 <sup>a</sup>	±	0.17

<sup>1</sup> = rate per minute, <sup>2</sup> = percentage, stretching, urogenital check <sup>3</sup> = includes manipulating environment, sneezing, yelping, grooming <sup>4</sup> = grooming includes biting and licking

Table 13 Predicted mean behaviour scores per ASST tested on the presence of the stranger and/or the owner or neither. REML output with the predicted mean and standard error of the constant and the p-values for the stranger present, owners present and the interaction between stranger and owner for 40 behaviours on 35 dogs. If the difference between two predicted means was higher than two times the standard error of differences, the p-value was  $\leq 0.05$  for that specific contrast, which is indicated by a different character (a, b, c or d).

Behaviour	Stranger present			Owner present								
	0.0	mean	± se	0.1	mean	± se	1.0	mean	± se	1.1	mean	± se
freezing, paw lifting, biting leash <sup>1</sup>	0.00 <sup>a</sup>	±	0.02	0.03 <sup>a</sup>	±	0.01	0.00 <sup>a</sup>	±	0.02	0.01 <sup>a</sup>	±	0.02
stretching, urogenital check <sup>13</sup>	0.07 <sup>a</sup>	±	0.03	0.04 <sup>a</sup>	±	0.02	0.02 <sup>a</sup>	±	0.02	0.05 <sup>a</sup>	±	0.03
sneezing, yelping, grooming <sup>14</sup>	0.07 <sup>a</sup>	±	0.05	0.08 <sup>a</sup>	±	0.02	0.05 <sup>a</sup>	±	0.03	0.11 <sup>a</sup>	±	0.05
shaking <sup>1</sup>	0.02 <sup>a</sup>	±	0.04	0.17 <sup>a</sup>	±	0.03	0.02 <sup>a</sup>	±	0.03	0.05 <sup>a</sup>	±	0.04
panting <sup>1</sup>	2.16 <sup>a</sup>	±	0.63	3.03 <sup>b</sup>	±	0.55	2.83 <sup>ab</sup>	±	0.58	2.26 <sup>ab</sup>	±	0.63
yawning <sup>1</sup>	0.02 <sup>a</sup>	±	0.04	0.08 <sup>a</sup>	±	0.02	0.07 <sup>a</sup>	±	0.03	0.14 <sup>b</sup>	±	0.04
tongue flicking <sup>1</sup>	0.83 <sup>ab</sup>	±	0.21	1.17 <sup>b</sup>	±	0.17	0.55 <sup>a</sup>	±	0.18	0.66 <sup>a</sup>	±	0.21
sniffing <sup>1</sup>	0.05 <sup>a</sup>	±	0.05	0.07 <sup>a</sup>	±	0.03	0.05 <sup>a</sup>	±	0.03	0.19 <sup>b</sup>	±	0.05
barking <sup>1</sup>	1.17 <sup>b</sup>	±	0.42	0.30 <sup>a</sup>	±	0.31	0.85 <sup>ab</sup>	±	0.35	0.56 <sup>ab</sup>	±	0.42
whining <sup>1</sup>	5.24 <sup>d</sup>	±	0.87	0.83 <sup>a</sup>	±	0.69	3.72 <sup>c</sup>	±	0.75	2.22 <sup>b</sup>	±	0.87
jumping <sup>1</sup>	0.02 <sup>a</sup>	±	0.10	0.22 <sup>b</sup>	±	0.06	0.08 <sup>ab</sup>	±	0.07	0.06 <sup>ab</sup>	±	0.10
growling <sup>1</sup>	0.00 <sup>a</sup>	±	0.10	0.16 <sup>a</sup>	±	0.06	0.19 <sup>a</sup>	±	0.08	0.04 <sup>a</sup>	±	0.10
avoid stranger <sup>1</sup>	0.00 <sup>a</sup>	±	0.02	0.00 <sup>a</sup>	±	0.01	0.08 <sup>b</sup>	±	0.02	0.01 <sup>a</sup>	±	0.02
avoid owner <sup>1</sup>	0.00 <sup>a</sup>	±	0.02	0.03 <sup>a</sup>	±	0.01	0.00 <sup>a</sup>	±	0.01	0.00 <sup>a</sup>	±	0.02
looking away from stranger <sup>1</sup>	0.00 <sup>a</sup>	±	0.06	0.00 <sup>a</sup>	±	0.03	0.24 <sup>a</sup>	±	0.04	0.01 <sup>a</sup>	±	0.06
looking away from owner <sup>1</sup>	0.00 <sup>a</sup>	±	0.01	0.01 <sup>a</sup>	±	0.00	0.00 <sup>a</sup>	±	0.00	0.00 <sup>a</sup>	±	0.01
tail wagging <sup>1</sup>	0.42 <sup>a</sup>	±	0.51	4.65 <sup>c</sup>	±	0.38	2.30 <sup>b</sup>	±	0.43	4.28 <sup>c</sup>	±	0.51
sniffing environment <sup>1</sup>	0.33 <sup>a</sup>	±	0.45	2.78 <sup>b</sup>	±	0.22	0.38 <sup>a</sup>	±	0.32	1.43 <sup>a</sup>	±	0.45
soliciting attention <sup>1</sup>	0.00 <sup>a</sup>	±	0.11	0.36 <sup>b</sup>	±	0.07	0.01 <sup>ab</sup>	±	0.09	0.41 <sup>b</sup>	±	0.11
pulling leash <sup>1</sup>	0.11 <sup>a</sup>	±	0.16	0.35 <sup>ab</sup>	±	0.11	0.51 <sup>b</sup>	±	0.13	1.31 <sup>c</sup>	±	0.16
social play stranger <sup>2</sup>	0.00 <sup>a</sup>	±	1.82	0.07 <sup>a</sup>	±	1.09	8.06 <sup>b</sup>	±	1.38	6.40 <sup>b</sup>	±	1.82
no playing <sup>2</sup>	93.72 <sup>b</sup>	±	4.89	65.91 <sup>a</sup>	±	3.27	86.88 <sup>b</sup>	±	3.89	83.03 <sup>b</sup>	±	4.89
non-social play <sup>2</sup>	0.00 <sup>a</sup>	±	0.43	1.01 <sup>b</sup>	±	0.23	0.11 <sup>a</sup>	±	0.31	0.03 <sup>a</sup>	±	0.43
social play owner <sup>2</sup>	3.42 <sup>a</sup>	±	3.17	15.02 <sup>b</sup>	±	1.71	0.66 <sup>a</sup>	±	2.30	0.00 <sup>a</sup>	±	3.17
petting owner <sup>2</sup>	2.86 <sup>a</sup>	±	3.63	17.99 <sup>b</sup>	±	2.44	4.29 <sup>a</sup>	±	2.89	10.54 <sup>a</sup>	±	3.63
standing <sup>2</sup>	42.61 <sup>a</sup>	±	4.60	40.87 <sup>a</sup>	±	3.36	47.77 <sup>b</sup>	±	3.82	53.38 <sup>b</sup>	±	4.60
lying <sup>2</sup>	28.99 <sup>b</sup>	±	4.33	7.58 <sup>a</sup>	±	2.87	27.42 <sup>b</sup>	±	3.43	12.13 <sup>a</sup>	±	4.33
sitting <sup>2</sup>	17.82 <sup>c</sup>	±	3.31	6.78 <sup>a</sup>	±	2.34	13.11 <sup>bc</sup>	±	2.70	7.10 <sup>ab</sup>	±	3.31
moving <sup>2</sup>	10.58 <sup>a</sup>	±	3.51	44.77 <sup>c</sup>	±	2.17	11.69 <sup>a</sup>	±	2.69	27.39 <sup>b</sup>	±	3.51
not being near <sup>2</sup>	30.63 <sup>b</sup>	±	4.98	29.81 <sup>b</sup>	±	2.72	18.47 <sup>ac</sup>	±	3.64	14.96 <sup>a</sup>	±	4.98
near owner <sup>2</sup>	6.20 <sup>a</sup>	±	4.37	65.35 <sup>c</sup>	±	2.49	2.96 <sup>a</sup>	±	3.24	53.97 <sup>b</sup>	±	4.37
near owner chair <sup>2</sup>	57.75 <sup>b</sup>	±	4.32	3.64 <sup>a</sup>	±	2.34	55.60 <sup>b</sup>	±	3.14	2.30 <sup>a</sup>	±	4.32
near stranger <sup>2</sup>	0.00 <sup>a</sup>	±	2.85	0.79 <sup>a</sup>	±	1.66	22.57 <sup>b</sup>	±	2.13	28.77 <sup>b</sup>	±	2.85
near stranger chair <sup>2</sup>	5.42 <sup>b</sup>	±	0.99	0.40 <sup>a</sup>	±	0.52	0.39 <sup>a</sup>	±	0.71	0.00 <sup>a</sup>	±	0.99
no staring <sup>2</sup>	52.49 <sup>a</sup>	±	3.55	74.78 <sup>c</sup>	±	2.38	51.44 <sup>a</sup>	±	2.82	63.51 <sup>b</sup>	±	3.55
staring door <sup>2</sup>	43.96 <sup>c</sup>	±	2.56	2.25 <sup>a</sup>	±	1.58	28.43 <sup>b</sup>	±	1.96	2.27 <sup>a</sup>	±	2.56
staring stranger chair <sup>2</sup>	1.97 <sup>b</sup>	±	0.47	0.19 <sup>a</sup>	±	0.24	0.02 <sup>a</sup>	±	0.33	0.05 <sup>a</sup>	±	0.47
staring owner <sup>2</sup>	0.43 <sup>a</sup>	±	2.13	22.71 <sup>c</sup>	±	1.30	0.13 <sup>a</sup>	±	1.62	11.13 <sup>b</sup>	±	2.13
staring stranger <sup>2</sup>	0.00 <sup>a</sup>	±	1.42	0.07 <sup>a</sup>	±	0.75	18.90 <sup>b</sup>	±	1.02	22.90 <sup>c</sup>	±	1.42
staring owner chair <sup>2</sup>	1.14 <sup>b</sup>	±	0.30	0.00 <sup>a</sup>	±	0.15	1.09 <sup>b</sup>	±	0.21	0.14 <sup>a</sup>	±	0.30

<sup>1</sup> = rate per minute, <sup>2</sup> = percentage, stretching, urogenital check <sup>3</sup> = includes manipulating environment, sneezing, yelping, grooming <sup>4</sup> = grooming includes biting and licking

## Appendix X ANOVA results

Table 14 The behaviours of the dogs during the ASST were checked for a relationship with the parenting style of the owner of the dog in a ANOVA analysis (35 dogs, 14 behaviours and 4 parenting styles with 6 parenting style interactions) The first column gives the behaviours, the second column gives the amount of variance that is explained by the behaviour and the third column gives the standard error. The other columns represent the p-values that were given as output for the 10 parenting styles variations. If the p-value was  $\leq 0.05$ , it was printed in bold.

	variance	se	AUTV	AUTN	PERM	UNIN	AUTV .AUTN	AUTV .PERM	AUTN .PERM	AUTV .UNIN	AUTN .UNIN	PER M.UNIN
<i>shaking</i> <sup>1</sup>	6	0.26	0.426	0.140	0.136	0.135	0.088	0.309	0.599	0.364	0.310	0.906
<i>panting</i> <sup>1</sup>	26.5	3.17	0.291	<b>0.015</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.001</b>	<b>0.000</b>	<b>0.007</b>	0.343
<i>tongue flicking</i> <sup>1</sup>	9.3	1.22	0.502	<b>0.005</b>	<b>0.041</b>	<b>0.000</b>	0.269	<b>0.041</b>	0.071	0.235	0.091	0.168
<i>whining</i> <sup>1</sup>	27.2	4.55	0.841	0.099	<b>0.000</b>	<b>0.029</b>	<b>0.029</b>	<b>0.027</b>	<b>0.000</b>	0.368	<b>0.000</b>	<b>0.003</b>
<i>avoid stranger</i> <sup>1</sup>	4.1	0.14	0.547	0.127	0.715	0.739	0.522	0.212	<b>0.054</b>	0.788	<b>0.014</b>	0.138
<i>tail wagging</i> <sup>1</sup>	7.3	3.23	0.094	<b>0.013</b>	0.705	<b>0.042</b>	<b>0.000</b>	<b>0.001</b>	0.214	<b>0.000</b>	<b>0.042</b>	0.970
<i>sniffing environment</i> <sup>1</sup>	Residual variance exceeds variance of response variate											
<i>soliciting attention</i> <sup>1</sup>	6.4	0.67	0.217	0.400	0.423	0.280	<b>0.008</b>	0.565	<b>0.008</b>	0.195	<b>0.017</b>	0.472
<i>pulling leash</i> <sup>1</sup>	13	0.93	<b>0.018</b>	<b>0.000</b>	<b>0.000</b>	<b>0.001</b>	0.646	0.064	0.552	0.507	<b>0.001</b>	0.429
<i>no playing</i> <sup>2</sup>	5	30.10	0.448	0.577	0.653	0.600	<b>0.000</b>	<b>0.000</b>	<b>0.035</b>	<b>0.001</b>	0.279	0.508
<i>standing</i> <sup>2</sup>	7.8	26.30	<b>0.034</b>	0.964	0.885	0.326	<b>0.002</b>	<b>0.033</b>	0.417	0.185	<b>0.021</b>	0.185
<i>lying</i> <sup>2</sup>	8.1	26.10	<b>0.013</b>	0.398	0.133	0.934	<b>0.011</b>	<b>0.008</b>	<b>0.010</b>	0.139	0.344	0.319
<i>sitting</i> <sup>2</sup>	6.1	19.20	0.426	0.694	0.769	0.303	0.797	0.284	<b>0.013</b>	0.386	<b>0.000</b>	0.224
<i>moving</i> <sup>2</sup>	Residual variance exceeds variance of response variate											
<i>near owner</i> <sup>2</sup>	0	38.70	0.058	0.597	0.157	0.172	0.510	0.932	0.813	0.442	0.234	0.321
<i>not being near</i> <sup>2</sup>	1.7	29.70	<b>0.019</b>	0.818	0.360	0.375	0.765	0.588	0.951	0.615	0.667	0.121
<i>staring owner</i> <sup>2</sup>	1.8	16.10	0.221	0.172	0.286	0.164	0.096	0.204	0.309	0.765	0.907	0.573

Table 15 Output from an ANOVA analysis. Interaction effect on panting behaviour of an authoritative and authoritarian parenting style. AUTV 10 represents a score of 10% authoritative parenting style and AUTV 90 represents a score of 90% authoritative parenting style on a scale of authoritarian parenting style on a scale of 10 to 90 percent.

<i>Panting</i>			
		AUTV 10	AUTV 90
<i>AUTN</i>	10	-23.57	9.01
	30	-2.26	3.62
	50	19.05	-1.77
	70	40.36	-7.16
	90	61.66	-12.56

Table 16 Output from an ANOVA analysis. Interaction effect on whining behaviour of an authoritative and authoritarian parenting style. AUTV 10 represents a score of 10% authoritative parenting style and AUTV 90 represents a score of 90% authoritative parenting style on a scale of authoritarian parenting style on a scale of 10 to 90 percent.

<i>Whining</i>			
		AUTV 10	AUTV 90
<i>AUTN</i>	10	-10.982	2.931
	30	0.795	2.379
	50	12.573	1.827
	70	24.351	1.276
	90	36.129	0.724

Table 17 Output from an ANOVA analysis. Effect of an authoritative, authoritarian, permissive and uninvolved parenting style of dog owners on the amount of pulling leash behaviour that was displayed during the ASST.

<i>Pulling leash</i>				
	AUTV	AUTN	PERM	UNIN
10	-0.3071	-0.1203	-0.39	1.188
30	-0.1191	0.3214	0.28	0.216
50	0.0689	0.7632	0.951	-0.756
70	0.2569	1.205	1.622	-1.727
90	0.4449	1.6468	2.293	-2.699

Table 18 Output from an ANOVA analysis. Interaction effect on standing and lying behaviour of an authoritative and authoritarian parenting style. AUTV 10 represents a score of 10% authoritative parenting style and AUTV 90 represents a score of 90% authoritative parenting style on a scale of authoritarian parenting style on a scale of 10 to 90 percent.

<i>Standing and Lying</i>					
		AUTV 10 standing	AUTV 90 standing	AUTV 10 lying	AUTV 90 lying
AUTN	10	-92.73	70.79	141.85	-2.24
	30	-6.04	57.49	68.05	6.16
	50	80.64	44.19	-5.75	14.56
	70	167.33	30.9	-79.55	22.96
	90	254.01	17.6	-153.36	31.36

Table 19 The information sharing behaviours of the dogs during the Altruism test were checked for a relationship with the parenting style of the owner of the dog in a ANOVA analysis (40 dogs and 4 parenting) The first column gives the behaviours, the second column gives the amount of variance that is explained by the behaviour and the third column gives the standard error. The other columns represent the p-values that were given as output for the 4 parenting styles. If the p-value was  $\leq 0.05$ , it was printed in bold.

	Variance	se	AUTV	AUTN	PERM	UNIN
<i>Time boxzone</i>	Residual variance exceeds variance of response variate.					
<i>Look at boxzone</i>	Residual variance exceeds variance of response variate.					
<i>Approach boxzone</i>	3.1	0.5	0.129	0.62	0.132	0.773
<i>Reference boxzone once</i>	Residual variance exceeds variance of response variate.					
<i>Stress signals</i>	4.3	16.2	0.752	0.36	0.151	0.997

Table 18 Output from an ANOVA analysis. Effect of an authoritative, authoritarian, permissive and uninvolved parenting style of dog owners on the amount of tongue flicking behaviour that was displayed during the ASST.

<i>Pulling leash</i>					
	AUTV	AUTN	PERM	UNIN	
10	1.181	1.5332	1.682	-0.342	
30	1.156	1.0862	1.1225	1.252	
50	1.131	0.6392	0.563	2.845	
70	1.106	0.1922	0.0036	4.439	
90	1.08	-0.2548	-0.5559	6.032	

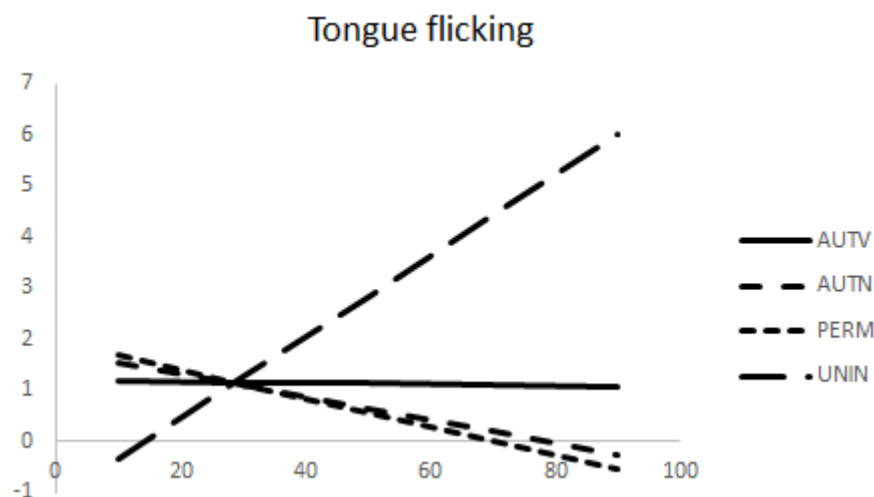


Figure 5. Scores for tongue flicking (y-axis, expressed as % of the observation time) in dogs during the Ainsworth Strange Situation Test (ASST) for measuring dog to owner attachment. Shown is the effect of an authoritative, authoritarian, permissive and uninvolved parenting style of dog owners on the amount of pulling leash behaviour that was displayed during the ASST.

Table 19 Output from an ANOVA analysis. Interaction effect on tail wagging behaviour of an authoritative and authoritarian parenting style. AUTV 10 represents a score of 10% authoritative parenting style and AUTV 90 represents a score of 90% authoritative parenting style on a scale of authoritarian parenting style on a scale of 10 to 90 percent.

<i>Tail wagging</i>			
		AUTV 10	AUTV 90
AUTN	10	-11.298	7.545
	30	0.234	3.974
	50	11.765	0.403

70	23.297	-3.168
90	34.829	-6.739

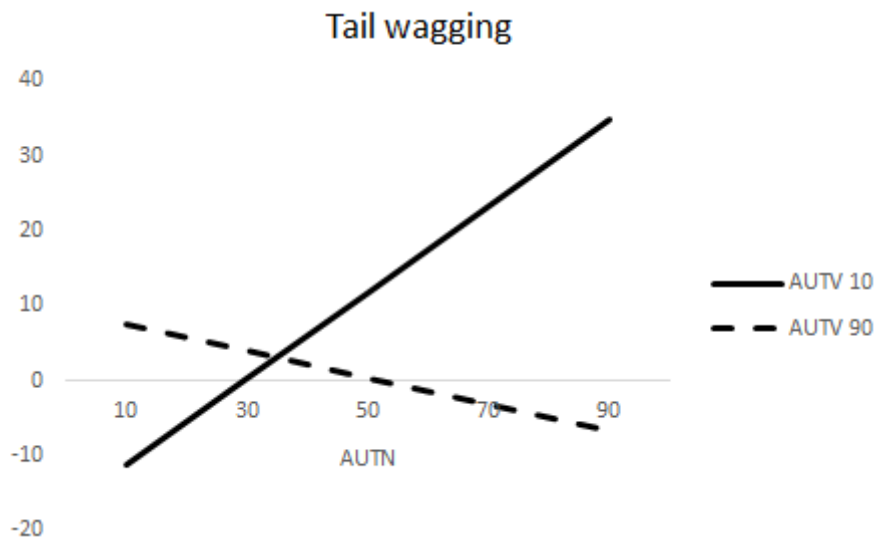


Figure 6 Scores for tail wagging (y-axis, expresses as % of the observation time) in dogs during the Ainsworth Strange Situation Test (ASST) for measuring dog to owner attachment. Shown is the significant interaction effect of parenting authoritarian (x-axis, expressed as % of the maximum possible) and authoritative (solid line versus interrupted line). The solid line represents a score of 10% authoritative parenting and the interrupted line represents a score of 90% authoritative parenting.

Table 20 Output from an ANOVA analysis. Interaction effect on soliciting attention behaviour of an authoritative and authoritarian parenting style. AUTV 10 represents a score of 10% authoritative parenting style and AUTV 90 represents a score of 90% authoritative parenting style on a scale of authoritarian parenting style on a scale of 10 to 90 percent.

<i>Soliciting attention</i>			
		AUTV 10	AUTV 90
AUTN	10	2.121	-0.068
	30	0.125	0.164
	50	-1.87	0.396
	70	-3.866	0.628
	90	-5.862	0.86

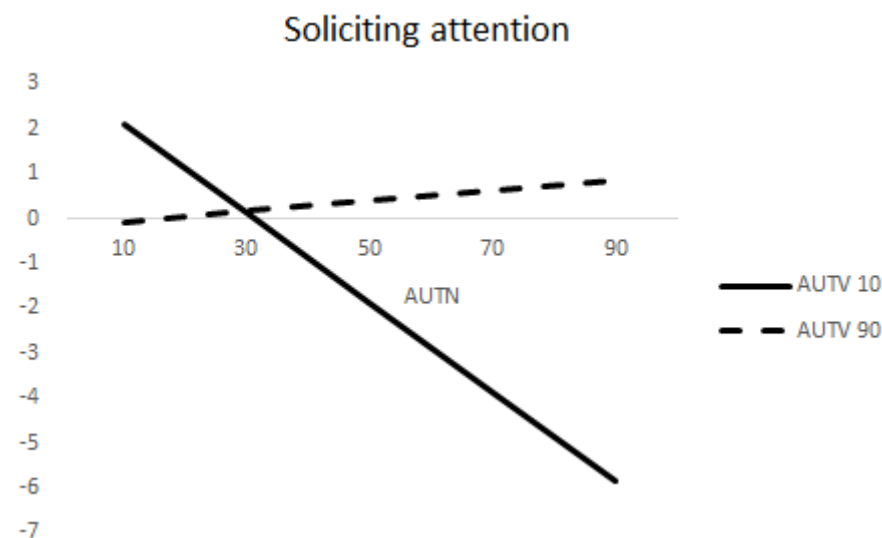


Figure 7 Scores for soliciting attention (y-axis, expresses as % of the observation time) in dogs during the Ainsworth Strange Situation Test (ASST) for measuring dog to owner attachment. Shown is the significant interaction effect of parenting authoritarian (x-axis, expressed as % of the maximum possible) and authoritative (solid line versus interrupted line). The solid line represents a score of 10% authoritative parenting and the interrupted line represents a score of 90% authoritative parenting.

Table 21 Output from an ANOVA analysis. Interaction effect on whining behaviour of an authoritative and authoritarian parenting style. AUTV 10 represents a score of 10% authoritative parenting style and AUTV 90 represents a score of 90% authoritative parenting style on a scale of authoritarian parenting style on a scale of 10 to 90 percent.

<i>No playing</i>			
		AUTV 10	AUTV 90
AUTN	10	235.05	51.5
	30	108.46	70.84
	50	-18.13	90.18
	70	-144.72	109.52
	90	-271.31	128.86

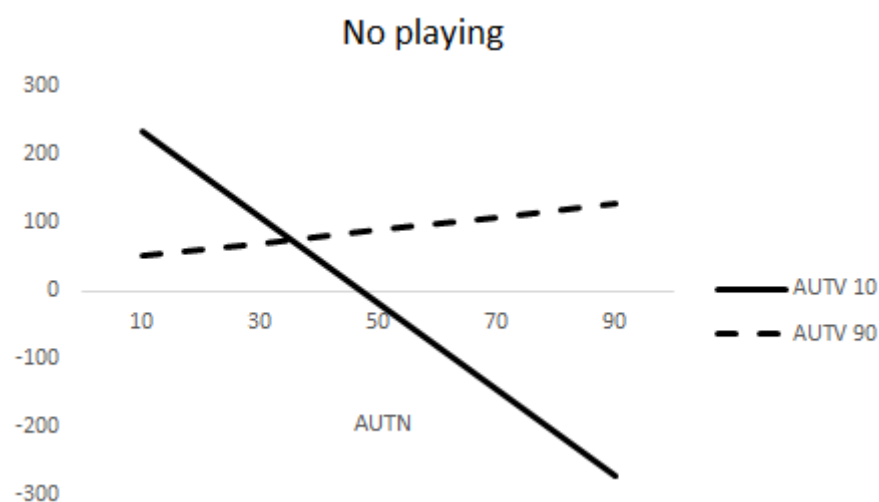


Figure 8 Scores for no playing (y-axis, expresses as % of the observation time) in dogs during the Ainsworth Strange Situation Test (ASST) for measuring dog to owner attachment. Shown is the significant interaction effect of parenting authoritarian (x-axis, expressed as % of the maximum possible) and authoritative (solid line versus interrupted line). The solid line represents a score of 10% authoritative parenting and the interrupted line represents a score of 90% authoritative parenting.

Table 22 Output from an ANOVA analysis. Effect of an authoritative, authoritarian, permissive and uninvolved parenting style of dog owners on the amount of not being near a specified object or person that was displayed during the ASST.

<i>Not being near</i>				
	AUTV	AUTN	PERM	UNIN
10	60.53	24.65	17.35	28.8
30	48.94	22.47	22.32	21.87
50	37.35	20.29	27.29	14.93
70	25.76	18.11	32.26	8
90	14.17	15.93	37.23	1.07

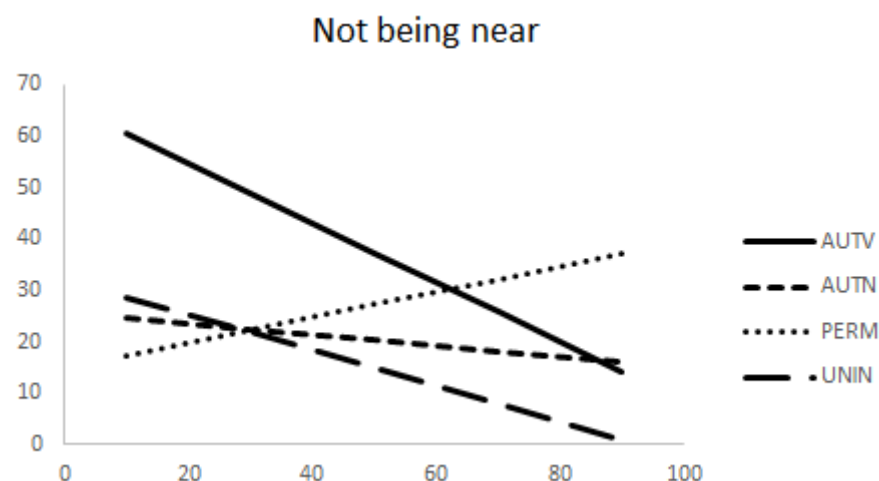


Figure 9 Scores for not being near (y-axis, expressed as % of the observation time) in dogs during the Ainsworth Strange Situation Test (ASST) for measuring dog to owner attachment. Shown is the effect of an authoritative, authoritarian, permissive and uninvolved parenting style of dog owners on the amount of pulling leash behaviour that was displayed during the ASST.

Table 6 The behaviours of the dogs during the ASST were checked for a relationship with the parenting style of the owner of the dog in a ANOVA analysis (35 dogs, 14 behaviours and 4 parenting styles with 6 parenting style interactions) The first column gives the behaviours, the second column gives the amount of variance that is explained by the behaviour and the third column gives the standard error. The other columns represent the p-values that were given as output for the 10 parenting styles variations. If the p-value was  $\leq 0.05$ , it was printed in bold. See Table 14 Appendix V for full table.

	variance	se	AUTV	AUTN	PERM	UNIN	AUTV. AUTN	AUTV. PERM	AUTN. PERM	AUTV. UNIN	AUTN. UNIN	PERM. UNIN
<i>panting</i> <sup>1</sup>	26.5	3.17	0.291	<b>0.015</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.001</b>	<b>0.000</b>	<b>0.007</b>	0.343
<i>tongue flicking</i> <sup>1</sup>	9.3	1.22	0.502	<b>0.005</b>	<b>0.041</b>	<b>0.000</b>	0.269	<b>0.041</b>	0.071	0.235	0.091	0.168
<i>whining</i> <sup>1</sup>	27.2	4.55	0.841	0.099	<b>0.000</b>	<b>0.029</b>	<b>0.029</b>	<b>0.027</b>	<b>0.000</b>	0.368	<b>0.000</b>	<b>0.003</b>
<i>avoid stranger</i> <sup>1</sup>	4.1	0.14	0.547	0.127	0.715	0.739	0.522	0.212	<b>0.054</b>	0.788	<b>0.014</b>	0.138
<i>tail wagging</i> <sup>1</sup>	7.3	3.23	0.094	<b>0.013</b>	0.705	<b>0.042</b>	<b>0.000</b>	<b>0.001</b>	0.214	<b>0.000</b>	<b>0.042</b>	0.970
<i>sniffing environment</i> <sup>1</sup>	Residual variance exceeds variance of response variate											
<i>soliciting attention</i> <sup>1</sup>	6.4	0.67	0.217	0.400	0.423	0.280	<b>0.008</b>	0.565	<b>0.008</b>	0.195	<b>0.017</b>	0.472
<i>pulling leash</i> <sup>1</sup>	13	0.93	<b>0.018</b>	<b>0.000</b>	<b>0.000</b>	<b>0.001</b>	0.646	0.064	0.552	0.507	<b>0.001</b>	0.429
<i>no playing</i> <sup>2</sup>	5	30.10	0.448	0.577	0.653	0.600	<b>0.000</b>	<b>0.000</b>	<b>0.035</b>	<b>0.001</b>	0.279	0.508
<i>standing</i> <sup>2</sup>	7.8	26.30	<b>0.034</b>	0.964	0.885	0.326	<b>0.002</b>	<b>0.033</b>	0.417	0.185	<b>0.021</b>	0.185
<i>lying</i> <sup>2</sup>	8.1	26.10	<b>0.013</b>	0.398	0.133	0.934	<b>0.011</b>	<b>0.008</b>	<b>0.010</b>	0.139	0.344	0.319
<i>sitting</i> <sup>2</sup>	6.1	19.20	0.426	0.694	0.769	0.303	0.797	0.284	<b>0.013</b>	0.386	<b>0.000</b>	0.224
<i>moving</i> <sup>2</sup>	Residual variance exceeds variance of response variate											
<i>not being near</i> <sup>2</sup>	1.7	29.70	<b>0.019</b>	0.818	0.360	0.375	0.765	0.588	0.951	0.615	0.667	0.121

<sup>1</sup> = rate per minute, <sup>2</sup> = percentage

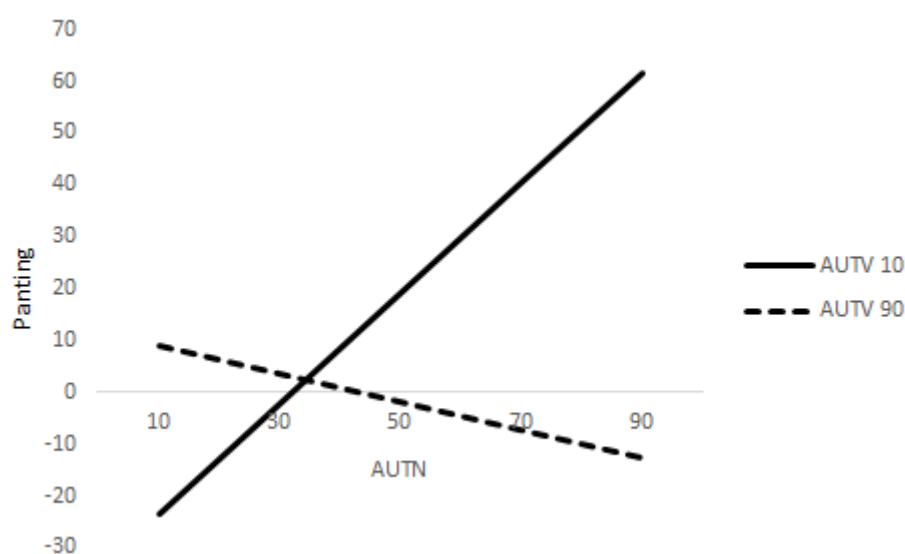


Figure 1 Scores for panting (y-axis, expresses as % of the observation time) in dogs during the Ainsworth Strange Situation Test (ASST) for measuring dog to owner attachment. Shown is the significant interaction effect of parenting authoritarian (x-axis, expressed as % of the maximum possible) and authoritative (solid line versus interrupted line). The solid line represents a score of 10% authoritative parenting and the interrupted line represents a score of 90% authoritative parenting.

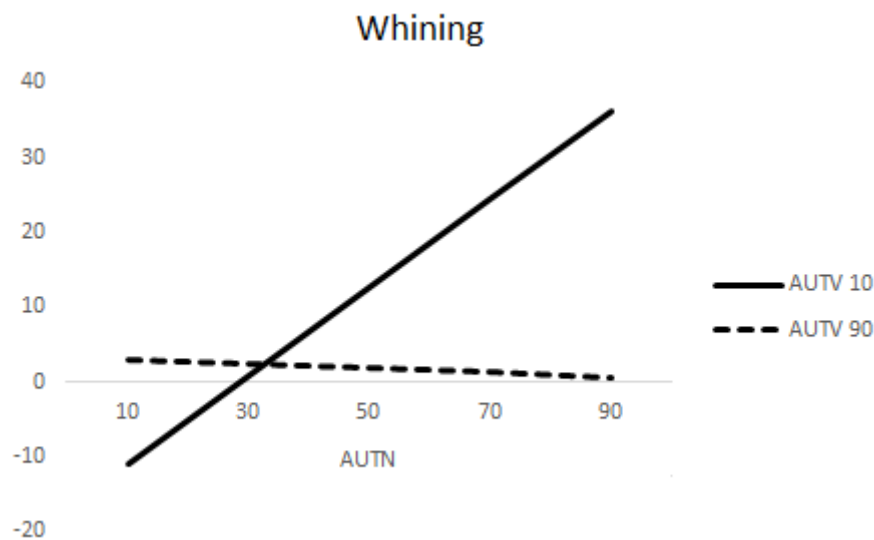


Figure 2 Scores for whining (y-axis, expresses as % of the observation time) in dogs during the Ainsworth Strange Situation Test (ASST) for measuring dog to owner attachment. Shown is the significant interaction effect of parenting authoritarian (x-axis, expressed as % of the maximum possible) and authoritative (solid line versus interrupted line). The solid line represents a score of 10% authoritative parenting and the interrupted line represents a score of 90% authoritative parenting.

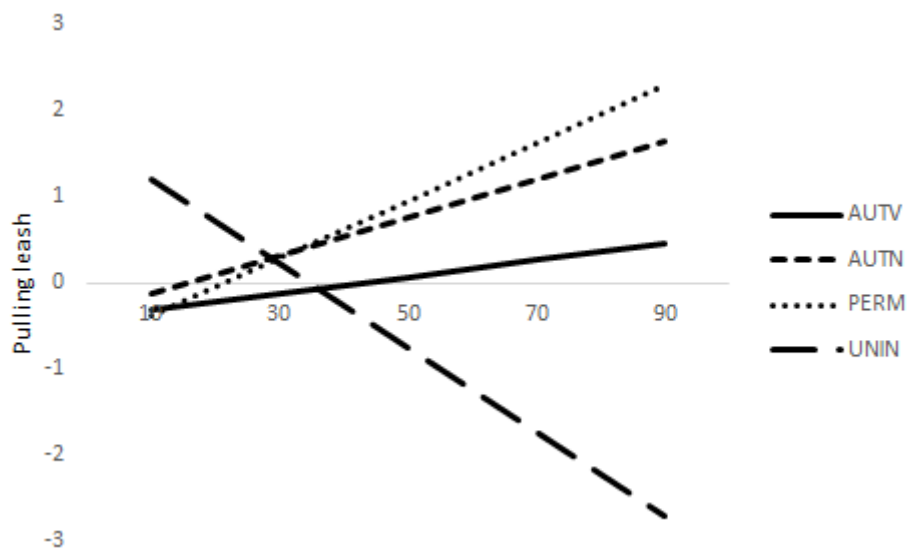


Figure 3 Scores for pulling leash (y-axis, expressed as % of the observation time) in dogs during the Ainsworth Strange Situation Test (ASST) for measuring dog to owner attachment. Shown is the effect of an authoritative, authoritarian, permissive and uninvolved parenting style of dog owners on the amount of pulling leash behaviour that was displayed during the ASST.



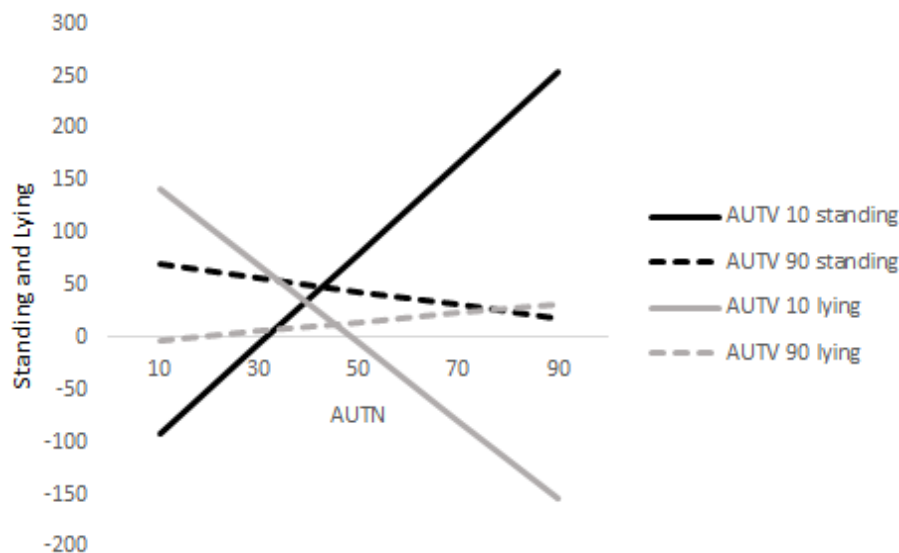


Figure 4 Scores for standing and lying (y-axis, expresses as % of the observation time) in dogs during the Ainsworth Strange Situation Test (ASST) for measuring dog to owner attachment. Shown is the significant interaction effect of parenting authoritarian (x-axis, expressed as % of the maximum possible) and authoritative (solid line versus interrupted line). The solid lines represents a score of 10% authoritative parenting and the interrupted lines represents a score of 90% authoritative parenting.

The behaviours the dogs displayed during the ASST were checked for correlations with the parenting styles. When viewing panting behaviour it was found in this study that it occurred significantly ( $p=0.000$ ) more when the owner had a high authoritarian parenting style in combination with a low authoritative parenting style. Panting is a stress behaviour (Beerda et al., 1997) indicating that these dogs experienced more stress. When looking at panting behaviour it seems that being authoritative attenuates the effects of being authoritarian. Tongue flicking behaviour is a stress indicator (Beerda et al., 1998) and a high uninvolved parenting style led to the most tongue flicking behaviour. Whining is a behaviour that indicates that the dogs seek to be close to the owner while being separated (Prato-Previde et al., 2003; Mariti et al., 2014). During the ASST It appeared that when an owner scores high in an authoritarian parenting style and the amount of authoritative is low, a lot of whining behaviour was being displayed by the dog but with a low amount of authoritarian there is little whining. This suggests that an owner with a high amount of an authoritarian parenting style leads to less secure dogs. They were more stressed (Mariti et al., 2014) and this indicates that they had poorer welfare. One might conclude that a high authoritarian parenting style is not good for the welfare of dogs. Tongue flicking occurred most when the dog had an owner with a high uninvolved parenting style. Tongue flicking is a behaviour in dogs that indicates stress (Beerda et al., 1998). Tail wagging is an excitement behaviour (Beerda et al., 1999). When looking at the interaction effect of authoritative and authoritarian ( $p=0.000$ ) the dogs that wagged their tails most had an owner with a low authoritative and high authoritarian parenting style. Soliciting attention was significant for the interaction effect between authoritative and authoritarian ( $p=0.008$ ). The lowest amount of soliciting for attention of the dogs was displayed when the owner had a low authoritative and high authoritarian parenting style. When both authoritative and authoritarian were low the highest amount of soliciting for attention was observed in the dogs. When the authoritative parenting style was high the level of authoritarian did not influence the amount of soliciting for attention much. Soliciting attention is viewed as a sign of attachment behaviour (Palmer and Custance, 2008), suggesting that a high

authoritarian and low authoritative owner lead to low attachment. Pulling leash behaviour can be viewed as exploratory and proximity seeking behaviour. Highly permissive ( $p=0.000$ ) owners had the highest amount of pulling leash behaviour. This is logical due to the fact that a permissive owner corrects less and thus allows for the dog to pull on their leash more compared to other parenting styles. It was found that owners with a high uninvolvement ( $p=0.001$ ) parenting style had dogs that displayed the lowest amount of pulling leash behaviour. This indicates that these dogs are less social and exploratory. No playing behaviour was found significant for the interaction between authoritative and authoritarian owners ( $p=0.000$ ). It was found that dogs display the most no playing behaviour when there is low authoritative style present combined with a low authoritarian style. When looking at the interaction effect of authoritative and authoritarian for standing ( $p=0.002$ ) and lying ( $p=0.011$ ) behaviour, it was observed that standing occurs more when the amount of authoritarian style is high (90%) and lying occurs less in this case. This indicates that during the ASST dogs with owners with a higher amount of authoritarian parenting style in combination with a low authoritative style will increase their standing behaviour and decrease their lying behaviour. This could indicate that these dogs are more restless. When looking at whether the dogs were not being near either the owner, stranger or chairs, it was concluded that this behaviour was only significant for an authoritative parenting style ( $p=0.019$ ). Owners with a low authoritative parenting style had dogs that distanced themselves the most compared to the other parenting styles during the ASST. Because proximity seeking is one of the four characteristics of an attachment bond (Payne et al., 2016). This indicates that a low parenting style score on authoritative leads to a lesser attachment bond between owner and dog compared to owners who have a high authoritative parenting style. Aforementioned results all indicate the parenting style of the owner had an influence on the amount of stress related behaviours and proximity and exploratory behaviours displayed by the dogs during the Ainsworth Strange Situation Test (ASST). Owners with an authoritative parenting style had dogs that displayed the least stress indicative behaviours and the most behaviours indicating a stable attachment owner-dog bond such as proximity seeking and exploratory behaviour.