

# PARENTING STYLES IN THE OWNER DOG RELATIONSHIP AND THEIR EFFECT ON DOG BEHAVIOUR

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## Abstract

The relationship between an owner and its dog has similarities with the parent-child relationship and the resemblances make us assume that dog owners raise their dogs according to the parenting styles applied by parents when raising their children. Child parenting styles have a significant impact on child development and we tested if the parenting styles that dog owners use affect the dogs' behaviour. Dog parenting styles were measured and validated by having dog owners (N=431) answer questionnaires based on child parenting practices and views, combined with observing both owner and dog behaviour (N=33) during tug-of-war games and training exercises. Owners were asked about the occurrence of fearfulness and separation anxiety in their dog and problem behaviour scores were associated to owner parenting style measurements. Principle component analyses revealed that the three common child parenting styles, authoritarian, authoritative and permissive parenting are to a certain extent reflected also in the way dog owners raise their dogs. The authoritarian dog parenting style is characterized by owners who report to have high expectations of their dog enforced by consistent use of verbal and physical correction. Permissive dog parenting is the opposite where owners are often insecure and inconsistent in their use of discipline, asking little from the dog and trying to keep it satisfied. Authoritative owners focus on ensuring happiness of their pet and even though they were expected to have certain demands concerning their dog's behaviour, this was not found. None of the parenting styles were correlated to the level of separation anxiety shown by dogs, but authoritarian parenting was inversely related to fearfulness, whilst the latter related directly to permissive parenting. This supports the idea that dog parenting styles affect dog (problem) behaviour and future research could link parenting styles and dog behaviour in more detail as to better understand how owners differentially affect the manifestation of problem behaviours in their dog. Parenting styles that are known to influence the personality and behaviour of children were found to exist also in the owner to dog relationship and associations with dog personality (fearfulness) could be demonstrated in this study. Ultimately, knowledge on the link between owner parenting style and canine problem behaviour can assist in finding ways to reduce or even prevent these behaviours from occurring which will improve dog welfare and dog ownership satisfaction.

## Introduction

In the Netherlands alone a total of 1.5 million dogs reside in 18% of Dutch households. Tens of thousands of these dogs are handed over to dog shelters on a yearly basis (*Feiten & Cijfers Gezelschapsdierensector 2015*, 2015) and one of the main reasons for relinquishment is the occurrence of mild to severe problem behaviour in the dog (Pirrone et al., 2015; Wells & Hepper, 2000). Unwanted dog behaviour compromises the owner to dog relationship which reduces welfare of both. If the development of unwanted behaviours in dogs is prevented this contributes to overall dog well-being and dog ownership satisfaction. To accomplish this, more must be learned about what influences the development of problem behaviour in dogs which is dependent on both inherent factors such as breed as well as environmental factors like the training and education a dog experiences (Ben-Michael, 2005; Pirrone et al., 2015). One of the main ever present environmental influences on a dog is its owner, and this study focuses on an owner-related factor that potentially

relates strongly to dog behaviour in general, and thus also problem behaviour, being an owner's parenting style.

Characteristics of an owner are in part associated to dog behaviours. A questionnaire amongst 1276 Austrian dog owners revealed how inconsistent discipline by the owner was associated with a higher occurrence of dog aggression (Arhant et al., 2010). In another elaborate study, 55 dog owners described their dog's behaviour and were presented situations in which a dog portrayed an assortment of problem behaviours, after which they were asked to describe how they would respond, both disciplinary and emotionally. It was concluded that a combination of particular emotional reactions, perceptions and behavioural responses of an owner to the dog's behaviour can either positively or negatively affect how it behaves in challenging situations (Ben-Michael, 2005). When 14,000 owners rated their dog on calmness and sociability, questionnaire outcomes showed that the most sociable and calm dogs had owners who spent much time with them (Kubinyi et al., 2009). Also, a strong attachment bond between owner and dog, as reported by the owner, was indicative of a good performance of the dog in an owner-aided problem solving task (Ehyaei, 2013). The author concluded that the more strongly attached owners especially influence their dog and only for these owners dog behaviour corresponded with owner personality, though no causal relationship was determined. Evaluations of owner reports suggest that the impact an owner has on his/her dog is shaped by a variety of factors which may manifest in a "style of parenting". My assumption is that distinct views of an owner on pets translate into behaviours that affect dog behaviour and well-being and that such views and behaviours will group into parenting styles.

Even though dog owner parenting has rarely been investigated much is known about child parenting. There are four general child parenting styles named authoritarian, authoritative, permissive, and rejecting/neglecting parenting (Baumrind, 1971). These styles are distinguished by differing in the dimensions responsiveness and demandingness (Baumrind, 1991; Maccoby & Martin, 1983). Parenting styles result from a combination of views, beliefs, attitudes and accompanying behaviours and each style is linked to specific behavioural patterns in children (Coplan et al., 2002; Power, 2013). Parenting styles and practices influence almost every aspect of child development, including the occurrence of problem behaviour (Darling & Steinberg, 1993a; Fuentes et al., 2015; Power, 2013). Assuming similarities between child directed parenting styles and dog directed ones, the effects of parenting on the behaviour of children might resemble those of dog owner parenting on dog behaviour. For an overview of this topic we refer to the 'Theoretical framework' section of the results which elaborates on what exactly encompasses the child parenting styles and their specific effects on child behaviour. Regarding dogs, the existence of distinct dog owner parenting styles and their effects on dogs have not received much attention scientifically. The impact of child parenting styles on child obesity has been reviewed and compared to influences of dog ownership on dog overfeeding with results suggesting that dog owner parenting styles influence different aspects of dog health and welfare in a similar way as child parenting styles influence children (German, 2015). The notion that dog owner parenting styles could be like the accepted child parenting styles suggests information on child parenting can guide research into dog owner parenting styles.

The known mechanisms of child parenting may provide a theoretical framework for investigating dog parenting, if the dog-owner relationship is similar to the parent-child relationship. Dog owners who were questioned about their relationship with their dog confirm that they often feel strongly attached to their canine pets and tend to see and treat them as friends or family members (Archer, 1997; Blouin, 2013; Kurdek, 2009). They feel a responsibility and a need to care for their dog (Archer, 1997) and include their dog in many activities such as walks, training, play and affectionate moments. During these activities owner and dog interact and many dog owners report that they assume their dog has some understanding of its position in their relationship and that they have at least a rudimentary ability to think for themselves, assess situations and respond appropriately to behaviour performed by the owner (Beck & Katcher, 1996). Most dog owners view their dog as if it was a child and treat it as one. This makes it likely that, just as for children, a dog owner will try to raise his/her dog in a way that shapes its behaviour according to their expectations of what is 'right' (German,

2015). Dog owners probably apply certain parenting practises similar to child rearing practices to make their dogs behave appropriately. When parenting practices are consistently used across situations and are accompanied by a set of unchanging standards and views this is called a parenting style (Maccoby & Martin, 1983).

A dog owner's way of parenting is likely to affect a dog's behaviour and well-being as dogs are oriented strongly towards humans. Dogs tend to be strongly attached to their owner, as demonstrated with a strange situation test in which 55 dogs played more and were more explorative when their owner was present than when he or she was absent (Topál et al., 1998). When put in a novel environment, dogs are more likely to stay close to a human and solicit social contact than they do from another dog, and when owner and dog are separated dogs often show signs of distress and fear (Ogata, 2016; Tuber et al., 1996). The strong bond between dog and owner causes dogs to try, and regularly succeed, in understanding basic directions given by their owner. Dogs notice an owner pointing to something more readily than an unfamiliar person pointing and clearly dogs change their behaviour when disciplined by their owner (Ben-Michael, 2005; Pongrácz et al., 2003; Rooney, Bradshaw, & Robinson, 2001). Reviewing the history of human-dog interactions Askew (1996) even suggested that dogs have co-evolved with humans to elicit parental care and that owner dog interactions are like human parental care directed to another species. The close bond between humans and dogs supports the notion that dog owner parenting styles may impact on dog behaviour and welfare.

There are similarities between the owner-dog relationship and that between parent and child, but also there are differences which should not be overlooked. Clearly, dogs are of a different nature than children and cannot communicate language-based like children do, whilst dogs are relatively sensitive to behavioural signals and scents. Dog use an extensive behavioural repertoire to communicate with humans where humans only use limited dog-like behavioural signals, as shown in a number of behavioural tests in which human-dog interactions were monitored (McGreevy et al., 2012). An owner's attachment to his/her dog e.g. as registered by the Monash Dog Owner Relationship Scale does not always match the attachment of the dog to the owner, as measured with a Strange Situation Test (Rehn et al., 2014). This asymmetry may be more typical for a dog-owner relationship than a parent-child relationship. Furthermore, a dog owner may not portray the same role towards a dog as a parent does towards a child. When people who were both parent and dog owner were shown pictures of children and dogs performing unwanted behaviour they reported more positive views on the misbehaving dogs than on the children, meaning a dog would be found less guilty of doing something bad as the child would be in the same situation (Ben-Michael et al., 2000; Rajecki et al., 1999). These examples support the need for investigating parenting styles in dog owners as at least some aspects of the dog-owner relationship differ from the parent-child relationship and theories based on studies with parents do not necessarily translate to the human-dog relationship.

The main aim of this study is to investigate whether there are dog parenting styles similar as described for the parent-child relationship. There are similarities between child and dog parenting and for this reason a theoretical framework based on child parenting styles will be used to investigate dog parenting. This framework is based on a literature overview of child parenting styles and their effect on child behaviour. If the parallels between dog and child parenting are strong it is likely that the three most common child parenting styles, namely authoritative, authoritarian and permissive parenting, express in dog owners as well. If this is not the case it is still fruitful to use the two fundamental parenting dimensions responsiveness and demandingness for explaining variation in dog parenting since we assume there are at least some overlapping qualities in the interaction with children and dogs. A secondary aim of this study is to see if the known influence of owner-related factors such as attitude towards dogs, age or education level on dog behaviour are mediated by the use of specific parenting styles (Kubinyi et al., 2009). I expect that a more positive attitude towards dogs in general will be associated with a more nurturing and caring parenting style. A final aim is to test relationships between possible parenting styles and the occurrence of fear and

separation anxiety in dogs. Both factors are common behavioural problems making them likely to occur in at least some dogs in our testing population (Ben-Michael, 2005).

To assess the existence of dog parenting styles and their effect on dog behaviour both questionnaires and behaviour tests are used. The questionnaires consist of items concerning the three child parenting styles, responsiveness and demandingness, owner and dog related demographic factors, owner attitude and dog fearfulness and separation anxiety. Dog owners are invited to our behaviour research facility to participate in behavioural tests with their dog, including play exercises and training exercises. The behavioural tests are selected based on the findings that child parenting styles influence play activity in children and are associated to what and how parents teach their children (Hinkley et al., 2010; Loprinzi et al., 2014; Roskam et al., 2014). A game of tug-of-war is used as a tool to observe dog-owner interactions during play. The amount of time dog owners normally spend on playful interactions with their dog is positively linked to play motivation of the dog and negatively to cortisol levels and fearfulness of dogs during tug-of-war games (Horváth et al., 2008; Tóth et al., 2008). Behaviour of dogs observed during tug-of-war games depends on previous interactions with the owner and less on dog personality as described by the owner, making it a proper tool for observing owner-dog interactions such as they likely occur at home (Tóth et al., 2008). Tug-of-war outcomes are potentially related to owner parenting style in that letting the dog win indicates the owner being responsive (Rooney & Bradshaw, 2002). In humans, complex teaching tasks cause frustration in parents, which in turn causes them to strongly show behaviours related to their particular parenting style and for this reason a complex training task is used in this study (Denham et al., 2000). An exercise found to be difficult for most dogs in an earlier study is used, involving teaching the dog to pull a rope out of a vertical tube (Ehyaei, 2013). A play exercise and training exercise should provide a good overview on owner-dog interactions in different contexts and we expect to see different behavioural patterns in owners that are associated to specific parenting styles as determined by the questionnaires. The present study is a step towards determining which ownership views and practices can positively influence dog behaviour development and future applications include informing owners on appropriate raising practices and attitudes to help prevent the occurrence of problem behaviour in dogs.

## Method

### Literary study

A literary study on child parenting practices, views and underlying attitudes was performed with the aim of creating a theoretical framework for the present study on dog parenting. The focus was on child parenting styles, their related actions and viewpoints and their effect on child behaviour. Relevant articles were searched in Scopus using combinations of the search terms “parenting style”, “parent\*”, “authoritarian\*”, “authoritative\*”, “permissive\*”, “child\*”, “adolescent” and “behav\*”. Findings were extrapolated where possible to dog raising and an overview was constructed of what parenting practices I expect to find in dog owners and what factors could underlie potential dog parenting styles. The methodology used to determine child parenting styles was used as a starting point to investigate parenting styles in dog owners, meaning both questionnaires and behavioural tests were used to study dog owner parenting styles.

### Questionnaire distribution and design

Two questionnaires, Questionnaire A and Questionnaire B, were used for measuring dog owner parenting styles, their underlying factors and dog problem behaviour. Questionnaire A aimed to identify dog directed parenting styles based on questions normally used to assess child parenting styles, associated owner attitudes and demographic factors of dogs and owners. Questions concerning dog parenting styles were based on Block’s validated Child Rearing Practices report, specifically on the adaptation by Robinson et al. (Block, 1965; Robinson et al., 1995). The original

questionnaire contains ninety-one items and Robinson et al. narrowed this down to the most important, reliable and valid items for assessing the authoritarian, authoritative and permissive parenting styles. The items cover a combination of actions, views, beliefs and feelings about the parenting of children. From the reduced item list we determined which items could be applicable to dog parenting, excluding items like 'encouraging child to talk about the child's troubles' which seems irrelevant for dog owners. A total of forty-two items were retained of which sixteen measured authoritarian parenting, fourteen authoritative parenting and thirteen permissive parenting. One item was indicative of both the authoritarian and the permissive style, i.e. in a reverse manner. Items were then reworded to dog-related contexts, translated to Dutch and listed in a randomized order (see Questionnaire A, Appendix 1). Answers were on a scale from zero to four where zero means 'never' and four means 'always'. To measure owner attitude towards dogs Questionnaire A contained the twenty-three items from the Lexington Attachment to Pets Scale (LAPS). This scale measures an owner's attitude towards pets based on the dimensions 'general attachment' (eleven items), 'people substitution' (seven items) and 'animal rights' (five items). The LAPS has a good content validity combined with a sufficient construct validity, making it an appropriate tool for assessing owner attitude (Johnson et al., 1992). In all items the word 'pet' was replaced by 'dog', the items were translated to Dutch and put in a randomized order. Answers were on a four-points scale with one meaning 'completely disagree' and four meaning 'completely agree'. Lastly, Questionnaire A included items about the dog owners' age, sex, highest finished level of education and family composition. Items on the dogs were about breed, sexual status (male/female and neutered/intact), current age, age at acquisition, pedigree, weight class, number of former owners and purpose. At the end of Questionnaire A owners were invited to participate in behavioural tests. This questionnaire was spread via specific dog-related social media groups with a variety of focus points and professional and personal connections and was filled in by 431 Dutch dog owners.

The second questionnaire, Questionnaire B, targeted the dimensions responsiveness and demandingness which assumingly underlie the parenting styles found in Questionnaire A, and the effect of dog directed parenting styles on dog behaviour. Fifty-six items were included that related to demandingness and responsiveness in dog parenting, describing a variety of situations in which parenting practices and beliefs are relevant such as walking the dog, play activities, training activities, life at home, dog behaviour, owner-dog interactions and general dog raising. For described everyday situations statements were provided that measured responsiveness or demandingness and owners could answer on a scale from zero ('never') to four ('always'). The statements were composed by Anke Wieldraaijer and myself based on known characteristics of responsiveness and demandingness of child parenting reflecting our expectations about demanding and responsive behaviour and related views. Of the fifty-six items six were relevant for Anke Wieldraaijer's study only and excluded from further analysis. Eight items were used for the test-retest reliability analysis and not included in a final Principal Component Analysis (for details see the section on data analysis). Ambiguity in some of the questions, as indicated by the respondents, made us omit nine items from further analyses. For example, the item 'I find it important to have a good relationship with my dog' was deemed ambiguous regarding responsiveness and demandingness as it may reflect that you want the relationship to be good for you or for your dog. Other items such as 'during walks I take my dog to a dog play area' may be difficult to interpret as some dogs enjoy this whilst others do not. This left thirty-three items related to responsiveness and demandingness to be included in the final analysis (see Questionnaire B, Appendix 2). Considering dog behaviour, the degree to which dogs showed problem behaviour in daily life was assessed with parts of the Canine Behavioural Assessment & Research Questionnaire (C-barq, Hsu & Serpell, 2003) which were included in Questionnaire B (Appendix 3). The C-barq relies on the owner's knowledge of his/her dog to assess the occurrence of different kinds of canine problem behaviour and in this we focussed on fearfulness and separation anxiety. Answers were on a scale of zero to four, with the former indicating 'no signs' of the problem behaviour or 'never' shown and the latter indicating 'extreme' performance of the problem behaviour or 'always' shown. Finally, questions on owner dog interactions were answered on a scale of zero, meaning 'at least once a day', to four, meaning 'almost never'. Questionnaire B

was filled in by twenty-nine dog owners who had previously filled in Questionnaire A and who also participated in the behavioural tests.

### Behavioural tests

To discover relationships between both owner behaviour and dog behaviour and dog directed parenting styles thirty-three dog-owner dyads with dogs older than one year old were observed during behavioural tests. The first part of the tests was aimed at measuring anxiety and impulsivity of the dogs and findings are presented by Anke Wieldraaijer. The second part of the tests was aimed at characterizing owners for acting responsive and demanding towards their dogs. Every owner-dog dyad participated in two play sessions and two training sessions. All tests were filmed from four different angles and behaviours were analysed from video recordings. Before the tests owners were informed on the presence of the cameras and they were told that they could stop the test at any time without having to explain themselves. The step-by-step test procedure is described in Appendix 4. All tests were carried out at Wageningen University, facility Carus, in a room of approximately six by six metres. A grid of square meters taped on the floor was used to determine distance between dog and owner at any time and a chair for owners to sit on was placed next to a long leash attached to one wall. Dogs on the leash could reach the entire room except a small space near the entrance.

The play test involved that owners participated in a tug-of-war game with their dog twice, each time with a different toy that the owner could choose from a range of objects including ropes of different sizes, ropes with toy object attached to them and a puller. Owners were instructed to play with their dog as they normally would while trying to keep the dog motivated. The only restrictions were that the owner had to remain seated on the chair and the dog had to be on the leash attached to the wall during the entire test. Each play test lasted 90 seconds during which the owner had to take the tug object from the dog once in a manner as he/she would do at home. By the time of testing the test room was somewhat familiar to the dog due to the foregoing behaviour tests in this room. At the start of each session the owner was seated holding the object without directing the dog's attention to the object yet. The dog was leashed and after the observer had left the room a signal was given via the microphone that the owner could start playing. After 90 seconds another signal indicated that the play session was over. Between the two play sessions was one training session and a small break of approximately five minutes.

The training test involved that dog owners were given two times three minutes to teach their dog to pull a rope out of a vertical tube. Owners were somewhat pressed (stressed) by a countdown clock and the mentioning that the dog could later perform in a follow-up test (the exam) only if it mastered this exercise. Owners were instructed to act as they would during regular training bouts with their dog, though the dog had to stay on the long leash during the test. The tube with the rope was placed in the centre of the testing area and after the observer left the room and the timer had been activated the owner started training the dog. When the timer ran out after three minutes the owner was told via the microphone that the session had ended. If a dog would master the skill within the first three minutes a second training session was omitted. After two sessions all owners regardless of the success of their dog were given the opportunity to participate in an exam in which the dog got five attempts to get the rope out of the tube within five seconds. This exam was recorded but not used for later analysis. During both play and training a number of owner behaviours and dog behaviours were scored together with play motivation of both dog and owner, possessiveness of the dog over the tug object, latency to play for the dog, success of the dog during training and strategy switches of the owner during training were scored. For full behavioural descriptions and scoring methods see Appendix 5.

### Data processing analyses

All statistical analyses were performed in SPSS or GenStat. Test-retest reliability of parenting style items from questionnaires A and B was measured by a Spearman correlations between questions that were in both questionnaires (Appendix 6). To test for the existence of dog owner parenting

styles a Principal Component Analysis (PCA) (Jolliffe, 2005) was performed on all original forty-two items concerning the three child parenting styles and another PCA was done on thirty-three items belonging to the two parenting dimensions responsiveness and demandingness. PCA were done following procedures described by Van Reenen et al. (Van Reenen et al., 2004). Principal components represent underlying correlation matrices and identify items that co-vary, in the same or opposite direction, as indicated by loadings. Items with a loading  $>|0.4|$  in a component are relevant for that component. The relevance of components is indicated by the percentage of variation in the dataset that it explains and individual owner component scores are calculated from original scores using loadings as weighing factors. Since items in a component all correlate to one matrix a component can be considered a 'style' and component scores indicate the degree of which an owner applies this style. The components were checked for internal consistency by calculating Cronbach's alpha. A PCA was performed also on the attitude-related items with the aim of finding relevant dimensions in owner attitude and calculating owner attitude scores weighed by PCA loadings. Fear and separation anxiety scores were extracted from Questionnaire B by adding the number of points the dog scored on each behaviour specific subset of answers and expressing it as a percentage of the maximum number of points that could have been scored taking into account the number of questions that had been filled out. Associations between parameters were tested by means of Spearman correlations. ANOVA was applied to test the effect of independent variables on the PCA-based parenting style scores and attitude scores as dependent variables. The independent variables breed cluster (clusters FCI1 to FCI10 as determined by the Federation Cynologique Internationale) and sexual status (male/female and neutered/intact) were of the type factor, whilst owner age (18-25 years old, 26-35 years old etc.), owner education level (primary school to university), dog age (in years) and duration the dog has been with the current owner (in years) were set as covariates. Only main effects were considered and all independent variables were tested in one model simultaneously.

Behaviours of dog and owner were scored in 'rate per minute', in 'percentage of time' or as 'number of times the behaviour occurred' (for specifics see Appendix 5). Not all owners wanted to participate in every test and when a dog scored 0 for play motivation, meaning it did not play, it was excluded from further analysis. In the end 28 dog-owner dyads participated in the first play test, 27 in the second play test, 33 in the first training test and 19 in the second training test. A preliminary PCA was done on all owner vocalizations and based on the found components vocal behaviours were grouped by type, such as command, encouragement or correction. Behaviours that occurred only in 10% or less of the records were either grouped into relevant constructs or removed from the analysis (for specifics see Appendix 9 and 10). For dogs and owners separately, a PCA was performed on the relevant behaviours per behaviour test, so one for play and one for training. For the relevant components individual component scores were calculated and analysed in a Restricted Maximum Likelihood (REML) analysis. REML considers treatment effects and data distribution to explain covariance between scores of the same dog or owner. Four REML analyses were performed, for dog behaviour and owner behaviours separately per test type, with each test type having two session. The same model was used for all REML analyses:

$$Y_{ab} = \mu + TestSession_a + DogID_b + e_{ab}$$

$Y_{ab}$  represents the component scores from the preliminary PCA per dog or owner (N=25 for play, N=19 for training), and test sessions (n=1,2) per test type (play and training) are taken into account together with DogID as a random component to account for repeated measures on the same individual. REML results showed that both owner and dog behaviour was consistent across the play and training activities. Therefore, for further analysis average behavioural scores per test type based on the original behavioural measurements were used for both dogs and owners. Average behaviour scores were tested against the PCA-determined parenting style scores by means of Spearman correlations.



# Results

## Theoretical framework based on child parenting research

To be able to use information on child parenting styles as a theoretical framework for research into dog parenting it is important to elaborate on how child parenting styles were first determined, and what each style embodies. Here a literary overview on child parenting styles is provided and their underlying dimensions and consequences for child behaviour are discussed. Views and behaviours potentially relevant for dog parenting are of particular relevance here.

Child parenting became a topic of interest in 1967 when scientists theorized that children with different personalities had parents using distinct parenting styles (Baumrind, 1967). To determine patterns in child behaviour and emotion 110 children aged three or four years old were observed for fourteen weeks by a teacher and a psychologist whilst undergoing behaviour tests. Thirty-two of these children were selected for the study because they scored extremely high or low on two or more of the five measured dimensions self-control, approach-avoidance tendency, self-reliance, subjective mood and peer affiliation. The thirty-two children were divided across three patterns with pattern I children being self-reliant, self-controlled, explorative and content, pattern II children were relatively discontent, withdrawn and distrustful and pattern III children were characterized by little self-control and self-reliance, and a tendency to retreat from novel experiences. Parents of these children were interviewed and observed both at home and while interacting with their children, based on which they were scored on the four dimensions parental control, maturity demands, clarity of communication and warmth. Parents of children in different groups were found to have unique parental characteristics, or so called “styles of parenting” (Baumrind, 1967). In a follow-up study the views and behaviours of parents were first measured by means of home observations and interviews (Baumrind, 1971). Parental behaviour was assessed for fifteen hypothetical constructs by means of fifty behaviour rating scales. Parental values and attitudes were considered as well, though attitude was not associated to parenting style. Parents were said to use a certain style when scores of associated behaviours were either high or low based on criteria such as ‘being above the median’ or ‘being in the bottom 1/3<sup>rd</sup>’ of all the scores. Children (again three- and four-year-olds) of parents with different parenting styles were scored on levels of social responsibility and independent behaviour. This study, combined with data from the first investigation, gave rise to the four different parenting styles authoritative, authoritarian, permissive and rejecting/neglecting parenting (Baumrind, 1971). Each style could be divided into two or more subgroups but differences between them are small and hard to measure and in later research these four general parenting styles were often applied without subgroups.

Reviews on the characteristics of each parenting style indicated that each style is distinguished by unique combinations in levels of responsiveness and demandingness (Baumrind, 1991; Maccoby & Martin, 1983). Responsiveness is defined as “the extent to which parents intentionally foster individuality, self-regulation, and self-assertion by being attuned, supportive and acquiescent to children’s special needs and demands” (Baumrind 1991, p.62) whereas demandingness refers to “the claims parents make on children to become integrated into the family whole, by their maturity demands, supervision, disciplinary efforts and willingness to confront the child who disobeys” (Baumrind, 1991, pp. 61- 62). These dimensions are based on parental attitudes, beliefs and their associated practices, which are constant over time (Baumrind, 1971; Coplan et al., 2002; Darling & Steinberg, 1993). Situation dependent parenting practises may vary over time (Coplan et al., 2002) though and this is important to keep in mind when one investigates parenting styles. Next, the four child parenting styles and their implications for child behaviour and development are discussed, based on both comparative and experimental studies.

## Authoritative parenting

Authoritative parents are characterized by being both responsive and demanding (Baumrind, 1991). These parents are confident and supply their child with warmth and nurturance whilst setting strict



limitations and applying consistent, non-restrictive disciplinary action (Baumrind, 1971; Pederson et al., 2015). They have clear maturity demands, however they are reasonable and willing to listen to their child's point of view and take this into consideration during decision making (Coplan et al., 2002). Rules set by these parents will be explained to the child and when a child misbehaves the parents will act rationally and still try and build the parent-child relationship as opposed to using blunt punishment without considerations. The parents tend to be positive and encouraging towards their child and are likely to offer suggestions, choices and cooperation when a child is struggling (Power, 2013). This parenting style is considered most supportive to the child's development and already at a young age children with authoritative parents are independent, satisfied, explorative and non-rebellious (Baumrind, 1967). At a later age these children are more cooperative, intellectually and socially successful, self-assertive and emotionally stable than children raised under other parenting styles (Coplan et al., 2002; Power, 2013; Roskam et al., 2014). A small group of authoritative parents is nonconforming and this may cause dominance or even aggression in children, however this is not elaborately investigated (Baumrind, 1971). There are no indications that using the authoritative parenting style causes severe behavioural problems in children and it seems the most appropriate parenting style (as reviewed by Power, 2013).

#### Authoritarian parenting

The authoritarian parenting style is characterized by high demandingness and low responsiveness (Baumrind, 1991). Parents applying this style have high maturity demands and impose restrictive control on their children, demanding respect. They shape the behaviour and attitude of their children to 'absolute standards' (Baumrind, 1971). Obedience is valued highly and when the child conflicts with the parent this is not accepted. Authoritarian parents self-reported that they use punishment without reasoning, a severe tone of voice and a very strict set of rules that are enforced by consistent disciplining (Coplan et al., 2002). These parents show variable degrees of acceptance of the child. Overall they are low in warmth and flexibility and they tend to not communicate adequately with their children (Pederson et al., 2015). The point of view of the child is often considered unimportant and the child is not encouraged to form his or her own opinion (Power, 2013). Several negative behavioural outcomes in children are associated to authoritarian parenting, like being distrustful of others and be more prone to keep to oneself (Baumrind, 1967). Children parented in an authoritarian style are more likely to become dependent on their parents due to the parents being overprotective (Baumrind, 1971), or they become rebellious and hostile. At older age these children have relatively low academic achievement, high chances of aggression, hostility and frustration, low social skills, increased anxiety and poor impulse inhibition (Coplan et al., 2002; Denham et al., 2000; Fuentes et al., 2015; Pederson et al., 2015; Timpano et al., 2015). Clearly not all children develop similarly in response to a particular parenting style and some children from authoritarian parents are strongly achievement-orientated and socially responsible, showing that authoritarian parenting can also result in positive developmental outcomes (Baumrind, 1971). Problems that may arise in children from authoritarian parents are often related to the absence of a warm environment, lack of communication, combined with alienation from the parent (Baumrind, 1971; Power, 2013).

#### Permissive parenting

Permissive parenting results from high responsiveness in combination with low demandingness (Baumrind, 1991), ensuing in a nurturing environment for the child in the form of care, warmth and affection. Permissive parents are often insecure, have very few clear rules and demands and discipline is executed inconsequently or not at all (Baumrind, 1971; Power, 2013). These parents tend to avoid confrontation with the child and try to correct misbehaviour by reason and not by control. A permissive parent acts as a friend more than as a parent, giving advice like a friend would but without setting clear limits (Robinson et al., 1995). Withdrawal of love and affection is sometimes used as negative punishment (Baumrind, 1967). In general, permissive parents let their child regulate his or her own activities without providing much encouragement or stimulation, however they do

show interest in the child's hobbies and passions. When the child asks for something or wants something the parent is likely to give in to the child (Baumrind, 1971). Children of permissive parents are relatively spoiled, have little restraint and are dependent of others (Baumrind, 1967). Using withdrawal of affection as a measure of control involves the risk of making children feel guilty and insecure (Baumrind, 1971) and in adolescence such children are prone to become anxious, aggressive, resistant to authority and less achievement-orientated and socially responsible than children raised under the other parenting styles (Pederson et al., 2015; Power, 2013; Timpano et al., 2015). These problems arise due to a lack of structure in the developmental environment of the child combined with the child's inexperience in having responsibilities (Power, 2013).

### Rejecting/neglecting parenting

The rejecting-neglecting parenting style is uncommon and is distinguished by having both low responsiveness and low demandingness (Baumrind, 1991). This type of parenting is generally considered abusive since children do not get sufficient attention and there are only few or no developmental demands placed on them (Maccoby & Martin, 1983). The parents are often more concerned with their own life than that of their children and the children are likely to develop severe behavioural problems. Since this is a rare parenting style and unlikely to occur in our study population of dog owners it will not be discussed further.

For determining child parenting styles the dimensions control, maturity demands, communication and warmth were used first, but later these were redefined as variations along dimensions of responsiveness and demandingness (Baumrind, 1991; Maccoby & Martin, 1983). These two dimension encompass a wide range of parental beliefs and practices, which may be applicable also to the owner to dog relationship. In the following sections I provide an overview of my expectations of what responsive and demanding dog parenting would encompass, based on a variety of studies into child parenting views and practices (Ben-Michael et al., 2000; Coplan et al., 2002; Power, 2013; Rickel & Biasatti, 1982; Robinson et al., 1995). This aims to make transparent how we translate parent to child interactions into dog owner to dog interactions concerning parenting styles. The underlying assumptions are fundamental in the present search for dog owner parenting styles. Whether these expectations hold will be tested in the practical part of this study and for now they are presented as a framework on which the research is based.

### Responsive dog parenting

Responsive dog owners are assumingly dog-centred, showing warmth, support and encouragement. When decisions are made about parenting the dog's needs and wishes come first. A responsive owner notices and respond to behaviours of their dog which is done primarily in a positive way without enforcing strict rules or discipline. For example, when the dog exhibits unwanted behaviour a responsive owner is more likely to distract the dog than to punish him. If punishing does occur, it is done inconsistently. Good behaviour of the dog is generally noticed and rewarded. When the owner believes their dog is sad or uncomfortable support is provided. Overall, these dogs receive positive attention like cuddles, petting, and praise, and owners are likely to initiate positive interactions with their dog such as play. During dog training the focus lies mainly on the benefits for the dog, not for the owner and when the dog cannot accomplish something during training this is accepted by the owner or an alternative teaching method is tried. Inside the house the dog will have freedom, space and toys and it is not subject to strict rules. Responsive owners let their dog interact with visitors and unwanted behaviour like jumping up to the visitors is not corrected. During walks the owner takes the dog to places it appreciates. Responsive owners are likely to let their dog play with other dogs and this play is not monitored closely (Ben-Michael et al., 2000; Coplan et al., 2002; Power, 2013; Rickel & Biasatti, 1982; Robinson et al., 1995). These are assumed examples of beliefs and actions from responsive dog owners, all based on the same attitude that dogs should be nurtured and be in a warm environment.

### Demanding dog parenting

The demanding aspect of parenting is more focused on control and maturity demands and the following assumptions are again based on child parenting research. Demanding dog owners are likely to acquire a dog to please their needs, for example the need for companionship, protection or relaxation. Such owners feel responsible for their dog and will, therefore, try to raise it according to their beliefs. The dog is expected to perform according to the owner's wishes always. Demanding owners generally do not show a lot of patience with their dog and clearly indicate to the dog what they expect. Good behaviour of the dog is noticed but generally not rewarded whereas unwanted behaviour is consistently corrected by physical or verbal discipline, or by removal of toys or affection. When the dog acts out in public, this owner feels shame. The dog is typically well trained, again based on what the owner wants from his or her dog. Failure during training is not accepted easily and the owner is prone to believe it is due to the dog's limitations. Demanding owners will have the occasional play bout together with their dog and strict rules apply during such play bouts with the owner deciding when play time is over. Demanding dog owners want the dog to know its place in the family, meaning the dog is not allowed on the couch or bed, will have to sit before receiving food and will be walked under strict control. Interaction of the dog with visitors is either avoided or closely monitored (Ben-Michael et al., 2000; Coplan et al., 2002; Power, 2013; Rickel & Biasatti, 1982; Robinson et al., 1995).

Parenting styles along the dimensions of responsiveness and demandingness are based on the caretaker's views and beliefs. These views and beliefs will affect everyday owner dog interactions in subtle ways like general tone of voice used, body posture, amount and quality of interaction with the dog but also choice of feed, accommodation and training school. Such factors are hard to take into account during behaviour testing, though we acknowledge that they could have a great impact on development of a dog. However, it is accepted that looking at the more overt and detectable actions in a number of contextually different situations can still supply valid information about parenting styles (Darling & Steinberg, 1993; Power, 2013; Robinson et al., 1995; Williams et al., 2009). Parental features related to the child parenting styles are assumed to translate into responsive and demanding dog owner behaviours and views which associate to dog owner parenting styles, and these features will be scored in owners by means of questionnaires and behavioural tests, the results of which are presented next.

### Authoritarian, authoritative and permissive dog parenting

To determine if owner to dog parenting styles exist similarly to commonly accepted child parenting styles we analysed dog owner reports collected with Questionnaire A, which contained items about parenting authoritarian, authoritative and permissive. A total of 431 dog-owner dyads filled in the questionnaire of which the owners were predominantly female (N=405, 94%). The owner age level (mean  $\pm$  SD) was  $3.3 \pm 1.27$  indicating it was in the third range (35-44 years old). Their mean education level was  $4.2 \pm 1.26$  reflecting intermediate vocational education. Dogs were on average  $4 \pm 3.26$  years old and the dogs had been with their current owners for an average time of  $3.8 \pm 0.15$  years. All 10 Federation Cynologique Internationale (FCI) dog breed clusters were represented, together with a number of mixed breeds (N=94, 22% of total). There were 216 male dogs (114 neutered, 102 intact), 195 female dogs (137 neutered, 58 intact) and 20 dogs of unknown sex. Almost all owners were either satisfied (23%) or very satisfied (73%) with their dog and only 3% of the owners was mildly satisfied to not satisfied at all (1% left this question blank).

A preliminary Principal Component Analysis was performed on the answers to questions about parenting styles (42 items) and based on the outcomes 11 items with a loading  $< |0.4|$  in the relevant components were discarded. The PCA performed on the 31 remaining items yielded 3 relevant components explaining 37.1% of the variance (Table 1). The first component was labelled 'Authoritarian dog parenting' and contained 10 authoritarian items, explaining 14.5% of the

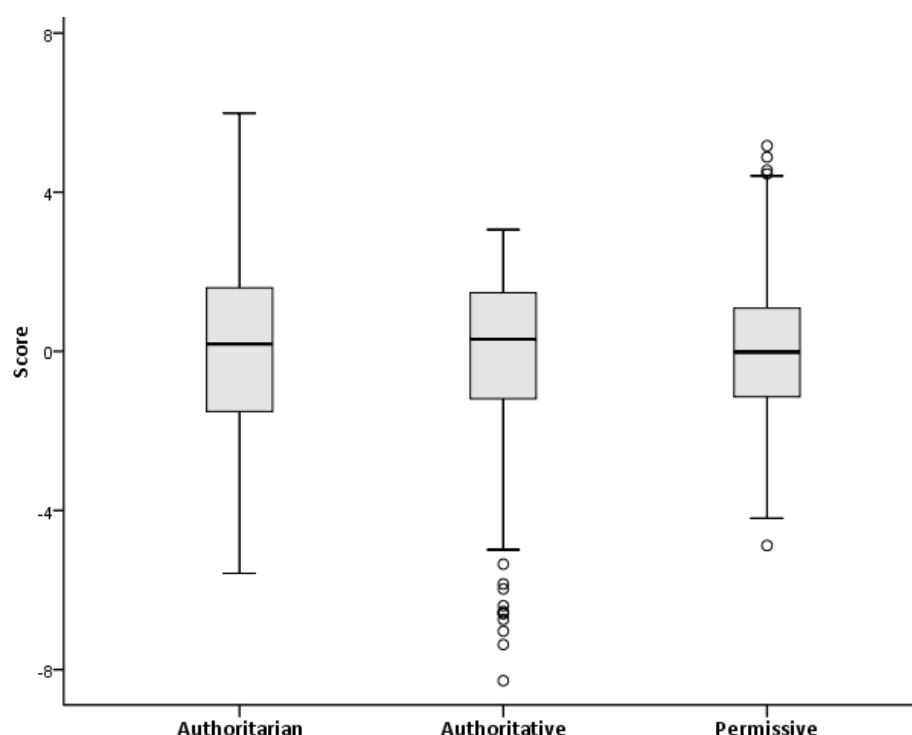
variation. The second component named 'Authoritative dog parenting' explained 13.1% of the variation and contained 12 authoritative items plus 1 permissive item. The last component, 'Permissive dog parenting', contained 6 questions regarding the permissive style and 1 question from both the authoritative and the authoritarian style. The last component explained 9.5% of the variation. Cronbach's alpha showed that the first two components had a good internal consistency ( $\alpha=0.82$  and  $\alpha=0.81$ , respectively), however the permissive component had a mediocre internal consistency ( $\alpha=0.62$ ) suggesting that the first 2 components were the most relevant and reliable indicators of a parenting style.

**Table 1: Dog owners (N=431) reported on how they parented their dog with each item (question) being answered on a scale from zero ('never') to four ('always'). Presented are the mean scores ( $\pm$  standard deviation) and loadings from a Principal Component Analysis performed on items about parenting [1] authoritarian, [2] authoritative and [3] permissive. The 3 main components, their key items and the percentage of variance they explain are displayed. Items marked (R) have been reversed for scoring purposes.**

<b>Component (% of variance explained)</b>	<b>Loading</b>	<b>Mean<math>\pm</math>SD</b>
<i>Component 1: Authoritarian dog parenting (14.5%)</i>		
I demand things of my dog <sup>[1]</sup>	0.68	2.27 $\pm$ 1.19
When my dog has to do something, it is because I am its owner <sup>[1]</sup>	0.66	1.87 $\pm$ 1.27
I correct my dog to improve his/her behaviour <sup>[1]</sup>	0.66	2.8 $\pm$ 1.14
I use physical punishment as a way of disciplining my dog <sup>[1]</sup>	0.66	0.87 $\pm$ 1.05
I correct my dog when his/her behaviour does not meet my expectations <sup>[1]</sup>	0.63	2.12 $\pm$ 1.29
I grab my dog when he/she is disobedient <sup>[1]</sup>	0.6	1.14 $\pm$ 1.12
I spank my dog when he/she is disobedient <sup>[1]</sup>	0.59	0.74 $\pm$ 0.99
I shove my dog when he/she is disobedient <sup>[1]</sup>	0.59	0.77 $\pm$ 1
I guide my dog by punishment more than by reason <sup>[1]</sup>	0.47	1.15 $\pm$ 1.15
I use threats as punishment <sup>[1]</sup>	0.45	0.5 $\pm$ 0.85
<i>Component 2: Authoritative dog parenting (13.1%)</i>		
I have warm and intimate times together with my dog <sup>[2]</sup>	0.64	3.73 $\pm$ 0.51
I show patience with my dog <sup>[2]</sup>	0.6	3.26 $\pm$ 0.82
I show sympathy when my dog is hurt or frustrated <sup>[2]</sup>	0.58	3.17 $\pm$ 0.94
I am easy going and relaxed with my dog <sup>[2]</sup>	0.58	3.41 $\pm$ 0.74
I do not appear confident about my parenting abilities (R) <sup>[3]</sup>	-0.56	3.21 $\pm$ 0.78
I play with my dog <sup>[2]</sup>	0.55	3.45 $\pm$ 0.69
I express affection by hugging and petting my dog <sup>[2]</sup>	0.53	3.56 $\pm$ 0.67
I am responsive to my dog's feelings and needs <sup>[2]</sup>	0.52	3.34 $\pm$ 0.8
I take my dog into account when making plans <sup>[2]</sup>	0.52	3.69 $\pm$ 0.62
I know which dogs my dog likes to play with and which ones he/she doesn't like to play with <sup>[2]</sup>	0.46	3.28 $\pm$ 0.84
I let my dog know what wanted and unwanted behaviour is <sup>[2]</sup>	0.45	3.48 $\pm$ 0.69
I provide comfort and understanding when my dog has a bad day <sup>[2]</sup>	0.44	2.75 $\pm$ 1.18
<i>Component 3: Permissive dog parenting (9.5%)</i>		
I find it difficult to discipline my dog <sup>[3]</sup>	0.6	0.91 $\pm$ 1.13
I am afraid that disciplining my dog for his/her misbehaviour will cause the dog to not like me <sup>[3]</sup>	0.57	0.39 $\pm$ 0.87
I withhold criticism even when my dog disobeys me <sup>[3]</sup>	0.55	1.07 $\pm$ 1.11
I appear unsure on how to solve my dog's misbehaviour <sup>[3]</sup>	0.54	1.14 $\pm$ 1.06
I threaten my dog with punishment more often than	0.52	0.52 $\pm$ 0.91

actually giving it <sup>[3]</sup>		
I take my dog's desires into account (for example not wanting to become wet) before I ask him/her to do something <sup>[2]</sup>	0.45	2.54±1.18
I use threats as punishment <sup>[1]</sup>	0.44	0.5±0.85
I bribe my dog with rewards to bring about compliance <sup>[3]</sup>	0.42	1.84±1.19

Scores for the first to third component indicate the respective levels of authoritarian parenting applied by the owner, authoritative parenting and permissive parenting. For the authoritarian component scores ranged from -5.58 to 5.99, for the authoritative component this was from -8.28 to 3.06, and for permissive the range was from -4.88 to 5.17 (Figure 1). When looking at the highest 10% of scores for all three parenting styles only 7 of the 122 high-scoring owners had scores in the top 10% of more than 1 parenting style. This suggests that most dog owners who use 1 parenting style strongly do not also use another style to such a great extent.



**Figure 1.** Dog owners (N=431) reported on the ways they parented their dogs by answering (modified) questions used for assessing child directed parenting styles. Item scores were analysed by Principle Component Analysis and component scores are presented as boxplots for authoritarian, authoritative and permissive parenting. For each parenting style the lowest score still within 1.5 interquartile range of the lower quartile, the highest score still within 1.5 interquartile range of the upper quartile, the first and third quartiles, the median and possible outliers are depicted.

To test if certain owner and dog demographic factors (owner age and education level, and dog breed, sex, age, and time with owner) could be associated to parenting styles an ANOVA (N=431) was performed with these factors as the independent variables and the PCA-generated parenting style scores as dependent variables. Only main effects were considered and all independent variables were tested in one model simultaneously. Owner age was associated to the authoritarian ( $F=5.90$ ,  $P=0.02$ ) and the permissive ( $F=4.7$ ,  $P=0.03$ ) parenting style scores. The youngest dog owners (18-25 years old) scored relatively low on authoritarianism (mean  $\pm$  SD was  $-0.75 \pm 2.11$ ) and the level of authoritarian parenting increased with age as the oldest dog owners (>65 years old) had a mean authoritarian score of  $0.01 \pm 2.02$ . Contrary, young dog owners scored high on permissiveness ( $0.67 \pm 1.78$ ) and this score decreased with age where the oldest dog owner scored on average -

0.25±1.86. No other associations between owner and dog demographic factors and any of the parenting style scores were found (for details see Appendix 7).

### Responsiveness and demandingness in dog parenting

To test if dog owners exhibit patterns of the underlying dimensions of parenting, responsiveness and demandingness, 29 of the dog owners who responded to Questionnaire A also answered 33 items concerning responsiveness and demandingness across a number of dog-related situations. Only 1 of the respondents of this Questionnaire B was male. The mean  $\pm$  SD age level of the respondents was 3.14±1.09 meaning it was in the range of 35-44 years old. Their mean education level was 4.55±1.48 indicating higher vocational education which is 1 level higher than in the first questionnaire. The mean age of the dogs was 4.82±0.43 years and they had been with their owners for an average time for 3.77±2.17 years. All FCI breed cluster except 6 (scent hounds and related breeds), 9 (companion and toy dogs) and 10 (greyhounds) were represented and 7 of the 29 dogs were mixes. A preliminary PCA identified 9 items with loadings  $<|0.4|$  which were dismissed for further analyses. A PCA performed on the final 24 items yielded 2 relevant components which together explained 43.3% of the variance (Table 2). The first component explained 24.9% of the variation and consisted of 9 demanding questions with a negative loading, 6 responsive questions with a positive loading and 1 demanding question with a positive loading. The second component explained 18.4% of the variation and consisted of 7 responsive items and 1 demanding item, all with a unidirectional loading.

**Table 2: Dog owners (N=29) reported on how they parented their dog in a number of situations with each item being answered on a scale from zero ('never') to four ('always'). Presented are the mean scores ( $\pm$  standard deviation) and loadings from a Principal Component Analysis performed on items about parenting [1] demanding and [2] responsive. The 2 main components, their key items and the percentage of variance they explain are displayed.**

Component (% of variance explained)	Loading	Mean $\pm$ SD
<i>Component 1: Responsive, not demanding (24.9%)</i>		
I train my dog because I want him/her to listen to me <sup>[1]</sup>	-0.74	2.83±0.93
I expect my dog to stay beside me when we are going for a walk <sup>[1]</sup>	-0.69	1.66±1.04
I expect certain behaviours from my dog (e.g. not pulling on the leash, not jumping, no excessive barking) <sup>[1]</sup>	-0.62	2.93±0.7
When I call my dog I expect him/her to respond immediately <sup>[1]</sup>	-0.61	3.07±0.84
I control the pace during walks with my dog <sup>[1]</sup>	-0.58	2.62±0.82
I criticize my dog when he/she displays unwanted behaviour <sup>[1]</sup>	-0.56	2.03±0.98
I expect my dog to be calm when we have visitors <sup>[1]</sup>	-0.54	2.66±0.81
I set certain boundaries for my dog at home (like not being allowed in the kitchen or on the couch) <sup>[1]</sup>	-0.52	2.21±1.35
I stop playing with my dog when I don't feel like playing anymore <sup>[1]</sup>	-0.51	3.17±0.71
I have patience when I try to teach my dog something <sup>[2]</sup>	0.43	3.34±0.72
When my dog is not able to learn something I accept that <sup>[2]</sup>	0.55	2.93±1.03
I keep an eye on my dog when he/she is playing with other dogs <sup>[1]</sup>	0.55	3.72±0.65
When my dog asks for attention I will give it attention <sup>[2]</sup>	0.58	2.45±0.83
I try to distract my dog when he/she performs unwanted behaviour <sup>[2]</sup>	0.60	3±0.71
I teach my dog enjoyable tricks because I think my dog likes that <sup>[2]</sup>	0.61	2.31±1.58
When I notice that my dog does not want to do something during training I will stop with that activity <sup>[2]</sup>	0.64	3.07±0.8
<i>Component 2: Responsive (18.4%)</i>		
I train my dog because I think he/she enjoys that <sup>[2]</sup>	0.81	3.38±0.56
I believe it is important that my dog can perform his/her natural behaviour (like running, playing, having contact with other dogs) <sup>[2]</sup>	0.67	3.66±0.48
I encourage my dog to play with me <sup>[2]</sup>	0.66	2.45±0.91
I am consistent in disciplining my dog <sup>[1]</sup>	0.62	2.41±0.95
I think I notice it when something is wrong with my dog <sup>[2]</sup>	0.62	3.38±0.49
I respond to the body language shown by my dog <sup>[2]</sup>	0.51	3.52±0.51



When I see that my dog does not want to play anymore we stop playing <sup>[2]</sup>	0.45	3.34±0.94
When a certain training method does not work for my dog I am open to trying another method <sup>[2]</sup>	0.43	3.55±0.69

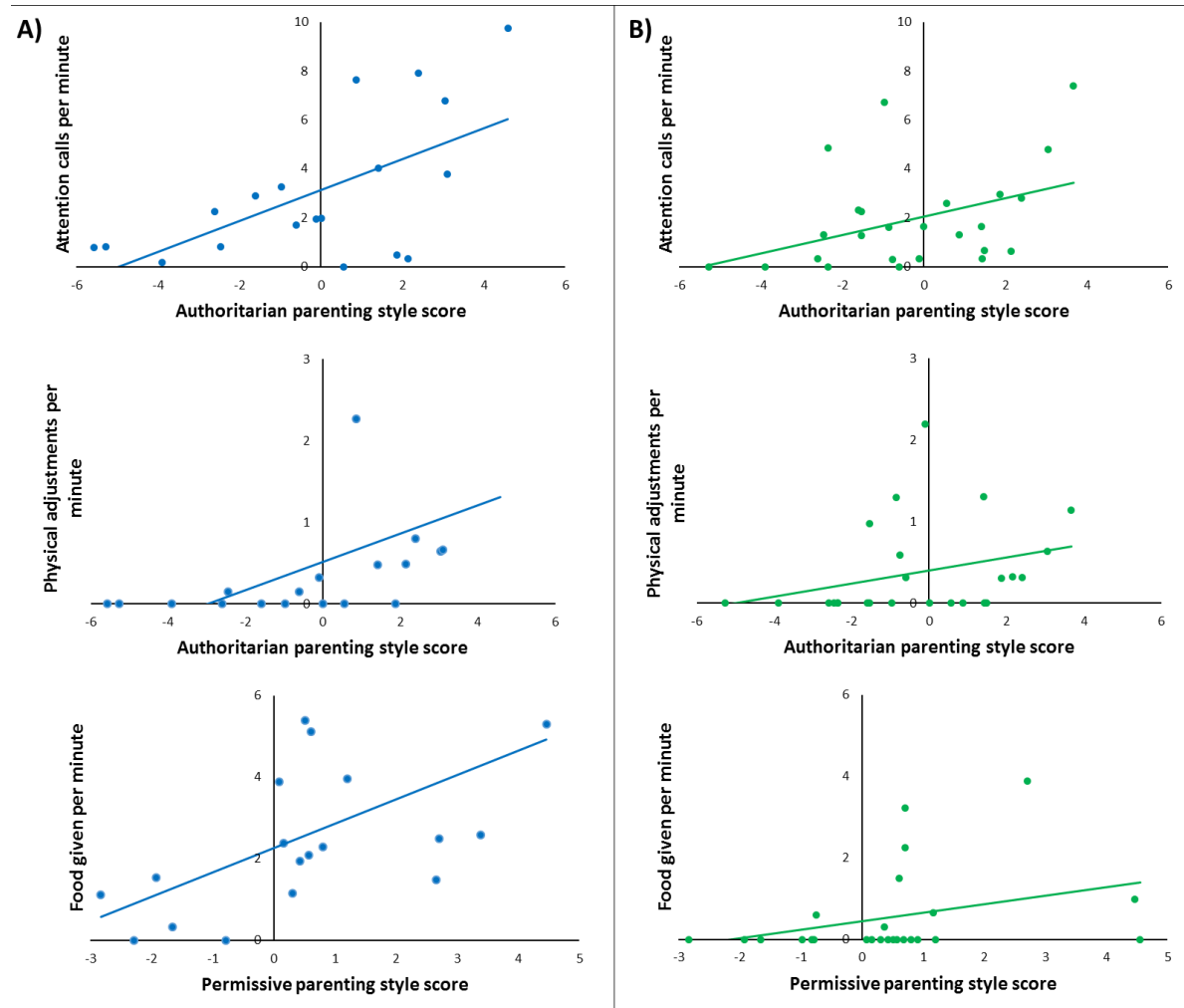
The PCA component scores for 'responsive, not demanding' component ranged from -5.9 to 5.8 and for 'responsive' this was from -3.69 to 3.4. Spearman correlations were calculated between component scores derived from Questionnaire A, i.e. for the 3 parenting styles, and component scores for the 2 parenting dimensions derived from Questionnaire B (N=29). Component scores were all expressed in a way that high positive scores indicated strong tendencies towards the style or dimension. Scores for the authoritarian parenting style were negatively correlated to scores for the 'responsive, not demanding' component ( $R=-0.63$ ,  $P<0.001$ ). The authoritarian style in child parenting was characterized by demandingness and here we see that this is similar for dog owners. Conversely, the permissive parenting style was positively correlated to the 'responsive, not demanding' component ( $R=0.33$ ,  $P=0.04$ ) which again resembles child parenting. However, the authoritative style was strongly correlated to the 'responsive' component ( $R=0.69$ ,  $P<0.001$ ) whilst in child parenting this style was characterized by being both responsive and demanding. One must keep in mind that the responsive items related to the authoritative parenting style are different items from those related to the permissive parenting style. Thus, dog owners seem to exhibit similar parenting styles as parents do. The 'Authoritarian dog parenting' component contained 10 of the 16 authoritarian items of the original questionnaire, indicating a clear use of the authoritarian parenting style by dog owners while suggesting that several items relevant for authoritarian child parenting matter not in authoritarian dog parenting. The component named 'Authoritative dog parenting' contained almost all authoritative items (12 out of 14) together with 1 permissive item with a reverse loading. This component had the strongest resemblance to the corresponding child parenting style. However, the 'Permissive dog parenting' component contained only 6 of the 13 questions regarding the permissive child parenting style combined with 2 questions from the other styles. It could be that dog owners are less likely to apply a permissive parenting style or that this style is based on other factors than the permissive child parenting style. The three dog parenting styles were associated to the responsive and demanding dimensions in a similar way as the child parenting styles were. Further analyses focusses on the 3 parenting style components instead of on the parenting dimension since 1 of the dimensional components contained both responsive and demanding items making it difficult to draw straight-forward conclusions when this component is associated with anything.

### Parenting styles and owner behaviour

Specific parenting styles should express in the way dog owners interact with their dogs and to test this dog owner behaviour (N=29) was observed during two tug-of-war games with their dog and two training sessions in which the dog was trained to pull a rope out of a pipe. A number of verbal and non-verbal owner behaviours were scored in either 'rate per minute' or 'percentage of time' and average behaviour scores per activity (play and training) were calculated. To identify behavioural patterns a PCA was performed on owner behaviour during both play and training (Appendix 8) and scores for the relevant PCA components were retrieved and tested for associations with parenting style scores. Out of 6 components only 1 was correlated with parenting and we decided to shift our attention to the relationship between parenting style scores and individual behaviours by doing multiple Spearman correlation tests. Mean behaviour scores obtained for both play and training are presented in Appendix 9 and these were tested against the PCA-generated parenting style scores. The number of correlations tested (29 behaviour scores against the 3 parenting styles) imply that some were significant by chance and to control this effect here we emphasize the behaviours that were correlated to parenting regardless if measured during play or training (Figure 2). Scores for being authoritarian correlated with the use of attention calls (during training:  $R=0.51$ ,  $P=0.03$ ; during play:  $R=0.44$ ,  $P=0.03$ ) and physical adjustment (during training:  $R=0.75$ ,  $P<0.001$ ; during play:  $R=0.47$ ,  $P=0.02$ ). Attention calls and physical adjustments are both demanding behaviours which we expected



to see in owners with a more authoritarian style. Permissive parenting style scores correlated with giving food (during training:  $R=0.69$ ,  $P=0.001$ ; during play:  $R=0.43$ ,  $P=0.03$ ). Giving food is a responsive behaviour which fits perfectly in the permissive parenting style. Behaviours correlated positively to the authoritarian style and shown during training were verbal correction ( $R=0.58$ ,  $P=0.01$ ), attention sound ( $R=0.48$ ,  $P=0.04$ ), neutral contact ( $R=0.58$ ,  $P=0.01$ ) and petting/stroking ( $R=0.64$ ,  $P=0.003$ ). A training related behaviour that correlated to authoritative parenting was using hand movements ( $R=0.48$ ,  $P=0.04$ ) and during play this same behaviour correlated to permissiveness ( $R=0.40$ ,  $P=0.05$ ). Furthermore, during play a permissive style correlated inversely with the use of physical adjustment ( $R=-0.47$ ,  $P=0.02$ ) and imitating dog sounds ( $R=-0.46$ ,  $P=0.02$ ).



**Figure 2.** Dog-owner dyads participated in two play tests ( $N=25$ ) and two training tests ( $N=19$ ) during which owner behaviour was recorded in average rate per minute for A) play and B) training. Owners reported on their parenting styles towards dogs with items related to child parenting and a Principal Component Analysis resulted in individual parenting style scores which were tested against behavioural scores by Spearman correlations. The average rate at which owners used the behaviours ‘attention call’ and ‘physical adjustment’ were positively correlated to the authoritarian parenting style scores during both play (attention call:  $R=0.44$ ,  $P=0.03$ ; physical adjustment:  $R=0.47$ ,  $P=0.02$ ) and training (attention call:  $R=0.51$ ,  $P=0.03$ ; physical adjustment:  $R=0.75$ ,  $P<0.001$ ). The rate of ‘giving food’ was positively correlated to the permissive parenting style scores for both play ( $R=0.43$ ,  $P=0.03$ ) and training ( $R=0.69$ ,  $P=0.001$ ). Linear trendlines are displayed.

Parenting style scores were tested for correlations with the amount of time and the number of activities owners reported to undertake with their dog (Questionnaire B items). A significant Spearman correlation ( $N=29$ ) was detected between the permissive parenting scores and giving the dog treats ( $R=0.49$ ,  $P=0.01$ ) whilst the authoritative scores were positively correlated to giving the dog presents ( $R=0.53$ ,  $P<0.001$ ). The authoritarian style scores were negatively correlated to taking

the dog along on car drives ( $R=-0.41$ ,  $P=0.03$ ). Not all these correlations match our predictions on owner dog interactions and parenting styles. Some of the correlations are likely chance effects and / or reflect that the behavioural patterns accompanying parenting views and attitudes are quite complex.

### Parenting style and owner attitude

Dog owner attitude was measured by owners ( $N=428$ ) responding to items from the Lexington Attachment to Pets Scale in Questionnaire A along the dimensions 'general attachment', 'people substitution' and 'animal rights' (Johnson et al., 1992). A PCA performed on all 23 items showed that 22 of these items were relevant for the first component which explained 34% of the variation (Table 3). Component scores for this 'general attitude' were retrieved from the PCA and percentage scores for the three separate dimensions were calculated from the original answers that were grouped according to Johnson et al. (1992). The general attitude scores ranged from 3.78 to -11.74 with a few outliers in the lower range scores. Spearman correlation tests ( $N=428$ ) revealed that general attitude component scores correlated to all three parenting style scores. People with a higher attitude score also scored high on both being permissive ( $R=0.20$ ,  $P<0.001$ ) and authoritative ( $R=0.41$ ,  $P<0.001$ ) whilst the general attitude score was negatively correlated to the authoritarian parenting ( $R=-0.12$ ,  $P=0.01$ ). Spearman correlation tests ( $N=428$ ) with the percentage scores for the three separate LAPS dimensions showed that the score for 'animal rights' was positively correlated to both the permissive parenting style ( $R=0.25$ ,  $P<0.001$ ) and the authoritative style ( $R=0.28$ ,  $P<0.001$ ), whilst being negatively correlated to the authoritarian style ( $R=-0.24$ ,  $P<0.001$ ). For 'people substitution' the correlations were similar (permissive:  $R=0.2$ ,  $P<0.001$ ; authoritative:  $R=0.3$ ,  $P<0.001$ ; authoritarian:  $R=-0.1$ ,  $P=0.03$ ). 'General attachment' was positively correlated to the authoritative scores ( $R=0.47$ ,  $P<0.001$ ) and the permissive ones ( $R=0.21$ ,  $P=0.02$ ) however this dimension showed no correlation to the authoritarian style scores. Overall, owners who are more attached to their dog, see their dog as a substitution for humans and believe their dog has certain rights are likely to have either an authoritative or a permissive style of parenting. People with a higher authoritarian parenting style score tend to be more distant from their dog, see their dog more as pet than as a person and believe their dog does not have many rights. Variation in dimensions of being responsive and demanding seem to play a role in how attitude is linked to parenting style and this effect is similar in dog owners and parents.

**Table 3: Dog owners ( $N=428$ ) reported on their attitude and attachment towards dogs with each item being answered on a scale from one ('completely disagree') to four ('completely agree'). Presented are the mean scores ( $\pm$  standard deviation) and loadings from a Principal Component Analysis performed on items about [1] general attachment, [2] people substitution and [3] animal rights. The main component, its key items and the percentage of variance it explains are displayed. Items marked (R) have been reversed for scoring purposes.**

Component (% of variance explained)	Loadings	Mean $\pm$ SD
<i>Component 1 (34%)</i>		
I consider my dog to be a great companion <sup>[1]</sup>	0.72	3.63 $\pm$ 0.61
I consider my dog to be a friend <sup>[1]</sup>	0.71	3.45 $\pm$ 0.75
I believe my dog is my best friend <sup>[2]</sup>	0.7	3.23 $\pm$ 0.86
My dog means more to me than any of my friends <sup>[2]</sup>	0.66	2.61 $\pm$ 1.05
My dog and I have a very close relationship <sup>[1]</sup>	0.65	3.58 $\pm$ 0.65
I love my dog because he/she is more loyal to me than most of the people in my life <sup>[2]</sup>	0.64	2.73 $\pm$ 1.12
My dog makes me feel happy <sup>[1]</sup>	0.64	3.73 $\pm$ 0.52
I feel that my dog is part of my family <sup>[3]</sup>	0.64	3.62 $\pm$ 0.65
Owning a dog adds to my happiness <sup>[1]</sup>	0.64	3.77 $\pm$ 0.49
I would do almost anything to take care of my dog <sup>[3]</sup>	0.62	3.73 $\pm$ 0.52
My dog understands me <sup>[1]</sup>	0.62	2.71 $\pm$ 0.93
I believe that dogs should have the same rights and privileges as my family members <sup>[3]</sup>	0.59	2.26 $\pm$ 1.01

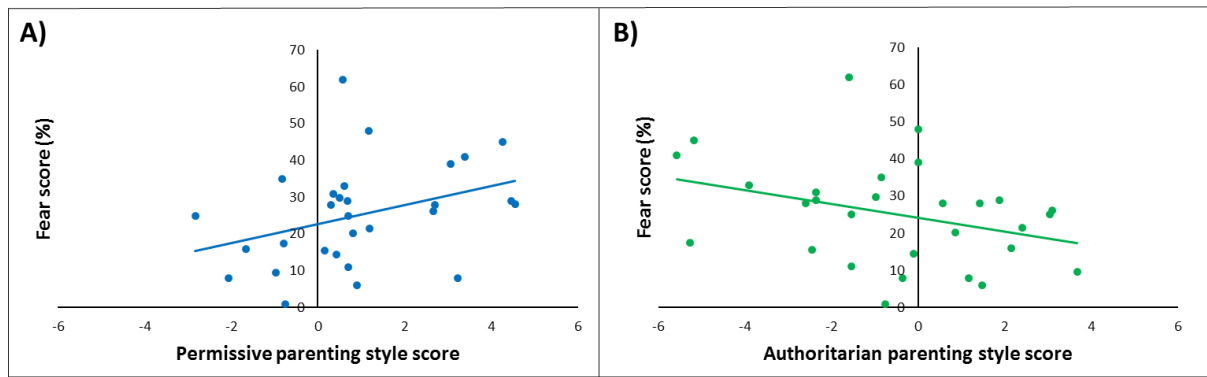
Dogs deserve as much respect as humans do <sup>[3]</sup>	0.59	3.54±0.74
I enjoy showing other people pictures of my dog <sup>[2]</sup>	0.58	3.32±0.85
Quite often my feelings towards people are affected by how they react to my dog <sup>[2]</sup>	0.54	2.72±1.07
I often talk to other people about my dog <sup>[1]</sup>	0.52	3.19±0.77
I believe that loving my dog helps me stay healthy <sup>[1]</sup>	0.51	3.24±0.88
My dog knows when I'm feeling bad <sup>[1]</sup>	0.51	3.43±0.75
I love my dog because it never judges me <sup>[2]</sup>	0.51	2.97±1.09
I play with my dog quite often <sup>[1]</sup>	0.48	3.43±0.69
I think my dog is not just a pet (R) <sup>[3]</sup>	0.42	2.39±1.14
Quite often I confide in my dog <sup>[2]</sup>	0.42	3.02±0.99

To gain insight into what might be associated to owner attitude an ANOVA (N=428) was done with the PCA scores for the owner's general attitude as the dependent variable and demographic factors of both dog and owner as independent variables. Only main effects were considered and all variables were tested simultaneously in one model. Both owner age ( $F=10.48$ ,  $P=0.001$ ) and owner education level ( $F=5.93$ ,  $P=0.02$ ) were associated to owner attitude. The youngest dog owners (18-25 year old) had a mean  $\pm$  SD attitude score of  $1.03\pm2.36$  and the dog owners older than 65 years old had a mean attitude score of  $-0.91\pm3.03$  showing that an increase in age was associated with decreasing scores for general attitude. Considering education, dog owners with the lowest education level had an average attitude score of  $0.97\pm1.57$  whilst dog owner with the highest education level scored on average  $-0.58\pm2.68$  on general attitude, indicating a decrease in attitude score with increasing education level. No other associations between demographic factors and dog owner attitude were demonstrated (for details see Appendix 7).

### Dog parenting style and dog behaviour

Behaviour of dogs during tug-of-war and training exercises was not tested for relations to that of the owners, but rather we focussed on relating it to the parenting style scores directly and to dog problem behaviour in daily life. Mean behavioural scores for both play and training are displayed in Appendix 10 and by means of Spearman correlations (N=26) it was found that the time a dog spends focussed on his or her owner during play related to the level of permissiveness ( $R=0.47$ ,  $P=0.02$ ), but not to the authoritarian and authoritative style scores. During play the permissive parenting style score was also inversely correlated to the rate of vocalizations of the dog ( $R=-0.49$ ,  $P=0.01$ ) and the level of authoritarian parenting was correlated to the rate of contact seeking by the dog ( $R=0.42$ ,  $P=0.03$ ). Play motivation of the dog was negatively correlated to the permissive parenting style ( $R=-0.35$ ,  $P=0.05$ ). During training (N=19) the permissive parenting style score was negatively correlated to the rate of contact seeking by the dog ( $R=-0.47$ ,  $P=0.04$ ). No other correlations were found to be significant (Appendix 10).

Dog owners (N=29) reported on their dog's fearfulness and separation anxiety in Questionnaire B, based on which a percentage score for both behaviours was calculated. In our sample the fear level ranged from 1 to 62 percent (a mean  $\pm$  SD of  $25.2\pm13.8$ ) and the separation anxiety level scores were between 7 and 52 percent ( $27.2\pm10.1$ ). Separation anxiety of a dog was not correlated to any of the parenting styles. The level of fear of a dog as described by its owner tended to be positively related to the permissive parenting style scores ( $R=0.36$ ,  $P=0.06$ ) and negatively to the authoritarian parenting style scores ( $R=-0.37$ ,  $P=0.05$ , Figure 3). The level of fear and anxiety of these dogs was also measured in a behaviour assay performed by Anke Wieldraaijer, together with their degree of impulsivity and stress. None of these features was correlated to the use of a parenting style.



**Figure 3.** Dog owners (N=29) reported on their dog's fearfulness in the Canine Behavioural Assessment & Research Questionnaire, and percentile fear scores for each dog were calculated. Dog owners also reported on how they parented their dog, and a Principal Component Analysis resulted in individual component scores for each parenting style which were tested against dog fear scores by Spearman correlation tests. Dog fear scores were somewhat positively correlated to A) the permissive parenting style scores ( $R=0.36$ ,  $P=0.06$ ) and were negatively correlated to B) the authoritarian parenting style scores ( $R=-0.37$ ,  $P=0.05$ ). Linear trendlines are displayed.

## Discussion

This study explored the idea that dog owners apply particular parenting styles when interacting with their canine pet and that these styles cover distinct views, attitudes and practices contributing to dog raising. Dog parenting styles were expected to be similar to child parenting styles due to the many parallels between the parent-child relationship and the owner-dog relationship. A questionnaire on the three main child parenting styles (authoritative, authoritarian and permissive parenting) was transformed to fit dog-related situations and filled in by 431 Dutch dog owners. A Principal Component Analysis performed on the items (answers) showed that dog owners indeed use similar parenting styles as parents do. Ten of the 16 questions concerning authoritarian parenting were in a first component, 12 of the 14 authoritative questions were in a second component together with 1 permissive item and 6 of the 13 permissive-related questions were in a third component along with 1 authoritarian item and 1 authoritative item. Each component can be linked to one parenting style and PCA component scores indicated to what degree each style was used by a dog owner. Thirty-three of the dog owners that responded to the first questionnaire also answered a second questionnaire on the underlying dimensions of parenting, responsiveness and demandingness. Responsiveness has to do with recognizing and responding to needs of the dog and being supportive while demandingness is related to making claims on the dog, and using supervision and discipline (Baumrind, 1991). A PCA performed on the questionnaire items concerning the two dimensions revealed two relevant components, one containing responsive and demanding items with reverse loadings and one with only responsive items with unidirectional loadings. Owner PCA scores per component were tested against the parenting style (component) scores by means of Spearman correlation tests, which confirmed that dog parenting styles are based on the dimensions responsiveness and demandingness in a similar way as child parenting styles are. Authoritarian dog parenting was related to a high level of demandingness and a low level of responsiveness and for permissive dog parenting this was the other way around, just as we see in child parenting (Maccoby & Martin, 1983). However, authoritative dog parenting was correlated only to responsiveness items whilst for child parenting this style was based on a balance between responsiveness and demandingness (Baumrind, 1971). Possible causes of this discrepancy and other details concerning the three dog parenting styles are discussed in the following.

The 33 dog owners who filled in the second questionnaire also participated in several behavioural tests with their dog. The dog-owner dyads engaged in two tug-of-war sessions and two training sessions in which the dog had to be taught to retrieve a rope out of a vertical pipe. Owner behaviours were tested for correlations with the PCA-generated parenting style scores with a Spearman

correlation test. Only a few behaviours were significantly correlated to a parenting style and these correlations matched expectations regarding the underlying dimensions as seen in child parenting. For example the behaviours 'physical adjustment' and 'attention calls' are considered demanding and were correlated to use of the authoritarian parenting style, which is based on a high level of demandingness. However, the responsive behaviour 'petting/stroking' as shown during training was also correlated to the authoritarian parenting style. This correlation and several others did not match our expectations based on the known child parenting styles, which demonstrates that not every aspect of child parenting is directly applicable to dog parenting. Each dog parenting style is discussed in further detail, and specific correlations with the underlying dimensions, owner behaviour but also owner attitude, demographic factors and dog problem behaviour as measured by the questionnaires are evaluated.

### Authoritarian dog parenting

A first component from the Principal Component Analysis performed on the parenting style questionnaire (N=431) concerned authoritarian parenting. The 10 items in this component indicate that authoritarian dog parenting is characterized by an owner placing many demands on their dog concerning appropriate behaviour, reinforcing these demands by means of correction and punishment. Higher authoritarian parenting style scores are correlated to a more distant general attitude towards dogs and authoritarian owners see their dog more as pet than as a friend or child. The authoritarian parenting component was negatively correlated to the 'responsive, not demanding' component from the questionnaire on the parenting dimensions demandingness and responsiveness. This component included several owner expectations such as 'dog must stay besides owner during a walk', 'dog must respond immediately when called' and 'dog must stay calm when there are visitors'. Authoritarian dog owners make claims on their dog in a variety of situations, just as authoritarian parents do. When authoritarian and authoritative parents of pre-school children were compared it was found that authoritarian parents place higher demands on their children, expecting them to 'act their age' (Baumrind, 1967). Also, when authoritarian parents of children aged 30 to 70 months old were asked about their child's misbehaviour they indicated that they felt personally responsible and could even experience shame when their child misbehaved in public (Coplan et al., 2002). If this is similar for dog owners with a high authoritarian score it explains why they place such high demands of their dog and are so firm in correcting inappropriate behaviour.

A variety of physical disciplinary methods such as grabbing, spanking and shoving the dog were in the authoritarian parenting component suggesting that these methods are common practice for authoritarian owners. However, several dog owners who filled in the questionnaire mentioned that they found items concerning correction 'suggestive', 'interpretable in multiple ways' or even 'a little weird'. Ambiguity of the correction-related items could explain the relatively high standard deviation from the mean score for all these items. Also, the items refer to disciplinary actions used typically by parents on children and these may be inappropriate for owner dog interactions. A questionnaire concerning common disciplinary practices of Pennsylvania dog owners (N=140) found that the actions 'hitting or kicking dog', 'growling at dog', 'physically force the release of an item from a dog's mouth' and 'alpha roll' are most widely used in correcting unwanted dog behaviour (Herron et al., 2009). The last three actions apply specifically to the owner-dog interaction and are therefore not in the parenting style questionnaire, but the frequency of which they are used could be related to authoritarian dog parenting. Future research should study the role of physical discipline in authoritarian dog parenting by looking at specific dog-related means of correction. A clear definition of each disciplinary method must be provided to decrease ambiguity of the questions.

The notion that physical interactions play a role in authoritarian dog parenting is supported by the outcome of the behavioural tests where the behaviour 'physical adjustment' performed in both play and training was correlated to the authoritarian parenting style. Physical adjustment was defined as 'using intermediate physical force to make the dog perform an action, or to make the dog obey', and observed behaviours included pulling the leash, forcing the head of the dog in a certain direction or

pushing the dog to make it sit. Physical adjustment does not involve correcting but rather directing dog behaviour. For children behaviour is often directed verbally which is reflected in the original child parenting practices questionnaire which contains items such as 'tells child what to do' and 'scolds and criticizes to make child improve' (Robinson et al., 1995). Physical means of directing behaviour are not evaluated, however our study suggests this is a relevant aspect of authoritarian dog parenting.

The authoritarian dog parenting component was negatively correlated to responsive items of the 'responsive, not demanding' component and authoritarian dog owners thus scored low for responsiveness. This mimics authoritarian child parenting where authoritarian parents are relatively low in warmth and nurturance compared to authoritative and permissive parents (Baumrind, 1967; Power, 2013). However, when behaviour of authoritarian owners during training is considered, next to a few demanding behaviours (using attention calls, attention sounds, and verbal corrections) these owners also significantly more often petted or stroked their dog. When dogs (N=24) in an earlier study were observed while being petted by either a familiar or an unfamiliar person they exhibited less redirected behaviours and more relaxed behaviours when petted by a familiar person, suggesting that petting by the owner is enjoyable for the dog and it thus a responsive behaviour (Kuhne et al., 2012). We observed that these authoritarian owners are somewhat physically oriented when it comes to interacting with their dogs and it is possible that they do show appreciation in a physical manner when the dog behaves appropriately, which is not typical for child authoritarian parenting (Coplan et al., 2002). Another possibility is that authoritarian dog owners pet and stroke their dog because of the positive effect it has on the owner. When oxytocin levels of owners were measured before and after petting a dog, it was found that these levels are significantly increased after petting (Odendaal & Meintjes, 2003). Oxytocin is known to induce a positive state of mind and reduce stress, showing that owners directly benefit from petting their dog (Domes et al., 2010; Heinrichs et al., 2003). The use of responsive behaviours by authoritarian dog owners could be investigated further with these possible benefits for the owner in mind. Overall, our study suggests that authoritarian dog parenting is mainly based on demandingness and not on responsiveness, with the possible exception of petting of the dog during training.

### Authoritative dog parenting

Key items in the authoritative dog parenting component that resulted from the PCA on the first questionnaire indicate that this style is mostly based on warmth, sympathy and responsiveness towards a dog. Authoritative owners spend pleasant times with their dog accompanied by positive physical contact and play and needs of the dog are taken into account across situations. Correlations with general attitude scores as indicated by the Lexington's Attachments to Pets Scale showed that authoritative owners are often strongly attached to their dog and view it as a friend or child. The importance of responsiveness in the authoritative style is reflected in the correlation to the second questionnaire 'responsive' parenting component, in which we see that many behaviours of the owner are aimed at ensuring happiness of their canine pet. When authoritative parents of three- and four year old children were compared to authoritarian and permissive parents the authoritative parents were loving and supportive towards their children (Baumrind, 1967). However, authoritative parents were distinguished by combining love and communication with clear demands and control (Baumrind, 1967, 1971). The role of demandingness in authoritative dog parenting seems insignificant compared to what we see in child parenting. A possible explanation for this is that in authoritative child parenting demandingness is often combined with reasoning and democracy (Pederson et al., 2015; Robinson et al., 1995). When parenting practices, beliefs and attitudes of authoritative mothers were reviewed by means of a questionnaire and compared to those of authoritarian mothers it was found that authoritative mothers often explain why something is asked and take input from the child concerning the demands placed on him or her (Coplan et al., 2002). Even though some dogs have been known to learn up to 200 distinct words, there is no scientific evidence that dogs can understand complex reasoning and clearly they cannot communicate



language-based like humans do (Kaminski et al., 2004). The combination of communication and placing demands on children is a key feature of authoritative child parenting and since communication between dog and owner is different from parent and child the demanding aspect of authoritative dog parenting can potentially not be properly measured by the tool used here. If demandingness is relevant for authoritative dog parenting it is most likely expressed in a different way, for example by asking something from your dog only when you see it is in a calm and positive state of mind. If this is the case then demandingness in authoritative dog parenting can only be measured by creating alternative questions with the nature of the owner-dog relationship kept in mind.

Besides using an unfit tool for measuring demandingness of authoritative dog owners, it is also likely that the study's sample population consists mainly of owners who are not very demanding in general. From all owners in the tested sample 92% had their dog for company and 68% kept a dog for walking whilst only 7% of the dogs are used as working dogs and 9% as guard dogs. Dogs used for working and guarding often have to meet certain standards, for example official guide dogs not only have to learn basic tasks such as how to deal with traffic, walk in a straight line and stop at kerbs, but they also must be intelligent, good-natured and have adequate temperamental qualities ("What a guide dog does | Guide Dogs," 2016). In contrast, only few demands are placed on companion dogs. Italian dog owners (N=770) who were asked about their ideal dog said that a dog should be housetrained, healthy, friendly and obedient (Diverio et al., 2016). Australian dog owners (N=877) expected similar traits from their companion dogs, suggesting that owner expectations are somewhat consistent across regions (King et al., 2009). These expectations are minimal compared to what is expected of working dogs and authoritative dog owners of dogs purely used for companionship most likely do not have high demands. Though they might show demandingness subtly whilst interaction with their dog this would not be revealed by the two questionnaires. Because demandingness is such an important feature of authoritative child parenting it is unwise to completely disregard the possibility of it playing a role for authoritative dog owners as well even though this aspect was not revealed in the current study.

Considering owner behaviour as observed during our behaviour tests (play and training) only the rate of hand movements used during training was correlated to authoritativeness of dog owners. During training owners had to convey information to their dog so we expected to see at least some demanding behaviours such as hand movements, vocalizations or commands in all owners. However, using hand movement to guide a dog is also partly responsive since dogs are known to understand human gestures more easily than for example vocalizations (McGreevy et al., 2012; Soproni et al., 2002). This type of behaviour which shows a balance between demandingness and responsiveness is characteristic of the authoritative child parenting style as well (Coplan et al., 2002; Power, 2013). It is possible that authoritative dog owners adapt their behaviour over time to accommodate the dog's needs. When both authoritative and authoritarian parents (N=24) of three year old children were asked to assist their child in the process of performing three difficult tasks (a block construction task, a matrix classification task and a story retelling task) it was found that authoritative parents also are likely to adapt their way of teaching to the child's learning process (Pratt et al., 1988). These parents changed their way of providing information in response to success or failure of the child in understanding the task. From the current study, no conclusive evidence can be provided on the degree to which authoritative dog owner adapt their behaviour to that of the dog. However, when similar methods are used as for investigating parent scaffolding we expect this trait to become apparent. Especially looking at temporal behavioural patterns will assist in classifying owner behaviour as responsive, demanding or a combination of both and this will provide more insight into which individual behaviours or behavioural patterns are associated to the authoritative parenting style.



### Permissive dog parenting

The permissive dog parenting component extracted by PCA from the first questionnaire was positively correlated to the 'responsive, not demanding' component from the second questionnaire. The results confirm that permissive dog owners are very responsive but demand little of their dogs, just like permissive parents do towards their children (Maccoby & Martin, 1983). Permissive dog owners reported to be more likely to be insecure and to only apply inconsistent, non-controlling disciplinary methods such as bribing and distraction because they are afraid that using strict corrections will lessen the relationship with their dog. Different levels of control exhibited by parents of three- and four year old children were compared by Baumrind (1971) and she concluded that permissive parents also avoid confrontation and give in easily to the child's demands. Authoritative parents encourage the child to participate in his or her preferred activities, whilst permissive parents often do not control what activities their child enrolls in and do not demand participation in specific activities (Baumrind, 1971, 1991). Permissive dog owners are similar, for example in that they show patience during training and accept it when their dog cannot learn something, instead of actively trying another method like authoritative owners reported to do. Permissive owners take responsiveness to the extreme in that they do not require the dog to do anything it does not want to do even though it might eventually enjoy the activity or benefit from it in some other way. The resemblance between permissive parents and permissive owners is striking, however since the permissive dog parenting component only explains 9.5% of the variation and contains only about half of the original questions on permissive parenting the results must be interpreted with caution.

The amount of food dog owners gave to their dog during training and play was correlated positively to permissive parenting style scores and self-reports indicated that permissive owners also give their dog many treats at home. Parenting styles are known to influence feeding habits of children. A questionnaire on parenting styles and feeding practices was spread among 101 African-American parents and 130 Hispanic parents (Hughes et al., 2005). Correlation tests revealed that permissive Hispanic parents tend to indulge their child's feeding behaviour, for example by supplying food whenever the child asks for it whilst permissive African-American parents are uninvolved in their children's feeding behaviour. The permissive dog owners in our study are similar to the permissive Hispanic parents in the sense that they actively feed the dog treats on many occasions. The indulgent feeding style of parents lead to children having a higher BMI and even though specific measurements of dog weight were not performed in this study it is likely that permissive dog owners also stimulate overeating in their dog (Hughes et al., 2005). Not only does this finding support the theory that permissive child parenting is very similar to permissive dog parenting, it also gives an example of how dog parenting styles might influence canine health. Overall, the resemblance between child parenting styles and dog parenting styles is strong, although each dog parenting style shows some discrepancies with its child parenting counterpart.

### Parenting style and canine fear

Besides investigating the existence of dog parenting styles correlations between dog owner parenting style use and the occurrence of problem behaviour were also studied. Both fearfulness and separation anxiety of dogs were scored by the owner in the C-barq resulting in one percentage score per behaviour. No correlations between the level of separation anxiety and the parenting style scores were found, however fearfulness of dogs tended to be positively correlated to the permissive dog parenting style scores and negatively to the authoritarian dog parenting style scores. Interestingly, when both anxiety levels and perceived parenting style were recorded in German high school students (N=276) it was found that a more authoritarian parenting style was linked to high levels of anxiety whilst permissive child parenting was related to low anxiety (Wolfradt et al., 2003). These conflicting results can be attributed to the different nature of the owner-dog and the parent-child relationship. A high level of parental control can cause a variety of behavioural problems in children (reviewed by Power, 2013) whilst for dogs control can lead to a stable and predictable environment. Authoritarian dog owners place many demands on their dog reinforced by consistent discipline.

Because of this consistency a dog will more easily learn what is expected of him across situations. Also, interactions with the owner or the dog's environment will always be based on the same set of rules, making them predictable. When dogs (N=108) were put in a variety of fear-inducing situations in which their fear response was measured it was discovered that predictability of the environment lead to a decreased fear response in most dogs (King et al., 2003). The predictable environment that authoritarian owners provide could thus explain the low level of fear we see in their dogs. However, authoritarian owners do use physical and verbal discipline and several large-scale studies on the effect of dog owner disciplinary methods show that this can increase dog fearfulness (Arhant et al., 2010; Hiby et al., 2004). It is possible that firm discipline applied in a positive and predictable environment can be constructive for the development of the dog, however investigating the exact causal relationship was beyond the scope of the current study.

Permissive dog owners place little demands on their dog, and are often inconsistent in applying discipline. Contrary to authoritarian owners permissive owners create an unpredictable environment for their dog which likely induces fear. Thereby, since permissive owners are characterized by not placing many demands on their dog they are also less likely to spend much time on obedience training or participation in doggy classes. When the link between participation in formal training classes and the occurrence of canine problem behaviour was surveyed a number of studies concluded that regular participation in formal training was related to a reduced chance of the dog exhibiting unwanted behaviours (Arhant et al., 2010; Bennett & Rohlf, 2007). Unpredictability of the owner in combination with minimal training are likely to be the cause of the increased fearfulness we found in dogs of permissive owners. It should be noted that a causal relationship between owner parenting style and dog fearfulness is assumed here because this is also the case for child parenting (Timpano et al., 2015). However, based on this study the possibility that for example permissive owners are more likely to take in anxious dogs cannot be excluded and this must be taken into account when interpreting the results.

### Limitations and future research

This study revealed that there are at least three dog parenting styles which are defined by their level of responsiveness and demandingness. Elements concerning owner attitude, views, beliefs and behaviours were associated to the three styles and future research should review these elements with the aim of establishing precise definitions of what a particular dog parenting style encompasses. Only when these styles are well-defined can the relationship between parenting and dog behaviour be properly investigated. In this study some owners scored high on two of the three parenting style components, making it harder to see differences between parenting styles. This could indicate that a more complex parenting style distinction is present for dog owners, possibly with each style having a number of substyles just as we see in child parenting (Baumrind, 1971). However, this effect could also be negated when a more exact tool for measuring parenting styles is developed.

The aim of this study was to discover general parenting styles for dog owners, however since 94% of the participants of the study were female it is possible that only female parenting styles have been measured here. Male and female dog owners are known to differ in some aspect on how they interact with their dog. Twenty-five dog owners (10 male, 15 female) were observed during the strange situation procedure where it was found that women spend more time talking to their dog than men and they talked in a more mothering tone (Prato-Previde et al., 2006). When owner demographics and a number of dog traits were surveyed Kubinyi et al., (2009) found that dogs of female owners are more trainable than those of men (N=14,004) whilst Kotrschal et al., (2009) saw that female owners had less sociable dogs than males do (N=24). These differences between male and female dog owners could potentially be attributed to the use of different kinds of parenting styles, therefore for now our results are only applicable to female dog owners. Repetition of this study including more male dog owners and taking owner sex into account is advised.

When dog parenting styles have been well defined meaningful accompanying owner behaviours can be examined. Several owner behaviours exhibited during the play and training exercise were

correlated to the use of a particular parenting style, often matching the expected level of demandingness or responsiveness of a style. These dimensions can be taken into account more easily when temporal behavioural patterns are examined in which behaviour of both owner and dog are included. This way the focus lies more on the interaction between owner and dog than on individual owner behaviours. Follow-up research into owner behaviour should include a larger variety of situations both at home where behaviour occurs more naturally and in a testing facility where the environment is more controlled. Especially owner response to inappropriate dog behaviour can be indicative of owner parenting styles since the styles differ greatly on the use of disciplinary action. When investigating owner behaviour associated to owner parenting style one must take into account that not only the individual behaviours are relevant but also the context in which these behaviours are applied. An example of this was already provided by Baumrind (1967) when she posited that controlling practices used by authoritative parents can have positive developmental outcomes due to the warm and nurturing environment in which they are applied as opposed to the more distant environment created by authoritarian parents. A contextual model of child parenting styles was later developed by Darling & Steinberg (1993) after reviewing the history of research into child parenting styles and their accompanying practices. The model suggests that parental goals and values shape both the parenting style and parenting practices but that parenting style directly determines the effect parenting practices have on developmental outcomes of the child and indirectly affect these outcomes by shaping the child's willingness to be socialized. Considering the similarities between child and dog parenting it is likely that the environment in which owner parental behaviours occur greatly influences how the dog processes this behaviour. Therefore, it is necessary to recognize the context in which owner parental practices are applied instead of focussing solely on parental behaviour.

Considering dog problem behaviour an association between parenting style and dog fearfulness was discovered. The causality of this association can only be revealed by thorough experimental research which is also an appropriate tool for investigating the relationship between other canine problem behaviours and specific owner parenting styles. Until now, research concerning the relation between owner behaviour and canine problem behaviour has been inconclusive. For example, when 413 dog owners were surveyed about their behaviour and unwanted behaviours of their dog it was concluded that more engagement in training activities was predictive of a lower occurrence of almost all recorded problem behaviours, however a similar study on 192 dog owners found no such relationship (Bennett & Rohlf, 2007; Blackwell et al., 2008). We posit that causal, straight-forward correlations can be found when not individual owner characteristics but a variety of owner views, beliefs and practices that shape the parenting style of an owner are taken into account. The interaction between dog and owner is likely too complex for individual owner traits to have a strong independent effect on dog behaviour, however when considering the complete context in which owner behaviours are applied such effects could come forward. Based on the associations found between dog fearfulness and owner parenting style we theorize that the authoritarian dog parenting style is associated mainly to positive developmental outcomes of dogs whilst the permissive dog parenting style negatively affects dog welfare. The effects of authoritative parenting are yet unknown because this style is not yet well defined for dog owners.

## Conclusion

All three child parenting styles are to some extent reflected in dog owners and different combinations of the dimensions responsiveness and demandingness appear to be good indicators of these styles. The authoritarian dog parenting style is characterized by owners being demanding and not responsive. Display of unwanted behaviour is corrected either physically or verbally and warm intimate moments with the dog are rare, however appropriate behaviour can be rewarded by positive physical contact. Permissive dog parenting is in most aspects the opposite of authoritarianism where owners expect little from their dog and focus more on nurturing and even

spoiling their dog by giving it a lot of food. Dogs are loved and cared for and are not forced to do anything they do not want to do. A permissive owner tries to change unwanted behaviour to wanted behaviour, but disobedience is not punished. Authoritative dog parenting is mainly based on responsiveness, however these owners are more confident about their parenting abilities and are more active in trying to provide the dog with what he or she requires. Demandingness may matter in authoritative dog parenting and it seems unwise to completely disregard the possibility of general demandingness being relevant for dog parenting. Owner attitude as well as demographic factors such as owner age and education level influence which parenting style an owner tends to apply. The questionnaires based on child parenting styles and the underlying dimensions of parenting are both useful tools for assessing dog owner parenting style, although refinement of the items is required. Authoritarian parenting was associated to a low level of fear in dogs whilst permissiveness is related to increased fearfulness. These results support that owner parenting styles have an effect on dog problem behaviour. When parenting styles are better defined and accompanying owner behaviours are determined it becomes possible to more precisely investigate the general effect of owner parenting on dog behaviour. The focus of future research should not only be on problem behaviour but also on dog obedience, happiness and welfare. If causal relationships between parenting styles and dog behaviour are discovered the next step is to determine how dog owners can adapt their parenting style to accommodate their dog's needs and requirements, thereby increasing dog welfare and owner satisfaction.

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# Appendix

## Appendix 1

**Table 4:** Items from Questionnaire A concerning parenting styles based on Block's (1965) child rearing questionnaire (adapted by Robinson et al., 1995). Items were converted to dog-related statements and translated to Dutch. Dog owners (N=431) responded to each item on a scale zero ('never') to four ('always'). Associated child parenting styles and the mean ( $\pm$  standard deviation) for each item are presented. Items marked (R) have been reversed for scoring purposes.

Item	Parenting style	Mean $\pm$ SD
Ik laat mijn hond merken wat gewenst en ongewenst gedrag is	Authoritative	3.48 $\pm$ 0.69
Ik corrigeer mijn hond door hem/haar tijdelijk alleen te zetten	Authoritarian	0.51 $\pm$ 0.91
Ik troost mijn hond en toon begrip wanneer hij/zij een slechte dag heeft	Authoritative	2.75 $\pm$ 1.18
Ik corrigeer mijn hond niet wanneer hij/zij ongewenst gedrag vertoont	Permissive	1.2 $\pm$ 1.29
Wanneer mijn hond iets niet wil doen wat ik vraag, dan laat ik het daarbij	Permissive	1.07 $\pm$ 1.11
Ik ben bang dat mijn hond mij niet meer aardig zal vinden als ik hem/haar corrigeer	Permissive	0.39 $\pm$ 0.87
Ik corrigeer mijn hond wanneer zijn/haar gedrag niet aan mijn verwachtingen voldoet	Authoritarian/ Permissive (R)	2.12 $\pm$ 1.29
Ik houd rekening met mijn hond wanneer ik plannen maak	Authoritative	3.69 $\pm$ 0.62
Ik probeer mijn hond met beloningen "om te kopen", zodat hij/zij doet wat ik wil	Permissive	1.84 $\pm$ 1.19
Ik gebruik een corrigerende tik wanneer mijn hond niet doet wat ik wil	Authoritarian	0.74 $\pm$ 0.99
Wanneer ik zie dat mijn hond zich slecht voelt, maak ik dat hij/zij zich beter voelt	Authoritative	3.17 $\pm$ 0.94
Wanneer mijn hond iets moet doen, is het omdat ik dat zeg en de baas ben	Authoritarian	1.87 $\pm$ 1.27
Ik speel samen met mijn hond	Authoritative	3.45 $\pm$ 0.69
Ik probeer ongewenst gedrag van mijn hond om te zetten in gewenst gedrag	Authoritative	3.45 $\pm$ 0.7
Ik heb vaak "strijd" met mijn hond	Authoritarian	0.66 $\pm$ 0.85
Ik heb bepaalde regels waaraan mijn hond zich moet houden	Permissive (R)	3.27 $\pm$ 0.86
Ik verwen mijn hond	Permissive	2.65 $\pm$ 1.06
Ik eis dat mijn hond naar mij luistert	Authoritarian	2.27 $\pm$ 1.19
Ik probeer leuke momenten met mijn hond te hebben	Authoritative	3.73 $\pm$ 0.51
Ik corrigeer mijn hond vaak zonder erbij na te denken	Authoritarian	1.15 $\pm$ 1.15
Ik vind het moeilijk om mijn hond te corrigeren	Permissive	0.91 $\pm$ 1.13
Ik ben geduldig met mijn hond	Authoritative	3.26 $\pm$ 0.82
Ik barst in woede uit naar mijn hond	Authoritarian	0.32 $\pm$ 0.58
Ik gebruik lichamelijk contact zoals knuffelen en aaien om de liefde voor mijn hond te uiten	Authoritative	3.56 $\pm$ 0.67
Ik corrigeer mijn hond om te zorgen dat zijn/haar gedrag betert	Authoritarian	2.8 $\pm$ 1.14
Ik vind het moeilijk om het gedrag van mijn hond te veranderen	Permissive	1.14 $\pm$ 1.06
Ik dreig vaker met straf dan daadwerkelijk te straffen	Permissive	0.52 $\pm$ 0.91
Ik prijs mijn hond wanneer hij/zij braaf is	Authoritative	3.68 $\pm$ 0.65
Ik laat toe dat mijn hond andere mensen lastig valt	Permissive	0.48 $\pm$ 0.81
Ik dreig als manier om te corrigeren	Authoritarian	0.5 $\pm$ 0.85
Ik gebruik een fysieke correctie wanneer mijn hond niet doet wat ik wil	Authoritarian	0.87 $\pm$ 1.05
Ik weet met welke honden mijn hond graag speelt en met welke niet	Authoritative	3.28 $\pm$ 0.84

Ik ga ontspannen om met mijn hond	Authoritative	3.41±0.74
Ik corrigeer mijn hond door het wegnemen van zijn/haar speeltjes	Authoritarian	0.48±0.94
Ik kom zelfverzekerd over in de opvoeding van mijn hond	Permissive (R)	3.21±0.78
Ik negeer ongewenst gedrag van mijn hond	Permissive	2.07±1.25
Ik sta open voor de gevoelens en behoeften van mijn hond	Authoritative	3.34±0.8
Ik pak mijn hond beet wanneer hij/zij niet naar mij luistert	Authoritarian	1.14±1.12
Ik trek/duw mijn hond als hij/zij niet naar mij luistert	Authoritarian	0.77±1
Ik houd rekening met mijn hond (zoals het liever niet nat willen worden) voordat ik hem/haar iets laat doen	Authoritative	2.54±1.18
Ik roep wanneer ik het gedrag van mijn hond afkeur	Authoritarian	2.37±1.12
Ik houd me meer bezig met mijn eigen gevoelens dan met de gevoelens van mijn hond	Authoritarian	1.06±1.01

## Appendix 2

**Table 5.** Items from Questionnaire B concerning the dimensions responsiveness and demandingness in parenting created by Anke Wieldraaijer and Allyson Ipema based on research into child parenting. Dog owners (N=29) responded to each item on a scale of zero ('never') to four ('always'). Associated dimensions and the mean (± standard deviation) for each item are presented. Items in bold are relevant for this study, other items were either relevant for another study or they were removed due to redundancy or indistinctness.

Item	Dimension	Mean±SD
Ik roep wanneer ik het gedrag van mijn hond afkeur	Demanding	2.76±0.95
<b>Ik schaam me voor mijn hond als hij/zij iets verkeerd doet</b>	<b>Demanding</b>	<b>1.1±1.05</b>
Ik gebruik een fysieke correctie wanneer mijn hond niet doet wat ik wil	Demanding	0.83±0.71
Ik prijs mijn hond als hij/zij braaf is	Responsive	3.52±0.51
<b>Ik vind het belangrijk dat mijn hond zijn/haar natuurlijke gedrag (zoals rennen, spelen, contact hebben met andere honden) kan uiten</b>	<b>Responsive</b>	<b>3.66±0.48</b>
Mijn hond krijgt één waarschuwing wanneer hij/zij iets fout doet, daarna onderneem ik actie/corrigeer ik hem/haar	X	1.55±1.3
<b>Ik geef kritiek op mijn hond wanneer hij/zij ongewenst gedrag vertoont</b>	<b>Demanding</b>	<b>2.03±0.98</b>
<b>Ik probeer mijn hond af te leiden als hij/zij ongewenst gedrag vertoont</b>	<b>Responsive</b>	<b>3±0.71</b>
<b>Ik verwacht bepaald gedrag van mijn hond (niet trekken tijdens het wandelen, niet opspringen, niet overdadig blaffen)</b>	<b>Demanding</b>	<b>2.93±0.7</b>
Ik corrigeer mijn hond meteen als hij/zij ongewenst gedrag vertoont	Demanding	2.1±1.29
Van een oudere hond heb ik hogere verwachtingen dan van een puppy	X	2.83±1.1
Ik heb een hond omdat ik daar zelf gelukkig van word	Demanding	3.45±0.63
<b>Als ik denk dat er iets mis is met mijn hond ga ik meteen met hem/haar naar de dierenarts</b>	<b>Responsive</b>	<b>2.86±0.79</b>
<b>Ik geloof dat ik het merk wanneer er iets mis is met mijn hond</b>	<b>Responsive</b>	<b>3.38±0.49</b>
<b>Als ik me gestrest voel, dan raak ik eerder gefrustreerd om mijn hond</b>	<b>Demanding</b>	<b>2.48±1.02</b>
Ik heb een hond zodat ik hem/haar een goed leven kan geven	Responsive	3.38±0.68
Ik laat mijn hond zitten of liggen voor hij/zij eten krijgt	Demanding	1.69±1.47
<b>Ik heb thuis bepaalde grenzen gesteld aan het gedrag van mijn hond (zoals niet in de keuken komen, niet op de bank)</b>	<b>Demanding</b>	<b>2.21±1.35</b>
Ik voer mijn hond terwijl ik zelf aan het eten ben	X	1.14±1.09
<b>Ik begroet mijn hond met blijdschap als ik thuis kom</b>	<b>Responsive</b>	<b>2.9±1.18</b>
<b>Mijn hond mag op schoot of naast mij op de bank</b>	<b>Responsive</b>	<b>3.03±1.24</b>
<b>Als er visite is doe ik mijn hond in een andere kamer</b>	<b>Demanding</b>	<b>0.76±0.91</b>
<b>Ik verwacht van mijn hond dat hij/zij rustig is als er visite is</b>	<b>Demanding</b>	<b>2.66±0.81</b>

Mijn hond komt wanneer ik hem/haar roep	X	3.03±0.82
Ik verwen mijn hond	Responsive	2.76±1.21
<b>Ik reageer op de lichaamstaal van mijn hond</b>	<b>Responsive</b>	<b>3.52±0.51</b>
<b>Als mijn hond om aandacht vraagt dan krijgt hij/zij dat ook</b>	<b>Responsive</b>	<b>2.45±0.83</b>
Ik eis dat mijn hond naar mij luistert	Demanding	2.07±1.22
Wanneer ik mijn hond corrigeer en hij/zij hierdoor van streek raakt, geef ik alsnog toe	Responsive	0.76±0.87
<b>Ik ben consistent in het disciplineren van mijn hond</b>	<b>Demanding</b>	<b>2.41±0.95</b>
Ik vind het belangrijk om een goede band te hebben met mijn hond	Responsive	3.86±0.45
Wanneer ik zie dat mijn hond zich slecht voelt, maak ik dat hij/zij zich beter voelt	Responsive	3.34±0.48
Ik gebruik lichamelijk contact, zoals knuffelen en aaien, om de liefde voor mijn hond te uiten	Responsive	3.48±0.83
<b>Als ik mijn hond roep, wil ik dat hij/zij meteen bij de eerste keer komt</b>	<b>Demanding</b>	<b>3.07±0.84</b>
<b>Ik houd mijn hond in de gaten wanneer hij/zij met andere honden aan het spelen is</b>	<b>Demanding</b>	<b>3.72±0.65</b>
<b>Als ik zie dat mijn hond geen zin meer heeft tijdens het spelen dan stoppen we</b>	<b>Responsive</b>	<b>3.34±0.94</b>
<b>Ik stop met spelen met mijn hond als ik er geen zin meer in heb</b>	<b>Demanding</b>	<b>3.17±0.71</b>
Mijn hond heeft altijd beschikking tot speelgoed	Responsive	3±1.44
<b>Ik spoor mijn hond aan om met mij te gaan spelen</b>	<b>Responsive</b>	<b>2.45±0.91</b>
Ik laat mijn hond los van de riem als hij/zij met andere honden aan het spelen is	Responsive	3.48±1.06
<b>Als een bepaalde trainingsmethode voor mijn hond niet werkt, sta ik open om een andere methode te proberen</b>	<b>Responsive</b>	<b>3.55±0.69</b>
<b>Ik train mijn hond omdat ik wil dat hij/zij naar mij luistert</b>	<b>Demanding</b>	<b>2.83±0.93</b>
<b>Ik leer mijn hond gemakkelijke trucjes zodat ik dat aan andere mensen kan laten zien</b>	<b>Demanding</b>	<b>0.86±1.06</b>
<b>Ik train mijn hond omdat ik denk dat hij/zij daar plezier aan beleeft</b>	<b>Responsive</b>	<b>3.38±0.56</b>
<b>Ik leer mijn hond gemakkelijke trucjes omdat ik denk dat mijn hond dat leuk vindt</b>	<b>Responsive</b>	<b>2.31±1.58</b>
<b>Ik heb geduld als ik mijn hond iets probeer te leren</b>	<b>Responsive</b>	<b>3.34±0.72</b>
<b>Als het mijn hond niet lukt om iets te leren dan accepteer ik dat</b>	<b>Responsive</b>	<b>2.93±1.03</b>
<b>Als ik zie dat mijn hond iets niet wil doen tijdens training dan stop ik met die trainingsactiviteit</b>	<b>Responsive</b>	<b>3.07±0.8</b>
<b>Als mijn hond aangeeft dat hij/zij moet plassen neem ik hem/haar meteen mee naar buiten</b>	<b>Responsive</b>	<b>3.24±0.91</b>
Tijdens het uitlaten ga ik met mijn hond naar een hondenspeelplaats	Responsive	1.31±1.34
<b>Ik verwacht dat mijn hond naast mij loopt tijdens het uitlaten</b>	<b>Demanding</b>	<b>1.66±1.04</b>
<b>Ik bepaal het looptempo tijdens het uitlaten van mijn hond</b>	<b>Demanding</b>	<b>2.62±0.82</b>
Mijn hond trekt niet aan de lijn tijdens het wandelen	X	1.72±0.92
<b>Als mijn hond tijdens het wandelen ergens aan snuffelt wacht ik even totdat hij/zij klaar is</b>	<b>Responsive</b>	<b>2.48±0.91</b>
Ik gebruik een gentle leader tegen het trekken aan de riem	X	0.31±0.89
Mijn hond moet zitten voordat de riem om gaat en we naar buiten gaan	Demanding	1.48±1.5

### Appendix 3

Table 6. Items from Questionnaire B concerning dog fearfulness, separation anxiety and general interaction. Dog owners (N=29) responded to each item on a scale from zero to four, where for fearfulness zero means 'dog shows no signs of fearful behaviour' and four means 'dog shows extreme fear', for separation anxiety zero means 'never' and four means 'always', and for interaction-related questions zero means 'at least once a day' and four means 'almost never'. Per section the general question concerning all items is mentioned between quotation marks. Mean score (± standard deviation) per item are presented.

Item	Mean±SD
<i>Fearfulness: "In hoeverre reageerde uw hond de laatste tijd angstig..."</i>	
Als reactie op onverwachte of harde geluiden (b.v.: stofzuiger, knal van een uitlaat van een auto, wegwerkzaamheden, vallende voorwerpen, enz.	1.52±1.06
Bij druk verkeer	0.93±1.07
In reactie op vreemde of onbekende voorwerpen op of in de buurt van de stoep (b.v.: plastic zakken, bladeren, afval, wapperende vlaggen)	0.86±0.71
Tijdens onweer	1.1±1.21
Als uw hond voor het eerst blootgesteld wordt aan onbekende situaties (b.v.: eerste rit in de auto, eerste keer in de lift, eerste bezoek aan de dierenarts)	1.34±1.08
In reactie op wind of opwaaiende voorwerpen	0.55±0.74
Als uw hond buitenshuis direct benaderd wordt door een onbekend kind	1±1.22
Als onbekende honden bij uw thuis op bezoek komen	1.07±1.22
Als uw hond buitenshuis direct benaderd wordt door een onbekende volwassen man	1.21±1.24
Als uw hond buitenshuis direct benaderd wordt door een onbekende volwassen vrouw	0.83±0.85
Als een gezinslid de nagels van uw hond knipt	1.14±1.22
Als een gezinslid de hond in bad doet of borstelt	0.69±0.85
Als zijn/haar poten door een gezinslid afgedroogd worden	0.41±0.87
Als de hond onderzocht of behandeld wordt door een dierenarts	1.59±1.09
Als uw hond direct benaderd wordt door een onbekende hond van dezelfde grootte of groter	1.45±1.27
Als een onbekende hond naar uw hond blaft, gromt of uitvalt	1.66±1.29
Als uw hond direct benaderd wordt door een onbekende hond die kleiner is dan uw hond	1.03±1.02
Als uw hond direct benaderd wordt door een onbekende teef tijdens het aangelijnd uitlaten	1.07±1.16
Als uw hond direct benaderd wordt door een onbekende reu tijdens het aangelijnd uitlaten	1.45±1.27
Tegen één van uw andere honden	0.4±0.75
Als uw hond benaderd wordt op zijn favoriete rust/slaapplaats door één van uw andere honden	0.45±0.94
Als één van uw andere honden de hond benadert terwijl hij/zij aan het eten is	0.6±0.82
Als uw hond direct benaderd wordt door een onbekende pup tijdens het aangelijnd uitlaten	0.64±1.22
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.	0.7±0.92
<i>Separation anxiety: "Hoe vaak heeft uw hond de afgelopen tijd de volgende tekenen van afhankelijkheid of aandacht vragen laten zien?"</i>	
Is sterk gehecht aan één bepaald gezinslid	2.72±1.22
Heeft de neiging om u (of andere gezinsleden) te volgen door het hele huis, van kamer tot kamer	2.07±1.03
Heeft de neiging om dicht bij u (of een ander) of tegen u aan te zitten als u zit	2.41±0.87
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	1.89±0.92

Wordt onrustig (janken, opspringen, proberen tussenbeide te komen) als u (of anderen) genegenheid toont (tonen) voor een ander persoon	1.31±1.14
Wordt onrustig (janken, opspringen, proberen tussenbeide te komen) als u (of anderen) genegenheid toont (tonen) voor een andere hond of een ander dier	1.72±1.13
Trillen, beven of bibberen	0.24±0.69
Overmatig speekselen	0.17±0.6
Onrust/opwinding/heen en weer lopen	0.72±0.96
Janken	0.52±0.95
Blaffen	0.48±0.87
Huilen	0.38±0.78
Knagen of krabben aan deuren, de vloer, ramen, gordijnen enz.	0.31±0.66
Verlies van eetlust	0.28±0.75
<i>General interaction: "Hoe vaak..."</i>	
Speelt u met uw hond?	3.1±1.35
Neemt u uw hond mee op visite?	1.41±0.98
Geeft u uw hond snoepjes?	3.66±1.04
Geeft u uw hond een kusje?	3.1±1.47
Neemt u uw hond mee in de auto?	2.93±0.96
Knuffelt u met uw hond?	3.79±0.68
Koopt u "cadeautjes" voor uw hond?	0.66±0.77
Is uw hond bij u wanneer u ontspant, bijvoorbeeld tijdens televisie kijken?	4±0
Verzorgt u de vacht van uw hond?	1.41±0.95
Vertelt u uw hond dingen die u aan niemand anders vertelt?	0.79±1.42
Heeft u het gevoel dat het verzorgen van uw hond een vervelende taak is?	0.17±0.47
Weerhoudt uw hond u ervan dingen te doen die u graag zou doen?	0.62±0.9
Heeft u het gevoel dat het houden van een hond meer moeite kost dan dat het waard is?	0.1±0.41

## Appendix 4

**Table 7. Full procedure of the behavioural tests aimed at determining canine impulsivity and anxiety, and investigating owner and dog behaviour to find possible associations between these factors and owner parenting style. Test phase, phase procedure and duration in minutes are presented. Bold text indicates phases relevant for the current study.**

Phase	Procedure	Duration in minutes
Welcoming of candidates	Owner and dog enter canteen, owner is offered a drink and dog can explore, often off leash. Observer tells owner shortly what the tests encompass, that he/she can choose not to participate in a test, and can stop the test at any time. Owner is also informed on the presence of camera's in the testing area, and anonymity is ensured.	15
Open field test	Refer to Anke Wieldraaijer's study	2
Startle response	Refer to Anke Wieldraaijer's study	1
Novel object test	Refer to Anke Wieldraaijer's study	1
Break + owner explanation	Owner and dog are taken to canteen or outside, and the coming tests are explained in more detail.	5
Button push training 1	Refer to Anke Wieldraaijer's study	5
Sit-test	Refer to Anke Wieldraaijer's study	5
Button push training 2	Refer to Anke Wieldraaijer's study	5
<b>Play activity 1</b>	<b>Owner and dog enter test area, and dog is put on long leash. Owner picks a tug-of-war toy, and sits on chair without drawing</b>	<b>1.5</b>

	dog's attention to the toy. Observer leaves the room and owner is instructed via the microphone to begin playing. During play the owner once takes the toy from the dog. At the end of the test the owner is instructed via the microphone to stop playing and reward the dog.	
Button push exam	Refer to Anke Wieldraaijer's study	4
Break + owner explanation	Owner and dog are taken to canteen or outside, and the coming tests are explained in more detail.	5
<b>Training activity 1</b>	<b>A vertical tube containing a rope is put in the centre of the testing area. Owner and dog enter testing area and dog is put on long leash. Owner has been told that he/she had to teach the dog to pull out the rope, either command or by itself. Owner had to train the dog like he/she would at home, however dog has to stay on the leash. A timer will be set at three minutes, and owner was told that we want to know how fast the dog can learn this. Owner was also told that the dog is later allowed to participate in a special test only if it understands the training task well enough. When the owner has no further questions the observer starts the countdown clock which is set at 3:15, then the observer leaves the room and when the clock is at 3:00 the owner starts training. When the clock reaches 0:00 a signal is given via the microphone, and the owner is told to reward the dog.</b>	<b>3</b>
<b>Play activity 2</b>	<b>(See procedure Play activity 1)</b>	<b>1.5</b>
<b>Training activity 2</b>	<b>(See procedure Training activity 2)</b>	<b>3</b>
Exam	Owners are allowed to participate in the exam, where the dog gets five tries to get the rope out of the tube within five seconds, and the owner has to motivate the dog to do this. (This test has not been analysed)	3
Farewell and thank you	Owners are thanked for their effort and they receive a small gift for their participation.	5

## Appendix 5

### Dog behaviour

**Table 8. Protocol for assessing dog behaviour during a 90 second tug-of-war game and a three minute training session, both performed with their owner. Dog behaviours per behavioural class, behaviour type (event or state), description of the behaviour and test(s) in which the behaviour was scored are presented.**

<b>Behaviour (class)</b>	<b>Type</b>	<b>Description</b>	<b>Test(s)</b>
<i>Event behaviours</i>			
Paw lifting	Event	Lifting one of the forepaws, the wrist is bend up at an angle of 45 degrees	Play & Training
Play bow	Event	Characteristic form of challenging to play, the dog falls on his fore legs, and the hind legs are kept high, is often accompanied by the tail wagging and a relaxed open mouth smile	Play & Training
Tongue flicking	Event	Briefly shows the tip of the tongue straight ahead towards the nose, possibly even up to the nose (over the nose)	Play & Training
Snout licking	Event	Licking mouth with tongue, sideways tongue movement	Play & Training
Yawning	Event	An involuntary intake of breath through a wide open mouth	Play & Training
Barking	Event	Any type of bark	Play & Training



High vocalization	Event	Peeping, whining, yelling or howling	Play & Training
Growling	Event	Low buzzing sound, lasting three seconds	Play & Training
Leaning	Event	The dog's body makes contact with the owner, exerting pressure	Play & Training
Jumping	Event	Jumping up at the owner	Play & Training
Pressing	Event	The dog presses the owner using the nose	Play & Training
Other contact	Event	Any physical contact other than the above mentioned, initiated by the dog	Play & Training
<i>Tail position (Breed dependent)</i>			
Neutral	State	Tail in neutral position	Play & Training
High	State	Tail higher than neutral	Play & Training
Low	State	Tail lower than neutral	Play & Training
<i>Tail wag</i>			
Not wagging	State	No movement of the tail	Play & Training
Normal tail wag	State	Sideways movement of the tail	Play & Training
Tail not visible	State	Tail not visible or not present at all	Play & Training
<i>Attention</i>			
No attention	State	Focus not on owner or object	Play & Training
Attention owner	State	Eyes faced towards owner, focus on owner	Play & Training
Attention object	State	Eyes faced towards object (toy, rope or tube), focus on object	Play & Training
<i>Distance to owner</i>			
Within one meter	State	Dog's right front paw is within one meter from the owner's feet	Play & Training
Over one meter	State	Dog's right front paw is over one meter away from the owner's feet	Play & Training
<i>Panting</i>			
Not panting	State	Dog is not panting	Training
Panting	State	Breathing in a high frequency, often accompanied by protrusion of the tongue	Training
Mouth not visible	State	Mouth not clearly visible on camera	Training

## Owner behaviour

**Table 9. Protocol for assessing owner behaviour during a 90 second tug-of-war game and a three minute training session with their dog. Owner behaviours per behavioural class, behaviour type (event or state), description of the behaviour and test(s) in which the behaviour was scored are presented. Modifiers are used for all owner vocalizations where the tone can be either neutral (such as in a normal conversation), high (higher than neutral) or low (lower than neutral), and the sound level can be neutral (such as in a normal conversation), hard (harder than neutral) or soft (softer than neutral).**

<b>Behaviour (class)</b>	<b>Type</b>	<b>Description</b>	<b>Test(s)</b>
<i>Vocalizations</i>			
Command phrase	Event	Verbal phrase (no more than two words) with the aim of making the dog perform an action	Play & Training
Command sentence	Event	Verbal sentence (more than two words) with the aim of making the dog perform an action	Play & Training
Attention phrase	Event	Verbal phrase (no more than two words) with the aim of directing the attention of the dog to either the owner or the object	Play & Training
Attention sentence	Event	Verbal sentence (more than two words) with the aim of directing the attention of the dog to either the	Play & Training

Encouraging phrase	Event	owner or the object Verbal phrase (no more than two words) with the aim of encouraging/motivating the dog to perform an action	Play & Training
Encouraging sentence	Event	Verbal sentence (more than two words) with the aim of encouraging/motivating the dog to perform an action	Play & Training
Correction phrase	Event	Verbal phrase (no more than two words) to indicate that the dog does something wrong and/or should not do something	Play & Training
Correction sentence	Event	Verbal sentence (more than two words) to indicate that the dog does something wrong and/or should not do something	Play & Training
Neutral/unclear phrase	Event	Verbal phrase (no more than two words) that either has a neutral meaning, or the meaning is unclear	Play & Training
Neutral/unclear sentence	Event	Verbal sentence (more than two words) that either has a neutral meaning, or the meaning is unclear	Play & Training
Praise phrase	Event	Verbal phrase (no more than two words) to reward the dog for appropriate behaviour	Play & Training
Praise sentence	Event	Verbal sentence (more than two words) to reward the dog for appropriate behaviour	Play & Training
<i>Other event behaviours</i>			
Hand movement	Event	Hand movement of the owner with the aim of communicating with the dog (waving, pointing, shaking toy)	Play & Training
Pressing clicker	Event	Owner presses clicker so that it makes a sound	Training
Giving food	Event	Giving food directly into the dog's mouth	Play & Training
Throwing food	Event	Throwing food on the floor or in the dog's mouth	Play & Training
Giving multiple foods	Event	Giving or throwing multiple foods in one motion	Play & Training
Play	Event	Small bout of play, often with toy or doing tricks, lasting three seconds	Training
Applause	Event	Clapping hands together, lasting three seconds	Play & Training
Tugging leash	Event	Owner pulls on the leash	Play & Training
Neutral/unclear contact	Event	Owner has physical contact with the dog, but with no clear intentions	Play & Training
Petting/stroking	Event	Owner pets or strokes the dog, lasting three seconds	Play & Training
Cuddling/kissing	Event	Owner has arms around dog or kisses dog, lasting three seconds	Play & Training
Physical punishment	Event	Owner uses physical interaction to punish dog for unwanted behaviour, lasting three seconds	Play & Training
Physical adjustment	Event	Owner uses intermediate physical force to make the dog perform an action, or to make the dog obey, lasting three seconds	Play & Training
Initiate play	Event	Owner attempts to initiate play with the dog, for the first time	Play
Imitating dog sounds	Event	Owner makes sound similar to barking or growling of the dog	Play & Training
Attention sound	Event	Sound made to attract attention from the dog to the owner or the object	Play & Training
Correction sound	Event	Sound made to indicate that the dog does something wrong and/or should not do something	Play & Training
<i>Posture</i>			
Upright	State	Owner stands or walks in upright position	Training
Sitting on chair	State	Owner sits on chair	Training

Bending over	State	Owner is standing or walking with a bend back	Training
Eye level	State	Owner is either sitting with bend knees or on butt on the floor	Training

## Behavioural scores

**Table 10. Behavioural variables of dogs and owners scored during a 90 second tug-of-war game and a three minute training session. Name of the behavioural variable, description of the variable, units of measurement and test in which the variable was scored are presented.**

Variable name	Description	Unit	Test
<i>Dog behavioural variables</i>			
Dog play motivation	How motivated the dog is to participate in the play activity (0= no mouth contact with object, 1= several mouth contacts with object but little to no pulling or retrieving of object, 2= many mouth contacts with object and pulling or retrieving object often)	Scale (0-2)	Play
Latency to play	How long it takes before the dog first touches the object	s	Play
Possessiveness	How possessive the dog is over the toy when the owner tries to take the toy away (0= dog does not hold object, 1=owner can take object without aggression or struggle, 2= there is struggle or dog tries to avoid owner, but owner eventually takes object, 3= owner cannot take object from dog)	Scale (0-3)	Play
Training success	How successful the dog is in pulling the rope out of the tube (0=no interest in rope/tube, 1=interest in rope/tube, 2= occasionally touching/pulling rope, 3= often pulling rope)	Scale (0-3)	Training
<i>Owner behavioural variables</i>			
Owner play motivation	How motivated the owner is to participate in the play activity (0=owner does not play, 1= when dog is not playing owner sometimes tries to initiate play, 2= owner continuously tries to initiate play if dog is not playing)	Scale (0-2)	Play
Switching strategy	Whether the owner uses an alternative strategy when necessary (0= dog shows understanding with use of one strategy, 1= owner never switches strategy even if dog shows little or no understanding, 2= owner switches strategy when dog shows little or no understanding)	Scale (0-2)	Training

## Appendix 6

**Table 11. Test-retest reliability of dog owner responds (N=29) to items present in both Questionnaire A and B on dog owner parenting styles measured with Spearman correlation tests. Items with corresponding R-statistic and P-value are presented. Sufficient P-values indicate a strong item reliability. \*\* indicates significance at P<0.01.**

Question	R	P-value
Ik roep wanneer ik het gedrag van mijn hond afkeur	0.19	0.34
Ik gebruik een fysieke correctie wanneer mijn hond niet doet wat ik wil	0.62	0.00**
Ik prijs mijn hond als hij/zij braaf is	0.73	0.00**
Ik eis dat mijn hond naar mij luistert	0.61	0.00**

Wanneer ik zie dat mijn hond zich slecht voelt, maak ik dat hij/zij zich beter voelt	0.36	0.06
Ik gebruik lichamelijk contact, zoals knuffelen en aaien, om de liefde voor mijn hond te uiten	0.48	0.01**
Ik verwen mijn hond	0.64	0.00**

## Appendix 7

**Table 12.** Dog owners (N=431) reported on how they parented their dog and on their attitude towards dogs, and Principal Component Analysis resulted in individual component scores for each parenting style and general attitude. Owner and dog demographic factors were tested as independent variables for their effects on component scores as dependent variables with ANOVAs. Breed cluster (FCI1-FCI10) and sexual status (male/female and neutered/intact) of the dog were set as factors, whilst owner age (18-25 years old, 26-35 years old etc.), owner education level (primary school to university), dog age (in years) and duration the dog has been with the current owner (in years) were set as covariates. Only main effects are taken into account and all variables were tested in one model simultaneously. F-statistic and the two-sided P-value are shown. \* indicates significance at  $P < 0.05$ , \*\* indicates significance at  $P < 0.01$ .

Factor	Authoritarian parenting		Authoritative parenting		Permissive parenting		Attitude	
	F	P	F	P	F	P	F	P
Dog breed group	0.59	0.81	0.91	0.52	1.09	0.37	0.34	0.96
Owner education level	0.09	0.77	0.04	0.84	0.02	0.88	5.93	0.02*
Owner age	5.90	0.02*	1.10	0.30	4.71	0.03*	10.48	0.001**
Dog sex and neutered status	1.68	0.17	0.59	0.62	1.01	0.39	0.14	0.94
Dog age	1.32	0.25	0.70	0.41	0.17	0.69	2.20	0.14
Duration dog has been with owner	0.49	0.48	1.21	0.27	0.90	0.34	1.65	0.20

## Appendix 8

**Table 13.** Dog owners (N=25) participated in a 90 seconds tug-of-war game with their dog in which owner behaviour was recorded. Presented are the loadings from the Principal Component analysis on [1] demanding and [2] responsive owner behaviours. The main components, their key items and the percentage of variance they explain are displayed.

Component (% of variance explained)	Loadings
<i>Component 1 (32.5%)</i>	
Giving food <sup>[2]</sup>	-0.47
Neutral talk <sup>[2]</sup>	-0.48
Attention sound <sup>[1]</sup>	-0.55
Encouragement <sup>[2]</sup>	-0.62
Praise <sup>[2]</sup>	-0.63
Attention call <sup>[1]</sup>	-0.66
Command <sup>[1]</sup>	-0.74
Hand movement <sup>[1]</sup>	-0.75
<i>Component 2 (17.7%)</i>	
Command <sup>[1]</sup>	0.42
Petting/Stroking <sup>[2]</sup>	-0.74
Imitating dog sounds <sup>[2]</sup>	-0.79
<i>Component 3 (16.4%)</i>	
Giving food <sup>[2]</sup>	0.74
Hand movement <sup>[1]</sup>	0.57
Encouragement <sup>[2]</sup>	-0.43

Due to the small sample size we concluded that only the first component is relevant for our study, and this component suggests that using the demanding behaviours 'hand movement', 'commands', 'attention call' and 'attention sound' is associated to showing the responsive behaviours 'praise',

‘encouragement’, ‘neutral talk’ and ‘giving food’. This component, however, is not correlated to any of the parenting styles. This could be because all these behaviours are generally used in some way during play by most people, independent of what parenting style they apply. To be able to draw solid conclusions about the link between behaviours shown during play and the use of parenting styles this experiment should be repeated with a larger, and possible more variable sample.

**Table 14.** Dog owners (N=19) participated in a three minute training session with their dog in which owner behaviour was recorded. Presented are the loadings from the Principal Component analysis on [1] demanding and [2] responsive owner behaviours. The main components, their key items and the percentage of variance they explain are displayed.

Components (% of variance explained)	Loadings
<i>Component 1 (22.4%)</i>	
Pressing clicker <sup>[1]</sup>	0.5
Throwing food <sup>[2]</sup>	0.45
Correction <sup>[1]</sup>	-0.42
Neutral contact <sup>[2]</sup>	-0.45
Neutral talk <sup>[2]</sup>	-0.48
Physical adjustment <sup>[1]</sup>	-0.52
Encouragement <sup>[2]</sup>	-0.54
Attention sound <sup>[1]</sup>	-0.65
Petting/Stroking <sup>[2]</sup>	-0.73
<i>Component 2 (21.2%)</i>	
Being at eye level <sup>[2]</sup>	0.81
Attention call <sup>[1]</sup>	0.72
Physical adjustment <sup>[1]</sup>	0.67
Neutral talk <sup>[2]</sup>	0.44
Giving food <sup>[2]</sup>	-0.47
Command <sup>[1]</sup>	-0.5
Bending over <sup>[1]</sup>	-0.66
Standing upright <sup>[1]</sup>	-0.72
<i>Component 3 (14.7%)</i>	
Praise <sup>[2]</sup>	0.79
Command <sup>[1]</sup>	0.65
Hand movement <sup>[1]</sup>	0.64
Giving food <sup>[2]</sup>	0.57

Only component one and two are relevant due to the small sample size (N=19). Component one is negatively correlated to the authoritarian style (Spearman,  $R=-0.8$ ,  $p=0.00$ ). Analysis of individual behaviours in this component with Spearman showed that the behaviours ‘physical adjustment’ ( $R=0.69$ ,  $p=0.00$ ), ‘petting/stroking’ ( $R=0.66$ ,  $p=0.00$ ), ‘neutral contact’ ( $R=0.57$ ,  $p=0.01$ ) and ‘encouragement’ ( $R=0.52$ ,  $p=0.02$ ) are all strong indicators of the level of authoritarianism. Component two was not associated with any parenting style. To be able to draw solid conclusions about the link between behaviours shown during play and the use of parenting styles this experiment should be repeated with a larger, and possible more variable sample.

## Appendix 9

Dog owner behaviour during tug-of-war tested against dog owner parenting styles

**Table 15.** Behaviours of dog owners (N=25) displayed during a 90 second tug-of-war game with their dog. Behaviours are measured in rate per minute (r). Mean rate ( $\pm$  standard deviation) is shown. Dog owners also reported on how they parented their dog and a Principal Component Analysis resulted in individual component scores for each parenting style which were compared to the behavioural rates by means of Spearman correlation tests. For every comparison the R-statistic and the two-way P-value is given. \* indicates significance at  $P<0.05$ .

Behaviour (r)	Mean $\pm$ SD	Authoritarian	Authoritative	Permissive score
---------------	---------------	---------------	---------------	------------------

		score		score			
		<i>R</i>	<i>P</i>	<i>R</i>	<i>P</i>		
Command	2.97±2.25	0.26	0.22	0.15	0.49	0.14	0.52
Attention call	1.92±2.06	0.44	0.03*	0.26	0.21	0.19	0.37
Encouragement	11.15±5.2	-0.02	0.94	0.27	0.19	-0.14	0.5
Verbal correction	0.34±0.53	0.05	0.82	0.09	0.66	0.26	0.21
Verbal praise	6.58±4.22	-0.27	0.19	0.26	0.21	-0.16	0.44
Neutral talk	0.95±0.69	-0.18	0.39	0.22	0.29	0.27	0.20
Attention sound	0.92±1.21	-0.13	0.55	0.09	0.68	-0.17	0.43
Hand movement	1.23±1.78	0.11	0.59	0.20	0.33	0.4	0.05*
Giving food	0.54±1.07	-0.17	0.41	-0.00	0.99	0.43	0.03*
Petting/Stroking	0.68±1.19	0.29	0.16	0.04	0.86	-0.13	0.53
Physical adjustment	0.37±0.58	0.47	0.02*	0.18	0.38	-0.47	0.02*
Imitating dog sounds	0.55±1.3	-0.02	0.92	0.08	0.72	-0.46	0.02*

### Dog owner behaviour during training tested against dog owner parenting styles

**Table 16. Behaviours of dog owners (N=19) displayed during a three minute training session with their dog in which owners had to teach their dog to pull a rope out of a vertical pipe. Behaviours are measured in rate per minute (r) or in percentage of time (%). Mean rate or percentage (± standard deviation) is shown. Dog owners also reported on how they parented their dog and a Principal Component Analysis resulted in individual component scores for each parenting style which were compared to the behavioural rates and percentages by means of Spearman correlation tests. For every comparison the R-statistic and the two-way P-value is given. \* indicates significance at P<0.05, \*\* indicates significance at P<0.01.**

Behaviour (r/%)	Mean±SD	Authoritarian score		Authoritative score		Permissive score	
		<i>R</i>	<i>P</i>	<i>R</i>	<i>P</i>	<i>R</i>	<i>P</i>
Command (r)	7.46±4.5	0.25	0.31	0.36	0.14	0.11	0.67
Attention call (r)	3.01±2.95	0.51	0.03*	0.04	0.88	-0.27	0.27
Encouragement (r)	7.13±4.91	0.28	0.25	0.27	0.26	-0.27	0.27
Verbal correction (r)	0.84±1.17	0.58	0.01*	0.01	0.96	-0.14	0.57
Verbal praise (r)	6.3±3.49	0.14	0.57	0.38	0.11	0.18	0.46
Neutral talk (r)	1.36±1.2	0.27	0.26	0.17	0.49	-0.03	0.91
Attention sound (r)	0.85±1.27	0.48	0.04*	-0.09	0.71	-0.42	0.08
Hand movement (r)	11.46±4.56	0.39	0.10	0.48	0.04*	0.35	0.14
Giving food (r)	2.63±1.97	-0.18	0.47	0.05	0.84	0.69	0.001**
Throwing food (r)	0.24±0.76	-0.41	0.08	0.38	0.11	-0.22	0.36
Play bout (r)	0.13±0.22	0.02	0.94	-0.05	0.83	-0.06	0.81
Neutral contact (r)	0.25±0.63	0.58	0.01*	-0.05	0.83	0.03	0.90
Petting/Stroking (r)	0.88±1.01	0.64	0.003**	-0.33	0.17	0.12	0.62
Physical adjustment (r)	0.49±0.86	0.75	<0.001**	-0.14	0.56	-0.39	0.10
Upright posture (%)	25.96±23.88	0.27	0.26	-0.19	0.45	0.04	0.86
Bending over (%)	34.05±26.71	0.24	0.32	-0.36	0.13	-0.15	0.54
Being on eye level (%)	39.99±42.75	-0.21	0.39	0.21	0.38	-0.06	0.81

## Appendix 10

### Dog behaviour during tug-of-war tested against dog owner parenting styles

**Table 17. Behaviours of dogs (N=25) displayed during a 90 second tug-of-war game with their owner. Behaviours are measured in rate per minute (r) or in percentage of time (%). Mean rate or percentage (± standard deviation) is shown. Owners of the dogs reported on how they parented their dog and a Principal Component Analysis resulted in individual component scores for each parenting style which were compared to the behavioural rates and percentages by means of Spearman correlation tests. For every comparison the R-statistic and the two-way P-value is given. \* indicates significance at P<0.05, \*\* indicates significance at P<0.01.**

Behaviour (r/%)	Mean±SD	Authoritarian	Authoritative	Permissive score
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		score		score			
		R	P	R	P	R	P
Stress signals (r)	0.21±0.43	-0.28	0.16	-0.14	0.49	0.05	0.8
Vocalizations (r)	2.76±4.15	0.1	0.61	0.01	0.96	-0.49	0.01**
Contact seeking (r)	1.03±1.49	0.42	0.03*	0.02	0.91	0.00	0.99
High tail position (%)	58.95±33.76	-0.05	0.82	-0.32	0.12	-0.17	0.42
Attention owner (%)	12.58±15.73	0.03	0.88	0.37	0.06	0.47	0.02*
Attention object (%)	79.26±19.49	-0.05	0.8	-0.22	0.28	-0.32	0.11
Within one metre of owner (%)	94.24±9.59	0.12	0.56	0.21	0.21	-0.06	0.78
Tail wagging (%)	66.37±27.77	-0.09	0.67	-0.18	0.38	-0.14	0.5

#### Dog behaviour during training tested against dog owner parenting styles

**Table 18.** Behaviours of dogs (N=19) displayed during a three minute training session with their owner in which owners had to teach their dog to pull a rope out of a vertical pipe. Behaviours are measured in rate per minute (r) or in percentage of time (%). Mean rate or percentage ( $\pm$  standard deviation) is shown. Owners of the dogs reported on how they parented their dog and a Principal Component Analysis resulted in individual component scores for each parenting style which were compared to the behavioural rates and percentages by means of Spearman correlation tests. For every comparison the R-statistic and the two-way P-value is given. \* indicates significance at  $P < 0.05$ .

Behaviour (r/%)	Mean $\pm$ SD	Authoritarian score		Authoritative score		Permissive score	
		R	P	R	P	R	P
Stress signals (r)	0.25±0.35	0.23	0.31	-0.43	0.07	-0.11	0.64
Vocalizations (r)	1.37±4.31	0.3	0.21	-0.06	0.81	-0.44	0.06
Contact seeking (r)	0.89±1.57	0.32	0.18	0.08	0.73	-0.47	0.04*
High tail position (%)	26.76±31.9	0.05	0.85	-0.03	0.89	0.00	1.00
Low tail position (%)	0.11±0.39	0.02	0.95	-0.08	0.75	-0.15	0.55
Attention owner (%)	51.31±15.32	-0.09	0.71	0.11	0.66	0.24	0.31
Attention object (%)	41.53±15.26	-0.31	0.19	0.17	0.49	0.1	0.7
Within one metre of owner (%)	92.59±9.61	-0.01	0.96	-0.11	0.65	-0.05	0.83
Panting (%)	36.43±25.99	0.34	0.16	0.23	0.35	0.27	0.27
Tail wagging (%)	39.41±31.81	-0.16	0.51	0.41	0.09	-0.24	0.31

#### Dog behavioural scores tested against dog owner parenting styles

**Table 19.** Behavioural scores of dogs (N=25) displayed during [1] a 90 second tug-of-war game with their owner, and [2] a three minute training session with their owner. Play motivation was scored on a scale of zero to two, latency to play was scored in seconds, and both possessiveness over toy and success during training were scored on a scale of zero to three. Mean score ( $\pm$  standard deviation) is shown. Owners of the dogs reported on how they parented their dog and a Principal Component Analysis resulted in individual component scores for each parenting style which were compared to the behavioural rates and percentages by means of Spearman correlation tests. For every comparison the R-statistic and the two-way P-value is given. \* indicates significance at  $P < 0.05$ .

Behaviour (r/%)	Mean $\pm$ SD	Authoritarian score		Authoritative score		Permissive score	
		R	P	R	P	R	P
Play motivation <sup>[1]</sup>	1.47±0,72	0.05	0.79	-0.03	0.87	-0.35	0.05*
Latency to play <sup>[1]</sup>	7.2±10,63	0.02	0.92	-0.14	0.42	0.27	0.13
Possessiveness over toy <sup>[1]</sup>	1.36±0,57	0.29	0.17	0.26	0.21	0.11	0.61
Success during training <sup>[2]</sup>	1.94±0,94	-0.07	0.7	0.27	0.13	0.07	0.72