



Dog-directed parenting styles predict verbal and leash guidance in dog owners and owner-directed attention in dogs

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ABSTRACT

Dog-directed parenting is an aspect of the owner-dog relationship that describes the overarching emotional sphere in which the dog's guidance and training take place. How dog-directed parenting styles express in specific owner-dog interactions is presently unknown. However, such knowledge can help to advise dog owners on appropriate parenting of their dog. Child-directed parenting is regarded appropriate when it is demanding for socially adaptive behaviour as well as responsive to the child's needs. This combination of high demandingness and responsiveness is known as authoritative parenting, which in dog-directed parenting manifests in two ways. Teaching the dog socially adaptive behaviour is key to the authoritative-training style (AUT) and being responsive to the dog's perceived needs and emotions is key to the authoritative-intrinsic style (AUI). A third dog-directed parenting style, the authoritarian-correction style (AUC), of high demandingness and low responsiveness focusses on correcting the dog's undesired behaviour. We determined these three dog-directed parenting styles by an online questionnaire and tested the styles for associations with owner and dog behaviours. The behaviours were scored as the owner-dog dyads walked a short course with distractions (treats and balls) that dogs should ignore ($N = 40$) or when they had a ten-minute break together ($N = 36$). Nine out of 49 behavioural observations, such as verbally praising or correcting the dog and leash tensions, related significantly (comparison-wise two-tailed $P < 0.05$) to the parenting styles and Spearman rank correlations explained up to 30 % of the variance. The self-report-based dog-directed parenting styles related logically to the way owners actually interacted with their dogs, verbally and by leash. AUI and AUT parenting related directly to verbally praising the dog. AUC parenting related directly to verbally correcting the dog and to leash tensions. Also, AUC parenting related inversely and AUT parenting directly to the dog frequently looking at its owner during the course with distractions. Thus, we find evidence that verbal communication and leash tensions are telling about dog-directed parenting styles and, possibly, constitute meaningful manifestations to address in educational interventions for dog owners. We see potential merit in moving AUC parenting dog owners away from leash-related guidance towards verbal praise-based guidance and a more authoritative dog-directed parenting style.

1. Introduction

Generally, the owner-dog relationship benefits both partners, given that dog ownership comes with human health gains (Cutt et al., 2007; Mubanga et al., 2017) and the dog population is much larger than that of its ancestor the wolf (Hindrikson et al., 2017; Mech, 2007; Murray et al., 2010; Rowan and Kartal, 2018). The UK alone harbours an estimated ten million dogs, based on the 31 % of UK-households owning a dog (Murray et al., 2010). Yet, the full potential of relationship benefits is not always achieved and disturbed relationships involve undesired dog behaviours.

Undesired dog behaviours are consequential because of their impact and prevalence. Reportedly, 73 % of Finnish dogs show undesired behaviours (Salonen et al., 2020) and 41 % of Australian dogs aggressed to humans or other animals (Howell et al., 2016). Aggression is particularly impactful and was estimated to be the reason behind 58 % of companion animal relinquishments (including dogs) in a review of 192 studies (Coe et al., 2014). Generally, undesired behaviours were a reason behind 10 % of dog euthanasia cases (Lambert et al., 2015) and more prominent in shelter-relinquished dogs than in dogs in continued ownership (New et al., 2000). Undesired dog behaviours and their consequences could be

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prevented, at least in part, by appropriate dog-directed parenting. Appropriate parenting presumably combines demandingness for a dog's socially adaptive behaviour with responsiveness to its species-specific needs. This based on what is known about demandingness and responsiveness as underlying dimensions of child-directed parenting styles (Baumrind, 2013).

Parenting styles comprise the overarching emotional sphere in which interactions take place between a caregiver, such as a parent or a dog owner, and a care receiver, such as a child or a dog (Baumrind, 2013; Van Herwijnen et al., 2018; Smetana, 2017). Combining sufficient demandingness and responsiveness creates an authoritative parenting style that stimulates socially adaptive behaviour in children and benefits child wellbeing and the parent-child relationship (Lamborn et al., 1991; Neel et al., 2018; Simons and Conger, 2007; Wing Chan and Koo, 2011; Wissink et al., 2006). Parenting lacking demandingness and responsiveness is neglectful or uninvolved. The authoritarian parenting style is high in demandingness but low in responsiveness and in this its opposite is the permissive parenting style (Baumrind, 2013). Parenting styles offer a framework to study long-term social interaction patterns, also between owner and dog as their relationship has resemblance to that of parent and child. For instance, dogs seem to tap into the oxytocin feedback loop (Nagasawa et al., 2009, 2015) that underlies parent-child bonding (Feldman et al., 2010; Francis et al., 2002). Also, dog owners direct 'baby talk' at their dogs (Prato-Previde et al., 2006). Further support for the owner-dog relationship resembling the parent-child relationship (but not being identical to it) comes from the similarities in patterns of functional magnetic resonance imaging (fMRI)-brain activation and similarities in ratings of excitement (arousal) and pleasantness (valence) in fourteen mothers who viewed their own child and dog versus an unfamiliar child and dog (Stoekel et al., 2014).

In dog owners, so far three dog-directed parenting styles have been identified (Van Herwijnen et al., 2018), using an adaptation of the original Parenting Styles and Dimensions Questionnaire (PSDQ, Robinson et al., 1995; Van Herwijnen et al., 2018). The authoritarian-correction style (AUC) reflects high demandingness, low responsiveness, and the reported use of correctional methods, such as shouting, using a slap or a correctional chain. The authoritative parenting style diverges into two styles. The authoritative-intrinsic value style (AUI) combines high responsiveness with a focus on the dog's species-specific needs and emotions, like allowing a dog to growl and express how it feels. The authoritative-training style (AUT) combines high demandingness, high responsiveness and a focus on teaching the dog how to behave socially through the use of praise and a step-by-step approach for teaching the dog new behaviours. A permissive style was not found in this study sample that consisted mainly of females and presumably highly engaged dog owners (Van Herwijnen et al., 2018). The neglectful style was not part of the original PSDQ and is studied less often (Olivari et al., 2013).

Using parenting styles as a framework to study long-term interaction patterns between owner and dog is new. To further the framework, we studied how the questionnaire-determined dog-directed parenting styles of AUC, AUI and AUT express in owner-dog interactions. Our study set up consisted of a course with 'treat-and-ball' distractions and of spending 'breaktime' together in a waiting room. We expected the more demanding treat-and-ball course to reflect task performance-related behaviour indicative of parental demandingness. We expected the breaktime to reflect more spontaneous behaviour indicative of parental responsiveness. Based on insights from child-directed parenting we predict that AUI and AUT associate directly with praising the dog and AUC with correcting it.

2. Methods

2.1. Web-based questionnaire and participant recruitment

Dog owners answered an online questionnaire that we constructed to

assess dog-directed parenting styles, and from which we recruited participants for subsequent behavioural tests. The outcomes of the questionnaire were used to test for associations with specific owner/dog behaviours. The 2,010 Dutch dog owners (86 % female ($N=1,723$), 14 % male ($N=275$); 12 missing values) who filled out the questionnaire had responded to our advertisements online, in dog magazines and in press releases of national and regional newspapers. The twenty dog-directed parenting style items were measured on a five-point Likert scale, rating the likelihood of scenarios occurring as never (score 0), nearly never (1), neutral (defined as about half of the time, 2), nearly always (3) and always (4). The parenting style of AUC (authoritarian-correction style) was measured with eight items, the parenting styles of AUI (authoritative-intrinsic value style) and AUT (authoritative-training style) were both measured with six items. Questionnaire respondents indicated their willingness to participate in behavioural tests and 41 participants visited our research facility (Carus, Wageningen University and Research) in the period from February 2018 to November 2018.

2.2. Ethical statement

The Animal Care and Use Committee of Wageningen University and Research evaluated the behavioural tests and considered these outside the category of animal experiments that require licencing. Participants to the behavioural tests were explained that they could end the test at any time, should they see any reason for this. They signed an informed consent for videotaping the sessions and use thereof for scientific and educational/presentational purposes. Options were on videotaping as such and the use thereof for educational/scientific presentations either within Wageningen University and/or outside this institute.

2.3. Treat-and-ball course and breaktime observations

The two behavioural tests that we performed with owner-dog dyads were conducted to establish how owners and dogs interacted when performing a task by walking a 'treat-and-ball' (distraction) course or when being together in a waiting room during a break. Two separate rooms were used at Carus research facility (Wageningen University and Research). For the treat-and-ball course owners were instructed to walk their leashed dog without interruptions through a room of 6.3×6.5 m that contained the treat and ball distractions. We used tape on the floor to mark the walking route: a squared path of sixteen meters. The positions for the twelve treats and eight tennis balls were also marked with tape. These positions were 20 cm from the marked walking route, with the treats and balls at opposing sides as follows. In each corner of the squared walking route two treats were placed to the outer side of the square and one ball inside the square. At each centre part of a square side one treat was placed inside the square and one ball at the outer side.

The room was equipped with Axis® M10 network cameras in the four corners of the ceiling and one loudspeaker. The procedures were explained to the participating owner just before entering the room. The owner was asked to prevent the dog from touching, mouthing or eating the treats or balls and to prevent this as he/she would do so in normal life. The objective of this instruction was to elicit the owner's 'normal life' dog guidance behaviours. The dog itself was still able to touch, mouth or eat the objects, depending on the owner's guidance and the dog's response to this guidance. We therefore chose tennis balls that were made for dogs to play with (Kong®) and low-allergenic treats (Caniland® Soft Ostrich Snack Grainfree). Upon the start, the owner was given a standard two-meter leash. This leash was used instead of the owner's own leash as to standardize the leash length. The owner attached this leash to the dog's own collar. After this the dyad entered the testing room through a door to walk the square with distractions once and leave the room through the same door. This was repeated twice. Between repetitions, after the dyad left the room, the experimenter ensured that all treats and balls were in their original positions. After completion of all test elements and observations, the dogs were

allowed to eat the treats and/or play with the balls, as their owners saw fit.

For the second behavioural test - the breaktime observations - the procedure was simple, as here our intention was to study spontaneous owner-dog interactions in a relaxed situation. The owner was led into the waiting room, was offered coffee or tea and we explained that the dog could be off-leash as soon as the researcher had left the room. The purpose of the ten-minute break was not explained to the owner other than that it was intended to relax owner and dog, and they could do as they liked. The room was sized 5.1 × 7 m and furnished with a chair and table. On the table we placed coffee, tea and magazines. Next to the table there was a blanket for the dog to lie on and several dog toys were on the floor. This room held two cameras positioned in view of the participants and directed at the chair-table setting.

2.4. Data collection and statistical analysis

The behaviour of the 41 owner-dog dyads was videotaped and digital recordings were analysed using focal sampling continuous recording with Noldus Observer® XT-software. The Noldus software was used for behaviour scoring and descriptive statistics. Statistical tests were done with GenStat® (18th edition) software. A total of 25 behaviours was recorded for the treat-and-ball course and of 30 behaviours for the breaktime, using the behaviours as listed in Appendix 1. Table 1 provides a sample and shows the behaviours that associated significantly with dog-directed parenting styles. Behaviours were observed as either point events, expressed as rate per minute or as states of behaviours, expressed as percentage of observation time.

Behaviours for the treat-and-ball course were summed over the three times this course was walked. Behaviours that rarely occurred were omitted from further analyses, which were point behaviours that on average happened less than 0.01 times per minute and state behaviour that occurred less than 1% of the observation time. Such rare behaviours were found only for the treat-and-ball course and concerned Collar snap, Collar steady, Foot correction, Hand move and Bark (and see Appendix 1 for a description of these behaviours). We merged two behaviours that both reflected a lack of leash tension, being Leash floor (leash held by owner and attached to dog lays on/drag the floor >3 s) and Leash bow (leash held by owner and attached to dog does not lay on/drag the floor or forms a straight line, but is arched >3 s). Consequently, for further analyses nineteen behaviours remained for the treat-and-ball course and 30 behaviours for the breaktime. Breaktime observations were not available for five participants and one treat-and-ball course recording was lost due to technical issues. Thus, we processed observations on 40 participants for the treat-and-ball and on 36 participants for the breaktime.

Table 1
Ethogram of owner and dog behaviours.

Treat-and-ball	
Dog look at owner (point)	Dog directs nose towards owner <3 s
Leash snap (point)	Upon interest shown by dog in object, person or location: owner strains or shortens the leash of the dog and/or takes one or more step(s) away from an object, person or location. Straining/shortening movement starts with an accelerated movement of the hand/arm of the owner.
Leash tension (state)	Leash held by owner and attached to dog forms a straight line from owner to dog >3 s.
Verbal praise (point)	Owner uses voice in soft and/or high pitch manner uttering kind words such as 'good dog', 'well done'.
Verbal correction (point)	Harsh, sharp, intense voice lower frequency such as 'No', 'Eh eh'.
Breaktime	
Close meter (state)	Dog <1 m of owner >3 s.
Dog at owner (state)	Dog has nose pointed in the direction of owner >3 s.
Laying head down (state)	Dog lays down in ventral or lateral position, all four legs and belly contact the floor and the head contacts floor and/or forepaws.
Verbal praise (point)	Owner uses voice in soft and/or high pitch manner uttering kind words such as 'good dog', 'well done'.

Ethogram of the behaviours of the owners and their dogs that associated with dog-directed parenting styles (and see Appendix 1 for all observed behaviours). 'Point' indicates the behaviours that were observed as point events and expressed as rate per minute. 'State' indicates the behaviours that were observed as states and expressed as percentage of observation time.

Parenting style scores were calculated following Van Herwijnen et al. (2018) by summing scores for items on a same parenting style and expressing the sums as percentages of the theoretical maximum. Statistical analyses were done with Spearman rank correlations for testing relationships between the three dog-directed parenting styles and the behaviours of owners and dogs during the two standardized situations. We also calculated Spearman rank correlations between the three parenting styles as to quantify the overlap between these. We did not control for familywise error rates and maintained the significance level at two-tailed P-values <0.05, meaning that the statistical outcomes will readily identify patterns of interest but require further validation in more specified hypothesis-driven experiments. Our main interest was in how single behaviours related to parenting styles, but in addition we reduced the set of behaviours that correlated with parenting styles into the main pattern(s). For this we performed a Principal Component Analysis (PCA, Jolliffe, 1986) on nine behaviours and three parenting styles of the 35 dyads that completed both behavioural tests. PCA-components were based on correlations matrices underlying item scores and expressed in patterns of loadings, with the latter ranging from -1 to +1. We regarded loadings >|0.5| as an indication that an item fitted into a component and present the two (first) components as these explained more than 10 % of variance (latent roots > 1.0).

2.5. Participants and parenting styles

The participating dog owners and their dogs were characterized as follows ($N = 41$, of which $N = 40$ did the treat-and-ball and $N = 36$ the breaktime). Participating dog owners were 88 % female ($N = 36$), 12 % male ($N = 5$). The majority (90 %; $N = 37$) had completed upper secondary education or higher. Age of the participants was indicated in seven categories, 7% was 18–25 years old ($N = 3$), 17 % 25–35 years ($N = 7$), 20 % 35–45 years ($N = 8$), 24 % 45–55 years ($N = 10$), 27 % 55–65 years ($N = 11$) and 5% was 65 years or older ($N = 2$). Their dogs were aged between 6 months and 12 years, representing a variety of breeds and mixes, with the dog's weight classes ranging from less than five kilos to 41–50 kilogrammes. Participating dogs were bought at an age younger than sixteen weeks by the participating owner. Pedigree dogs ($N = 21$) and non-pedigree dogs ($N = 20$) were distributed near evenly. Slightly more female dogs participated ($N = 12$ neutered and $N = 9$ intact) than male dogs ($N = 9$ neutered and $N = 9$ intact; 2 missing values).

The dog-directed parenting style scores, calculated as a percentage of the theoretical maximum of 100 %, were an average (\pm standard deviation, range) 26.1 \pm 18.2 % (0–68.8) for AUC (authoritarian-correction style), 65.2 \pm 17.5 % (29.2–100) for AUI (authoritative-intrinsic value style) and 81.1 \pm 15.7 % (33.3–100) for the AUT (authoritative-training

style). For female owners only ($N = 36$), these scores were $24.4 \pm 17.4\%$ (0–62.5) for AUC, $66.6 \pm 17.2\%$ (29.2–100) for AUI and $83.7 \pm 12.9\%$ (45.8–100) for AUT. For the dog-directed parenting styles, 23 % of variation explained the inverse relationship between AUC and AUI ($r_s = -0.48$, $P = 0.002$, $N = 41$). No significant association was found between AUC and AUT ($r_s = -0.26$, $P = 0.10$, $N = 41$) or AUI and AUT ($r_s = 0.25$, 0.12 , $N = 41$).

3. Results

3.1. Owner and dog behaviours during the treat-and-ball-course and the breaktime

We outline the averages (\pm standard deviations, ranges) for those owner and dog behaviours during the treat-and-ball course and the breaktime behaviours that Spearman rank correlated with the dog-directed parenting styles in Table 2 (see Appendix 2 for all behaviours). Averages indicate that during the treat-and-ball course dogs tended to be on a tight leash, with the leash in a straight line from owner to dog for more than three seconds ($63.0 \pm 32.3\%$ of the observation time, 0–100, Leash tension). This common tight leash may have resulted from the owner's guidance of the dog, the dog's pulling, or both. Owners verbally praised their dogs more so (6.7 ± 7.0 rpm, 0–26.4, Verbal praise) than verbally corrected it (4.0 ± 4.0 rpm, 0–17.7, Verbal correction). Most of the ten-minute breaktime the owners sat ($86.5 \pm 13.7\%$, 44.5–100, Sitting) and on average the dogs tended to stay near the owner ($64.9 \pm 31.2\%$, 10.2–100, Close meter).

3.2. Rank correlations between parenting styles and owner/dog behaviours

Analysing the data on treat-and-ball course ($N = 40$) and breaktime ($N = 36$) separately, we quantified associations between the dog-directed parenting style scores and the owner/dog behaviours with Spearman rank correlations (for an overview of the outcomes see Table 3). Particularly the owner behaviours of verbally praising the dog, verbally correcting it and leash tensions related to the parenting styles of AUC (authoritarian-correction style), AUI (authoritative-intrinsic value style) and AUT (authoritative-training style), explaining up to nineteen percent of variance. For the dog's behaviour the most telling behaviour was the dog looking at the owner, explaining up to 30 % of variance.

AUC related to verbal expressions by owners in the expected directions: directly to verbally correcting the dog and inversely to verbally praising it ($r_s = 0.42$, $P = 0.008$, Verbal correction, treat-and-ball; $r_s = -0.43$, $P = 0.006$, Verbal praise, treat-and-ball). AUC related directly also to leash tension ($r_s = 0.32$, $P = 0.047$, Leash tension, treat-and-ball) and inversely to the dog's looking at the owner ($r_s = -0.55$, $P < 0.001$, Dog look at owner, treat-and-ball), to the dog's staying close to the owner when off the leash ($r_s = -0.47$, $P = 0.004$, Close meter, breaktime) and to the dog's laying head down during the breaktime ($r_s = -0.34$, $P = 0.043$, Laying head down, breaktime).

AUI contrasted AUC for verbal expressions as AUI related directly to

verbally praising the dog ($r_s = 0.44$, $P = 0.005$, Verbal praise, treat-and-ball) and inversely to verbally correcting it ($r_s = -0.35$, $P = 0.029$, Verbal correction, treat-and-ball). Also, AUI related inversely to leash snaps ($r_s = -0.43$, $P = 0.005$, Leash snap, treat-and-ball) and inversely to the dog's looking at the owner during the breaktime ($r_s = -0.33$, $P = 0.049$, Dog at owner, breaktime).

AUT related directly to dog's looking frequently at the owner during task performance ($r_s = 0.33$, $P = 0.004$, Dog look at owner, treat-and-ball) and to verbally praising the dog during the breaktime ($r_s = 0.35$, $P = 0.037$, Verbal praise, breaktime).

3.3. Main pattern of associations between dog-directed parenting styles and owner/dog behaviours

To highlight the main pattern(s) of associations between dog-directed parenting styles and owner/dog behaviours, we ran a Principal Component Analysis (PCA, $N = 35$) and here report the two explanatory components (Table 4). The outcomes emphasized how during the course with distractions AUC parenting (loading of -0.8) combined with verbally correcting the dog (Verbal correction, treat-and-ball, -0.6) and that this opposed the combination of authoritative parenting (AUI/AUT, 0.6), verbally praising the dog (Verbal praise, treat-and-ball 0.7) and the dog's looking at the owner (Dog look at owner, treat-and-ball, 0.7). This first component explained 29 % of variance (latent root 3.4). The second component seemed of little importance since it explained substantially less variance (14 %, latent root 1.7) and grouped only two behavioural parameters that did not fit in the first component. It related AUI (0.6) inversely with the breaktime behaviours of the dog's duration of looking at the owner and the owner's verbal praising of the dog (Dog at owner/Verbal praise, breaktime, -0.7).

4. Discussion

Parenting styles are known to affect the wellbeing of children and the quality of the parent-child relationship (Lamborn et al., 1991; Neel et al., 2018; Simons and Conger, 2007; Wing Chan and Koo, 2011; Wissink et al., 2006), making it interesting to know how these styles work out in the owner-dog relationship. Here we explored how dog-directed parenting styles express in specific owner-dog interactions. Dog owners with known dog-directed parenting styles walked their dog through a treat-and-ball course and were observed when having a ten-minute break with their dog, representing conditions that we presumed to trigger parental demandingness and responsiveness respectively. This notion was supported by the overall higher level of verbal dog guidance during the treat-and-ball course than during the breaktime. The owner behaviours that were most telling about the dog-directed parenting styles occurred during this treat-and-ball course and these were verbally correcting or praising the dog, next to leash tensions. Owners that scored relatively high for AUC (authoritarian-correction) parenting tended to verbally correct the dog instead of praising it and walked with relatively higher leash tensions.

Table 2

Descriptive statistics for owner and dog behaviours that associated with dog-directed parenting styles.

Treat-and-ball course behaviours	$\mu \pm$ s.d. (range)	Breaktime behaviours	$\mu \pm$ s.d. (range)
Dog look at owner (point)	5.50 ± 5.38 (0–19.70)	Close meter (state)	64.90 ± 31.19 (10.21–99.98)
Leash snap (point)	2.26 ± 2.98 (0–12.40)	Dog at owner (state)	27.17 ± 20.12 (3.02–74.32)
Leash tension (state)	63.01 ± 32.30 (0–100)	Laying head down (state)	10.19 ± 17.59 (0–74.12)
Verbal praise (point)	6.70 ± 6.99 (0–26.36)	Verbal praise (point)	0.40 ± 0.58 (0–2.59)
Verbal correction (point)	3.97 ± 4.04 (0–17.71)		

Averages (\pm standard deviations, ranges) for the owner and dog behaviours that Spearman rank correlated with dog-directed parenting styles during the treat-and-ball course (over all three runs) and during the breaktime in 41 owner-dog dyads. The averages are presented in rate per minute for point behaviours and as percentage of observation time for state behaviours.

Table 3
Spearman rank correlations between dog-directed parenting styles and owner/dog behaviours.

	AUC parenting	AUI parenting	AUT parenting
Treat-and-ball			
Dog look at owner	$r_s = -0.55$ ($P < 0.001$)	–	$r_s = 0.33$ ($P = 0.004$)
Leash snap	–	$r_s = -0.43$ ($P = 0.005$)	–
Leash tension	$r_s = 0.32$ ($P = 0.047$)	–	–
Verbal praise	$r_s = -0.43$ ($P = 0.006$)	$r_s = 0.44$ ($P = 0.005$)	–
Verbal correction	$r_s = 0.42$ ($P = 0.008$)	$r_s = -0.35$ ($P = 0.029$)	–
Breaktime			
Close meter	$r_s = -0.47$ ($P = 0.004$)	–	–
Dog at owner	–	$r_s = -0.33$ ($P = 0.049$)	–
Laying head down	$r_s = -0.34$ ($P = 0.043$)	–	–
Verbal praise	–	–	$r_s = 0.35$ ($P = 0.037$)

Dog owners and their dogs ($N = 41$) were tested in a treat-and-ball course ($N = 40$) and during the breaktime ($N = 36$). Spearman rank correlations were calculated between the dog-directed parenting styles and the observed owner/dog behaviours ($P < 0.05$).

Contrasting this, owners that scored relatively high for AUI (authoritative-intrinsic value) parenting tended to verbally praise the dog. Concerning the dog's behaviour, relatively high frequencies of looking at the owner combined with owners that scored relatively high for AUT (authoritative-training) parenting and this contrasted AUC parenting.

Thus, verbally correcting and praising the dog during task performance together with leash tensions are particularly indicative of dog-directed parenting styles. Here, AUC and AUI are opposites and, seemingly, conducive to rather fixed ways of interacting with dogs compared to the more flexible ways of AUT parenting. This as AUT parenting did not relate to any of the behaviours that owners showed during task performance, indicating variability across such owners. Dog-directed parenting styles may affect dogs in maintaining (eye) contact with their owner, although our interpretations come from associations of which the underlying causalities are unknown and it cannot be excluded that dog behaviour underlies the dog owner's parenting.

Noteworthy was that only a small spectrum of behaviours related to the parenting styles, with more verbal than physical behaviours. Possibly the latter was contributed to by our mostly female study group. Indeed, female owners talked for longer duration and with shorter latency than male owners upon return to the dog in a separation/reunion-based testing situation (Prato-Previde et al., 2006). If generally females are more vocal when interacting with dogs this may underlie the higher level of verbal than physical behaviours in our study. Differences between female and male dog owners have been scarcely studied. No differences were found between female and male dog handlers' behaviours directed at the dog in a study on the associations between dogs' salivary cortisol levels and humans' salivary cortisol levels, behaviours, and performance perception during an agility competition (Buttner et al., 2015). The behaviours included verbally praising the dog, verbally correcting it and snapping the dog's leash among other

behaviours. However, the dogs' cortisol levels were higher after the competition for dogs handled by males ($N=14$) than females ($N=44$; Buttner et al., 2015). Also, females displayed more positive animal attitudes, including about animal protectionism (Herzog, 2007), reported to have more trainable, sociable, less bold dogs (Kubinyi et al., 2009), whereas males reported to have more disobedient dogs (Bennett and Rohlf, 2007). Thus, gender differences in dog ownership may exist and these deserve more research attention as owner-dog studies often unintentionally include high percentages of female participants. For example, even higher percentages than our 88 % females were reported for studies using similar online recruitment: 93 % females of 3,080 respondents (Norman et al., 2020) and 91 % females of 653 respondents (Volsche and Gray, 2016). Interestingly, study methods of in-person approach of dog owners, for instance during park-dog walks or when visiting veterinary clinics, resulted in lower percentages of female respondents of 70 % (Hiby et al., 2004) and 67 % (Blackwell et al., 2008). These approaches could therefore benefit future studies that wish to include higher percentages of male dog owners.

Alternatively or additionally to our high percentage of female study participants using verbal behaviours rather than physical behaviours, the here found behavioural levels could be affected by our (videotaped) research setting. Generally, research participation affects participants' behaviours, although the extent at which it does so is difficult to measure (McCambridge et al., 2014). For videotaped research settings specifically the change in participant behaviour may compromise validity. This as videotaped participants tend to behave more according to what they think the researcher expects, as seen in videotaped hospital personnel behaving more formal and without jokes (Latvala et al., 2000). Unintentionally, in our study we could have prompted similar 'behaving as expected' through directing the attention of our participants to the videotaping via the videotaping-consent form, which we

Table 4
Main pattern of associations between dog-directed parenting styles and owner/dog behaviours.

	Component 1 (28.6 % of variance, latent root 3.4)	Component 2 (14.3 % of variance, latent root 1.7)
AUC parenting	-0.79	0.18
AUI parenting	0.59	0.56
AUT parenting	0.64	0.04
Dog look at owner - Treat-and-ball	0.73	-0.21
Leash snap - Treat-and-ball	-0.40	-0.19
Leash tension - Treat-and-ball	-0.30	0.22
Verbal praise - Treat-and-ball	0.74	0.12
Verbal correction - Treat-and-ball	-0.62	0.00
Close meter - Breaktime	0.19	-0.42
Dog at owner - Breaktime	-0.12	-0.74
Laying head down - Breaktime	0.41	0.17
Verbal praise - Breaktime	0.34	-0.68

To highlight the main pattern(s) of associations between three dog-directed parenting styles and nine owner/dog behaviours we performed Principal Component Analyses (PCA). We tested data from 35 owner-dog dyads that walked through a treat-and-ball course and spent breaktime together. We regarded loadings $>|0.5|$ as meaningful and we present the two components on which one or more dog-directed parenting styles loaded and that explained more than 10 % of variance and with a latent root > 1.0 .

deemed necessary for ethical reasons. This could have affected the participants' levels of physical behaviours directed at the dog.

Next to owner behaviours we were interested in the dog's and we found maintaining (eye) contact of particular interest as it related inversely to AUC parenting and directly to AUT parenting. Although we cannot imply causality, AUT parenting is training orientated and previous studies indicate that training a dog increases the dog's looking at the owner. As an example, dogs with high levels of obedience training displayed high frequencies of looking at the owner in the two minutes before commencing a series of obedience exercises (Mongillo et al., 2016). Such looking behaviour may be trained in relatively short time spans and Border Collies looked at their owner with shorter latencies and for longer durations following five minutes of clicker training only, with a minimum of twenty reinforced clicks (Wallis et al., 2015). If AUT parenting indeed increases a dog's looking at the owner this could make the dog more susceptible to social support and helpful communication. Assumingly, through this looking the dogs solicit owner support and receive cues to solve problems or assess the threat levels of novelties by a mechanism of social referencing (Merola et al., 2014; Müller et al., 2015). Indeed, when confronted with an unsolvable task, dogs looked at their caretaker with shorter latencies and for longer durations than did socialized wolves (Miklósi et al., 2003). The unsolvable task involved pulling a rope that previously, but no longer, led to receiving a piece of meat. After a median one minute of effort, seven out of nine dogs looked back at their caretaker, whereas two out of nine wolves did (Miklósi et al., 2003). In another unsolvable task experiment, the reactions of dogs and toddlers were compared when the manipulation of a container ceased to offer a reward. Both the dogs and the toddlers increased their gaze alternation between the container and their caretaker (Marshall-Pescini et al., 2013). Next to providing support, the dog's looking at the owner may make it appear more cooperative and likeable in the eyes of the owner (Roth and Jensen, 2015). Finally, a dog's looking at the owner comes with attentiveness that may facilitate desired behaviours and/or prevent the development of undesired behaviours (McGreevy et al., 2017; Payne et al., 2017).

It is quite possible that a dog's undesired behaviour and/or inattentiveness makes an owner opt for AUC parenting. However, the finding that looking at the owner relates inversely to AUC and directly to AUT, points to the latter as the more effective way to encourage desired dog behaviours. This as looking at an owner increases the opportunity of gaining a dog's attention to request and reward desired behaviours (McGreevy et al., 2017; Payne et al., 2017) and this comes with the benefits of the dog being seen as more cooperative by its owner (Roth and Jensen, 2015) and allowing gentler guidance, as in the loudness of voice and roughness of physical contact (Schilder and Vinke, 2015). For AUI parenting our study presents less-clear indications for its relevance to desired dog behaviours. We found owners relatively high in AUI to verbally praise the dog often and to use few leash snaps and verbal corrections, in line with this style reflecting a focus on a dog's needs and emotions. However, AUI parenting was not related to a dog's frequent looking at the owner during task performance nor to the duration of looking at the owner during the breaktime. This raises the question if this style, for instance through a lack of demandingness, represents missed opportunities in parenting of the dog.

We point out that the present study identified patterns of interest. However, these were only partly in line with a priori predictions and do not evidence casual relationships or hypotheses. The direction of found relationships remain speculative and we did not control for familywise error rates as to limit type 2 errors (β), thus accepting a higher risk of type 1 errors (α). Our findings seem logical but do require further validation in more specified hypothesis-driven experiments.

The present study links desirable behaviours in both dog owners and their dogs to parenting ways that are known to work well in the parent-child relationship. Thus, the targeting of dog-directed parenting styles in educational interventions for dog owners, such as dog obedience classes, seems valuable. Through addressing parenting styles educational

interventions can target patterns of behaviour in an owner, as well as the emotional sphere in which a dog's guidance takes place. This may add value to the mere teaching of mechanical training skills and offering of dog knowledge. How educational interventions for dog owners can address such parenting styles effectively remains to be studied and this study area could advance intervention effectiveness, the owner-dog relationship and ultimately benefit dog welfare.

Declaration of Competing Interest

The authors report no declarations of interest.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.applanim.2020.105131>.

References

- Baumrind, D., 2013. Authoritative parenting revisited: history and current status. In: Larzelere, R.E., Sheffield Morris, A., Harrist, A.W. (Eds.), *Authoritative Parenting. Synthesizing Nurture and Discipline for Optimal Child Development*. American Psychological Association, Washington, pp. 11–34.
- Bennett, P.C., Rohlf, V.I., 2007. Owner-companion dog interactions: Relationships between demographic variables, potentially problematic behaviours, training engagement and shared activities. *Appl. Anim. Behav. Sci.* 102 (1–2), 65–84.
- Blackwell, E.J., Twells, C., Seawright, A., Casey, R.A., 2008. The relationship between training methods and the occurrence of behavior problems, as reported by owners, in a population of domestic dogs. *J. Vet. Behav.* 3 (5), 207–217.
- Buttner, A.P., Thompson, B., Strasser, R., Santo, J., 2015. Evidence for a synchronization of hormonal states between humans and dogs during competition. *Physiol. Behav.* 147, 54–62.
- Coe, J.B., Young, I., Lambert, K., Dysart, L., Nogueira Borden, L., Rajić, A., 2014. A scoping review of published research on the relinquishment of companion animals. *J. Appl. Anim. Welf. Sci.* 17 (3), 253–273. <https://doi.org/10.1080/10888705.2014.899910>.
- Cutt, H., Giles-Corti, B., Knuijan, M., Burke, V., 2007. Dog ownership, health and physical activity: a critical review of the literature. *Health Place* 13 (1), 261–272.
- Feldman, R., Gordon, I., Schneiderman, I., Weisman, O., Zagoory-Sharon, O., 2010. Natural variations in maternal and paternal care are associated with systematic changes in oxytocin following parent-infant contact. *Psychoneuroendocrinology* 35 (8), 1133–1141. <https://doi.org/10.1016/j.psyneuen.2010.01.013>.
- Francis, D.D., Young, L.J., Meaney, M.J., Insel, T.R., 2002. Naturally occurring differences in maternal care are associated with the expression of oxytocin and vasopressin (V1a) receptors: gender differences. *J. Neuroendocrinol.* 14, 349–353.
- Herzog, H.A., 2007. Gender differences in human-animal interactions: a review. *Anthrozoös.* 20 (1), 7–21.
- Hiby, E.F., Rooney, N.J., Bradshaw, J.W.S., 2004. Dog training methods: their use, effectiveness and interaction with behaviour and welfare. *Anim. Welf.* 13 (1), 63–70.
- Hindrikson, M., Remm, J., Pilot, M., Godinho, R., Stronen, A.V., Baltrūnaitė, L., Czarnomska, S.D., Leonard, J.A., Randi, E., Nowak, C., Akesson, M., Lopez-Bao, J.V., Alvares, F., Llana, L., Echeagaray, J., Vila, C., Ozolins, J., Rungis, D., Aspi, J., Paule, L., Skrbinec, T., Saarna, U., 2017. Wolf population genetics in Europe: a systematic review, meta-analysis and suggestions for conservation and management. *Biol. Rev.* 92 (3), 1601–1629. <https://doi.org/10.1111/brv.12298>.
- Howell, T.J., Mornement, K., Bennett, P.C., 2016. Pet dog management practices among a representative sample of owners in Victoria, Australia. *J. Vet. Behav.* 12, 4–12. <https://doi.org/10.1016/j.jvbe.2015.12.005>.
- Jolliffe, I.T., 1986. *Principal Components Analysis*. Springer-Verlag, New York.
- Kubinyi, E., Turcsán, B., Miklósi, A., 2009. Dog and owner demographic characteristics and dog personality trait associations. *Behav. Processes* 81 (3), 392–401.
- Lambert, K., Coe, J., Niel, L., Dewey, C., Sargeant, J.M., 2015. A systematic review and meta-analysis of the proportion of dogs surrendered for dog-related and owner-related reasons. *Prev. Vet. Med.* 118 (1), 148–160. <https://doi.org/10.1016/j.prevetmed.2014.11.002>.
- Lamborn, S.D., Mounts, N.S., Steinberg, L., Dornbusch, S.M., 1991. Patterns of competence and adjustment among adolescents from authoritative, authoritarian, indulgent and neglectful families. *Child Dev.* 62, 1049–1065.
- Latvala, E., Vuokila-Oikkonen, P., Janhonen, S., 2000. Videotaped recording as a method of participant observation in psychiatric nursing research. *J. Adv. Nurs.* 31 (5), 1252–1257.
- Marshall-Pescini, S., Colombo, E., Passalacqua, C., Merola, I., Prato-Previde, E., 2013. Gaze alternation in dogs and toddlers in an unsolvable task: evidence of an audience effect. *Anim. Cogn.* 16 (6), 933–943.
- McCambridge, J., Witton, J., Elbourne, D.R., 2014. Systematic review of the Hawthorne effect: new concepts are needed to study research participation effects. *J. Clin. Epidemiol.* 67 (3), 267–277. <https://doi.org/10.1016/j.jclinepi.2013.08.015>.

- McGreevy, P., Starling, M., Payne, E., Bennett, P., 2017. Defining and measuring dogmanship: a new multidisciplinary science to improve understanding of human-dog interactions. *Vet. J.* 229, 1–5. <https://doi.org/10.1016/j.tvjl.2017.10.015>.
- Mech, L.D., 2007. Annual arctic wolf pack size related to arctic hare numbers. *Arctic* 60 (3), 309–311.
- Merola, I., Prato-Previde, E., Lazzaroni, M., Marshall-Pescini, S., 2014. Dogs' comprehension of referential emotional expressions: familiar people and familiar emotions are easier. *Anim. Cogn.* 17 (2), 373–385. <https://doi.org/10.1007/s10071-013-0668-1>.
- Miklósi, Á., Kubinyi, E., Topál, J., Gácsi, M., Virányi, Z., Csányi, V., 2003. A simple reason for a big difference: wolves do not look back at humans, but dogs do. *Curr. Biol.* 13 (9), 763–766.
- Mongillo, P., Pitteri, E., Candaten, M., Marinelli, L., 2016. Can attention be taught? Interspecific attention by dogs (*Canis familiaris*) performing obedience tasks. *Appl. Anim. Behav. Sci.* 182, 30–37. <https://doi.org/10.1016/j.applanim.2016.05.018>.
- Mubanga, M., Byberg, L., Nowak, C., Egenvall, A., Magnusson, P.K., Ingelsson, E., Fall, T., 2017. Dog ownership and the risk of cardiovascular disease and death—a nationwide cohort study. *Sci. Rep.* 7 (1), 1–9. <https://doi.org/10.1038/s41598-017-16118-6>.
- Müller, C.A., Schmitt, K., Barber, A.L., Huber, L., 2015. Dogs can discriminate emotional expressions of human faces. *Curr. Biol.* 25 (5), 601–660. <https://doi.org/10.1016/j.cub.2014.12.055>.
- Murray, J.K., Browne, W.J., Roberts, M.A., Whitmarsh, A., Gruffydd-Jones, T.J., 2010. Number and ownership profiles of cats and dogs in the UK. *Vet. Rec.* 166 (6), 163–168.
- Nagasawa, M., Kikusui, T., Onaka, T., Ohta, M., 2009. Dog's gaze at its owner increases owner's urinary oxytocin during social interaction. *Horm. Behav.* 55, 434–441.
- Nagasawa, M., Mitsui, S., En, S., Ohtani, N., Ohta, M., Sakuma, Y., Onaka, T., Mogi, K., Kikusui, T., 2015. Oxytocin-gaze positive loop and the coevolution of human-dog bonds. *Science* 348 (6232), 333–336.
- Neel, M.L.M., Stark, A.R., Maitre, N.L., 2018. Parenting style impacts cognitive and behavioural outcomes of former preterm infants: a systematic review. *Child Care Health Dev.* 44 (4), 507–515. <https://doi.org/10.1111/cch.12561>.
- New, J.C., Salman, M.D., King, M., Scarlett, J.M., Kass, P.H., Hutchison, J.M., 2000. Characteristics of shelter-relinquished animals and their owners compared with animals and their owners in U.S. pet-owning households. *J. Appl. Anim. Welf. Sci.* 3 (3), 179–201.
- Norman, C., Stavisky, J., Westgarth, C., 2020. Importing rescue dogs into the UK: reasons, methods and welfare considerations. *Vet. Rec.* 186, 248. <https://doi.org/10.1136/vetrec-2019-105380>.
- Olivari, M.G., Tagliabue, S., Confalonieri, E., 2013. Parenting Style and Dimensions Questionnaire: a review of reliability and validity. *Marriage Fam. Rev.* 49, 465–490.
- Payne, E.M., Bennett, P.C., McGreevy, P.D., 2017. DogTube: an examination of dogmanship online. *J. Vet. Behav.* 17, 50–61. <https://doi.org/10.1016/j.jvb.2016.10.006>.
- Prato-Previde, E., Fallani, G., Valsecchi, P., 2006. Gender differences in owners interacting with pet dogs: an observational study. *Ethol* 112 (1), 64–73.
- Robinson, C.C., Mandleco, B., Olsen, S.F., Hart, C.H., 1995. Authoritative, authoritarian and permissive parenting practices: development of a new measure. *Psychol. Rep.* 77, 819–830.
- Roth, L.S., Jensen, P., 2015. Assessing companion dog behavior in a social setting. *J. Vet. Behav.* 10 (4), 315–323. <https://doi.org/10.1016/j.jvb.2015.04.003>.
- Rowan, A., Kartal, T., 2018. Dog population & dog sheltering trends in the United States of America. *Animal* 8 (5), 68–88. <https://doi.org/10.3390/ani8050068>.
- Salonen, M., Sulkama, S., Mikkola, S., Puurunen, J., Hakanen, E., Tiira, K., Araujo, C., Lohi, H., 2020. Prevalence, comorbidity, and breed differences in canine anxiety in 13,700 Finnish pet dogs. *Sci. Rep.* 10 (2962), 1–11. <https://doi.org/10.1038/s41598-020-59837-z>.
- Schilder, M.B.H., Vinke, C.M., 2015. Horsemanship, dogmanship and humanship. *Vet. J.* 205, 331–332. <https://doi.org/10.1016/j.tvjl.2015.06.008>.
- Simons, L.G., Conger, R.D., 2007. Linking mother-father differences in parenting to a typology of family parenting styles and adolescent outcomes. *J. Fam. Issues* 28 (2), 212–241.
- Smetana, J.G., 2017. Current research on parenting styles, dimensions, and beliefs. *Curr. Opin. Psychol.* 15, 19–25. <https://doi.org/10.1016/j.copsyc.2017.02.012>.
- Stoessel, L.E., Palley, L.S., Gollub, R.L., Niemi, S.M., Evins, A.E., 2014. Patterns of brain activation when mothers view their own child and dog: an fMRI study. *PLoS One* 9 (10), e107205. <https://doi.org/10.1371/journal.pone.0107205>.
- Van Herwijnen, I.R., Van der Borg, J.A.M., Naguib, M., Beerda, B., 2018. The existence of parenting styles in the owner-dog relationship. *PLoS One* 13 (2), e0193471. <https://doi.org/10.1371/journal.pone.0193471>.
- Volsche, S., Gray, P., 2016. “Dog moms” use authoritative parenting styles. *Hum. Interact. Bull.* 4, 1–16.
- Wallis, L.J., Range, F., Müller, C.A., Serisier, S., Huber, L., Virányi, Z., 2015. Training for eye contact modulates gaze following in dogs. *Anim. Behav.* 106, 27–35. <https://doi.org/10.1016/j.anbehav.2015.04.020>.
- Wing Chan, T., Koo, A., 2011. Parenting style and youth outcomes in the UK. *Eur. Sociol. Rev.* 27 (3), 385–399.
- Wissink, I.B., Dekovic, M., Meijer, A.M., 2006. Parenting behavior, quality of the parent-adolescent relationship, and adolescent functioning in four ethnic groups. *J. Early Adolesc.* 26 (2), 133–159.