Is the dog-human relationship affected by the type of dog-training activity undertaken?

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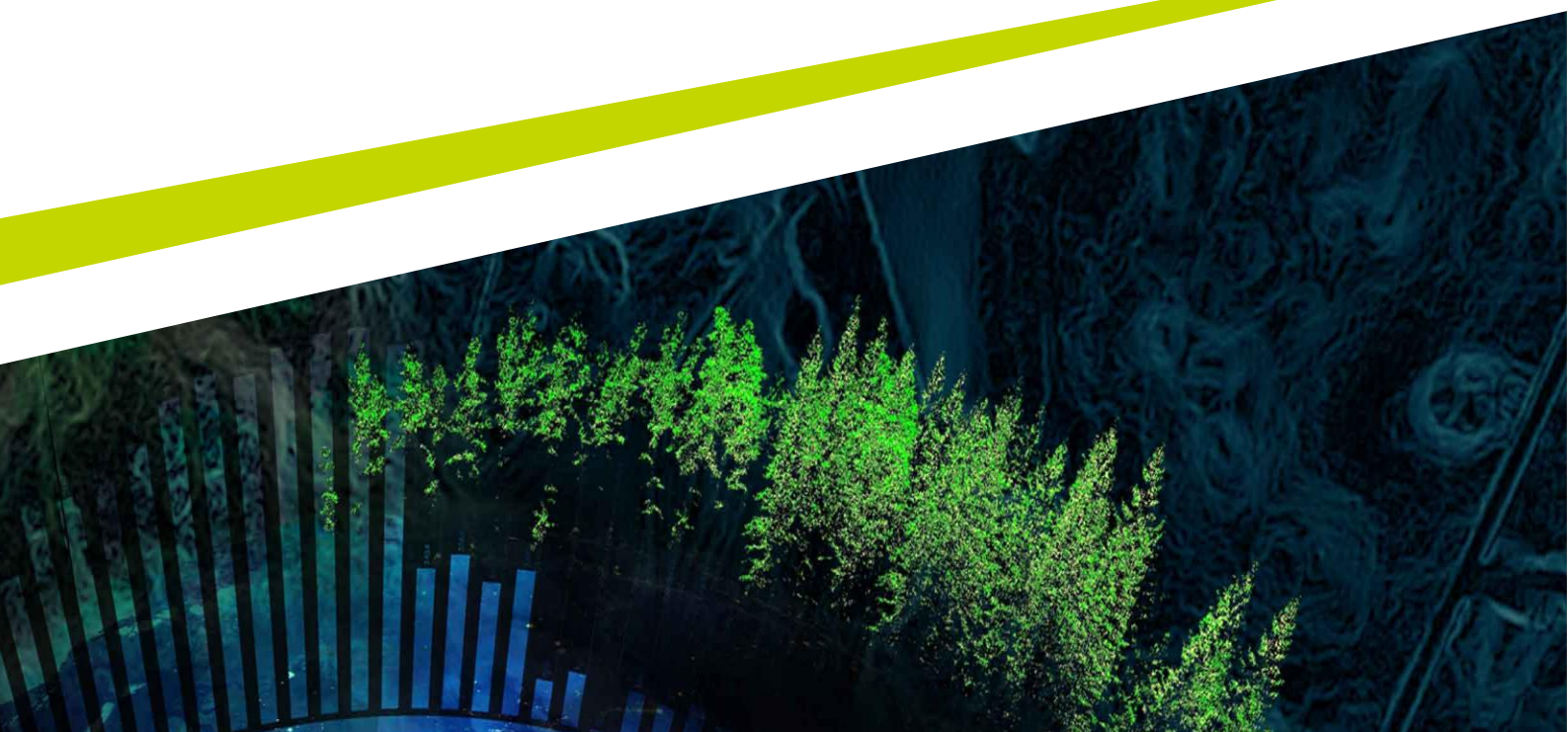

Is the dog-human relationship affected by the type of dog training activity undertaken?

Påverkas relationen mellan hund och ägare av aktivitetsområde?

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Abstract

The relationships formed between dogs and their owners are not only moulded by a large number of factors, but they also have the potential to significantly impact the physical and mental well-being of both dog and human. In the present study, the effects that the amount of formal activity and training may have on the dog-human relationship were investigated and compared to dyads who self-reported having had no previous experience and/or currently not undergoing any form of formal activity or training.

Data were collected by inviting owners of dogs in Sweden to complete an online questionnaire, which included details of their experiences with the type of formal activity and training undertaken with their dog. The questionnaire also included questions related to the Monash Dog Owner Relationship Scale (MDORS).

A total of 1775 respondents completed the questionnaire, on which further analysis could be undertaken. Of the three MDORS subscales, a significant difference ($p < 0.05$) was found to occur in the Emotional Closeness subscale between dogs defined as undertaking <5 hours/week activity (N=288) and dogs defined as undertaking >5 hours/week activity (N=1333), with the group reporting an activity level of <5 hours/week scoring higher. A difference ($p < 0.05$) was also found to occur in the Perceived Costs subscale between dogs defined as companion-only (N=154) compared to dogs defined as undertaking >5 hours/week activity, with the group reporting an activity level of >5 hours/week scoring higher.

Thereafter, based on the reported activities, two small categories were selected from the initial group of respondents in order to complete two further online questionnaires (the Adult Attachment Style Questionnaire (ASQ) and the Experiences in Close Relationships-revised (ECR-R)), as well as to participate in an attachment test, the Separation- and reunion test (SRT) with their dogs. This section of the study included a limited sample size and was mainly undertaken as an exploratory pilot study. Results from the ASQ and ECR-R questionnaires found no significant differences between dyads defined as companion-only dogs (N=7) and dyads defined as undergoing some form of formal activity (N=7). No significant differences in the behaviours exhibited by the dogs during the departure, separation and reunion phases of the SRT were found to occur when companion-only dogs were compared with dogs undergoing formal activity.

The study indicated that owner perception of certain aspects of their relationship with their dog was influenced by the types of activity they do together as well as the amount of time spent on the activity, when utilising the MDORS. However, no differences in the dog's attachment behaviour were observed related to whether or not the dyad participated in any activities, indicating that the dog's experience of the relationship to the owner was unaffected by the amount of activities. Further analysis would be required to more fully elucidate the underlying factors and motivations involved in the development of the dog-human relationship and the resultant bond formed.

Keywords: Dogs(s), *Canis familiaris*, dog-human relationship, Monash Dog Owner Relationship Scale (MDORS), Attachment Style Questionnaire (ASQ), Experiences in Close Relationships-revised (ECR-R), separation- and reunion test (SRT), attachment style, training, activity, breed appropriate activity

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Abbreviations

AAS	Adult Attachment Style
ASQ	Attachment Style Questionnaire
COST	Perceived Costs
DOI	Dog Owner Interaction
ECR-R	Experiences in Close Relationships – Revised
EMO	Emothional Closeness
FCI	Federation Cynologique Internationale
GDPR	General Data Protection Regulation
HR	Heart rate
HRV	Heart rate variability
MDORS	Monash Dog Owner Relationship Scale
SKK	Svenska Kennelklubben (Swedish Kennel Club)
SLU	Sveriges lantbruksuniversitet (Swedish University of Agricultural Sciences)
SRT	Separation- and reunion test
SST	Ainsworth Strange Situation Test

1. Introduction

Dogs (*Canis familiaris*) and humans share a long history thought to date back at least some 18,000 years (Thalmann et al., 2013), and has underpinned the development of a wide spectrum of symbiotic associations (Payne et al., 2015). The reciprocal relationships formed between dogs and their owners have been deemed both complex and multi-faceted, with many underlying factors contributing to their development (Rehn & Keeling, 2016). Whilst increasing attention is being paid to improving our understanding of the dog-human dyad (Maharaj & Haney, 2015; Hoummady et al., 2016; Rehn & Keeling, 2016; Rehn et al., 2017), the effects of the training activities utilised by owners to interact with their dog, as well as the level of appropriateness or fulfilment that these activities offer the dog, have not been fully addressed in terms of the dog-human relationship.

A deeper understanding of the dog-human relationship is greatly warranted given the varied and significant roles that dogs play in society (Cunningham-Smith & Emery, 2020). Such roles include, but are not limited to, working closely with humans in order to provide security and protection to their handlers involved in military or police branches, detect substances using their olfactory acuity, work closely with their human partner in assistance roles as well as various settings including sports and competitions ranging from obedience to agility, as well as assisting in the medical field by detecting cancer cells or alerting to seizures or other medical conditions (Otto et al., 2019). Dogs also play an integral role in hunting, herding, or sledding. Furthermore, their role in providing companionship, emotional support or simply as a form of enhancing the quality of life of their owners has been shown to be of great importance (Tóth et al., 2023). In fact, the ability of dogs to form attachments with their owners has been likened to that which is formed between children and their parents (Topál et al., 1998). This relationship can also be reciprocated; and owners may show similar care-giving behaviours towards their dogs as they would to their children (Topál et al., 1998, van Herwijnen et al., 2018).

In order to further improve our understanding of the dog-human relationship and potentially help to prevent misunderstandings that may ultimately lead to development of behavioural issues and possibly even relinquishment (Powdrill-Wells et al., 2021), it is important to continue to explore this area of research. In fact, it has been suggested that investigating the effects of applied contexts on the

dog-human relationship should be considered especially important (Udell & Brubaker, 2016). As such, it was hypothesised that the main activity, or the amount of time spent on activities, which dogs are exposed to influences the attachment behaviour observed between respective dog and owner. Dogs engaged in activities together with their owners may develop a more secure attachment to their owners, related to the fact that they are allowed to express their behavioural needs and collaborate with their owners on a regular basis (Payne et al., 2015). For example, relationship perception was improved in accordance with increased quality time spent together (Dotson and Hyatt, 2008) as well as with increased training engagement (Bennett & Rohlf, 2007).

In order to further explore this, Part one of this study examined potential links between Monash Dog Owner Relationship Scale (MDORS) subscales (dog-human interaction, emotional closeness and perceived costs) and the type of activity of the dog, as well as the amount of time invested in the activity/activities. Part two of this study examined the owner adult attachment style as an indirect measure of their caregiving (using the Attachment style questionnaire (ASQ) and the Experiences in Close Relationships-Revised (ECR-R) questionnaire), as well as the dog's attachment behaviour (as measured using the Separation- and reunion test (SRT)) in relation to the activity of the dog. In this way, the study attempted to establish whether dyads in which the dogs were defined as companion-only and dogs defined as undergoing some form of formal activity or training differed in their behaviour during the SRT. Furthermore, the study attempted to establish whether owner perception of the relationship in terms of whether the dyads were defined as companion-only or as undergoing some form of formal activity or training differed.

This study therefore posed, and attempted to answer, the following research questions; (1) Does the type of dog-related activity (or lack thereof) affect how the owner views the relationship with their dog?, (2) Does the type of dog-related activity (or lack thereof) affect the attachment behaviour expressed by the dog towards the owner?, and (3) Does owner adult attachment style (ie. their caregiving) influence the development of the dog's attachment to their owner, regardless of shared activity?

2. Literature review

2.1 The dog-human relationship

Dogs may be considered to be the earliest companion and domesticated animal of humans, and they therefore naturally share a long mutual history that has been shaped by the respective influences on each other as well as the large variety of roles that dogs have filled in human society (Cunningham-Smith & Emery, 2020). These roles have extended from sentinels, hunting and herding guides, modes of transport and carrying loads, sources of meat (Cunningham-Smith & Emery, 2020), as well as companionship with elevation to the status of family members (Maharaj & Haney, 2015). Subsequent selective breeding of various breeds and types of dog that are best suited to each of these roles has therefore resulted in a vast array of breeds and variations in morphology and behaviour (Cunningham-Smith & Emery, 2020).

Dogs exhibit complex behaviour patterns and emotional needs that contribute to within-species as well as between-species interactions (Cunningham-Smith & Emery, 2020), which translate to the potential for a high degree of variation in the development of a relationship between dogs and their owners. The complexities that are possible in human behaviour also contribute to the development of the dog-human relationship, that can for example be interpreted by dogs to reflect the appropriate social contexts (Rooney & Bradshaw, 2006) as well as allow them to comprehend referential gestures (Téglás et al., 2012). Whilst the ability to interact with humans to such a degree is thought to mainly be as a result of domestication and selective breeding, the subsequent relationships developed and shaped retains a degree of influence based on individual experiences (Persson et al., 2015).

Previous studies have investigated whether the bond formed between dog and human can in fact be regarded as an attachment (Tópal et al., 1998, Rehn & Keeling, 2016), where the term ‘attachment’ is specifically defined as an affectional bond that is persistent and non-interchangeable, provides security and comfort, and results in distress should involuntary separation occur (Ainsworth, 1989). The underlying behavioural system of attachment theory is manifested by behaviour that has the predictable outcome of maintaining proximity to one or a few select beings (attachment figures), such as the primary care-giver, who provide a secure base and

are fundamental to the survival and well-being of the individual in terms of providing a sense of safety and security (Ainsworth, 1989). The role of attachment may be regarded as providing evolutionary advantage, given that its primary purpose appears to be the increased survival of the vulnerable infant as a result of the presence and protection of its primary care-giver (Ainsworth, 1989).

Ainsworth (1989) was able to define particular categories of attachment as exhibited by infants to their mothers. The continued development of these patterns of attachment can be followed over time beyond infancy and into adulthood, during which a sense of autonomy is normally achieved and the individual seeks a new prinicipal attachment figure in the form of a partner, for example (Ainsworth, 1989). In this way, the attachment style initially developed can be reassigned to new relationships later in life and affect behaviours that are pertinent to parental care and caregiving, for example (Main, 2000).

The attachment style utilised may then be referrred to as an adult attachment style (AAS), and represents a more generalised approach, the characteristics of which may be defined in terms of the quality of attachment; secure/autonomous, insecure avoidant, and insecure anxious/ambivalent attachment styles. A fourth category was later added to include disorganised attachment (Main & Solomon, 1986).

Adults with secure AAS are especially likely to seek or maintain proximity to others and in so doing find protection, comfort or relief from the stressor (Shaver & Mikulincer, 2002). These individuals have presumably learned from interactions with others that acknowledgement and display of distress will elicit positive responses from others, that their own actions can actively reduce distress and thus are able to seek support and rely on others as an effective means of coping. In this way, the individual voluntarily moves away from the attachment figure in order to explore its environment and utilises the attachment figure as a secure base (Shaver & Mikulincer, 2002). This approach facilitates effective problem solving and the ability to flexibly adjust to various environmental cues (Shaver & Mikulincer, 2007). As caregivers, secure individuals are psychologically available, flexible and attentive to the child's needs, and provide support to the child in the event of a challenging scenario. If upset, the child signals to or seeks contact with the attachment figure and once comforted, will return to its exploration (Solomon & George, 2018). Prior to separation, the secure care-giver tends towards exhibiting increased affection in preparation of the separation, whilst exhibiting minimal anxiety, and tend towards immediate proximity and a smooth, positive reunion (Shaver & Mikulincer, 2007).

Adults with an insecure avoidant AAS are not as comfortable with being close to others, and as care-givers are psychologically unavailable with a reliance on distancing coping strategies such as stress denial or suppression, diversion of attention and behavioural or cognitive disengagement (Mikulincer & Shaver,

2018). The insecure avoidant care-giver values independence and exhibits little or no anxiety when separated (Shaver & Mikulincer, 2007). The child tends towards exploring readily, with little display of the secure base effect (Solomon & George, 2018). On separation, the child responds minimally, whilst on reunion will actively avoid the attachment figure and may focus on other objects such as toys (Solomon & George, 2018). By actively blocking the mental access to emotions, the adaptive aspect of experiencing emotion is lost (Shaver & Mikulincer, 2007).

Adults with an insecure anxious/ambivalent AAS tend towards a sustained and exaggerated pessimistic approach, often finding threat in even fairly benign events, initially developed as a result of emotionally negative interactions with unavailable or unreliable attachment figures (Shaver & Mikulincer, 2007). The heightened vigilance directed towards potential threats prevents the adaptive aspects of emotional experience that would otherwise provide a functional aspect from occurring (Shaver & Mikulincer, 2007). The anxious/ambivalent care-giver may respond unevenly to signals from the child, with signals of increasing intensity required of the child in order to gain acknowledgement, and may provide confusing instructions or interfere with the child's completion of a task (Solomon & George, 2018). On separation, both the attachment figure and child exhibit high degrees of distress, and whilst contact is sought upon reunion, this may not adequately provide comfort (Solomon & George, 2018).

Adults with a disorganised AAS may appear to lack observable goals or intentions; and can rapidly alternate between contradictory behaviours (Solomon & George, 2018). This form of attachment is rooted in the paradoxical scenario whereby the attachment figure is regarded as a source of anxiety, and as such result in a variety of responses such as unresponsiveness to signalling or inappropriate selection or modification of behaviours (Pollard, 2019). The child subsequently responds in a similarly disjointed manner to the unpredicatble behaviours shown by the caregiver, and may include behaviours such as apprehension to the attachment figure, freezing, stereotypies and incomplete, interrupted movements (Solomon & George, 2018).

Attachment can therefore be characterised by distinct behaviours, such as seeking proximity with the attachment figure in times of distress or threatening situations (Ainsworth, 1989). The attachment bonds that characterise human caregiver-infant relationships have since been investigated within the context of the dog-human dyad and are believed to be similar (Payne et al., 2015). The four characteristics of attachment bonds as defined by Bowlby (1958) have been found to occur in the dog-human dyad (Tópal et al., 1998, Payne et al., 2015); namely that dogs may exhibit proximity-seeking behaviour towards the attachment figure during times of stress as a means of coping with the stress, the presence of the attachment figure may attenuate the coping response and allow for the safe haven effect or allow the dog to explore novel objects more freely due to the secure-base

effect, whilst the absence of the attachment figure may elucidate signs of separation-related distress. The attachment style of the owner may influence the way in which the dog responds to various challenging situations, presumably as an effect of the type and level of support provided by the owner (Rehn et al., 2017).

Whilst it is generally agreed that attachment remains relatively stable over prolonged periods of time, short-term adult attachment instability has been reported (Sibley & Liu, 2004). Whilst such instability may be influenced by the current circumstances of the participant, it is important to reduce any variation that may have been introduced by unreliable or imprecise methods of measurement (Sibley & Liu, 2004). The ability to measure or in some way assess the dog-human relationship by utilising reliable methods of assessment allows for a means of improving dog-human relationships, which in turn helps to ensure healthy relationships and a good quality of life for the dog as well as avoid the consequences of poorer relationships (González-Ramirez & Hernández, 2021).

2.1.1 Measuring the dog-human relationship

2.1.1.1 Questionnaire-based measures of the dog-human relationship

A number of questionnaire-based studies have been undertaken in an attempt to measure the dog-human relationship, which, by the very nature of questionnaires focus on the perceptions of the owner and may subsequently result in a very unequal representation of the relationship, as well as the inclusion of anthropocentric bias (Samet et al., 2022). Self-report measures have been critisized for focusing on the current points of view of the participant, which are in turn reliant on the contemporary state of the individual and rely on an awareness of behaviours (Ravitz et al., 2010). Despite this, questionanire-based studies have the potential to be cost-efficient, and to reach many respondents over large geographical areas (Wardropper, 2021).

Of the many scales utilised to assess the dog-owner relationship (Wilson & Netting, 2012), the Monash Dog Owner Relationship Scale (MDORS) is considered to provide the most robust assessment in terms of the owner's perception of the dog-human realtionship (Payne et al., 2015). The development of the MDORS was based around the concepts of the social exchange theory, which is founded on the psychological theory that a relationship is only maintained when the perceived costs and benefits are either kept in balance or when the perceived benefits outweigh the perceived costs (González-Ramirez & Hernández, 2021), and thus offers a fairly balanced relationship assessment.

The MDORS consists of three sub-scales; 'dog-owner interaction' (DOI), 'perceived emotional closeness' (EMO) and 'perceived costs' (COST), and as such includes a way of assessing both positive and negative aspects of the dog-human

relationship (Dwyer et al., 2006). The subscales are assessed using a Likert scale, which consists of a number of statements or questions followed by a number of answer statements. Respondents are asked to choose one answer that best corresponds to their opinion or feeling with regards the statement. Each response is scored from one to five, with negative items reverse-coded (Willits et al., 2016). Each of the subscales are scored separately (van Herwijnen et al., 2018), which allows for assessment of the three subscales for each of the respondents.

The DOI subscale indicates the extent to which dogs and owners are involved in mutual activities, including those considered more general such as grooming, as well as more intimate activities such as hugging. The relationship is therefore assessed according to the formation of affectional bonds based on quantitative and qualitative aspects of reciprocal interactions (Dwyer et al, 2006).

The EMO subscale indicates the degree of psychological attachment, social support, companionship and unconditional love provided by the relationship (Dwyer et al., 2006), whilst the COST subscale represents aspects such as economic factors, increased responsibility and other restrictions to the owner (González-Ramirez & Hernández, 2021), and provides the negative counter-balance to the perceived benefits of the relationship (Dwyer et al., 2006).

The Experiences in Close Relationships-Revised (ECR-R) questionnaire aims to measure participants on two subscales of attachment; ‘avoidance’ and ‘anxiety’ (Fraley et al., 2000). Individuals identified as ‘avoidant’ by this questionnaire tend towards independence and the avoidance of intimacy, whilst individuals identified as ‘anxious’ tend towards a fear of rejection and abandonment (Fraley et al., 2000). This questionnaire was originally developed and aimed at investigating attachment between emotionally intimate relationships between humans (Strand & Ståhl, 2008). The ECR-R questionnaire consists of a 36-item measure designed to focus on relationship insecurity (Fraley et al., 2000). Any resulting low scores from the two dimensions assessed within relationship insecurity are thereafter used to infer presence of security (Justo-Nunez et al., 2022). Sibley and Liu (2004) were able to demonstrate that the ECR-R provided both reliable and replicable assessment of adult romantic attachments, and therefore allows for a relatively reliable measure of both adult attachment anxiety and avoidance subscales. Beck and Madresh (2008) modified the ECR-R and reduced the repetitiveness of this version by eliminating various items and shortening the ECR-R to a 16-item measure. The study aimed to extend the application of the ECR-R to encompass that of the relationships formed between humans and their pets. In order to make the scale more applicable to the pet-human relationship, Beck and Madresh (2008) targeted the relationship items applicable to these interactions. By applying this modified scale to a population of dog and cat owners, Beck and Madresh (2008) concluded that this modified ECR-R was indeed a meaningful and reliable approach to investigating two types of realtionship insecurity in pet-human relationships.

The Attachment Style Questionnaire (ASQ) is a widely utilised form of attachment measurement (Karantzas et al., 2010) that utilises a 40-item measure assigned to five scales; 'confidence', 'discomfort with closeness', 'need for approval', 'preoccupation with relationships' and 'relationships as secondary' (Feeney et al., 1994). The 'confidence' scale relates to secure attachment, which may be interpreted as having a high degree of security and trust both in oneself as well as with others, and allows for the ability to undergo separations with minimal discomfort as well as to form close relationships. The remaining scales refer to different aspects of insecure attachment. For example, 'discomfort with closeness' and 'relationships as secondary' scales correspond to insecure-avoidant attachment. 'Discomfort with closeness' refers to an apprehension towards close contact with others and the maintenance of emotional distance. 'Relationships as secondary' refers to the prioritising of individual achievements over forming bonds with others, with value being placed on independence from others. The 'need for approval' and 'preoccupation with relationships' scales together represent an insecure-anxious attachment, with one's attitude towards oneself being the main focus. 'Need for approval' refers to the requirement for acceptance from others, whilst 'preoccupation with relationships' refers to the process of obtaining feelings of security and belonging by seeking out others in an exaggerated manner (Feeney et al., 1994, Kerekes et al., 2024).

The ASQ was utilised by Rehn et al. (2017) in examining the links between the AAS of the owner and the strategies used by the dog to cope with a number of challenging situations. In this study, it was found that dogs tended to utilise different strategies to cope with the challenges according to the AAS of the owner. For example, owners that were defined as more secure according to the ASQ had dogs that spent longer oriented towards the sudden visual and auditory stressors, whilst owners defined as being more anxious according to the ASQ had dogs that spent longer being oriented toward the owner during the approach of a strange-looking person, and owners that were defined as more avoidant according to the ASQ had dogs that spent longer oriented towards the owner during the appearance of the visual stressor (Rehn et al., 2017).

2.1.1.2 Behavioural measures of the dog-human relationship

A basic component of the social relationship is attachment (Topál et al., 2005). Attachment may be considered as a type of behavioural strategy which underlies the organisation of social structures and group formation, and was originally investigated and assessed in the context of human-infant attachment patterns via the Ainsworth Strange Situation Test (SST) (Topál et al., 2005). In order to assess the investment of the dog's role in the dog-human relationship, studies involving a version of the Ainsworth Strange Situation Test (SST) have been utilised (Samet et

al., 2022). By exposing the individual to a challenging situation, the attachment system is subsequently activated, which in turn allows for the support-seeking behaviour to be studied (Rehn et al., 2017). During the SST separation from the care-giver in an unfamiliar environment induces anxiety and proximity seeking, whilst subsequent reunion induces various forms of contact-seeking behaviours (Topál et al., 2005). Modifications to this form of assessment have been applied in order to investigate the dog-human relationship, with the main discrepancies being documented in proximity-seeking and behaviour at reunion (Rehn & Keeling, 2016).

The attachment profile of the owner, as determined by completion of attachment questionnaires, has been found to be associated with the response of the dog during application of the SST, and hence the dog-owner attachment bond (Siniscalchi et al., 2013). The utilisation of questionnaires designed to determine the attachment profile of the owner should therefore be combined with the behaviour of the dog during separation from and reunion with the owner in order to assess dog-human relationships. In addition, such determinations could be further enhanced and the nuances of a relationship more accurately captured by assessing and combining additional approaches, such as various physiological factors, including plasma oxytocin levels, cortisol and heart rate variability (HRV) (Rehn & Keeling, 2016).

2.1.1.3 Physiological measures of the dog-human relationship

Heart rate may be considered a crude indicator of stress, whereas HRV may be a lot more indicative of the coping strategy of an individual to various psychological or environmental stressors (Vincent & Leahy, 1997). The use of HRV provides either positive or negative emotional context (Arhant et al., 2020), which allows for the objective assessment of the autonomic balance between the sympathetic and parasympathetic nerve activity. This, in turn, allows for an objective assessment of the dog's ability to cope in particular situations (Zupan et al., 2016).

The release of oxytocin is associated with positive social and emotional states (Marshall-Pescini et al., 2019), and may be considered indicative of close bonding between dog and handler (Handlin et al., 2015). Oxytocin was in fact found to be released in dogs on reunion with the owner, and its elevation found to persist longer if the owner physically affirmed the dog upon reunion (Rehn, 2014b).

Changes in cortisol levels have been widely investigated in terms of environmental and emotional challenges (Coppola et al, 2006; Chmelikova et al., 2020), with increases in cortisol indicative of experiencing stress (Hekman et al., 2014). Buttner et al. (2015) found that the affective state of the human may have a synchronous effect on their dog; as elevations in cortisol in the handler were shown to be associated with similar elevations of cortisol in the dog during agility competition. These elevations in cortisol were found to be higher in dogs who had male handlers as compared to female handlers (Buttner et al., 2015), suggesting that

various external factors such as the gender of the handler play a role in affecting the affective state of the dog. The direction of this transmission of emotional state, whether the physiological state of the human influenced the dog, or whether the physiological state of the dog influenced the human, cannot be construed from this study.

Schöberl et al. (2015) found that cortisol release in male dogs of male owners exhibited the lowest cortisol reactivity compared to all other owner-dog gender combinations in a study that examined various factors influencing cortisol modulation in dogs during SSTs. In the same study, cortisol reactivity was found to decrease with increasing age up to 8 years of age (Schöberl et al., 2015), which may suggest that increasing age allows for increasing experience of novel situations and increasing practise in habituating and adpating to these.

Schöberl et al. (2015) also showed that the relationship between dog and owner, as defined by the Ainsworth attachment classification system, can be related to the stress response of the dog, in terms of salivary cortisol release. Following the classification of dog attachment patterns and the contexts of a play session with the owner and two versions of the SST, the study found that lower cortisol release occurred in 'securely attached' dogs during the attachment and play scenarios, whilst a higher cortisol release occurred in these dogs during the threat scenario when the owner was absent when compared to 'insecure' dogs (Schöberl et al., 2015). This suggests that 'securely attached' dogs are better able to cope with stress.

The cortisol reactivity of the dogs was also found to be directly proportional to the owner's self-reported insecure-ambivalent attachment toward the dog and their perception of the dog as a social support (Schöberl et al., 2015). Low cortisol reactivity was reported in dogs whose owners scored high in neuroticism and agreeableness, which Schöberl et al. (2015) suggest is related to the finding that these dogs approach their owners often, leading to higher proximity and the provision of a secure base that leads to a calming effect.

2.2 Factors that affect the dog-human relationship

Various factors postulated to affect attachment development and style have been reviewed (Rehn & Keeling, 2016) and investigated; including between-breed and within-breed differences (Lenkei et al, 2021), level of maternal care (Tiira & Lohi, 2015; Foyer et al, 2016), socialisation (Tiira & Lohi, 2015), the length of the dog-owner relationship (Marinelli et al., 2007) as well as the type of work performed by the dog (Mariti et al, 2013).

Whilst no statistically significant differences in attachment style could be elicited in search and rescue dogs compared to companion dogs, Mariti et al. (2013) did report a trend for increased levels of attachment in these working dogs compared to companion dogs. The role that the dog is perceived to fulfil for the owner, and

the associated quantitative and qualitative aspects of the subsequent relationship in terms of engagement, may have significant impact on the dog-human relationship. For example, Meyer and Forkman (2014) suggest that the relationship can be negatively correlated with owners defining their dog as companion-only, compared to those who partake in training activities such as agility and working dog trials. Unfortunately, this study did not explore this relationship further. Topál et al. (1997) suggest that dogs with stronger and more dependent owner attachments perform less well at problem-solving, which may play a role in the level of independent decision-making utilised or required in various activity roles utilised respectively as companion-only, agility or protection dogs. Given the findings that the amount of time spent as a dyad and the level of owner engagement has a critical effect on the dog-human relationship (Gácsi et al., 2001; Payne et al., 2015), and that regular owner interaction results in increased proximity-seeking behaviour in dogs upon reunion with their owner (Rehn et al., 2014a) it is highly pertinent to further explore the effects of the types of activity with which owners participate in with their dogs in order to elucidate any subsequent effects on their relationships.

2.2.1 Age and length of the dog-human relationship

In a study that investigated the effect of age of Beagles on eye contact seeking behaviour during an unsolvable task, older dogs were found to score higher (Persson et al., 2015). It was postulated that older dogs had had more experience interacting and communicating with humans compared to younger dogs (Perssson et al., 2015), a finding similar to that of Passalacqua et al. (2011). Barrera et al. (2011) suggested that utilising human-directed gaze as a form of communication with a human is influenced by the exposure to and utilisation of associative learning as part of the dog-human experience. This association was postulated given the finding that human-directed gaze was used more during an unsolvable task by pet dogs compared to shelter dogs that had all been kept at a shelter for at least 2 years, and hence exposed to only limited human interaction (Barrera et al., 2011). The influence of the surrounding environment in terms of the number of opportunities made available to learn various communicative interactions, as well as the duration to which the dog is exposed to this environment, should therefore be considered influential in shaping the subsequent interaction between dog and human.

Bentosela et al. (2008) were able to show a difference in human-directed gaze in pet dogs compared to Schutzhund trained dogs. The increased eye contact utilised by the Schutzhund trained dogs may be indicative of the development of various interactions as well as the relationship between dog and human during training (Bentosela et al., 2008), which suggests that the activity undertaken together may have influence over the communication and interaction between dog and human.

In comparison, Marshall-Pescini et al. (2008) found that untrained dogs sought more eye contact compared to highly trained dogs. This suggests that the interaction between dog and human is reliant on the level of training up to a certain point, after which the skills gained during training and the practising of more advanced activities allows the dog a degree of inependence from the owner as it seeks to solve tasks without assistance.

The influence of the reaction of the human to the development of this tendency to increasingly seek eye contact in dogs as a factor of age should however not be overestimated, given that the visual status of the human appeared to not have any effect on the utilisation of human-directed gaze in pet dogs versus guide dogs for the blind (Gaunet, 2010).

2.2.2 Sex

Persson et al. (2015) were able to show that female Beagles sought more physical contact from the experimenter and scored higher in human-directed social behaviours compared to male Beagles, when faced with an unsolvable task. This study utilised dogs from a highly standardised population, which in turn allowed for a more standardised interpretation of the results (Persson et al., 2015).

The potential effect of the gender of the owner should also not be dismissed when considering the interations between dogs and their owners. For example, Prato-Previde et al. (2006) found that women tended to show a greater disposition towards utilising language as a relational tool, as well as using motherese during vocal communication, when compared to men. This difference was replicated by Shih et al. (2020), who also found that male dogs exhibited increased leash tension and pulling behaviour whilst being walked when compared to female dogs, and that interaction with men resulted in increased displays of stress related behaviours (such as lip-licking and lowered tail carriage) when compared to women. For this study, Shih et al. (2020) utilised male and female dogs that had all been gonadectomised. All the dogs were sourced from a shelter, and their histories as well as the timings of their gonadectomies would naturally all have shown great variation. Despite this, significant differences between both human gender and canine sex were elucidated, which may speak to the potentially large impact that sex might have on forming and maintaining relationships.

2.2.3 Development of breeds for specific uses

Mitochondrial DNA testing suggest that the domestication of the dog began some 40,000 years ago (Savolainen et al., 2002). Since then a large variety of specific dog types and breeds, each associated with variations on morphology and

behavioural traits, have been developed as a result of extended periods of artificial selection (Svartberg, 2006). In fact, changes in behaviour may be considered to represent the most significant phenotypical trait brought about by the domestication of the dog (Miklósi & Topál, 2013).

The selective breeding of dogs to fulfil various roles is widely practised (Svartberg & Forkman, 2002). For example, working dogs are bred for particular purposes; including for protection work, substance detection, search and rescue, assistance of the blind or handicapped, as well as for various hunting and herding roles. (Svartberg & Forkman, 2002). Svartberg and Forkman (2002) suggest that the underlying personality traits evident in dogs, namely 'playfulness', 'curiosity/fearfulness', 'chase-proneness', 'sociability' and 'aggressiveness', not only allow for the prediction of behaviour of the individual dog but should also be used in the selection of individual dogs for breeding suitable dogs for specific tasks. A fairly widespread practice of categorising breeds according to the nature of the task with which certain breeds are commonly associated with is utilised by various national and international kennel club organisations (Mehrkam & Wynne, 2014). Whilst this practice may lead to the assumption that certain breeds have been selected for exhibiting behavioural traits of use in certain tasks, it should be noted that a considerable overlap between breed groupings and genetic clusters was found by Parker and Ostrander (2005).

Pongrácz et al. (2020) hypothesized that the selection for particular interactive ability and level of working intimacy in different breeds would be of significance in the response of these dogs to separation from their handler. It was shown that breeds developed for the purposes of co-operative working tasks reacted more strongly to separation from their owner, in terms of stress related behaviours such as barking and whining, and in their perceived intention to follow or find their owner (Pongrácz et al., 2020). Furthermore, dog breeds that were developed to work in close co-operation with their handler and maintain this contact during their work have been found to more successfully follow human pointing gestures (Gácsi et al., 2009), suggesting that the relationship between dog and handler must also be of consequence.

Selective breeding for particular behavioural profiles in specific breeds in order to allow these dogs to better meet particular requirements such as guarding or herding (Lord et al., 2014) may also have an impact on the relationship. If certain behavioural or training needs are not provided the opportunity for adequate expression, it is possible that the development of mis-directed or problematic behaviours, for example, may occur (Olby, 2017).

The subsequent selection, whether intended or not, for various behavioural traits may also be affected by the influences of localised preferences within a breed, for example the selection for working- versus show-type dogs (Miklósi & Topál, 2013). For example, such influences may vary according to geography; for

example, farming communities may tend towards selecting for individuals that are better suited to working environments, whilst urban communities may favour more companion-like attributes or a more docile temperament as a way of better suiting the surrounding environment.

2.2.4 Effect of breed-specific uses and training activities on the dog-human relationship

In order to train and partake in various activities, communication between the handler/owner and the dog needs to occur in the form of sending and interpreting clear signals (Braem & Mills, 2010). Different activities may however be characterised by specific sets of traits and requirements that are essential to grasp and excel at in order to achieve success or that may need to be further developed during the process of training for specific activities. Furthermore, given that specific breeds of dog are genetically selected for the purposes of exhibiting particular phenotypic characteristics (Ostrander & Wayne, 2005), such as specific working behaviours (Maejima et al, 2007; Fadel et al, 2016), it might be extrapolated that dogs may benefit from expressing certain behaviours and personality traits. The tendency for the Border collie to be commonly utilised for herding (Ridgway, 2021) and agility trials (Inkilä et al, 2022), whilst the tendency for the Malinois and German shepherd to be more commonly utilised as working police dogs (Brady et al, 2018) may signify a human tendency to follow the norm (Bar-On & Lamm, 2023), but may also signify a less well-defined appropriation of certain breeds to certain tasks.

Whilst all forms of activity require a degree of learning capacity and ability to focus on and co-ordinate with the owner (Zink, 2013), the nature of various activities ultimately differ and hence place different demands on the dogs and owners. For example, the requirements to work independently or in close collaboration with the owner differ between different forms of activity (Zink, 2013). Furthermore, the traits for which certain breeds have been selected for, such as close co-operation with humans and the ability to utilise human pointing gestures in sheepdogs for example, will differ between breeds (Gácsi et al, 2009), and hence have an effect on the potential benefit experienced as a result.

Dogs that spent more time with their owner engaged in activities together were found to be more obedient and exhibited a lower expression of behaviours indicative of impaired welfare (Lefebvre et al, 2007), whilst search performance in working dogs was shown to be more precise and faster in dogs deemed to have a higher quality relationship with the owner in terms of increased levels of play over and above the time spent working together (Hoummady et al, 2016). Dogs engaged in activities together with their owners may therefore develop a more secure

attachment to their owners, related to the fact that they are allowed to express their behavioural needs and collaborate with their owners on a regular basis.

The significance of training and attributing a dog to a specific function was indeed found to play a role in the perceived calmness of a dog (Kubinyi et al., 2009). This study, based on an online questionnaire, also found that the number of people in the household was positively correlated with calmness, although this relationship was only found in female dogs, and also related to lower trainability. Calmness was also found to increase the longer the number of hours that the owner and dog spent together, whilst frequent playing together was found to be related to higher perceived trainability (Kubinyi et al., 2009).

3. Method

The study consisted of two different sections; a larger questionnaire-based data collection (‘Part one’) and a subsequent smaller questionnaire- and behavioural-based data collection (‘Part two’). Part two may be regarded as an exploratory pilot study with the main function being a learning exercise, due to the small sample size utilised. All dogs and owners that participated in any part of this study were recruited through advertisement, and owner participation was voluntary. The owners were directed to information regarding the SLU policy on the handling and storage of personal information, and asked to consent to this prior to participation.

3.1 Subjects

3.1.1 Subjects: Part one

A wide advertisement for recruitment of participants took place via social media, contact with various breed and training clubs in Sweden via email, Facebook, flyer advertisement at Stockholm Hundmässan 2023, and via personal contacts. Potential participants were not informed of the details with regards the aims of the study, but rather informed that the study aimed to explore dog-owner relationships in relation to what the owners do together with their dogs. The potential participants were also informed of the SLU policy regarding the handling of any personal information collected; General Data Protection Regulation (GDPR), and then asked to complete the questionnaire for Part one of the study. A total of 1775 owners completed the questionnaire for part one of the study.

Participants were required to be 18 years or older and to have lived with their dog for a minimum of 1 year. In the event of a multi-dog household, participants were asked to choose one dog on which to base their answers. No guidance was given as to how to choose which dog to focus on. A minimum age of 1 year was applied to the dog in an attempt to allow for time and opportunity to establish a relationship, and possibly develop specific attachment patterns, between dog and owner.

3.1.2 Subjects: Part two

Part two of the study aimed to select two sub-categories from the participants of Part one of this study (consisting of a companion-only group and an activity-based group) in order to compare them with regards to their perceptions on their relationships with their dog and the dog behaviours exhibited during a Separation- and reunion test (SRT). The definition, and inclusion, of dyads in the activity-based group is summarised under the 'Data collection: Part one' section.

A sub-sample (N=14) of the owners that completed the questionnaire in Part one of the study was therefore selected based on a set of inclusion criteria, and subsequently asked to complete the ASQ and ECR-R questionnaires (both online via Netigate®) as well as to attend an SRT with their dog.

The inclusion criteria for this subsample was based on the ability of the owners to travel to a central study location in Uppsala, where Part two of the study took place, as well as owners that completed the questionnaire in Part one that reported partaking in various training activities with their dogs in order to allow for the comparison of statistically viable group numbers. Inclusion criteria was also based on the breed of dog; with dogs defined as companion-only being matched to dogs of the same or similar breed, age and sex as closely as possible in order to reduce potential confounding factors in the study design.

As the SRT was carried out using privately-owned dogs, and deemed non-invasive and did not pose any physical or mental harm to the dogs, an ethical permit was not required; as stipulated by the The Swedish Animal Welfare Act (7 chap. 2 § and 9§ 2018:1192) (Sveriges Riksdag, 2024). All participants of Part two of the study were however informed of their ability to withdraw their dog from any part of the procedure in the event that they were not comfortable proceeding, such as if they felt the procedure was too stressful for the dog. All owners provided informed written consent regarding the use and handling of their personal information, as stipulated under the General Data Protection Regulation (GDPR) of the European Union (EU); Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 (European Union, 2024).

The sub-sample consisted of owners of dogs participating in one or more of the following areas of training activities; obedience, rally, agility, nosework, search, and weightpull, as well as owners of dogs kept solely as companion dogs. Please refer to the 'Data collection: Part one' section for details with regards to the definition of participation within an activity.

The following breeds of dog were subsequently included in Part two of the study; Labrador retriever, Finsk lapphund, mixed breed, Miniature schnuazer, Tibetan terrier, Kromfohrländer, Terrier Brasiliero, and Jack Russell terrier. Table 1 summarises the characteristics of the owners and their dogs.

Table 1. Characteristics of paired owner and dog matches included in Part two of the study.

Companion group					Activity group				
Owner Gender	Owner Age (years)	Dog Breed	Dog Sex	Dog Age (years, months)	Owner Gender	Owner Age (years)	Dog Breed	Dog Sex	Dog Age (years, months)
F	46	Labrador retriever	F	2y, 6m	F	58	Labrador reteriever	F	5y, 10m
M	33	Finsk lapphund	M	2y, 0m	F	27	Finsk lapphund	F	3y, 0m
F	31	Mixed breed	MC	2y, 10m	F	67	Mixed breed	MC	2y, 3m
F	75	Miniature schnauzer	F	1y, 3m	F	34	Miniature schnauzer	F	1y, 8m
F	76	Tibetan terrier	F	1y, 7m	F	72	Kromfohrländer	F	8y, 0m
F	n/a	Terrier Brasiliero	MC	11y, 11m	F	34	Jack Russell terrier	M	5y, 10m
M	51	Jack Russell terrier	F	4y, 10m	F	20	Jack Russell terrier	F	5y, 9m

3.2 Data collection

Data was collected during the period December 2023 - March 2024, and consisted of two sections: ‘Part one’ and ‘Part two’, as outlined below.

3.2.1 Data collection: Part one

The questionnaire utilised in Part one of the study consisted of a general section that aimed to collect information with regards the dog and owner (breed, age, sex), as well as detailed information regarding their involvement with formal dog-related activities. Participants were asked to indicate whether they had experience or were currently participating in any of the activities with their dog listed in the questionnaire. These activities were drawn from the courses and competitions officially recognised by the Swedish Kennel Club and listed on their website (SKK, 2024), and were as follows; working/utility (obedience & tracking), working/utility

(obedience & search), working/utility (obedience & unaccompanied tracking), working/utility (obedience & patrol), working/utility (obedience & schutzhund Nordic), mondioring, search and rescue, schutzhund (protection, tracking, obedience), endurance, sledding, weightpull, obedience, rally, special search, nosework, agility, freestyle/heelwork, herding, hunting (retrieving), hunting (driving), hunting (wild boar), hunting (underground), assistance dog, show, and other (referring to any other formally organised activity not included in the above list). A further option for owners to indicate if their dog was primarily a companion with whom the owner does not undertake any training except for everyday socialisation or play was also included. Owners who selected this Companion-only option were asked not to select this option if they had any previous experience with their dog with any of the activities listed above.

Questions that were sourced from the Monash Dog Owner Relationship Scale (MDORS) were added to this questionnaire (translated to Swedish) (Dwyer et al., 2006) in order to collect information with regards measures of the relationship quality from the owner's point of view. The MDORS questions were combined with the general questionnaire in order to improve the experience of the participant, who were thus only required to complete a single questionnaire, and hence potentially improve the rate of questionnaire completion. The MDORS questions were categorised according to dog-human interaction, perceived emotional closeness and perceived costs of the relationship. These three categories were thereafter used as subscales during analysis.

The subscales were assessed according to the standardised MDORS process; utilising a Likert scale (Willits et al., 2016). The Likert scale consists of a number of statements or questions followed by a number of answer statements. Respondents were asked to choose one answer that best corresponds to their opinion or feeling with regards the statement. Each response was scored from one to five, with negative items reverse-coded (Willits et al., 2016). Each of the subscales were scored separately (van Herwijnen et al., 2018), allowing for the separate assessment of each of the three subscales for each of the respondents.

In order to complete the questionnaires, the participants were directed to an online link via Netigate© (Netigate, 2023).

3.2.2 Data collection: Part two

Questionnaires

Selection of a sub-sample of participants to participate in Part two of the study was undertaken in a rolling manner as completed replies of the general qustionnaire in Part two were registered. Due to the relatively low numbers of dyads who reported companion-only dogs, focus was placed on recruting companion-only dogs to

partake in the behavioural study. Dyads that reported dogs partaking in activity were thereafter selected based on an equal a match as possible in terms of dog breed, age and gender, and where possible the age and gender of the owners. The selected sub-sample of owners were asked to complete a further two questionnaires (see below). As in Part one, the owners were directed to an online link via Netigate© (Netigate, 2023) in order to complete these questionnaires.

(1) Attachment style questionnaire (ASQ) (Feeney et al., 1994)
(2) Experiences in Close Relationships - Revised (ECR-R) (Beck & Madresh, 2008)

These questionnaires were utilised in order to determine the adult attachment style of the owners, as an indirect measure of their care-giving. The ASQ consisted of 42 questions relating to aspects of how the owner values him/herself, other people and their relationships. The questions had been translated to Swedish according to Tengström and Håkanson (1996). The ECR-R consisted of 16 questions relating to the dog avoidance and dog anxiety scales, as determined by Beck and Madresh (2008). The translation of these questions into Swedish was undertaken by the author, with input from Strand and Ståhl (2008). There was insufficient time to undertake a back-translation.

Separation- and reunion test (SRT)

The selected sub-sample of owners also participated in a separation- and reunion test (SRT) (MacKenzie Cardy, 2022) with their dogs.

The SRT testing area consisted of two separate rooms; Room 1 in which the dog was recorded, and Room 2 in which the owner and the author remained during the separation period.

During data collection the owner and author were unfortunately unable to visually monitor the dog, but were able to hear the dog at all times. Data collection would have been halted immediately and the dog and owner reunited should the dog have been deemed by either the owner or the author to be in any form of distress.

Figure 1 illustrates the design of Room 1, in which the separation and reunion phases of the SRT were recorded.

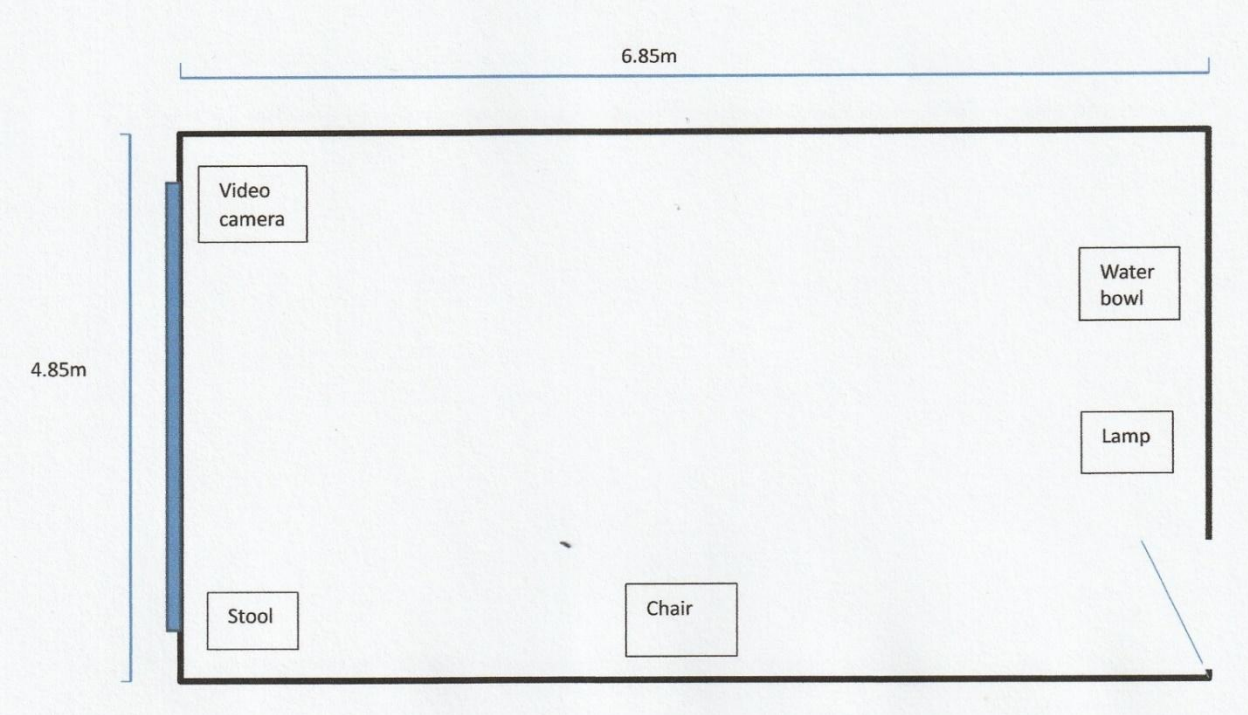

Figure 1. Measurements and fittings of Room 1, in which the departure, separation and reunion phases of the SRT were recorded.

Behavioural Assessment Procedure

The owner was instructed to lead the dog to Room 1, which was unfamiliar to both owner and dog. Once comfortable to leave their dog, the owner proceeded to leave their dog in Room 1 behind a closed door. The owner then joined the author in Room 2 for a period of 3 minutes, during which time minimal sounds or other distractions were made. Following this period of separation, the owner returned to Room 1 to be reunited with their dog. This reunion period lasted a further 6 minutes, during which time the owner and dog were free to interact according to their own choice. No instructions or guidance was provided to the owner with regards their interaction during this reunion phase.

The behaviour of the dyad during this entire period (total of 9 minutes) was documented by video recording, using one GoPro HERO9 Action Camera whose view covered the entire room, except for approximaely 1.0m in the proximate corners of the room.

Behavioural Analyses

The video recordings were analysed using the observation software Interact (Mangold, 2023). The behaviours exhibited by the dog prior to, during and after the

separation phase were observed and recorded according to an ethogram (Table 2), utilising instantaneous (every 5 seconds), continuous or 1/0 sampling (every 5 seconds). Three phases were identified within each video recording; namely author departure, owner separation (time interval that follows the interval in which the owner shuts the door when leaving the dog), and owner reunion (time interval in which the door opens and owner returns).

Behavioural observations were thereafter analysed using the Mann Whitney U test in order to investigate any differences between the Companion group and Activity group in all three of these phases.

Table 2. Ethogram utilised in the observation and analysis of video recordings obtained as part of the SRT.

Behaviour	Definition
Instantaneous sampling (5s interval)	
Lying alert	Dog is recumbent, head not in contact with the floor
Lying resting	Dog is recumbent; the head is in contact with the floor (includes lying on its back and being petted by owner)
Sitting	Dog is in sitting position, with the thoracic limbs extended and at least one of the pelvic limbs flexed
Standing	Dog is in standing position; either all four paws in contact with the floor or paws of both pelvic limbs in contact with the floor (with thoracic limbs placed on owner or other object)
Walking	Dog is moving around the room at a regular pace by lifting and setting down each foot in turn
Running	Dog is moving around the room at a pace faster than walking; includes trotting, bounding, galloping
Proximity to door	Dog has at least two paws in contact with the mat placed at the door
Proximity to owner	Dog is within one arm's length of the owner
Proximity to chair	Dog is within approximately 5cm of the chair
Attention towards owner	Dog has its nose oriented towards the owner
Attention towards door	Dog has its nose oriented towards the door

Continuous sampling	
Lip-licking	Dog manipulates tongue in order to lick snout or lip, and tongue is visible
One-zero sampling (5s interval)	
Exploring	Dog moves around the room with intent; includes sniffing, looking at or otherwise investigating objects in the room (except for owner or door)
Grooming	Dog is licking, chewing, scratching etc. at any part of its body
Drinking	Dog is lapping water from the water bowl
Panting	Dog exhibits an increased frequency of inhalation and exhalation via its open mouth; includes the characteristic sound produced during panting
Tail-wagging	Dog exhibits lateral movement of the tail; includes any velocity of wagging and any dorso-ventral orientation of the tail. Excludes positioning of tail in breeds in which the tail is held in an upright position.
Yawning	Dog extends its mouth widely and simultaneously inhales and closes eyes
Barking	Dog makes sharp, explosive sound
Whining	Dog makes a high-pitched cry or sound
Howling	Dog makes a drawn-out wail
Growling	Dog makes a low, guttural sound
Other vocalisation-dog	Dog produces a vocalisation that cannot be defined by Barking, Whining, Howling or Growling
Body stretching	Dog deliberately extends a part of or its whole body
Body shaking	Dog shakes any part of or its whole body from side to side
Door physical contact	Dog makes physical contact with the door (<5cm proximity); includes any part of the body and includes scratching at door with paws
Interaction - toy	Dog has toy in mouth, dog has snout within 5cm of toy, dog moves with intent towards toy with any part of body, or manipulates toy in any way
Dog physical contact	Dog initiates any form of physical contact directed towards the owner or maintains the initiated physical contact with the owner
Owner physical contact	Owner initiates any form of physical contact directed towards the dog or maintains the initiated physical contact with the dog
Owner verbal contact	Owner makes any form of vocalisation, including talking, murmuring etc

The ethogram was developed from an ethogram utilised in a previous SRT study (MacKenzie Cardy, 2022) as well as from observation of the video recordings, and related to behaviours associated with pertinent aspects of attachment theory.

3.3 Statistical analyses

3.3.1 Statistical analyses: Part one

All data were initially entered into a computer spreadsheet (Excel; Microsoft) and further processed by filtering in order to remove respondents that did not complete the MDORS section of the questionnaire, as well as grouping respondents according to the level of activity that they reported. In this way, the remaining respondents were classified into one of three groups; group 1 (dogs classified as companion-only), group 2 (dogs classified as undertaking less than 5 hours/week of training within one or more activities) or group 3 (dogs classified as undertaking more than 5 hours/week of training within one or more activities). The approach to this grouping did not differentiate between dyads that spent their total time on a specific activity versus dyads that spent less time on individual activities but were involved in multiple activities. Values for the three MDORS-subscales were then generated for each respondent utilising a standardised MDORS formulation, according to the protocol established by Dwyer et al. (2006). Descriptive statistics were also generated from the resulting dataset, with breeds of dogs classified according to the Federation Cynologique Internationale (FCI) (Group 1: Sheepdogs and Cattledogs, Group 2: Pinscher and Schnauzer, Group 3: Terriers, Group 4: Dachshunds, Group 5: Spitz and primitive types, Group 6: Scent hounds and related breeds, Group 7: Pointing dogs, Group 8: Retrievers, Flushing dogs, Water dogs, Group 9: Companion and Toy dogs, Group 10: Sighthounds (FCI, 2024). An additional group (Group 11: Other) was added and included all crossbreeds and breeds not officially recognised by the FCI.

Further statistical testing of the data was then undertaken in Minitab®. The MDORS subscale scores, as generated according to the owner responses following the application of standardised MDORS formulae (Dwyer et al., 2006), were analysed using the one-way ANOVA with Tukey pairwise comparison in order to assess the relationship according to the activity level of the dyad and the three MDORS-subscale values generated. The interpretation of the MDORS subscales were such that lower values for the DOI and EMO subscales indicated a closer/more positive perception of the dog-human relationship, whilst higher values for the COST subscale indicated a more positive perception of the dog-human relationship. The three groups of dyads as based on their reported companionship/activity levels represented the independent variable, whilst the subscale scores represented the dependent variables. The investigation of co-variables, such as sex of the dog or

gender of the owner, number of dogs in the household, presence/absence of children or partners, previous experience with keeping dogs, previous experience with training dogs, whether the dog was bought from a breeder or adopted in adulthood, and initial primary reason for obtaining dog etc., was not included in the model at this stage. The main reason for this was a restriction of time on the project. Other reasons for this included that we did not hypothesize, based on previous literature, that these covariables would affect the owner's view of the relationship. Whilst the data collection was broad, the research questions were limited for this particular student project to only include a few main variables; the activity level of the dyad and the owner's view of the relationship in order to remain within reasonable time frames and limitations. Inclusion of co-variables, such as those mentioned above, may be of interest to include in future analyses.

The following statistical model was utilised for the ANOVA:

$$y_{ij} = \mu + \alpha_j + e_{ij} \quad (1)$$

where:
y_{ij} denotes the MDORS subscale score for person j, μ is the overall mean, α is the fixed effect of companionship/activity level i (i = companionship only, <5 hrs training per week, >5hrs training per week) and e_{ij} is the random residual effect related to observation y_{ij} ~ND (0, Iσ^2_e) where σ^2_e is the residual variance.

3.3.2 Statistical analyses: Part two

The ASQ and ECR-R subscales were calculated according to standardised formulae, and thereafter analysed using the Two-sample T-test in order to determine whether any differences could be found between the Companion and Activity groups in terms of the relevant subscales.

Descriptive statistics was performed on the behavioural data in order to illustrate occurrences of specific behaviours during the each of the departure, separation and reunion phases, according to Companion and Activity group. The behavioural data was thereafter further analysed using the Mann Whitney U test to determine whether any significant differences could be detected between the Companion and Activity groups in relation to the respective behaviours during each of the departure, separation and reunion phases. In order to determine the significance of the results, the p-values were not adjusted for ties, in order to allow for a more conservative interpretation of the results (Minitab®, 2024).

4. Results

4.1 Results: Part one

A total of 2287 questionnaires were returned. Following the filtering of these responses using the inclusion criteria of completion of all the MDORS questions, a total of 1775 completed and valid responses were utilised for further anlaysis (representing a 77.6% return rate). Table 3 summarises the subsequent grouping of the 1775 dyads, according to their level of activity.

Table 3. Number of dyads filtered according to level of activity, where Group 1: companion-only, Group 2: less than 5 hours/week activity, and Group 3: more than 5 hours/week activity.

Group	Total number of dyads	Percentage of dyads (%)
(1) (Companion-only)	154	8.7
(2) (<5 hours/week training)	288	16.2
(3) (>5 hours/week training)	1333	75.1

The dogs included in Part one of the study had all reached a minimum of 1 year of age (mean 4.8 ± SD 2.9 years old). The distribution of the reported sex and breed groupings of the dogs are illustrated in Figures 2 and 3 below.

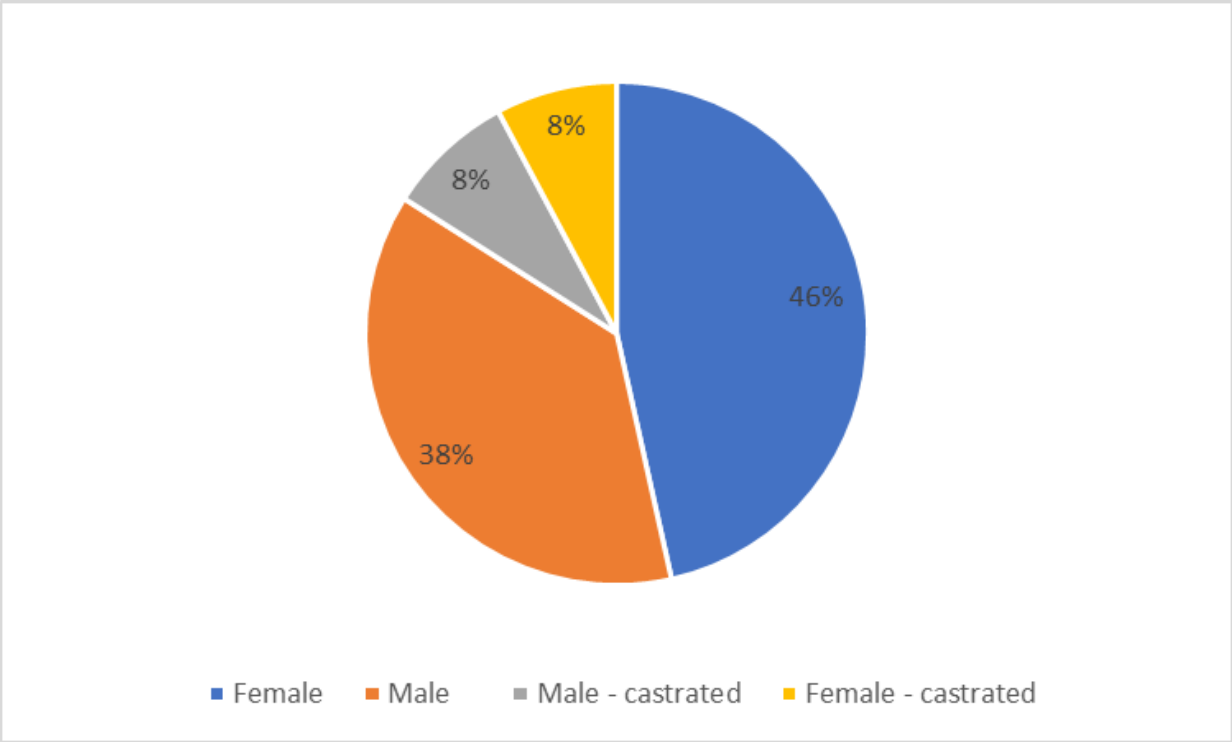

Figure 2. Distribution of reported sex of dogs included in Part one of the study.

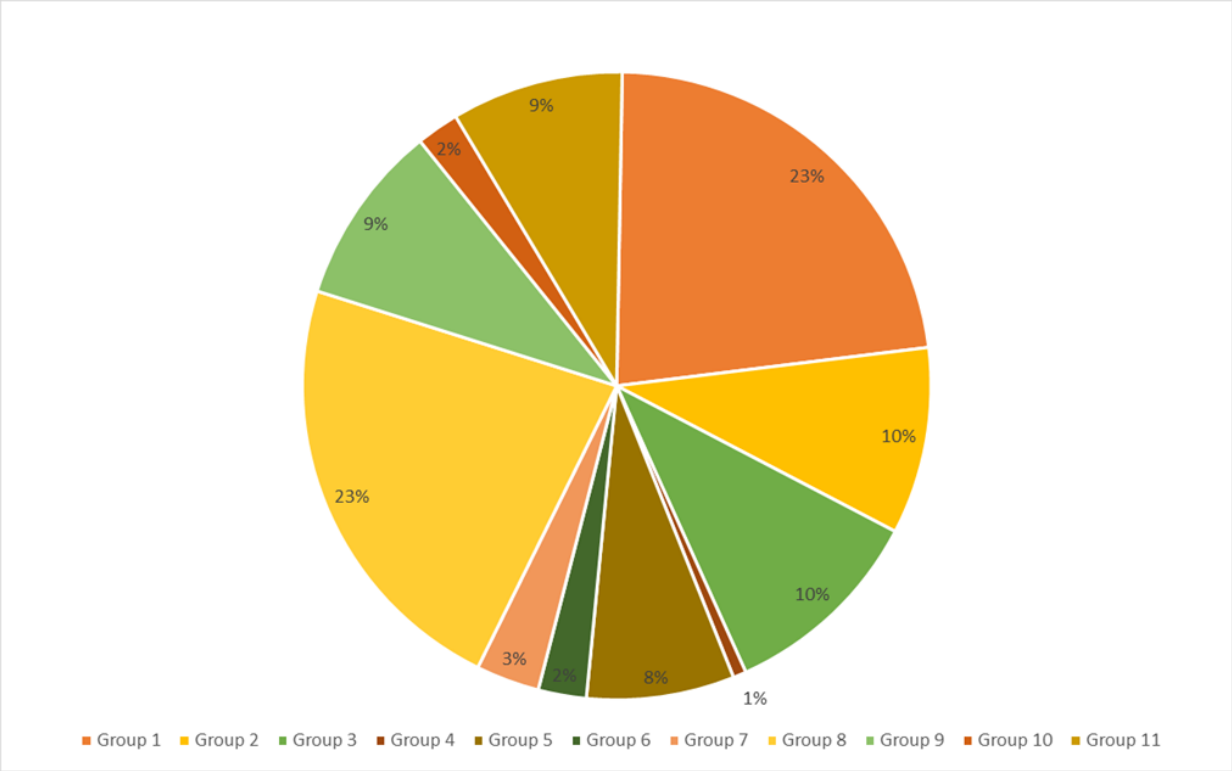

Figure 3. Distribution of reported breed groups of dogs included in Part one of the study. (Group 1: Sheepdogs and Cattledogs, Group 2: Pinscher and Schnauzer, Group 3: Terriers, Group 4: Dachshunds, Group 5: Spitz and primitive types, Group

6: Scent hounds and related breeds, Group 7: Pointing dogs, Group 8: Retrievers, Flushing dogs, Water dogs, Group 9: Companion and Toy dogs, Group 10: Sighthounds, Group 11: Other).

The owners that participated in Part one of the study were found to have a mean age of 51.3 ± 14.8 years, with a strong bias towards female respondents, as illustrated below in Figure 4.

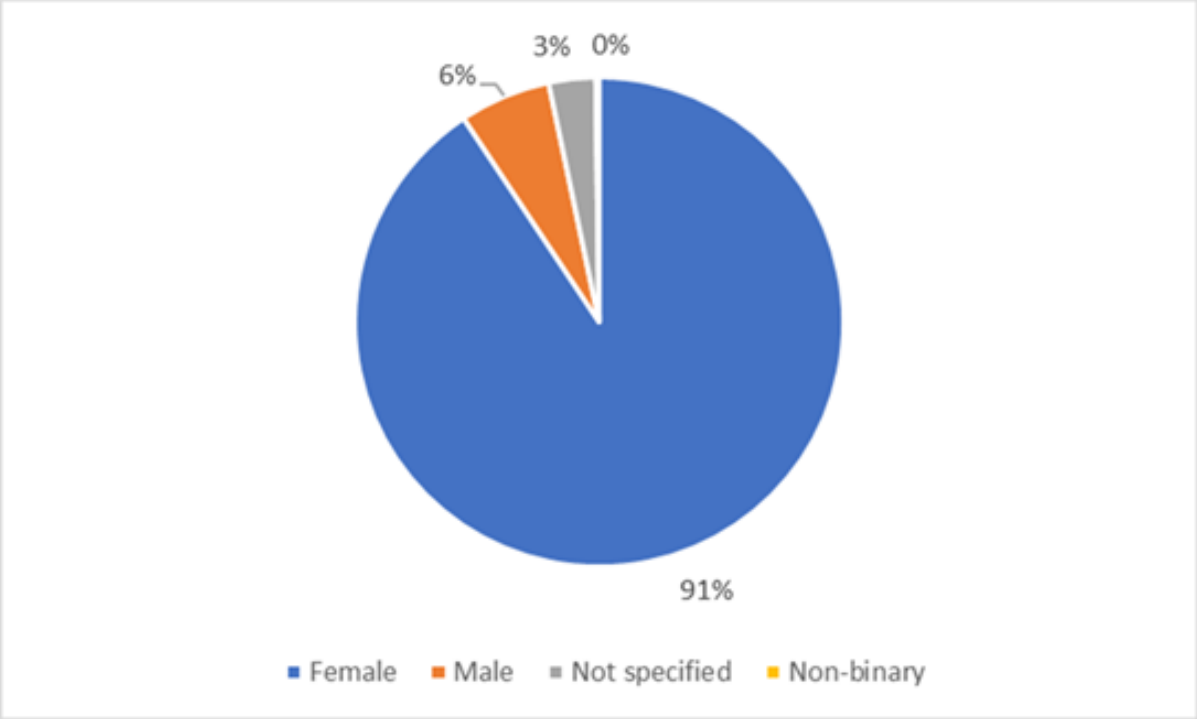

Figure 4. Distribution of reported gender of owners participating in Part one of the study.

With regards to the Dog-Owner Interaction (DOI) subscale of the MDORS, no significant difference (F-value =2.45, p = 0.086) between any of the three groups (Companion-only, >5hours/week activity, >5hours/week activity) was found.

With regards to the Emotional Closeness (EMO) subscale of the MDORS, a significant difference (F-value = 3.30, p = 0.037) between group 2 (>5hours/week activity) and group 3 (>5hours/week activity) was found.

With regards to the Perceived Costs (COST) subscale of the MDORS, a significant difference (F-value = 4.91, p = 0.007) between group 1 (Companion-only) and group 3 (>5hours/week activity) was found.

Table 4 below summarises the mean MDORS subscale scores for each group, and indicates the significant differences obtained.

Table 4. Summary of mean MDORS subscale scores ± SD for the Companion group, <5 hours/week Activity group, and >5 hours/week Activity group. Significant differences ($p<0.05$) are indicated by (A) and (B) in the Emotional Closeness (EMO) subscale score, and (A) and (B) in the Perceived Costs (COST) subscale score. Groups that did not exhibit a signifciant difference are indicated by (AB). Note: DOI and EMO were scored such that a lower value indicates a more positive perception of the relationship, and COST was scored such that a higher value indicates a more positive perception of the relationship.

Group	Dog-owner Interaction (DOI) subscale score (mean ± SD)	Emotional Closeness (EMO) subscale score (mean ± SD)	Perceived Costs (COST) subscale score (mean ± SD)
(1) Companion group	1.99 ± 0.47 [AB]	1.97 ± 0.58 [AB]	4.07 ± 0.71 [A]
(2) <5 hours/week Activity group	1.96 ± 0.43 [AB]	1.99 ± 0.60 [A]	4.16 ± 0.61 [AB]
(3) >5 hours/week Activity group	1.92 ± 0.42 [AB]	1.90 ± 0.56 [B]	4.22 ± 0.57 [B]

4.2 Results: Part two

4.2.1 ASQ and ECR-R Questionnaires

With regards to the ASQ, none of the 5 subscales were found to differ significantly between the two groups (Companion group and Activity group). With regards to the ECR-R, neither of the 2 subscales were found to differ significantly between the two groups (Companion group and Activity group). Table 4 summarises the mean values for each of the subscales of the ASQ, and Table 5 summarises the mean values for the subscales of the ECR-R.

Table 5. Summary of mean ASQ subscale scores ± SD for the Companion group and Activity group. No significant differences found between groups.

Subscale	Attachment style	Companion group Mean ± SD	Activity group Mean ± SD
Confidence	Secure	4.61 ± 0.74	4.29 ± 0.98
Discomfort with closeness	Avoidant	3.54 ± 0.85	3.60 ± 1.20

Relationships as secondary	Avoidant	2.45 ± 0.49	2.49 ± 0.82
Need for approval	Anxious	2.14 ± 0.67	2.20 ± 0.80
Preoccupation with relationships	Anxious	2.79 ± 0.24	2.57 ± 0.82

Table 6. Summary of mean ECR-R subscale scores ± SD for the Companion group and Activity group. No significant differences found between groups.

Subscale	Companion group Mean ± SD	Activity group Mean ± SD
Avoidance	2.20 ± 0.86	2.13 ± 0.47
Anxiety	2.09 ± 0.64	1.96 ± 0.52

4.2.2 Behavioural observations during the SRT

There were no significant differences between the Companion group and Activity group with regards to any of the behaviours observed during all three phases of the SRT; departure (Figure 6), separation (Figure 7) and reunion (Figure 8). Trends were found to occur with regards to two of the behaviours; Activity-group dogs showed more tail-wagging ($p=0.097$) in the departure phase, and Companion-only group dogs showed more attention directed at the door ($p=0.074$) in the separation phase.

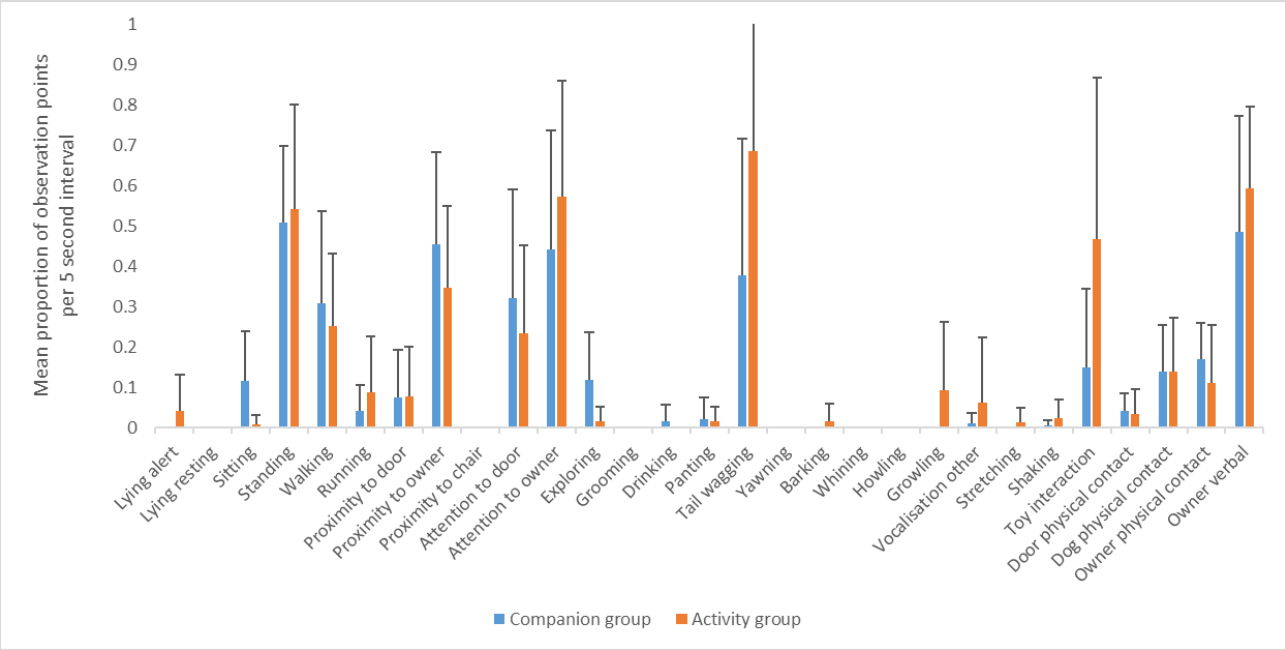

Figure 5. Dog behaviour comparison at the Departure phase of the SRT, with regards to the mean (±SD) number of observation points/5 second interval. For illustrative purposes, only the positive component of the error bars is shown.

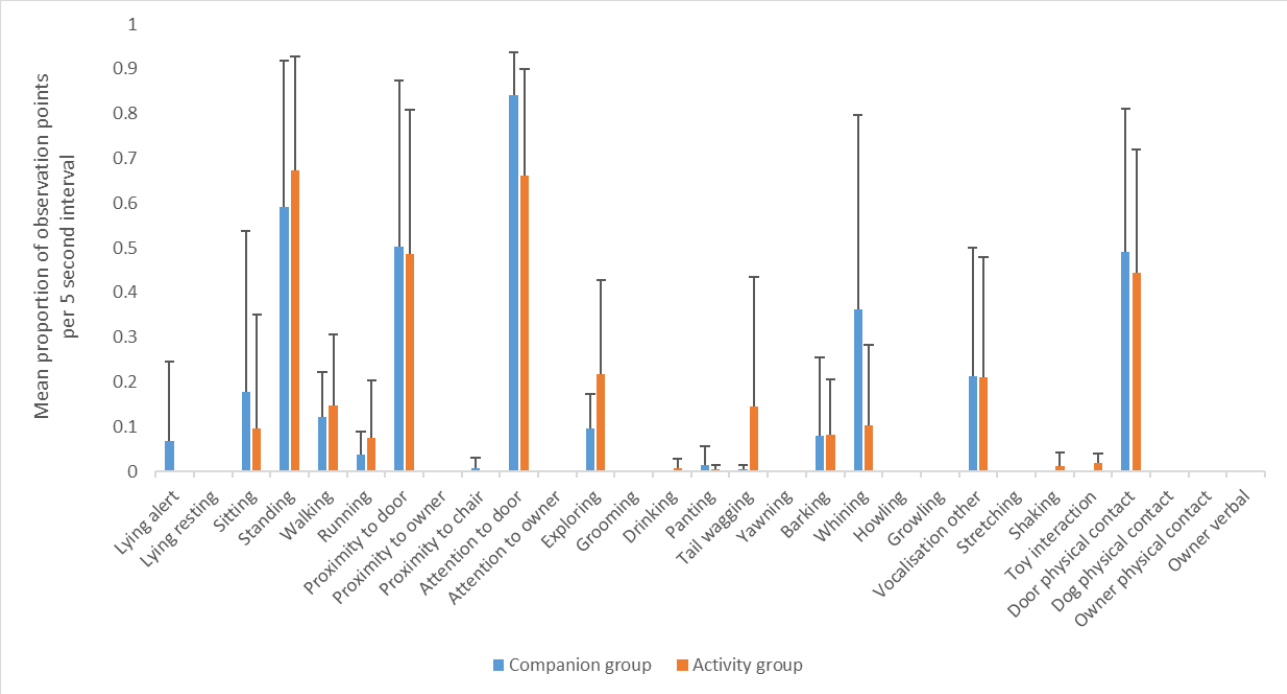

Figure 6. Dog behaviour comparison at the Separation phase of the SRT, with regards to the mean (±SD) number of observation points/5 second interval. For illustrative purposes, only the positive component of the error bars is shown.

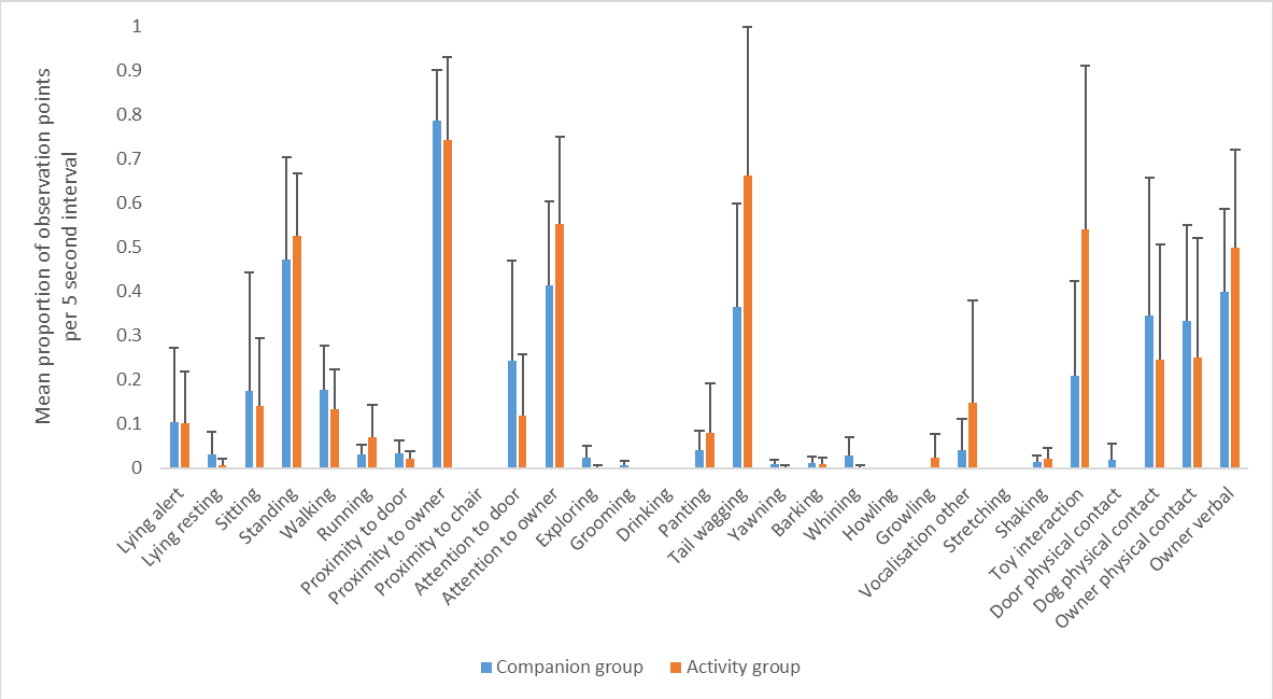

Figure 7. Dog behaviour comparison at the Reunion phase of the SRT, with regards to the mean (±SD) number of observation points/5 second interval. For illustrative purposes, only the positive component of the error bars is shown.

5. Discussion

5.1 Discussion: Part one

5.1.1 Method and sample

The study was based on a convenience sample, and as such, inherently included sampling bias (Golzar et al., 2022). Whilst this sampling method allows for ease of access to participants, which allows for inherent benefits such as being cost-effective and less time-consuming, it does also possess drawbacks such as not being representative enough and being subject to the sampling bias mentioned (Golzar et al., 2022). Convenience sampling where respondents were recruited via online means was however also utilised in similar studies by Calvo et al. (2016) and Höglin et al. (2021). Both of these studies were still able to characterise and distinguish relationship patterns between dog and owner. This form of data collection should therefore be considered applicable to the study of dog-human relationships.

The total number of respondents that was used for analysis following an initial filtering for completion of the MDORS component of the questionnaire was 1775. This number is comparative to a study utilising a similar approach in order to investigate the dog-human relationship in Spain in which 1850 replies were completed (Calvo et al., 2016), which speaks to the applicability of this study to dog-human relationship investigations. Part one of this study demonstrated a 77.6% return rate, which compared favorably to the 68% return rate reported by Sallander et al. (2001) in a questionnaire study based on the demographic data of a population of insured Swedish dogs.

Female owner gender was over-represented at 91.0%, a result that is comparative to similar previous studies in which participation was voluntary and an over-representation of female owners significant (Dwyer et al., 2006; Marinelli et al., 2007; Calvo et al., 2016). The nature of this study would however not allow for this result to be pre-empted and avoided. Whilst it is possible that women show a tendency to more willingly participate in online surveys (Smith, 2008), it is also

interesting to note that women may be traditionally regarded as performing the maternal care-giver role towards children (Van Polanen et al., 2017) and, given that the dog-human relationship has been compared to that which forms between child and parent (Prato-Previde et al., 2006), an argument may be made in support of the increased involvement and engagement of female owners with their dogs. In light of this skew towards female owners, the results obtained should be interpreted as being valid for female dog owners. Further investigation into the dog-human relationship, with an emphasis on male dog owners may be warranted. This could also allow for owner gender to be explored as a co-variable within the model utilised for this study.

A mean owner age of 51.3 ± 14.8 years may relate to a number of factors that can only be speculated upon, such as differences in the use of internet resources (and hence exposure to this particular study), availability of time (given the length of the questionnaire), or simply the inclination to participate voluntarily. The mean age does however compare to that obtained by Meyer and Forkman (2014), which was found to be 47 ± 11.4 years.

A more equally balanced sample of dog sex was however achieved in the study, with entire males and females comparing well, and castrated males and females comparing well. The larger proportion of entire males and females may be considered as expected, given the well established trend of not castrating dogs in Sweden (Egenvall et al., 2000, Sallander et al., 2001).

The sample of dogs included in Part one of the study consisted of a relatively small number of companion-only dogs (8.7%), with dogs reported as undertaking either <5 hours/week activity (16.2%) or >5 hours/week activity (75.1%) making up a much larger proportion. This is in stark contrast to the 69.0% of participants who stated that the main purpose of owning their dog was for companionship in a questionnaire study of Swedish dog owners (Sallander et al., 2001). Whilst the most common reason for owning a dog in Western societies has been found to be companionship (Holland et al., 2022; Endenburg et al., 1994), it is possible that owners aquired their dogs for the primary purpose of companionship but a large proportion of these owners made use of formal activities and training as a means of interaction and activation, whilst a smaller proportion of owners chose to spend their time with their dogs in less formally recognised or organised activities.

The sample of dogs consisted of 91.0% purebred dogs; where breeds were classified according to those officially recognised by the Federation Cynologique Internationale (FCI) (FCI, 2024). This is not surprising given that the main form of recruitment was via the official breed groups in Sweden. The remaining 9.0% of the dogs was made up of a combination of breeds not officially recognised by the FCI and/or dogs reported as cross-breeds or of unknown parentage. The proportion of purebred dogs (91.0%) compares well to that reported by Egenwall et al. (1999), who investigated the composition of the Swedish dog population and reported an

86.7% proportion of purebred dogs. The sample of dogs had a mean age of 4.8 ± 2.9 years, which is comparative to that obtained in a similar convenience sampling study of dog-human relationships, training engagament and shared activities, which reported a mean dog age of 5.1 ± 3.7 years (Bennett and Rohlf, 2007). Egenvall et al. (2000) reported a mean age of 5.0 years for males and 4.9 years for females in a study of 200 000 insured dogs in Sweden. These figures suggest that the mean age found in this study may be regarded as fairly representative of the Swedish dog population.

5.1.2 MDORS Subscales

Within this study population, similar Dog-Owner Interaction (DOI) subscale scores were obtained across all three dog groups (Companion-only, <5 hours/week Activity and >5 hours/week Activity groups), with no significant variations. In this study, a lower DOI score indicated a higher positive owner perception. Due to a lack of normative data for the MDORS subscale, the specific value cannot be interpreted (Calvo et al., 2016). However, as all three groups scored similarly, it is fair to conclude that similar levels of DOI were reported by owners in relation to their relationships with their dogs irrespective of the level of activity or whether the dog is kept solely as a companion. The amount of interaction between owner and dog (as reflected by the DOI) increases in proportion to the level of owner engagement both in the training regime as well as the level of involvement in shared activities (Bennett and Rohlf, 2007) and responsibility for the dog's health and behaviour (Rohlf et al., 2010). These findings are important to note, and may help explain the lack of significant differences found between the Companion-only group and the two levels of Activity groups. Whilst the level of DOI is easily explained by the training regimens utilised in groups 2 and 3, it may be surmised that the owners of the Companion-only dogs achieve similar levels of interaction through less formal means. For example, these dogs may be more fully incorporated into daily social life, such as following the owner to work or social engagements, or participate in less structured training and socialisation opportunities within the home environment.

It is interesting to note that the different reported levels of activity all result in similar DOI scores, and the interpretation of these results must include some consideration of the dog/dog breed suitability to the particular owner and environment. For example, working breeds receiving a level and type of interaction that is suitable to them, and companion breeds receiving a level and type of interaction that is suitable to them.

The effect of convenience sampling should also be considered when interpreting the DOI scores. It is presumed that the respondents who voluntarily completed a

fairly substantial questonnaire based on their relationship and shared activities with their dog would have exhibited a reasonable level of investment and interest in their dog, which in turn translated into a relatively high degree of reported DOI. The incorporation of less committed and invested owners in future studies may therefore be important in providing a more complete, and hence accurate, picture.

With regards to the Emotional Closeness (EMO) subscale scores of this study population, groups 1 (Companion-only) and 2 (<5 hours/week Activity) scored similarly to each other, whilst a significant difference ($p<0.05$) was found to occur between groups 2 (<5 hours/week Activity) and 3 (>5 hours/week Activity), with group 2 scoring higher than group 3. In this study, a lower score in the EMO subscale indicated a higher positive owner perception. According to these results, the more time the owner therefore spends with the dog in dog-related activities, the lower they score on the EMO subscale, and the higher their perceived emotional closeness.

These results are in agreement with those of Meyer and Forkman (2014), who found that owners of dogs kept solely for companionship with no engagement in formal activities such as agility, working trials or dog shows, scored lower on the EMO subscale. In their study, however, the lower EMO scores were interpreted as indicative of a more negative owner perception of the dog-human relationship (Meyer and Forkman, 2014). The mutual finding that Companion-only owners perceive their dog-human relationships less positively with regards emotional closeness than what the owners of dogs undertaking >5 hours/week Activity do may highlight the importance of taking part in formal activities on the perceived closeness within a relationship.

The EMO subscale can be used to indicate level of attachment with the dog (Dwyer et al., 2006). Considering that factors such as having children in the household tends to reduce the levels of affection with the dog as well as to reduce the overall time and amount of shared activities spent with the dog (Marinelli et al., 2007), it is important to consider the initial reasoning for acquiring the dog in the first place. For example, if the dog was acquired because the owner does not have children and the dog is intended to fill the primary role of emotional closeness, friendship or companionship, with the added benefit of being able to take up the time created by not having children, then higher EMO scores for group 1 might be expected. The presence or absence of children was not included in the analysis of this study, and the effect of this factor should not be dismissed.

Another factor that may play a role in the perception of the owner includes whether or not the owner has previous experience of dog ownership (Bouma et al., 2020). Previous experience of dog ownership and the associated ability to modulate expectations and better match these with reality should not be underestimated in preventing or improving any problems, whichin turn, have the potential to affect the owner's perception of the dog-human relationship (Bouma et al., 2020). The

possible effects of anthropomorphism should also be taken into account when interpreting the results. For example, dogs, especially those kept mainly for companionship, may be regarded and treated more as surrogate children or friends (Mota-Rojas et al., 2021), which can only affect the owner expectation and perception of the relationship. The possibility of the existence of an effect developing from the expectations placed by an owner on the relationship between a primarily working dog versus a primarily companion dog should also not be dismissed, and should be investigated in future studies.

Höglin et al. (2021) found that owners of dogs kept mainly for the purposes of hunting scored lower on the EMO subscale compared to owners of dogs mainly kept as companions. Höglin et al. (2021) interpreted their results as the owners of the hunting dogs perceiving their relationships as weaker in comparison to the owners of the companion dogs who perceived their relationships more positively. In their study, therefore, a higher EMO score was interpreted as indicative of a more positive relationship perspective.

These results are in contrast to those obtained in this study, where the owners with the most active dogs scored lowest on the EMO subscale, indicating the most positive relationship perception, whilst the owners of the Companion-only dogs scored higher than this but still scored lower than the owners of the <5 hours/week Activity dogs. As the owners of the dogs undertaking <5 hours/week Activity scored the highest in the EMO subscale, these owners may be interpreted as having the lowest relationship perception.

Höglin et al. (2021) also found that the scores between the owners who kept dogs as companions and those using dogs in herding competitions did not differ in their EMO scores. It may therefore be suggested that a more complex association between the main use of the dog and the resulting EMO score exists, and that a more nuanced approach be utilised in investigating the effect of the purpose of the dog, the breed selection, and the personality of both owner and dog on the resulting EMO scores.

Within this study population, a difference was found to occur for the Perceived Costs (COST) subscale between group 1 (Companion-only) and group 3 (>5 hours/week Activity), with group 1 scoring lower than group 3. In this study, a higher score in the COST subscale indicated a more positive owner perception, in that the owner perceives the relationship to cost less (Calvo et al., 2016). Whilst all three groups scored relatively highly for this subscale, the COST score for group 3 was highest (and significantly so when compared with group 1). This suggests that the most active group of dyads have the most positive perception of their relationship, which can be interpreted as the owners of this group perceiving their relationships to cost them the least.

Given that investing more into their relationship with their dog resulted in a more positive perception of the relationship, it may logically be presumed that the higher

the level of investment is the higher the resulting returns are. The associated benefits of increased levels of activity and exercise, as well as the potential for increased social interaction and a perceived sense of belonging within a specific community, which can be regarded as a fundamental need in humans (Allen et al., 2021) that may be achieved by regularly attending training clubs or competitive events, for example, may help to counteract the otherwise costly nature of investing time, money and energy into various activities.

Whilst spending a lot of active time together may inherently lead to elevated COST scores, this link also needs to be interpreted in the context of the tendency for these dogs to exhibit or develop fewer behavioural problems (Bennett and Rohlf, 2007). Fewer behavioural problems may, in turn, act to reduce the perceived versus the actual costs and thus further enhance the dog-human relationship.

5.2 Discussion: Part two

Part two of this study may be regarded as an exploratory pilot study, the main prospect of which was as a learning opportunity and the chance to gather an initial understanding of the use of the ASQ, ECR-R and SRT. As such, the resultant sample size may be considered as too small to offer any substantial findings. This section does however offer the potential of further future investigation and analysis as a means of better understanding the dog-human relationship. No significant differences were found to occur in any of the subscales for either the ASQ (Karantzas et al., 2010) or the ECR-R (Beck and Madresh, 2008) questionnaires, which were utilised to indicate the adult attachment style (AAS) of the owners participating in the SRT portion of the study. This consistency of results between the two questionnaires may however in and of itself offer some meaning, by allowing for some assurance that the owners in the Companion and Active groups involved with the SRT did indeed not significantly differ in terms of AAS.

Furthermore, no differences were found between the Companion and Activity groups of dogs in terms of any of the behaviours exhibited during the departure, separation or reunion phases of the SRT. Trends were however found to occur in two of the dog behaviours. In the departure phase, Active dogs tended to score higher for ‘tail-wagging’. In the separation phase, Companion dogs tended to show more ‘attention to door’. Whilst these differences were found to not be statistically significant, the numerical values obtained for each group differed markedly. Whilst the p-value may help to indicate that a difference exists it does not reveal the size of the effect (Sullivan & Feinn, 2012). It is important to consider the impact of the sample size in the interpretation of these results (Sullivan & Feinn, 2012). The small sample size utilised in this part of the study provides a less reliable estimate of the population due to the subsequent decreased statistical power to detect smaller effects, which results in higher p-values. A larger sample size would therefore

increase the chances of finding significance should a genuinely significant effect be present. The trend that was found to occur in the departure phase with regards 'tail-wagging' may not offer much in terms of biological significance or interpretation, given that the departure phase included the presence of the author as well as the owner, and no indication or context was recorded as to who or what the behaviour was directed at or was as a result of. However, the trend found to occur in Companion-only dogs with regards to increased 'attention to door' behaviour during the separation phase of the SRT may be regarded as a reflection of a more owner-dependent dog that attempts to seek support from the owner during the stressful experience of being separated from the owner (Rehn et al., 2014b). The comparatively lower frequency of this behaviour in the Active dogs may be regarded as a reflection of the independence of these dogs, which may be a factor that is utilised, and hence practiced and trained for, in their various activities. Alternatively, these dogs may have been socialised to a greater extent as a by-product of accompanying their owners to the various activities (Rehn et al., 2014b), and hence not exhibited any changes to their behaviour whether or not the owner was present. Other behaviours were found to not differ significantly but did exhibit large numerical differences. For example, Active dogs showed a much higher numerical incidence of the behaviour 'toy interaction' at the reunion phase. Such a difference may be indicative of the approach with which the respective owners take in interacting with their dogs as well as their method of reward or training. In this case, owners of the Active dogs may use toys or play as a way of rewarding the dog during training sessions or may use toys as a means of re-directing the attention of the dog during their training sessions. However, given the small sample size and relatively large intra-group variation, the interpretation of these numerically different but statistically insignificant behaviours can however only remain speculative, and hence of little value.

The small number of participants in this part of the study allows for a large outlier effect (Rahman and Amri, 2011), and a larger influence of individual dogs. Hence, individuals that displayed a large frequency of a particular behaviour may result in apparently large differences between the groups, yet offer no statistical or biological significance.

The interpretation of the results in the second part of the study is therefore constrained by the small number of dyads that took part, as well as the relatively large variation in breed, age and gender of the dogs, as well as the variation in the age and gender of the owners. The enrolment of participants could have been vastly improved had the time period available for selection and recruitment been longer.

A relatively high number of statistical testing occurrences was utilised during the comparison analysis of each of the behaviours listed in the ethogram. When treatment groups are compared multiple times, the chance of finding a difference merely by chance will naturally increase; resulting in an increased chance of a Type

1 error occurring (Ranganathan et al., 2016). This raises the possibility of a false significant difference being reported and analyses should consider correcting for multiple testing if necessary. This effect can however be disregarded in the interpretation of the Part two statistical analyses as no significant differences were found.

5.3 Ethics

All participants in both Parts one and two of the study were informed of the SLU policy regarding the handling of personal information collected, and provided with the official General Data Protection regulations (GDPR) prior to their participation. Participants of Part two of the study were also asked to either provide or withdraw consent (according to their preferences) for the future use of any video material, as well as identifiers such as owner and dog names, collected during the SRT. All owners were provided with the choice of being sent a digital copy of the video pertaining to their dog.

As the SRT was carried out using privately-owned dogs, and deemed non-invasive and did not pose any physical or mental harm to the dogs, an ethical permit was not required; as stipulated by the The Swedish Animal Welfare Act (7 chap. 2 § and 9§ 2018:1192) (Sveriges Riksdag, 2024).

All participants of Part two of the study received an email prior to the test-day containing information with regards what to expect for the day and how the SRT would be carried out. Participants were also informed of their ability to withdraw their dog from any part of the procedure in the event that they were not comfortable proceeding, such as if they felt the procedure was too stressful for the dog. The separation phase of the SRT may be experienced as stressful by both dog and owner. This phase was however kept relatively short (3 minutes), and similarly utilised in comparable studies (Topál et al., 2005, Siniscalchi et al., 2013, Rehn et al., 2017).

Furthermore, the author as well as the owners were physically present in close proximity to the video-recording room, and were no more than one room away at all times during the SRT procedure. Whilst the dog could not be visually monitored during the separation phase, the dog could be heard at all times. All the owners understood their ability to immediately halt proceedings at any time, and were told that they could do so at any time with no explanations needed. All dogs that participated in the SRT completed all the components without any issues reported.

As mentioned, a short component of the SRT has the potential of being experienced as stressful. An argument could therefore be made in support of deeming the procedure unethical. However, a utilitarian approach in which the value of gaining pertinent knowledge with regards the factors that combine to contribute towards the improvement of the positive welfare of the many animals

with which humans share so much of their lives with may be considered to take on more significance and outweigh this argument. This approach also has the potential to conversely help prevent the development or indeed the worsening of problematic scenarios that may arise in the dog-human relationship. A better unerstanding and deeper knowledge base can only be of benefit in helping to improve the welfare of dogs and humans alike.

5.4 Sustainability

The relationships that develop between owners and their dogs have been deemed as potentially complex, with many contributing factors that have as yet not been fully investigated or fully elucidated (van Herwijnen et al., 2018; Höglin et al., 2021). It is however important to continue to more thoroughly understand the dog-human relationship in order to enhance the positive welfare of both dog and human (Marinelli et al., 2007) as well as to help avoid the development of poorer relationships and, in turn, pre-empt incidence of problematic behaviours and even relinquishment of dogs (Patronek et al., 1996; Mondelli et al., 2004). This would in turn allow for a more sustainable approach to dog-human relationships.

Improved understanding of the dog-human relationship may also allow for a more considered approach in selecting the breed or breed-type of dog in combination with the preferred activities the potential owner would realistically consider to undertake. In this way, a more successful and rewarding matching of dog and owner may be achieved, together with an increased quality of life as a result (Meyer & Forkman, 2014). A similar approach could also be utilised in improving adoption policies at rescue centres in attempting to optimise the success of canine adoptions.

5.5 Limitations of the study

The results of this study should be interpreted in light of the inherent inclusion of selection bias of the participants in Part one of the study. The use of this subject pool to select a further sub-section to participate in Part two of the study would unavoidably also have inluded this bias. The possible bias introduced by the participant gender (Marinelli et al., 2007; Calvo et al., 2016), participant age (Meyer & Forkman, 2014) and the recruitment mainly via official breed groups have all been previously discussed.

Whilst response rates for surveys can at times be considered low, the use of an online questionnaire format would have helped to improve the response rate (Wu et al., 2022). The voluntary nature of the study suggests a certain selection bias, with the sample being mostly representative of Swedish dog owners that are

relatively engaged with their dog and are interested in investigating their relationship and learning more about it. The results may therefore not include a representative proportion of less engaged Swedish dog owner population as a whole.

The very nature of a questionnaire-based format, and their intended participants, unavoidably introduces a degree of skew towards a human-centric representation. The dog-human relationship is a bi-directional one (Payne et al., 2015), which is why a behavioural component of the dogs was also incorporated into the study. In this way, some degree of input from the dogs was also included. However, it is unfortunate that the more dog-centric portion of the study was limited to a much smaller sample size compared to the human participation in Part one of the study, which would have naturally lead to less accurate results and interpretations. This was however unavoidable given the time constraints of the study, and correction of this should be prioritised in furture studies.

Whilst Part one of this study resulted in a relatively large sample size (N = 1775), the subsequent categorisation of these respondents resulted in a very uneven distribution between the three groups; Companion-only (N = 154), <5 hours/week Activity (N = 288), and >5 hours/week Activity (N = 1333) groups. Such an uneven distribution numerically may contribute a degree of inaccuracy in the analysis and interpretation of the results. The statistical power of an analysis is optimised by utilising equal numbers of subjects in each of the groups to be compared (Campbell et al., 1995). However, the design of this study did not allow for a pre-selection of respondents, and respondents self-reporting as undertaking activities out-numbered those reporting as companion-only. A more reliable result may have been achieved by pre-selecting a certain number of dyads based on their reported levels of activity or companionship, applying certain inclusion criteria in order to be defined within one of the three groups (such as the self-reporting of companionship or activity level) and capping the intake at a certain number for each of the groups. In such a way, equal numbers of dyads could theoretically be utilised in each of the groups, and potentially lead to a more reliable analysis and interpretation (Campbell et al., 1995).

As Part two of the study was treated as an explorative pilot study with the main aim considered to be a learning opportunity, and the fact that only a very small sample size was utilised, the interpretation of the resulting data was unfortunately very limited.

5.6 Suggested improvements and future studies

Whilst data collection for this study was broad, the research questions were limited to a few main variables; the activity level of the dyad and the owner's perception on the relationship. This was done in order to keep within time limitations

reasonable for this particular student project. The inclusion of co-variables, such as the number of dogs in the household, previous owner experience of keeping or training dogs, length of relationship/ownership, and the initial reason for aquiring the dog could be incorporated into future analyses. This would allow for further understanding of the dog-human relationship.

Further analysis of the MDORS results among owners engaged in different types of activities with their dogs, as well as the breeds or types of dogs in order to provide a more nuanced interpretation of the results would also have been of benefit. For example, it would be of interest to compare individuals of a breed that have been bred for a specific type of work, such as hunting, and compare these to individuals not utilised for this type of work such as, for example, Labrador retrievers mainly kept for companionship. Alternatively, the owner perspectives could be compared for a certain breed that has been specifically bred for a specific job, such as herding in Border collies. In this way, dogs primarily used as herding dogs and those whose activity consists of an alternative such as agility would be compared. Inherent to this investigation would be the (assumed) effects of attempting to replace a specific job such as herding with an activity, such as agility, that may attempt to replicate the physical and mental requirements of a task but are also far removed from the original purpose of the breed, and hence the potential for a lack of satisfaction in the specific activity with the possibility of a host of inherent behavioural ramifications.

Whilst a fairly sizeable sample size was collected for completion for Part one of the study, leading to results that could be interpreted with some degree of surety, the small size of the sub-sample selected for Part two of the study allowed for a much more restrictive view of the dog-focused aspects of the study. Not only was a small sample obtained, but a lack of uniformity within and between the two groups compared cannot be ignored. An increased time period to allow for a more refined selection as well as to gather larger numbers of participants overall would have improved the study design and possibly the resulting outcomes.

Owners participating in Part two of the study frequently commented on the ambiguity and difficulty experienced in answering some of the questions posed in the ECR-R questionnaire. Given that the ECR-R was originally developed for measuring close relationships between humans, and that the version used had been extrapolated to that between dog and human (Beck & Madresh, 2008), such comments are to be expected. However, until a better approach is developed, the use of such questionnaires constitutes a ‘making the best of it’ approach. By utilising a combination of ASQ and ECR-R, it may be possible that some discrepancy was reduced. Participants were informed at the start of these questionnaires to bear in mind that some of the questions may sound strange, and they were asked to answer them to the best of their ability. The study would, of

course, have been further improved had an even more applicable scale and questionnaire been available.

Whilst no significant differences were found between the Companion-only and Activity groups for the various behaviours recorded during the SRT, certain behaviours exhibit numerical differences that may warrant further investigation in future studies with the use of larger sample sizes. In the reunion phase of the SRT dogs in the Activity group were, for example, recorded as showing a higher frequency of 'Toy interaction' when compared to dogs in the Companion group. It may be possible that the Activity group dogs are more prone to utilise toys to interact with their owner as an extension of their usual activity-based relationships. Future studies with larger sample sizes may help elucidate this. Alternatively, a difference in whether the owner or the dog initiates this toy interaction may also play a role in the interpretation of this finding, and may reflect different owner strategies. No differentiation was made, nor recorded, with regards to whether the owner or the dog initiated this behaviour in this study. It is suggested that this be noted in any future studies.

Care should also be taken in the interpretation of certain behaviours, such as 'Whining' and 'Attention to door' in the Separation phase of the SRT. Such behaviours may be interpreted as an indicator of separation distress (Parthasarathy & Crowell-Davis, 2006), as opposed to an indicator of whether the dog should be considered secure or avoidant in terms of attachment. Care should therefore be taken in assigning any group differences to the attachment style.

6. Conclusions

The dog-human relationship was analysed by utilising a scale that incorporates attachment and social exchange theory (MDORS). Groups of owners that related to the level of formal activity undertaken with the dog were shown to exhibit significantly different patterns of perception of the dog-human relationship in relation to the EMO and COST subscales. These results indicate that the relationship between dog and owner may indeed be influenced by the level of engagement between dyads in terms of whether the dog was kept as a companion or whether involved with a formal activity, as well as the amount of time spent on this activity. An attempt was made to elucidate the potential influence of adult attachment style on the development of the dog's attachment to their owner, regardless of shared activity (or lack thereof), but no definitive conclusions could be drawn given the small sample size and the need for more in-depth analysis.

By further understanding and, with time, more accurately predicting the formation of the dog-human relationship, it may be possible to better predict risk factors that could have a detrimental effect on the relationship and allow for a means of avoiding them. Conversely, by being better able to predict positive relationship outcomes, the positive welfare of the dog, as well as the well-being of the owner, can be safeguarded and even improved upon.

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Popular science summary

The relationships formed between dogs and humans have a long and varied history. The roles that dogs play in human society range from herding, guarding, hunting, substance detection to companionship and emotinal support. A common thread runs through all of these roles; that of the underlying interactions and attachments formed in the development of the relationship between the dog and his owner. A large number of factors, from both the dog and human persepctive, play a role in the development of this relationship. From the human perspective, the environment and parental care received can impact how the person subsequently reacts and interacts with their dog. Other human-based factors include the gender of the owner, whether the owner is single or lives in a family with children, the cultural and societal values, and the socioeconomic status. The initial reason for aquiring the dog, as well the owner's expectations of the future relationship also play a role.

Many dog-related factors also have an impact. These include, for example, the socialisation of the puppy, the gender, the breed of the dog, the number of dogs in the household, as well as the age, which is in turn inter-linked with the length of the relationship with the owner. An aspect that may play a role in the development of the dog-human relationship that has not yet been fully investigated is the potential role of the type of activities which dog and owner spend together and the duration spent on these.

This study therefore attempted to more fully understand whether any differences may be found in the owner perception on their relationship with their dog between those who reported their dog as being primarily a companion (not participating in in any organised or formal activities or training) and those who reported their dog as participating in either less than 5 hours/week or more than 5 hours/week of organised or formal activity and training.

Owners participating in the study completed an online questionnaire, which asked for some general information regarding the dog and owner, as well as a set of questions that make up the Monash Dog Owner Relationship Scale (MDORS). The MDORS aims to measure owner perception of their relationship with their dog. The results of the MDORS can be classified into three different subscales; the Dog-Owner Interaction (DOI), the Emotional Closeness (EMO) and the Perceived Costs (COST) subscales. The DOI subscale measures the extent of mutual and affectional activities, the EMO subscale indicates the degree of psychological attachment and

companonship, whilst the COST subscale indicates the effect of perceived restrictions such as increased responsibility and economic demands.

In this study, owners of dogs undertaking less than 5 hours/week activity scored significantly higher than those of dogs undertaking more than 5 hours/week activity on the EMO subscale. This suggests that whilst a certain degree of mutual activity is desirable in developing emotional closeness with our dogs, there may be a certain threshold of time spent on this after which differences in the view of the relationship occurs.

Meanwhile, on the COST subscale, owners not undertaking any formal activity or training with their dogs experienced the relationship as more costly compared to owners undertaking more than 5 hours/week activity or training. This suggests that owners of the most active dogs in the study had a much more positive perception on their relationship and regarded their relationships as being the least costly to them when compared to the costs perceived by the owners of companion dogs.

In order to investigate how the dogs themselves perceived their relationships with their owners, the study also included a behavioural component. This behavioural study consisted of a separation- and reunion test (SRT), whereby the owner leaves their dog alone in a novel room for a period of time (in this case, for 6 minutes), after which the owner reunites with their dog and interact according to how they best feel for a period of time (in this case, for 3 minutes). The dogs were recorded on video during the entire period, and their behaviours subsequently analysed. Two groups of owners and their dogs were compared; a companion group in which none of the dogs were undertaking any formal or organised actiivity or training, and an activity group in which all of the dogs were undertaking some form of activity or training.

Whilst no differences in behaviour between the two groups of dogs could be found, these results may have been adversely affected by the relativley small numbers of dogs that were recruited for this part of the study.

The results of the first part of the study do indicate that the amount and type of interactions that dogs and their owners engage in does influence the owner perception of the relationship. Given the complexity of the dog-human relationship, it would be very rewarding to further investigate the reasons and motivations underlying the development of these relationships. By increasing our understanding of these effects, we may be better able to further improve our relationships, help avoid less suitable partnerships and even improve how we approach adoption policies at rescue centres in being better at matching dogs to their potential owners.

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