

# Human caregiving style and its effect on the dog-human relationship

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## Abstract

Dogs have evolved alongside humans since their domestication 15 000 years ago. No other animal has lived in such close proximity to humans which makes the bond between them unique. The dog-human relationship has started to interest scientists and studies have been performed to investigate the nature of this bond. These studies suggest that the relationship resembles that of the relationship between children and their parents. Furthermore, it has been shown that dogs express attachment behaviour towards their owner and that dogs use their owner as a secure base. However, few studies have looked at how the human's attachment style and caregiving style may affect the relationship between dogs and humans. In this study, we looked at how the human caregiving style affected the dog-human relationship when faced with different challenging situations. We applied two of the four caregiving styles described in human psychology; the secure caregiving style and the disorganised caregiving style. The dogs interacted with two test persons applying one caregiving style each for 15 days. They were then exposed to challenging situations together with these two persons to investigate which one the dog would choose to seek comfort from. The results showed that when dogs were exposed to the approach of an unfamiliar person they were more oriented towards the person with the secure caregiving style. When the dogs were left alone in a room for three minutes and then reunited with both test persons the dogs initiated more physical contact and spent more time in proximity to the person with the secure caregiving style.

These findings support the hypotheses that dogs are affected by human caregiving style and that they preferred to seek comfort from a person mimicking a secure caregiving style compared to a person mimicking a disorganised caregiving style. These findings help us get a better understanding of the characteristics of the dog human relationship and can help when matching dog and owner when rehoming dogs to ensure a better welfare for the dog.

# 1. Introduction

Dogs have lived in close proximity to humans since their domestication, 15 000 years ago (Savolainen *et al.*, 2002). This long-lasting close relationship has meant that dogs have evolved alongside humans and that dogs have developed the ability to understand a large amount of human communicative cues (Virányi *et al.*, 2004; Miklósi *et al.*, 2001; Riedel *et al.*, 2008). The relationship that dogs have with humans is unique and is therefore an interesting field of anthrozoology research. Knowledge and research about the dog-human relationship is however limited. For example, we are still unaware of the extent to which dogs' bonding to humans is influenced and affected by human personality and human behaviour.

Dogs' connection to humans resembles, in many ways, the relationship between a child and its parent (Serpell, 2004; Topál *et al.*, 1998; Voith, 1985) and the emotional bond that many dog owners form to their dogs seems to be as strong as the bond formed to a family member (Archer, 1997). When comparing attachment behaviour between dogs and wolves, Topál *et al.* (2005) saw that dogs expressed attachment behaviours towards their caregiver while wolves did not. This is further proof of how the selective process of dogs have shaped the dog to be more attached to humans (Topál *et al.*, 2005). Dogs have developed the ability to understand a large amount of human behaviour and human communicative cues (Miklósi *et al.*, 2001; Riedel *et al.*, 2008). This is believed to be an adaptation that has been selected for during domestication (Riedel *et al.*, 2008). The method of using eye contact as a means of communication and understanding and acting on pointing gestures from humans are evidence of such adaptations (Virányi *et al.*, 2004; Miklósi *et al.*, 2001). McGreevy *et al.* (2012) investigated the dog-human dyad and showed that dogs reacted to human behaviour in a very similar way as when interacting with another dog. Also, some studies have been performed to look at how human behaviour and characteristics influence the relationship. Kotrschal *et al.* (2009) saw that the owner's personality influenced the relationship between owner and dog. Both the dog's behaviour and how well the dog and owner cooperated were influenced by the owner's personality; if the owner had a more neurotic personality they performed worse in a cooperation task than owners that had a more sympathetic and social personality (Kotrschal *et al.*, 2009). In the study by Marinelli *et al.* (2007) they could see that dog owners with a larger number of emotional bonds, e.g. living in a big family and having a large number of friends, had a stronger relationship with their dog indicated by for example, the dog played more, greeted the owner more after a separation, explored more when the owner was present and were more contact seeking with their owner. This might be due to the fact that these owners were more comfortable in social settings and formed social bonds more easily.

## 1.1 The theory of attachment

John Bowlby first developed the attachment theory in the 1950s (Bretherton, 1992). The focus was on attachment between children and their parents (Bretherton, 1992). The function of this attachment is protective, serving to keep the child close to the parent in case of danger but also instructive, where the parent functions as a secure base from which the child feels safe enough to go out and explore (Bowlby, 1988). There are four styles of attachment, three were defined in the 1970s – secure, insecure avoidant and insecure anxious/ambivalent (Ainsworth *et al.*, 1978; Belsky & Nezworski, 1988) and a fourth, the disorganised attachment style, which was first described in 1990 (Sagi *et al.*, 1994).

A secure attachment style is characterised by feelings of safety and security (Belsky & Nezworski, 1988). In a threatening situation, the individual will seek comfort from the

attachment figure but will turn to exploration as soon as they feel secure enough (Bowlby, 1980). An individual with a secure attachment will show intimacy and be positive in their interaction with the attachment figure (Ainsworth *et al.*, 1978). If a child experiences an insecure attachment style from their attachment figure, perhaps due to trauma or neglect where the attachment figure is emotionally distant towards the child, they often develop an insecure avoidant attachment style (Ainsworth *et al.*, 1978). This is especially shown at reunion with the attachment figure where the child seems to be in no need of physical contact and can even reject it if offered from the attachment figure (Ainsworth *et al.*, 1978). It is believed that the insecure avoidant attachment these children have is developed as a defence where they avoid to activate the biological attachment system due to the parents' inability to meet the child's needs (Bowlby 1980). Children with an insecure ambivalent attachment style usually express a lot of distress when separated from the attachment figure and are very anxious and difficult to sooth when the attachment figure returns (Ainsworth *et al.*, 1978). These individuals are also very insecure in their interaction with their attachment figure, indicating that the caregiver has been unpredictable and unresponsive to the child's needs (Ainsworth *et al.*, 1978). Children with insecure ambivalent attachment style are often delayed in their development compared to individuals with a secure attachment and are more reckless, lack a sense of self-protection and are less explorative (Lieberman & Pawl, 1988). A child with a disorganised attachment style usually behaves very unpredictable and the child can seem disoriented (Sagi *et al.*, 1994). Many behaviours appear out of context and inappropriate to the situation (Main & Solomon, 1990). These children can show incomplete behaviours, undirected movements or expressions, contradictory behavioural patterns, sudden passivity or even stereotypic behaviour (Main & Solomon, 1990). It is difficult to predict the behaviour of these children, since many of the behaviours performed seem to lack explanation, purpose or goal (Main & Solomon, 1990).

## 1.2 Adult attachment and caregiving style

Children's attachment style has been shown to extend into adulthood to other affectional bonds that are developed later in life (Ainsworth, 1989; Main, 2000). The goal of the attachment is still the same where it serves a protective and instructive function, however the actual behaviour varies with context and age (George & Solomon, 2008).

An adult person's attachment style is connected to that person's caregiving style. A person with an insecure attachment style usually has an insecure caregiving style (Symons *et al.*, 2016; Main 2000). The four different styles are (more or less) the same in caregiving but caregiving is focused on the protection and care of another individual, usually a child (George & Solomon, 2008). The behaviour can include calling, following and retrieving the child and this is performed to ensure proximity and to provide care for this individual (George & Solomon, 2008). A secure caregiving style is characterised by being reactive, understanding and sensitive to the child's signals and needs (Mikulincer & Shaver, 2007). When having an insecure avoidant caregiving style the parent shows very little or no response when the child is distressed and they encourage independence in the child (Mikulincer & Shaver, 2007). A parent with an insecure ambivalent caregiving style are inconsistent in their behaviour, alternating between comfort giving and neglecting the child (Mikulincer & Shaver, 2007). A disorganised caregiving style is characterised by an even higher inconsistency in a person's behaviour. They may show frightening or intrusive behaviour and are less responsive to the child's needs but can quickly change to being caring and attentive to the child (Collins & Ford, 2010; Collins *et al.*, 2009; Rehn & Keeling, 2016). At times, the person can be very evasive, try to avoid interaction and even be abusive towards the child (Collins & Ford, 2010;

Collins *et al.*, 2009). In the current study, the effect of the secure and the disorganised caregiving styles on the behaviour of the dog are investigated.

### 1.3 Attachment between dog and owner

The studies performed on attachment between dogs and humans have shown that dogs do show attachment behaviour towards their owner (Mariti *et al.*, 2013; Topál *et al.*, 1998; Siniscalchi *et al.*, 2013; Palmer & Custance, 2008; Prato-Previde *et al.*, 2003). Many dogs also see their owner as a safe haven to seek comfort from during a challenging situation (Gácsi *et al.*, 2013; Palmer & Custance, 2008). In studies investigating the dog-owner relationship, the dog's behaviour when the owner is present is compared to when the dog is alone or with an unfamiliar person. Attachment behaviours seen in dogs can be that they show proximity seeking behaviour towards their owner, they spend more time exploring the environment when the owner is present and play more in the presence of the owner compared to when with a stranger or when alone (Topál *et al.*, 1998). Furthermore, dogs show searching behaviours when separated from the owner and show a lot of contact seeking behaviour at reunion with the owner (Topál *et al.*, 1998).

Studies investigating attachment between dogs and humans has been done on privately owned dogs mainly, using the Ainsworth strange situation procedure (ASSP), which is a test that was first developed to look at attachment behaviour in humans (Ainsworth *et al.*, 1978). Recently, researchers applied the ASSP when looking at dog-human attachment (Mariti *et al.*, 2013; Topál *et al.*, 1998; Siniscalchi *et al.*, 2013; Palmer & Custance, 2008). In the study by Siniscalchi *et al.* (2013) they also investigated the influence of the owner's attachment style. The owners answered a questionnaire (the '9 attachment profile') that determined their attachment style measured as confident attachment style and not-confident attachment style and compared the result from the dogs' behaviour during the ASSP with the owners' attachment style. The results showed that owners scored as more confident had dogs behaving similar to how securely attached children behave (Siniscalchi *et al.*, 2013). Owners scored as not-confident had dogs that displayed insecure attachment behaviours, e.g. they did not greet their owner with the same intensity, they vocalised more when encountering the stranger when the owner was present but did not greet the stranger as much as the dogs with a secure owner and they did not alter their behaviour according to whether or not the owner was present or not indicating that they did not see their owner as a secure base (Siniscalchi *et al.*, 2013).

Physiological measures, such as heart rate, can be combined with behavioural observations to get a better understanding of the dogs' reactions (Palestrini *et al.*, 2005). Palestrini *et al.* (2005) saw that dogs emotional states gave changes in both heart rate and behaviour. When studying attachment and mother-infant bonding, researchers have found that the neuropeptide oxytocin promotes social behaviour and supports the bonding process between mother and child (Carter, 1998). Oxytocin works in the same way in mother-offspring bonding in animals (Olazábal & Young, 2006). When studying the role of oxytocin and different attachment styles it has been shown that mothers with a secure attachment to their child had a higher level of oxytocin compared to mothers with an insecure attachment (Strathearn *et al.*, 2009). When studying the role of oxytocin in dog-human relationship it has been found that the oxytocin level raises in both human and dog during positive interaction (Odendaal & Meintjes, 2003; Handlin *et al.*, 2012; Nagasawa *et al.*, 2015; Rehn *et al.*, 2014).

These findings give us an indication of the unique bond between dogs and humans and raise the question of how much they influence each other, both positively and negatively. Since the

dog-human bond has been compared to that between children and their parents (Serpell, 2004; Topál *et al.*, 1998), one way to investigate the relationship is to incorporate methods from human psychology research.

The main aim of the current study was to investigate if there was a difference in dog's contact and comfort seeking behaviour towards a person depending on if the person applies a secure or a disorganised caregiving style.

I hypothesised that dogs are affected by a human's caregiving style. Dogs will show more contact and comfort seeking behaviour towards a person with a secure caregiving style than towards a person with a disorganised caregiving style. The dogs will also have a higher heart rate (HR) when interacting with the disorganised person than with the secure person.

## 2. Materials and methods

### 2.1 Animals

Twelve dogs, six males and six females of mixed ages (1-9 years,  $5.0 \pm 0.9$  (mean  $\pm$  SE)) were used. All dogs were of the breed Beagle and were housed at the Swedish University of Agricultural Sciences. The dogs lived at a kennel in groups of 2-4 individuals. The dogs were kept in indoor pens (24 m<sup>2</sup>) during the night and in outdoor pens (145 m<sup>2</sup>) between 8:00-15:30 every day. The dogs were fed dry food twice daily and were walked regularly by their caretaker.

### 2.2 Treatments

The dogs took part in an interaction period of one month where two unfamiliar persons applied two different caregiving styles. The caregiving styles that were used in this study were the secure caregiving style (SC) and the disorganised caregiving (DC) style. The effect of the insecure (avoidant and anxious/ambivalent) caregiving styles will be evaluated in a future study. There were three test persons (women) involved in the study but each dog only interacted with two of these. One person interacted with all dogs while the other two interacted with half of the dogs each. All dogs interacted with one person employing the SC and one person employing the DC. They interacted with both persons separately for 20 minutes (approx. 4 h apart) during 15 days. The person they interacted with first was alternated each day during the interaction period. A well-known dog consultant, Eva Bodfäldt, was involved in the study, e.g. to help developing the standardised behaviour scheme used during the interactions (see below).

The dog was retrieved from the kennel by the test person and taken in a leash to the test room that was located a 3 minutes' walk from the kennel. Before entering the test room the dogs were equipped with a belt with the HR equipment on. The dog was let into the test room. The room was 15 m<sup>2</sup> and equipped with a chair, a small bookshelf, a blanket, two dog toys and a water bowl. The bookshelf contained a plastic jar with dog treats, a dog toy prepared with treats and a door mat (used for the cooperation part, see below). Each interaction consisted of 6 parts: separation/reunion, play and cooperation, passive interaction, play, passive without interaction and a final passive interaction part (Table 1).



**Table 1.** Scheme of one interaction session

<b>Interaction and time</b>	<b>Description</b>
Beginning of session	The test person enters the room with the dog and removes the leash according to caregiving style (CS).
Separation/reunion 00:00	The test person leaves the room for 30 seconds. The test person returns and stands passive for 5 seconds and will then interact with the dog according to CS for 55 seconds.
Play and cooperation 01:30	A doormat with candy underneath is placed on the floor and the dog is encouraged by the test person to try and solve the problem. If the dog retrieves the candy a new one is placed under the mat. The test person will interact according to their CS.
Passive interaction 04:30	The test person interacts calmly with the dog for 5 minutes. The test person will have physical and/or verbal contact with the dog according to their CS.
Play 09:30	The test person engages in play using a dog toy, prepared with candy, with the dog for 2 minutes according to their CS.
Passive 11:30	The test person sits passive on a chair and reads a book for 5 minutes. On days with stressors they will be applied here after 2 minutes. The test person will react to the stressor according to their CS and then return to being passive.
Passive interaction 16:30	The test person interacts calmly with the dog for 2 minutes. The test person will have physical and/or verbal contact with the dog according to their CS.
End of session 18:30	The test person puts on the leash according to CS and leaves the test room.

During two of the 15 days, the interaction sessions took place in an outside enclosure to which the dogs were familiar with.

### 2.2.1 *Secure interaction*

The person interacted with the dog according to the given caregiving style. During interaction, the SC person was calm and intuitive to the dog's needs. The SC person interacted both physically and verbally with the dog if the dog were seeking contact. When the dog was not seeking contact the SC person encouraged the dog verbally in everything it did, but not when the dog was seeking eye contact to encourage the dog to take own initiative and to show independence.

At the beginning of the session the SC person entered the room with the dog, removed the leash and started the HR equipment. The SC person was calm and crouched or sat down to remove the leash. The person then left the room while telling the dog that they would be back soon. When the person returned they calmly walked into the room and after 5 seconds sat down and greeted the dog. The SC person talked to the dog in a calm way and stroked it if the dog sought physical contact. When changing activity (e.g. interaction part), she bent away from the dog and slowly stood up. During play and cooperation, the SC person sat down with the door mat in front of her. The SC person then placed pieces of treats underneath the mat and verbally encouraged the dog whenever the dog was concentrating on retrieving the treats. During the passive interaction, the SC person sat down and verbally encouraged the dog in whatever it was doing. She stroked and talked to the dog if the dog was seeking contact. If the dog was hesitant or unwilling to take contact, the SC person focused her attention to her shoes

or other objects in the room, avoiding focusing on the dog to reduce the risk of stressing the dog and to encourage curiosity. When playing with the dog the SC person would drag a toy across the floor. She focused on the toy and avoided looking at and moving towards the dog. If the dog was uninterested in the toy the SC person would play with the toy by themselves and distribute the pieces of treats from the toy or on the floor during the playtime to encourage the dog to participate. During the passive part the SC person sat in the chair and read a book. She focused on the book but occasionally encouraged the dog in what they were doing and calmly greeted the dog if it was seeking contact. At the end of the session the SC person slowly walked over to the bookshelf and retrieved the leash. They squatted down and gently attached the leash and turned off the HR equipment before leaving the room together with the dog.

### 2.2.2 *Disorganised interaction*

During the interaction, the DC person was very inconsistent in her behaviour towards the dog. When the dog was seeking contact the DC person would alternately respond to the interaction both physically and verbally but the next time ignore the dog. The DC person could force the dog to interact with her, suddenly stop interacting, becoming agitated, scared or happy and alternating between these emotional responses. She would repeatedly give the dog commands such as “come here”, “lay down” and “go away”. The DC person alternated between interrupting the dog in what they were doing and encouraging the dog. Now and then, the DC person would pet the dog on their head and pick up their paws since dogs generally dislikes being handled this way (Kuhne *et al.*, 2012).

When entering the test room the DC person would bend over the dog and remove the leash and turn on the HR monitor. When leaving the dog, the DC person acted hesitant and repeatedly reassured the dog that she would be back and telling the dog to stay. When returning, she walked to the middle of the room and, after 5 seconds, greeted the dog while standing up. She would bend over the dog and pet it over the head and back. The DC person alternated between greeting and pushing the dog down. After 30 seconds, she sat down and continued to alternate between greeting, pushing the dog away and if the dog walked away, calling it back. When changing activity, the DC person would suddenly stand up and quickly change to the new activity. During play and cooperation, the DC person stood bent over the door mat and placed treats underneath the mat while pushing the dog away or verbally telling the dog to wait. The DC person would encourage the dog to search when it was seeking eye contact and complain over the dog when it was not searching well enough. The DC person would alternate between talking to the dog in an irritating way and encouraging the dog. During the passive interactions, she alternated between encouraging the dog, greeting the dog verbally and physically, pushing the dog away, moving around and acting as stressed or scared of the dog. Also, she demanded the dog, verbally or by physical force, to interact with her. Moreover, the DC person would suddenly stop the interaction to examine the dog or to become interested in something else in the environment. While playing with the dog the DC person would alternate between dragging the toy across the floor, verbally encouraging the dog and pushing the toy against the dog, demanding the dog to play and pushing the toy towards the dog’s face. During the passive part the DC person would sit in the chair reading a book and alternate between ignoring and greeting the dog if it was seeking contact. The DC person would repeatedly tell the dog to “come here”, “lay down” or “stop” whatever they were doing. At the end of the session the DC person would quickly stand up and retrieve the leash. She would bend over the dog and quickly put on the leash and turn off the HR equipment before leaving the room together with the dog.

### 2.2.3 Stressors

During the interaction period, four different stressors were applied to further emphasise the caregiving styles (Table 2). Each dog was exposed to each stressor twice, once with each caregiver. The order of which person it first experienced a stressor with was balanced to avoid any possible order effects. The stressors were spread out during the 4 weeks of the interaction period. The stressors were always applied during the passive part of the interaction session (minute 03:30 for stressor 1, 2, 4 and minute 01:00 for stressor 3).

**Table 2.** Stressors that were applied during the interaction period

<b>Stressors</b>	<b>Description</b>
<b>1- day 3</b>	Loud noise: The sound of fireworks was played on high volume for 20 seconds.
<b>2 – day 5 &amp; 6</b>	Stranger: An unfamiliar person entered the room and walk around in a predetermined pattern for 30 seconds without interacting with the dog.
<b>3 – day 5 &amp; 6</b>	Dog meeting, outside: The test person walked with the dog on a short leash and while walking, passed by an unfamiliar dog.
<b>4 – day 10</b>	Falling object: A stuffed animal was attached to a rope in the ceiling and was suddenly dropped down.

When a stressor was applied with the SC person, she would react by talking calmly to the dog and focus towards the stressor. She would encourage the dog to investigate the stressor. The DC person would react with fear towards the stressor. She alternated the focus between the dog and the stressor, tried to move away from the stressor and repeatedly told the dog to move away from the stressor while acting scared and distressed.

### 2.3 Challenging situations

Each dog was tested twice, a baseline test before the interaction period and a final test after the interaction period in order to investigate the effect of caregiving style. The dogs encountered three challenging situations together with both test persons, located at either side of the dog, balanced across dogs.

All tests were video recorded, and the recorded material was observed by one observer according to the ethogram (Table 3).

**Table 3.** Ethogram: Challenging situations (P1=The test person that interacted with all the dogs, P2/P3=Either of the two test persons that interacted with half of the dogs each)

<b>Category</b>	<b>Type</b>	<b>Description</b>
<b>Position</b>	Outside of P1	The dog is located on the side of P1 (any body part)
	Outside of P2/P3	The dog is located on the side of P2/P3 (any body part)
	Behind P1	The dog (full body) is located behind P1 (i.e. the test person is located between the dog and the stressor)
	Behind P2/P3	The dog (full body) is located behind P2/P3 (i.e. the test person is located between the dog and the stressor)
	Not visible	The dog's position is not observed within camera range
<b>Distance test person</b>	Close P1	The dog is within 5 cm away from (or in contact with) P1

	Close P2/P3	The dog is within 5 cm away from (or in contact with) P2/P3
	Slacked leash P1	The dog is within 5 cm-1.5 m away from P1
	Slacked leash P2/P3	The dog is within 5 cm-1,5 m away from P2/P3
	Stretched leash P1	The dog is within 1.5 m-2 m away from P1
	Stretched leash P2/P3	The dog is within 1.5 m-2 m away from P2/P3
	Away P1	The dog is not within leash length (>2m away from P1)
	Away P2/P3	The dog is not within leash length (>2m away from P2/P3)
<b>Head direction</b>	Toward stressor	The dog's nose is directed toward the stressor
	Toward P1	The dog's nose is directed toward the P1
	Toward P2/P3	The dog's nose is directed toward the P2/P3
	Toward other	The dog's nose is directed elsewhere (not toward stressor not test persons)
	Toward stressor, P1 and P2/P3	The dog's nose is directed towards the stressor, P1 and P2/P3 (only applicable when P1 and P2/P3 has approached the stressor)
	Not visible	Head direction is not visible

### 2.3.1 Visual surprise

As a visual surprise, a wooden board was suddenly pulled up in front of the dog when walking (Fig. 1).

The test persons and the dog started 15 meters from the visual surprise and walked towards it with the dog between them on a short leash. When at a 2-meter distance, a board was pulled up from horizontal to vertical. When elevated from the ground, the test persons immediately stopped, dropped the leash and were standing passive. Thereafter, the test persons were instructed by the test leader (TL) to act according to Table 4a depending on the response of the dog. As soon as the dog approached the stressor, i.e. was within 5 cm or in physical contact with it, the test was over and the test persons was encouraged to approach and praise the dog.

### 2.3.2 Auditory surprise

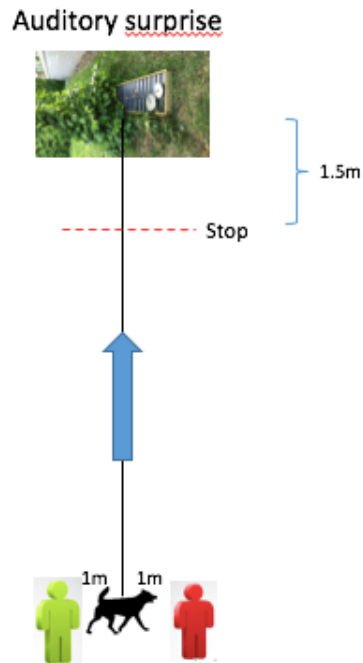
As the auditory surprise, a chain was dragged over a corrugated sheet (Fig. 2).

The test persons and the dog started 15 meters from the auditory surprise and walked towards it with the dog between them on a short leash. At a distance of 1.5 meters from the audible surprise the chain was pulled across the sheet. When pulled, the test persons immediately stopped, dropped the leash and remained passive. Thereafter, the test persons were instructed by the TL to act according to Table 4b depending on the response of the dog. As soon as the dog approached the stressor, i.e. was within 5 cm or in physical contact with it, the test was over and the test persons was encouraged to approach and praise the dog.

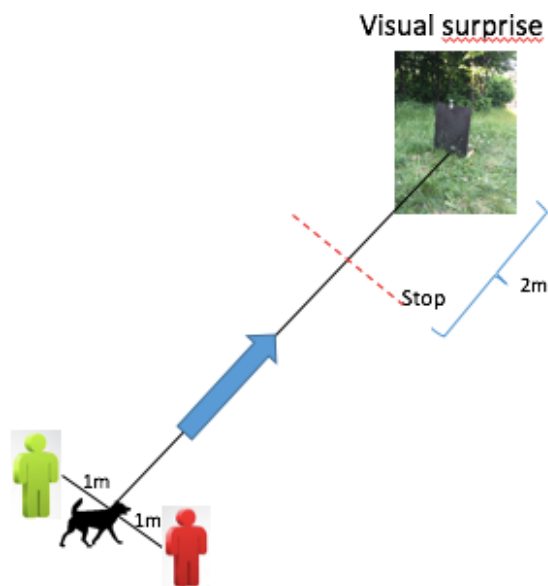
### 2.3.3 Approaching person

An unfamiliar person dressed in a robe, dark sun glasses and hat came out from a hiding place and slowly moved towards the dog (Fig. 3).

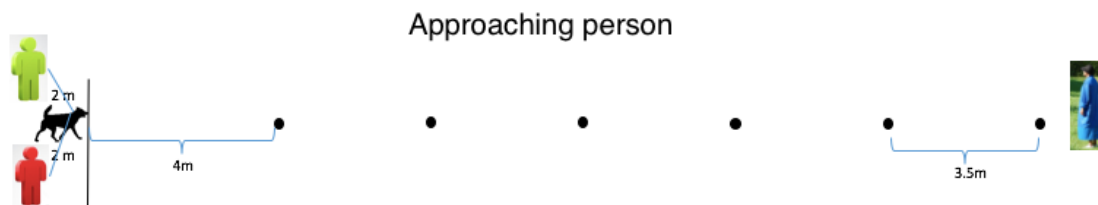
The test persons were standing stationary with the dog in between them with access to the full 2-meter length of the leash (the persons held one leash each). From directions of the TL the unfamiliar person clapped their hands 3 times and then came out from the hiding place. From direction of the TL the unfamiliar person walked slowly towards the dog and the test persons stopping every 3.5 meters until she was 4 meters from the dog and test persons. The test persons then dropped their leash. Thereafter, the test persons were instructed by the TL to act according to Table 4c depending on the response of the dog. As soon as the dog approached the stressor, i.e. was within 5 cm or in physical contact with it, the test was over and the test persons was encouraged to approach and praise the dog.



**Fig. 1.** Auditory surprise test.



**Fig. 2.** Visual surprise test.



**Fig. 3.** Approaching person test.

**Table 4a.** Procedure for the visual stressor test. If the dog had already approached to within 5 cm or was in physical contact with the stressor at any time into the test, the test persons rewarded the dog and the test was over. If it had not approached the stressor, the test persons acted according to the following timetable

Minute	Action (if dog had not approached the stressor)
00:30	The test persons walk all the way up to stressor, stop and remain passive
00:45	Test persons' squat by stressor, talk to/call the dog in an encouraging manner
01:00	Test is over

**Table 4b.** Procedure for the auditory stressor test. If the dog had already approached to within 5 cm or was in physical contact with the stressor at any time into the test, the test persons rewarded the dog and the test was over. If it had not approached the stressor, the test persons acted according to the following timetable

Minute	Action (if dog had not approached the stressor)
00:15	The test persons walk halfway towards stressor (0.75 m), stops and remains passive
00:30	The test persons walk all the way up to stressor, stops and remains passive
00:45	The test persons' squat by stressor, talks to/calls the dog in an encouraging manner
01:00	Test is over

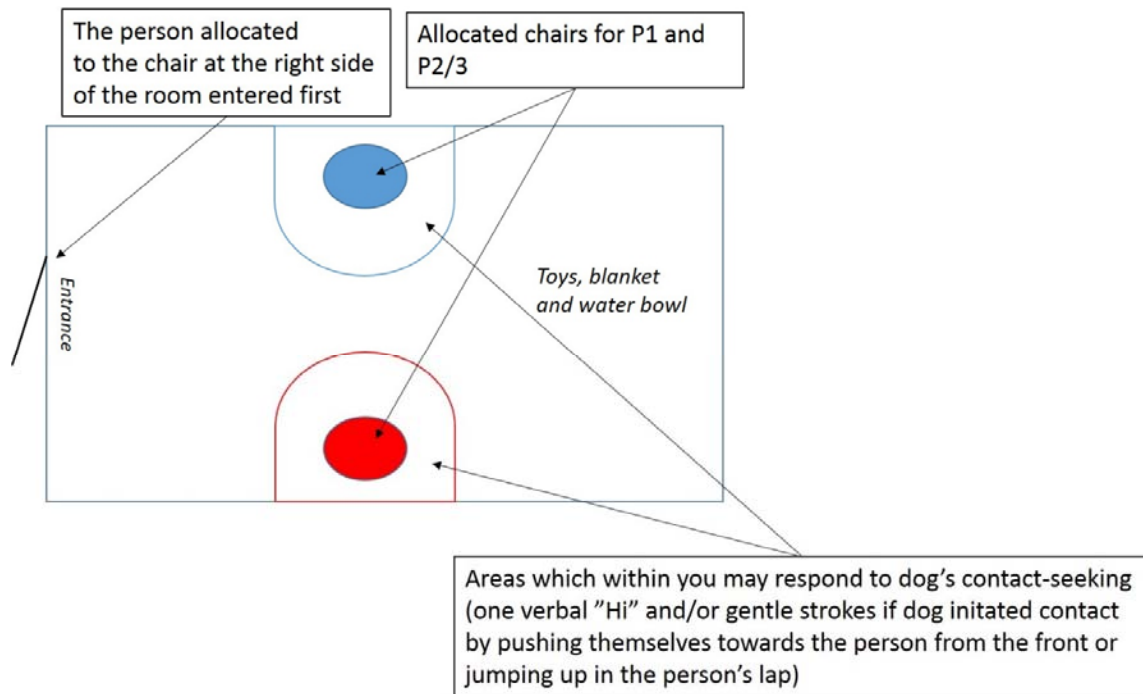
**Table 4c.** Procedure for the approaching person test. If the dog had already approached to within 5 cm or was in physical contact with the stressor at any time into the test, the test persons rewarded the dog and the test was over. If it had not approached the stressor, the test persons acted according to the following timetable

Minute	Action (if dog had not approached the stressor)
00:30	The test persons walk all the way up to the stressor and stand face-to-face with the person at a close distance, remain passive
00:45	Test persons talks to the approaching person and calls on the dog
01:00	The approaching person calls the dog, test persons are passive
01:15	The approaching person removes sunglasses and hat, the coat is removed and the person walks 5 m away from her original position
01:30	Test is over. The person squats down with the side of her body towards the dog, calling the dog

#### 2.4 Separation and reunion test

In addition to the challenging situations, three separate separation and reunion tests were performed. In order to investigate the effect of caregiving style on the behaviour of the dog,

tests were performed before (baseline), during (day 9, mid-test) and after (final test) the interaction period. The dog was let into a room and left alone for 3 minutes. Both test persons then entered the room and sat down on two chairs opposite of each other for 2.5 minutes. The order of entering the room (which person that would open the door and walk in first) and the side of the room the test persons sat was balanced to avoid an effect of which person that entered first and which side of the room the person was situated in. The test person remained neutral during the test but greeted the dog with a verbal “Hi” if the dog put both front paws inside that person’s test area (see Fig. 4). If the dog initiated physical contact, the test person stroked the dog until the dog left or for 10 seconds and then stopped and only continued if the dog was still seeking contact. The test was video recorded and the dog’s orientation, location in the room and physical contact with the test persons was later observed (Table 5).



**Fig. 4.** Overview of the room where the separation and reunion test was executed.

**Table 5.** Ethogram. Separation and reunion test

Category	Type	Description
<b>Position</b>	Zone A	The dog has at least two paws inside the marked area at Zone A
	Zone B	The dog has at least two paws inside the marked area at Zone B
	Close to door	The dog has at least two paws within 80 cm from the door/window
	Neutral zone	The dog has at least three outside the marked areas/80 cm from the door/window
<b>Orientation</b>	Person A	The dog’s nose is directed towards person A
	Person B	The dog’s nose is directed towards person B
	Door	The dog’s nose is directed towards the door/window

<b>Physical contact</b>	Person A	The dog has contact or is within 3 cm from person A
	Person B	The dog has contact or is within 3 cm from person B
<b>Not visible</b>	Head	The dog's head is not visible
	Dog	The dog is not visible

## 2.5 Heart rate

In addition to the behavioural tests the dogs wore a heart rate (HR) monitor during the interaction sessions. HR was only measured during the interaction period since we did not have the opportunity to habituate the dogs to the monitors before the baseline tests and there was a chance that the dogs would get disturbed by the novelty of wearing the monitors. The HR monitor was put on the dog outside the test rooms before each session and started when entering the test room. The monitor was turned off when the interaction session was over. The HR was compared between treatments over the entire interaction period (15 days) and the second half of the interaction period (8 days). This gave us an indication of how the dogs' HR was affected when interacting with the different caregivers and whether or not the dogs' HR changed over time after interacting with the different caregivers.

## 2.6 Behavioural observation

Behavioural data were collected by performing observations on the recorded material in Interact, an observation program developed by Mangold professional (Mangold, 2017). An ethogram was developed for the separation and reunion test to look at the dog's position, orientation and physical contact (Table 5). The ethogram for the challenging situations focused on the dog's position, orientation, and distance to the test person (Table 3). The observations during the separation and reunion tests were made with one/zero observation and instantaneous observations, both with 5 second interval. The challenging situation tests were observed using instantaneous observation every second. The data were summarised and analysed in Minitab 17 (Minitab, 2010).

## 2.7 Statistical methods

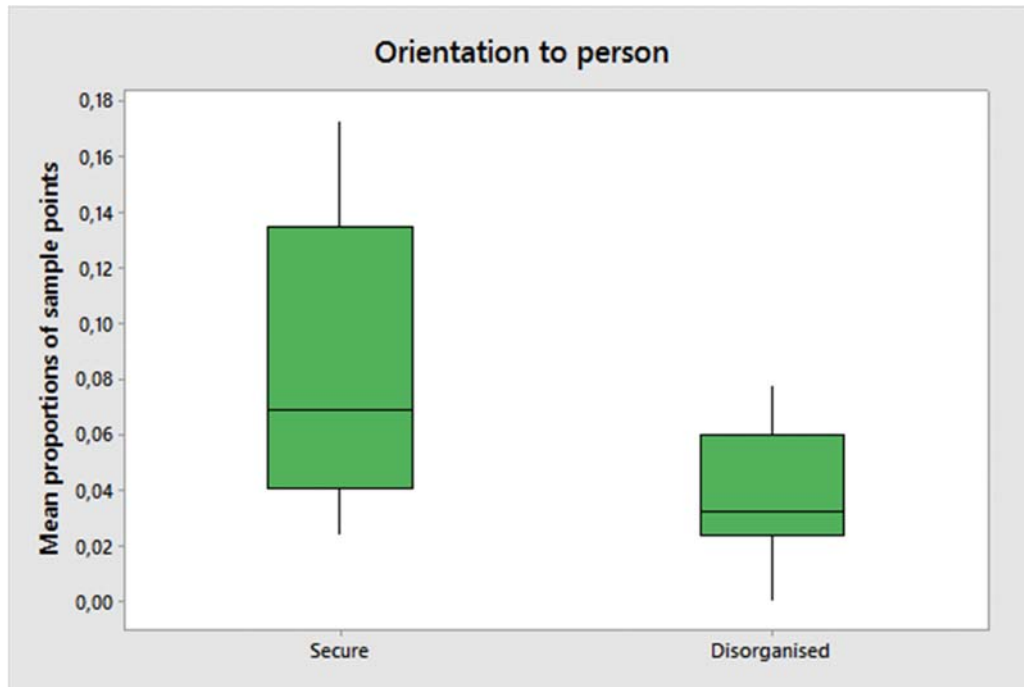
Non-parametric tests were performed on data from the challenging situations and separation and reunion tests since these were not normally distributed. Comparisons were made to look at which caregiver (SC or DC) the dog preferred to focus on/stay closer to/initiate physical contact with during the challenging situations and the separation and reunion tests. This was done by looking at proximity seeking behaviour visual orientation and the location of the dog in relation the test persons. Each dog acted as their own control and delta-values were calculated, either as differences in behaviour towards person SC and DC, or as differences in each dog's behaviour before (baseline), during (mid-test) and after (final) the interaction period. Wilcoxon sign ranked tests were used to look at the effects of caregiving style on behavioural responses during the tests. A paired T-test was performed on the HR data since the data were normally distributed. All HR data were summarised across the interaction period based on the last 17 minutes of interaction, i.e. excluding the recordings of the separation and reunion events of each interaction. Moreover, in order to investigate the effect of time interacting with the different caregivers, HR data half way through the interaction period (8 days) were compared between SC and DC interactions.



### 3. Results

#### 3.1 Challenging situations

Dogs were more often oriented towards the SC person than the DC person during the approaching person in the final tests ( $W=59.0$   $P=0.023$ , Fig 5). No such differences were found during the baseline tests. No other differences were found in the dogs' behaviour towards the SC and DC persons, in any of the other challenging situations.



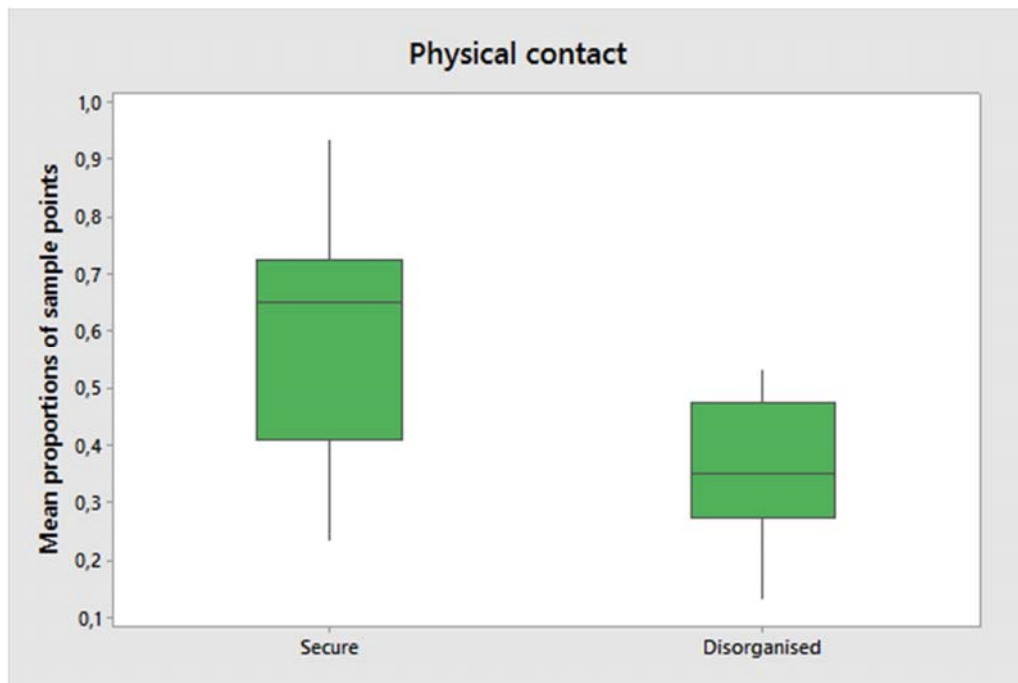
**Fig. 5.** Orientation to person at the approaching person test during final tests.

#### 3.2 Separation and reunion test

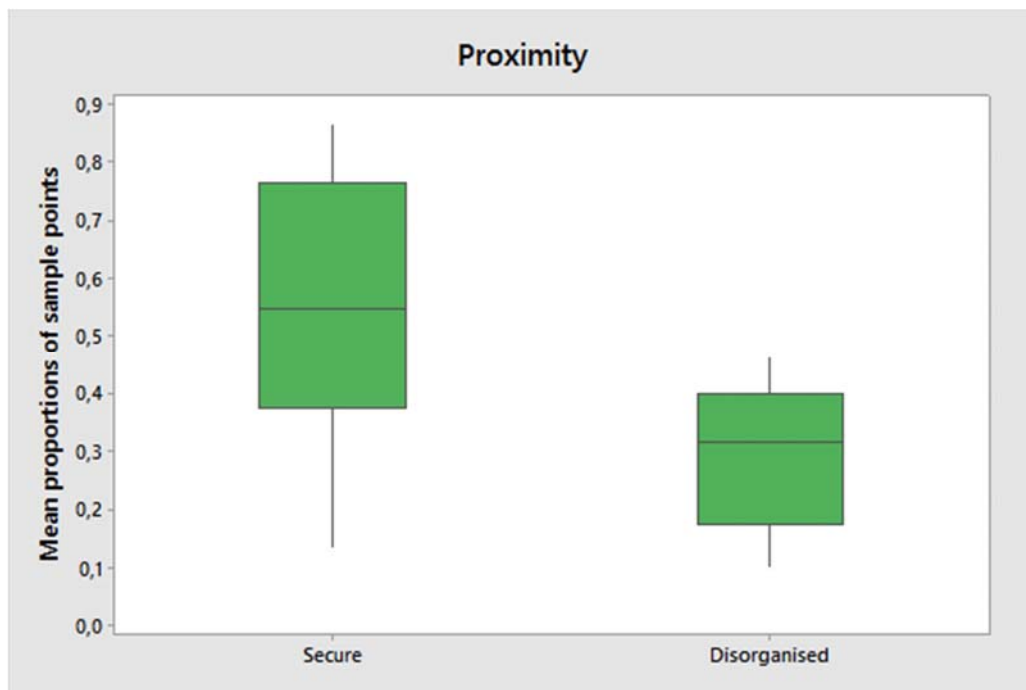
The dogs tended to initiate more physical contact with the SC person ( $W=63.0$   $P=0.065$ ) and dogs were more oriented towards the SC person ( $W=65.5$   $P=0.041$ ) than the DC person during the initial (baseline) separation and reunion test.

During the mid-test (after 9 days of interaction), dogs tended to initiate more physical contact with the SC person ( $W=53.0$   $P=0.083$ ) and they tended to spend more time in the SC person's zone (proximity) ( $W=63.0$   $P=0.065$ ).

During the final separation and reunion test (after 15 days of interaction), dogs initiated more physical contact with the SC person ( $W=52.5$   $P=0.013$ ) (Fig. 6) and spent more time in the SC person's zone (proximity) ( $W=65.0$   $P=0.045$ ) (Fig. 7).



**Fig. 6.** Differences in physical contact during final separation and reunion tests.



**Fig. 7.** Differences in proximity during final separation and reunion tests.

### 3.3 Heart rate

When comparing the treatments (entire interaction period), dogs tended to have a higher HR when interacting with the SC person (SC:  $131.2 \pm 2.1$  (mean $\pm$ SE); DC:  $129.0 \pm 1.44$ ;  $T=1.9$ ,  $P=0.09$ ). During the last half of the interaction period (8 days) dogs had a higher HR when interacting with the SC person (SC:  $132.6 \pm 2.6$ ; DC:  $129.7 \pm 1.85$ ;  $T=2.9$ ,  $P=0.02$ ).

## 4. Discussion

The aim of this study was to investigate if dogs would differ in their contact and comfort seeking behaviour towards a person depending on that person's caregiving style. The results revealed that dogs were affected by human behaviour and caregiving style. Dogs were more oriented towards a person with a secure caregiving style during a challenging situation and initiated more physical contact and spent more time in proximity to the person applying a secure caregiving (SC) style compared to a disorganised (DC). This indicates that dogs prefer to seek comfort from a person with a secure caregiving style in favour of a person with a disorganised caregiving style and that human personality and behaviour can influence the success of the relationship as well as the welfare of the dog. However, one issue with our results were the fact that the dogs were more oriented towards the SC person in the separation and reunion test during the baseline tests. The dogs were unfamiliar with the test persons before the test and the test persons did not know which dogs they would be acting as secure and disorganised towards. This is a problem that can occur when having a small number of study subjects.

We only got a result on the approaching person test during the challenging situations. The dogs did not show any contact seeking behaviours during the other two challenges. One explanation for this could be that these challenges were very short and the test persons would let go of the leash as soon as the stressor was applied. This allowed the dog to move away from the situation and avoid dealing with the stressor. When the dog moved away from the stressor we were also unable to distinguish the dog's orientation which could have been unknowingly directed towards the secure person. During the approaching person test the dog were unable to move away from the stressor and they were exposed to the stressor for several minutes.

The results regarding HR showed that the dogs had a higher HR when interacting with the SC person. This result was not in line with my hypothesis. One possible explanation for this result is that the dogs were more physically active when interacting with the SC person compared to when they interacted with the DC person. To successfully evaluate the physiological responses to different caregiving styles, physical activity should be evaluated from the current study and one alternative for future studies could be to incorporate complimentary physiological measurements such as oxytocin or cortisol or look at HR at specific events during the interaction to more easily evaluate the dogs' physical response.

The results of this study show that dogs are affected by human caregiving style and by using this method of evaluating how the dog is affected by their owner it could be used to evaluate the success of the relationship. This could also be used when matching dog and human when rehoming dogs.

When dogs encounter something unfamiliar and potentially frightening, they tend to seek contact with humans (Merola *et al.*, 2012a). If the dog reacts aversive to the frightening stimuli they are even more prone to seek human contact (Merola *et al.*, 2012a). When a dog encounters a frightening stimulus they generally do not react as aversive to it if their owner is present (Gácsi *et al.*, 2013). Gácsi *et al.* (2013) investigated the safe-haven effect when dogs were exposed to an approaching person while together with their owner and when alone. They could see that dogs had a reduced initial reaction towards the approaching person and a reduced HR when encountering the threat together with their owner compared to when they encounter it alone (Gácsi *et al.*, 2013). This is an indication that dogs see their owner as a safe

haven in the same way as children see their parents act as a safe haven when encountering something frightening (Bowlby, 1988). The safe haven and secure base effects are crucial parts of attachment in humans (Ainsworth, 1989). In our study, we could see a safe haven effect, where dogs would seek comfort from the SC person when exposed to a challenging situation such as the approaching person and after having been left alone in a novel environment. Since we did not evaluate exploratory behaviour, and more importantly, did not test dogs separately with each of the two caregivers, we could not draw any conclusions of a possible secure base effect. Since both persons were present together with the dog during the challenging situations, it would have been impossible to know which person affected the dogs' explorative behaviour (i.e. time to approach a threatening stimulus).

Merola *et al.* (2012b) investigated how dogs would use social referencing when encountering something frightening. They compared how dogs would react depending on the information they got and if it came from the owner compared to if it came from a stranger. They could see that the dogs would collect information from both persons but would only react to the information if it came from the owner (Merola *et al.*, 2012b). Merola *et al.* (2012a) could see that if the owner would react positively towards the frightening stimulus (moved towards the stimulus and had a happy facial expression) the dogs were more willing to explore the stimulus than if the owner reacted negatively (moved away from the stimulus and had a frightened facial expression). In another study investigating the owner's influence on the dog, Horn *et al.* (2013) compared dogs' behaviour in a manipulative task. They investigated how dogs' behaviour changed when their owner was present, the dog was alone or if the owner was replaced by an unfamiliar person. They saw that the dogs worked on the task for a longer time if the owner was present than if they were alone (Horn *et al.*, 2013). If the owner was replaced with an unfamiliar person dogs would work on the task for a shorter time compared to when the owner was present but longer than when they were left alone (Horn *et al.*, 2013). These two studies show us that dogs will recognize and gather information from both a familiar and an unfamiliar person. However, the dogs will be more reactive to the information provided from their owner and possibly more comfortable when their owner is present. In our study, we had both test persons present during all tests and the dogs could seek contact from both the SC and the DC person although they sought more contact with the SC person. Even though one of these test persons was applying a disorganised caregiving style the person would still be familiar to the dog since they had been interacting with the dog. The results of our study (that the dogs not only sought contact with the SC person in other tests than the approaching person) could be explained by the fact that dogs seek contact with persons even if they are unfamiliar to them (Horn *et al.*, 2013; Merola *et al.* 2012b). In a study by Kuhne *et al.* (2012) they found that dogs preferred to be petted by a familiar person over a stranger. However, in our study the dogs tended to initiate more physical contact and to be more oriented towards the SC person even in the baseline test. Both during the separation and reunion test and the challenging situation test the side of the DC person and the SC person was balanced across dogs to avoid a preference for side. Since the dogs were unfamiliar with the test persons before the test there is no clear explanation for this except the limited number of test subjects, i.e. that this unexpected outcome occurred by chance. The results of the baseline test made the results on the second test and the final test less definite.

The social behaviour towards humans can differ between breeds indicating there is a genetic component to the behaviour (Lit *et al.*, 2010; Passalacqua *et al.*, 2011). For example, there can be differences in the willingness to seek eye contact (Passalacqua *et al.*, 2011), the willingness to seek physical contact, responsiveness and reactivity to communicative cues (Lit *et al.*, 2010). There are differences in communication between different breed groups and a

possible explanation is that they have been bred for different purposes. For instance, herding and hunting dogs are more prone to use eye contact (Passalacqua *et al.*, 2011) while retrievers used more body contact when interacting with humans (Lit *et al.*, 2010). In this study, there were only dogs of the breed Beagle in order to gain a homogenous sample. However, using only one breed might affect the study results since a certain type of dogs might be more or less prone to seek contact with humans. However, since the dogs included in the study served as their own controls differences are reliable with regards to the treatment, although another breed might show more contact seeking behaviour or be more prone to seek comfort with humans. Moreover, studies suggest differences in social behaviours within a breed. Persson *et al.* (2015) investigated the differences in human directed contact seeking behaviour in Beagles. They could see that females were more prone to seek physical contact but that age and experience influenced how prone they were to seek eye contact (Persson *et al.*, 2015). In our study the dogs were of mixed ages and we used six males and six females to make sure that these aspects would not influence the results. Moreover, we know that dog's behaviour are affected by previous experience (Pluijmakers *et al.*, 2010; Foyer *et al.*, 2013; Foyer *et al.*, 2014) and that they are especially sensitive during the socialisation period between 2.5 to 15 weeks of age (Serpell & Jagoe, 1995; Pluijmakers *et al.*, 2010). During adulthood things like training techniques, living conditions and handling of a dog can also influence the relationship and performance of the dog (Lefebvre *et al.*, 2007; Horváth *et al.*, 2008; Schilder & van der Borg, 2004). Dogs that were regularly played with, trained without shock collars and got more attention from their owners were more obedient, less likely to show aggression and had a better welfare (Lefebvre *et al.*, 2007; Horváth *et al.*, 2008; Schilder & van der Borg, 2004). This indicates the importance of the owner's behaviour when looking at the success of the relationship. Even though the dogs used in our study were kept only for behavioural research and for veterinary students to practise handling on it is difficult to know exactly what kind of experience these dogs have with human contact. Some dogs might have a very positive experience with people while some might find human contact aversive. It is due to these individual differences that each dog acts as its own control. Even if the dogs would have bad experiences with humans they would be more prone to seek contact with the SC than the DC person. The same goes for those with positive experiences. Since there was a limited number of dogs at the test facility there was a limited opportunity of choosing the individuals, especially with the males since there only were six males at the facility, which makes this method even more important.

One important feature of attachment is to look at the behaviour of the attached individual upon reunion with the attachment figure (Ainsworth *et al.*, 1978). Our results revealed that dogs initiated more physical contact with, and spent more time close to the SC person when the dog had been left alone for three minutes. To use separation as a stressor to activate attachment behaviour could in some cases be difficult. In a study by Prato-Previde *et al.* (2003) they saw that dogs expressed proximity seeking behaviours when left alone, such as jumping and scratching at the door, vocalization and being oriented towards the door the owner left from. When reunited with their owner these behaviours stopped, but many of the behaviours disappeared even if the person that came back was a stranger (Prato-Previde *et al.*, 2003). This indicates that being left alone is a stressor for most dogs and that any human company is preferred. A similar result, where the influence of human company was tested, was seen in the study by Tuber *et al.* (1996) who saw that dogs were less stressed when accompanied by a human in a novel environment than if they were accompanied by another dog. In our study, we used separation as a stressor but instead of performing the test twice, once with the SC person and once with the DC person, both persons entered the room together. This way, we could perform a preference test without risking that the dogs would

just seek comfort from however entered the room. Also, it decreased the number of times the test was repeated to the dogs. Prato-Previde *et al.* (2003) saw that dogs showed more proximity and contact seeking behaviour towards their owner compared to a stranger and that was the case with physical contact and proximity in our study as well when comparing the SC and DC persons.

Heart rate as a measure of arousal or stress in dogs has been used in several studies (Beerda *et al.*, 1997; Beerda *et al.*, 1998; Engeland *et al.*, 1990; Palestrini *et al.*, 2005). This measurement is however not easy to evaluate since it is effected not only by emotional states but also by physical activity (Palestrini *et al.*, 2005; Maros *et al.*, 2008) and sometimes the valence of arousal (positive or negative) is difficult to interpret. Lensen *et al.* (2017) saw that HR increased when dogs experienced both positive and negative arousal and that without complementary behavioural observations, it is impossible to distinguish between the valences of arousal. In this study, we choose to look at the overall difference in HR comparing the two treatments. However, in contrast to our hypothesis, dogs had a higher HR when interacting with the SC person compared to the DC person. Most likely, this was due to a higher, positive, arousal or higher levels of physical activity when interacting with the SC person. A study of the activity level and behaviour of the dogs when interacting with the SC person compared to when they interact with the DC person needs to be done to see what kind of differences there are in the two treatments. To investigate this further we would also need to investigate the differences in HR in each part of the interaction period. Especially focusing on the passive parts of the interaction where the risk of physical activity influencing the results is reduced. Effects on HR when stressors were applied would also contribute to or knowledge about the dog-human bond (e.g. looking at the initial reaction and how long time it takes for the HR to return to normal after the stressor as well as comparing if they are interacting with SC person or the DC person). Another way to help interpret the responses is to measure e.g. cortisol and oxytocin (Schöber *et al.*, 2015; Odendaal & Meintjes, 2003; Handlin *et al.*, 2012). Schöber *et al.* (2015) discovered that dogs that were described as securely attached to their owner had a lower cortisol level when exposed to a challenging situation compared to dogs that were insecurely attached. To measure the attachment of the dogs Schöber *et al.* (2015) used the original ASSP protocol developed to assess attachment in toddlers but adapted it to the species-specific behaviours of dogs. Odendaal & Meintjes (2003), Handlin *et al.* (2012) and Rehn *et al.* (2014) found that the oxytocin levels increased in dogs during positive interactions with their owner. In the study by Persson *et al.* (2017) they could see that there is a genetic difference in how sensitive dogs are to oxytocin and that some dogs seek more social contact with human when exposed to oxytocin while some dogs show less social contact. These results teach us that the study of dogs' social behaviour is complex and that there is a need to combine different types of measurements, e.g. observational (behaviour) and physiological (e.g. cardiac activity and hormones). Combining different physiological measurements with behavioural studies can give us a better understanding of dog's emotional states and the influence of the relationship they have with their owner.

This study is the first to investigate attachment between dogs and humans in this way. Earlier studies like the one by Siniscalchi *et al.* (2013) investigated how human caregiving behaviour affected privately owned dogs and did this by assessing the owner's caregiving style using a questionnaire. The advantage of using our method is that all dogs participating lived at a research centre, reducing the risks of previous experiences effecting the results to the same extent as among privately owned dogs. Another advantage is the use of test persons applying the different caregiving styles in a controlled way instead of assessing caregiving style with a questionnaire. When using questionnaires there is always a risk that the answers are not

completely reliable. Another advantage of our study is using the dogs as their own control as they were exposed to both treatments (interacting with both a SC and DC person) and performing one test before the interaction period and one test after the interaction period. The latter made it possible to compare differences in behaviour when the dogs were not yet exposed to the person's caregiving style (baseline) with the behaviour when the dogs had been interacting intensely with the persons with the different caregiving styles. By using the dogs as their own control, we could see if the dogs would change their behaviour according to the caregiving style without risking that the dogs' different personality's or previous experiences affected the results to the same extent. We performed a controlled test and used research dogs in the study. However, when using dogs that lives at a research centre there is always a risk that the results cannot be directly extrapolated to companion dogs. Research dogs do not live in the same way as companion animals and might not have the same kind of relationship with humans. This could influence how well the results can be applied to the dog-owner dyad. However, using privately owned dogs could impose other types of problems since we wanted to test two different caregiving styles. One alternative could have been to look for dog owners that had these specific caregiving styles. It would have been possible but would require a large number of participants since there is a number of factors that could influence the results, such as breed and previous experience. Another problem with that study design would be to make sure that all dogs had been subjected to the same kind of caregiving style for long enough time.

One risk with the research was that the dogs would not develop a preference towards the test persons. However, Gácsi *et al.* (2001) found that dogs expressed attachment behaviour towards a person after only a limited time of interaction (3 days and a total of 30 minutes). In a study by Fallani *et al.* (2006) they tested the ability of guide dogs to form an attachment bond towards their new caretakers. They wanted to see how easily a dog could form a new attachment even though they already had an attachment figure. They saw that guide dogs established a new attachment bond towards their blind owner that was similar to the former attachment bond towards their attachment figure (Fallani *et al.*, 2006). The effect of familiarity was investigated in the study by Kerepesi *et al.* (2015). They saw that dog's behaviour towards humans was dependent on their level of familiarity. They compared the owner, a familiar person and a stranger in a number of tests to study the dog's behaviour during challenging situations, obedience and a modified version of the ASSP (Kerepesi *et al.*, 2015). They saw that the dogs preferred to interact with the owner and familiar person in favour of the unfamiliar person but during challenging situations the dogs would seek comfort from their owner and not the familiar person (Kerepesi *et al.*, 2015). In our study, we could see that the dogs would seek more comfort from the SC person during some of the challenging situations but not during all of them. Either the tests were not challenging enough to elicit the attachment system, i.e. comfort seeking behaviours in the dogs or the treatment was not effective enough that an attachment bond could have been developed to the extent as to resemble that of the relationship between a dog and its owner. The dogs in our study interacted with a person for 20 minutes per day during a total of 15 days (resulting in 5 hours spread out on one month). The dogs *did* express attachment behaviours such as seeking comfort in a challenging situation but since we did not perform a full ASSP test it is difficult to draw any conclusion on however the dogs formed a true attachment bond. To be able to investigate the possible attachment bond, future studies could include the ASSP in this type of study setup by, for example, performing a counterbalanced version of the ASSP were the SC and the DC persons both take part in the test as when performing it with a dog's owner and a stranger.

There is always a risk to include several test persons in the design since dogs might react differently to different individuals (a confounding effect which we minimised by applying the current study design). Dogs not only reacts to human behaviour but also to more subtle cues (Zubedat *et al.*, 2014; Lit *et al.*, 2011). Zubedat *et al.* (2014) saw that dogs reacted to stress in humans during a search exercise. The dogs were more reactive, moved faster and were more effective in their work if the person was stressed (Zubedat *et al.*, 2014). If the person was stressed about something that did not concern the search exercise the dogs were even more effective in their work (Zubedat *et al.*, 2014). Lit *et al.* (2011) saw that dogs trained in drug and bomb search were strongly influenced by their handler. The owner was told where the drugs were located before the search and even though there were no drugs at all the dogs still marked the place. This indicates that the dogs were strongly influenced by their owner's feelings or reactions during the search (Lit *et al.*, 2011). This imposes a problem for our research (and many more) since it is difficult to know how much the dogs are influenced by the test persons' emotional state. The test persons have different personalities and previous experiences that, unknowingly, influences their behaviour. The test persons can also have a caregiving style that is not the same as the one they are acting and this could influence the dog's reactions to the treatment. However, if the test persons are standardised in their behaviour (e.g behaves in the same way) smaller variations in personality and attitude usually do not influence the results when performing behavioural studies with dogs (Vas *et al.*, 2008). In this study, we got help from a well-known dog psychologist (Eva Bodfäldt) to develop the caregiving styles and to create the setup for the interaction period to be as similar to reality as possible. Moreover, the persons were balanced across dogs, minimising the influence of individual differences between persons. There were some disadvantages of having two different caregivers present during the challenging situations, e.g. we could not measure the secure base effect of the person. However, the alternative would have been to perform the test twice (each person participating with each dog) and then compare the results. The problems that we would have been faced with then were that each dog would have performed the tests a total of four times which increases the risk of becoming habituated to the situations. A benefit of having the two persons together with the dog is that we could observe the possible choice the dog would make. Hence, we could observe which person (the SC or DC person) the dog preferred to seek contact form in a challenging situation.

#### 4.1 Conclusion

The results showed that when dogs were exposed to challenging situations they chose to seek contact with a person mimicking a secure caregiving style in favour of a familiar person mimicking a disorganised caregiving style. These findings support the hypothesis that dogs are affected by human caregiving style and it gives us an indication of how much dogs are affected by human personality and behaviour. This research also demonstrates that this type of method, imitating caregiving strategies and apply it to research dogs for a limited amount of time, is suitable in order to further evaluate the dog-human relationship. These results will give us a better understanding of the dog- human bond and help us understand how much dogs are influenced by humans and human behaviour. This will help in evaluating dogs welfare and the success of the dog-human relationship.

#### 4.2 Future research

The main reason for studying attachment behaviour is to get an understanding of how to maximise the benefits for both dogs and humans in a relationship. Also, we want to investigate what elements can influence the relationship and how the relationship affects both the human and the dog. Moreover, this knowledge can be used to assess attachment styles in both human and dog attachment styles, which may help both in breeding of dogs (when



choosing breeding animals) but most importantly when matching dog and human when rehoming dogs. Further research should focus on how these caregiving styles may affect the dog and its behaviour and focus on the welfare of dogs when subjected to these different caregiving styles. More research should also be performed on the influence of human caregiving style but including an ASSP test in the study as well to look at the possible differences in the dog's attachment to persons with different caregiving styles. Since our results on HR were not in line with the hypothesis, further research should focus on incorporating more physiological measures when looking at the dog-human relationship. Oxytocin and cortisol can give us a better understanding of the dog's reactions and by looking at HR in different parts of the interaction sessions and comparing HR during specific events we could get a better understanding of the dog's reactions and how the caregiving styles influences the dog.

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