Does Play Pre-separation Affect Separation Behaviors in Dogs?

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Separation anxiety is one of the most common behavioral disorder in companion dogs. Dogs not suffering from separation anxiety may still exhibit separation-related behaviors, which can differ depending on environmental contexts. In the present study, dogs without separation-related problems were video recorded during a short separation (3 min) from, and during reunion with, their owner. Comparison was done between if the dogs had played or been calm pre-separation. The dogs spent most time in proximity to the entrance and gazing towards where the owner left during separation. Their body-position was mostly standing, followed by sitting. All dogs were wining during separation, which occurred approximately four times more than barking. Dogs that had played pre-separation were running around more and had a longer latency to the first movement, compared to when they had been calm pre-separation. During reunion, when dogs had played pre-separation, they wagged their tail more and had a longer latency to lip licking, compared to when they had been calm pre-separation. The separation behaviors that occurred in this study aligns with previous work in this subject. Furthermore, one can suggest that play pre-separation might have an effect on separation behaviors, where speculations can be done if the positive affect associated with play might be the underlying cause for these findings.
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1 Abstract
Separation anxiety is one of the most common behavioral disorder in companion dogs. Dogs not suffering from separation anxiety may still exhibit separation-related behaviors, which can differ depending on environmental contexts. In the present study, dogs without separation-related problems were video recorded during a short separation (3 min) from, and during reunion with, their owner. Comparison was done between if the dogs had played or been calm pre-separation. The dogs spent most time in proximity to the entrance and gazing towards where the owner left during separation. Their body-position was mostly standing, followed by sitting. All dogs were whining during separation, which occurred approximately four times more than barking. Dogs that had played pre-separation were running around more and had a longer latency to the first movement, compared to when they had been calm pre-separation. During reunion, when dogs had played pre-separation, they wagged their tail more and had a longer latency to lip licking, compared to when they had been calm pre-separation. The separation behaviors that occurred in this study aligns with previous work in this subject. Furthermore, one can suggest that play pre-separation might have an effect on separation behaviors, where speculations can be done if the positive affect associated with play might be the underlying cause for these findings.

2 Introduction
A common part of a companion dog’s everyday life is to be left alone at home. In one study, 73 % of Swedish dog owners daily left their dogs at home alone, when leaving for work (Norling and Keeling 2015). For many dogs, this is an uncomfortable situation, where some suffers more than others from separation anxiety or have some sort of separation-related problem (Overall et al. 2001; Tiira et al. 2016; van Rooy et al. 2018). Separation anxiety is an anxiety-related disorder that is common in companion dogs, which is expressed in the absence of the owner (Ogata 2016; Pongrácz et al. 2017). When looking at medical records from behavioral clinics, separation anxiety was the second most common behavioral problem reported for dogs, where the most common problem was aggression (Bamberger and Houpt 2006 cited by Ogata 2016). Such problems can jeopardize the bond between dog and human, and, as a result of this, these dogs might be left to shelters (van der Borg et al. 1991; Salman et al. 1998; Cannas et al. 2018). Separation anxiety is also a severe problem in the aspect of animal welfare (Amat et al. 2014; Dreschel 2010), as it causes the dog stress (Dreschel 2010) and might be getting the dog in a negative underlying mood (Mendl et al. 2010).
Anxiety can be defined as a physiological, psychological and behavioral state that is induced in humans and animals by a real or believed threat (Steimer 2002). A lot of studies have suggested that one thing that is defining anxiety is the uncertainty of an anticipated threat (Steimer 2002; Steimer 2011; Ogata 2016). By this definition, anxiety can be distinguished from fear, which instead is the response to a present threat (Steimer 2002). Separation anxiety, also called separation-related disorder ‘SRD’, in dogs refers to behaviors with any signs of anxiety, fear or phobia associated with when the dog is separated from the owner or other important person(s) (Sherman and Millis 2008 cited by Tiira et al. 2016). Common signs of separation anxiety often noted by dog owners are vocalization, house soiling, and destruction (Overall et al. 2001; Appleby and Pluijmakers 2004; van Rooy et al. 2018). However, for some dogs the anxiety can be even more severe, and not as commonly reported signs of this can be salivation, urination, defecation, vomiting, diarrhea or, in rare cases, even self-injury (Takeuchi et al. 2000; Appleby and Pluijmakers 2004). Video recording of dogs with SRD that were left home alone showed that dogs were spending most of their time vocalizing (defined as barking, whining and howling) and being oriented to the environment (defined as standing and sitting). These dogs did also commonly pant, and exhibit destructive- and passive behaviors (Palestrini et al. 2010). Video recording of dogs not suffering from SRD when left home alone showed that these dogs were spending most of their time resting (Rhen and Keeling 2011), which has also been shown in other studies (Aslaksen and Aukrust 2003 cited by Rhen and Keeling 2011; Frank et al. 2007; Vestrum 2009 cited by Rhen and Keeling 2011).

As separation anxiety is a common behavioral problem in dogs and as many dogs today are left home alone when their owner is at work, a treatment for this problem should be of great interest. There are many studies in this field where some have looked at medications as treatment for these problems (Cannas et al. 2014; Ogata 2016). However, treatments without medications would be preferable, and can for example be to increase the predictability of the owner’s departure (Amat et al. 2014). More knowledge about separation behaviors in dogs could help to improve the situation for these dogs. Even if far from all dogs suffer from separation anxiety, it has been shown that the duration of separation affects dogs that are not suffering from separation anxiety (Rhen and Keeling 2014). This means that this is an important question that affects all dogs, and not only those suffering from SRD.

To my knowledge, no previous studies have investigated how separation-behaviors in dogs are affected by different activities performed by the
dog pre-separation. It has been shown that shelter dogs that got additional exercise (by playing or running) spent more time on back and forth movement in the kennel (Protopopova et al. 2018). Another study (Horváth et al. 2008) looked at the effect of play on stress levels in police- and border guard dogs. Play decreased cortisol concentrations after the play-session in border guard dogs, and increased cortisol concentrations in police dogs (Horváth et al. 2008). These two studies show that play-activities effects stress-levels and behaviors in dogs. Therefore, one can speculate that play pre-separation might have an effect on dogs’ behaviors when they are left alone.

The aim of this study was to investigate separation behaviors in dogs (*Canis familiaris*) when they were separated from their owner. The purpose of this was to form a functioning, quantitative ethogram, and to see which behaviors that are common among dogs that are left alone by their owner. An ethogram like this can be useful for future studies, when looking at separation anxiety in dogs. This study, however, will focus on dogs that are not suffering from severe separation anxiety.

Furthermore, this study aimed to investigate if dogs, when separated from the owner, differ in their behavior when they have been engaged in a playful activity pre-separation, compared to when they have been quiet and calm pre-separation. It has earlier been shown that dogs separated from their owner differed in their behaviors first when reunited with the owner, but did not differ in their behavior during the time they were left alone (Rhen and Keeling 2011). The present study will therefore look at the dogs’ behavior in three different phases during separation: i) the separation phase, where the dog is left alone by the owner, ii) the pre-reunion phase, where the dogs can see the owner returning, and iii) the reunion phase, where the dogs are reunited with their owner.

3 Material & methods

3.1 Subjects

The dogs used in this study (*n* = 12; 6 males and 6 females; 10 purebred and 2 mixed breed, Table 1) were private owned of different breeds (Table 1). The dog owners were mainly course members at The dog’s and animal’s behavioral center (Hundens & Djurens Beteendecenter) in Linköping, Sweden, or the author’s class mates. The age of the dogs was between 11 months and 10 years (Table 1). The dog owners were informed about the study via e-mail, and decided themselves whether to participate in the study or not. All tests were performed in the facilities of the behavioral center, an environment that was not totally unfamiliar to
nine of twelve participating dogs, which had participated in at least one course section at the facility before they were attending in any tests in this study. The remaining three dogs were not familiar with the test facility.

Since the aim was to investigate dogs that are not suffering from severe separation anxiety, dogs with this type of behavior (i.e. extreme vocalization, house soiling, destruction, urination etc.) was not included. The criteria for this was the owners feeling; if they knew that their dog vocalizes, destroys things at home, or urinate or defecate when left alone, this dog was excluded. The dog owners were asked to fill in a questionnaire about their dog’s breed, sex and age. Furthermore, they were asked questions about for how long, how often and in which environment the dog normally is left alone, and how they think their dog behaves when left alone. These questions about alone habit were used to further ensure that the participating dogs were not suffering from separation anxiety.

Table 1. Breed, age and sex of the participating dogs.

<table>
<thead>
<tr>
<th>breed</th>
<th>age (months)</th>
<th>sex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pug</td>
<td>12</td>
<td>Male</td>
</tr>
<tr>
<td>Medium poodle</td>
<td>23</td>
<td>Male</td>
</tr>
<tr>
<td>Yorkshire terrier</td>
<td>11</td>
<td>Female</td>
</tr>
<tr>
<td>Mixed breed</td>
<td>24</td>
<td>Male</td>
</tr>
<tr>
<td>Shetland sheepdog</td>
<td>96</td>
<td>Female</td>
</tr>
<tr>
<td>Shetland sheepdog</td>
<td>120</td>
<td>Female</td>
</tr>
<tr>
<td>Pomeranian</td>
<td>12</td>
<td>Male</td>
</tr>
<tr>
<td>Golden retriever</td>
<td>36</td>
<td>Female</td>
</tr>
<tr>
<td>Cavalier King Charles spaniel</td>
<td>36</td>
<td>Female</td>
</tr>
<tr>
<td>Mixed breed</td>
<td>54</td>
<td>Female</td>
</tr>
<tr>
<td>Basenji</td>
<td>60</td>
<td>Male</td>
</tr>
<tr>
<td>Pharaoh hound</td>
<td>24</td>
<td>Male</td>
</tr>
</tbody>
</table>
3.2 Setup and treatments

A corner of a room at the Dog center facility was deposited as the test-arena (2.70 x 1.80 m) and separated from the rest of the room with compost grids (Figure 1). The test-arena was not enriched except for a water bowl placed in one of the corners. To make the room appear smaller for the dogs, compost grids covered with blankets were placed 1.5 m from the test-arena at its long side (Figure 1). Figure 2 shows a real picture of the test-arena. All tests were video recorded for a later analysis of the dogs’ behavior.

Each dog was tested twice: once where the dog and its owner was in a calm mood (i.e. the owner sat down, patted and talked calmly to the dog) pre-separation, and once when the owner was playing with the dog (i.e. playing with a toy, or anything else preferred by the dog, jumping and running around), so that the dog was excited or in a more active state pre-separation. The two different treatments took place outside the test-arena and was not video recorded.

3.3 Procedure

The dogs got at least 5 minutes to habituate after arrival to the facility before the first test started. During these minutes, the dog was allowed to explore the test-arena and the rest of the room. After habituation, the first test was started where the dog and the owner either i) remained calm and the owner patted the dog, or ii) the owner played with the dog. The treatment order was randomly assigned to each dog using an online number randomizer. The treatment, either being calm or play with the dog, was performed for 30 seconds, and thereafter the owner led the dog into the test-arena. When both dog and owner was inside the test-arena, the owner was not allowed to talk to the dog. The owner left the dog directly after arrival, closed the gate to the test-arena, and walked away in their normal walking-pace. About 10 m away from the test-arena, the owner disappeared into another room, hiding behind a wall. The dog was separated from the owner for 3 minutes, starting from the moment the owner closed the gate into the test-arena. When left alone, the dog was surveilled by the author, sitting on a chair in the corner of the room, about 4 m away from the test-arena (Figure 1). When 3 minutes had passed, the owner walked back to the dog in a normal pace, using no vocal communication. First when the owner entered the test-arena, vocal communication was allowed. The owner then sat down and patted the dog, instructed to greet the dog as if they were at home, in a normal situation. When the first test with one of the treatments was finished, the dog was taken out for a walk. The second test, with the other treatment, was started first 20 minutes after the first test had ended.
3.4 Behavioral measures and analyses

To record the dogs’ behaviors, the software program ‘The Observer’ was used. Each video was divided into three phases: i) separation phase, ii) pre-reunion phase, and iii) reunion phase. The separation phase was defined as the period when the dog was left alone, starting from the moment when the owner closed the gate to the test-arena, and recorded
for 3 minutes. As all dog owners had different walking-pace and the dog could see the owner approaching when 3 minutes of separation had past, the pre-reunion phase was defined as the 10 seconds before the owner reached the test-arena. When the dog owner thereafter opened the gate, the reunion phase was defined as started and recording of behaviors continued for 25 seconds.

When observing and recording behaviors, continuous sampling was used. For state behaviors, the duration of which the behavior occurred was measured in seconds. Event behaviors (frequency data) was measured in counts, i.e. the number of times the behavior occurred. Ethograms used when observing behaviors recorded on video was formed by observing the videos in beforehand, where all the behaviors that occurred were noted and carefully explained. Earlier studies in the field of separation anxiety in dogs were then used to complete the ethogram, covering the most common behaviors occurring during separation. The ethogram used for the observation of the separation- and the pre-reunion phase can be seen in Table 2. A different ethogram, containing more social behaviors, was used for the observation of the reunion phase (Table 3). In addition to duration and frequency of the behaviors, the latency for each behavior to occur was also investigated.

Table 2. Ethogram used when observing separation and pre-reunion between dog and owner (Overall 2014; Rhen et al. 2014; Rhen and Keeling 2011; Rooy et al. 2018; Scaglia et al. 2013; Parthasarathy and Crowell-Davies 2006; Prato-Previde et al. 2003).

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Definition</th>
<th>Duration/ frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gazing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gazing gate/owner</td>
<td>The dog is gazing (i.e. has its head directed towards) the gate or the corner in the direction where the owner disappeared</td>
<td>Duration</td>
</tr>
<tr>
<td>Gazing researcher</td>
<td>The dog is gazing (i.e. has its head directed towards) the researcher (away from solid wall on the short side, towards corner of the room)</td>
<td>Duration</td>
</tr>
<tr>
<td>Proximity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate/corner proximity</td>
<td>The dog is located near (head within one body length) or by the gate or corner towards where the owner disappeared</td>
<td>Duration</td>
</tr>
<tr>
<td>Body position/motor activity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standing</td>
<td>The dog is standing up with all four paws touching the floor, not moving</td>
<td>Duration</td>
</tr>
<tr>
<td><strong>Behavior</strong></td>
<td><strong>Definition</strong></td>
<td><strong>Unit</strong></td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Sitting</td>
<td>The dog is sitting with front legs extended and a lowered rear body/hind legs curved</td>
<td>Duration</td>
</tr>
<tr>
<td>Lying alert</td>
<td>The dog is lying down, with its sternum in full contact with the floor, and with its head in the air (not resting on the floor)</td>
<td>Duration</td>
</tr>
<tr>
<td>Lying resting</td>
<td>The dog is lying down, with its sternum in full contact with the floor, and with its head in contact with the floor (resting or sleeping)</td>
<td>Duration</td>
</tr>
<tr>
<td>Walking</td>
<td>The dog is walking around, moving, taking steps with all four paws</td>
<td>Duration</td>
</tr>
<tr>
<td>Running</td>
<td>The dog is running around, galloping or trotting</td>
<td>Duration</td>
</tr>
<tr>
<td>Locomotion</td>
<td>Walking and running</td>
<td>Duration</td>
</tr>
<tr>
<td>Jumping</td>
<td>The dog stands or jumps on its hind legs, with front legs in the air or leaning on something</td>
<td>Duration</td>
</tr>
</tbody>
</table>

**Vocalization**

<table>
<thead>
<tr>
<th><strong>Behavior</strong></th>
<th><strong>Definition</strong></th>
<th><strong>Unit</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Barking</td>
<td>The dog is barking, making high sounds with open mouth</td>
<td>Frequency</td>
</tr>
<tr>
<td>Whining</td>
<td>The dog is whining, making high pitch sounds</td>
<td>Frequency</td>
</tr>
</tbody>
</table>

**Activity**

<table>
<thead>
<tr>
<th><strong>Behavior</strong></th>
<th><strong>Definition</strong></th>
<th><strong>Unit</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Exploring</td>
<td>The dog’s attention and activity is directed towards any aspect of the environment (surface/object). Activity such as sniffing (nose within one head length of a physical surface), licking, or manipulation with paws</td>
<td>Duration</td>
</tr>
<tr>
<td>Escape attempt</td>
<td>The dog is pushing/scratching/jumping towards the gate or grid around entrance</td>
<td>Duration</td>
</tr>
</tbody>
</table>

**Mouth**

<table>
<thead>
<tr>
<th><strong>Behavior</strong></th>
<th><strong>Definition</strong></th>
<th><strong>Unit</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Panting</td>
<td>An increased frequency of breathing with mouth open and/or protrusion of the tongue</td>
<td>Duration</td>
</tr>
<tr>
<td>Lip licking</td>
<td>Movement of tongue outside the mouth when licking lips and/or snout, not in an attempt to lick the owner, or in association with drinking or exploring</td>
<td>Frequency</td>
</tr>
</tbody>
</table>

**Body**

<table>
<thead>
<tr>
<th><strong>Behavior</strong></th>
<th><strong>Definition</strong></th>
<th><strong>Unit</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tail wagging</td>
<td>Repetitive wagging movements of the tail</td>
<td>Duration</td>
</tr>
<tr>
<td>Body shaking</td>
<td>The dog shakes its whole body, or any part of the body, from side to side</td>
<td>Frequency</td>
</tr>
</tbody>
</table>

**Other**

<table>
<thead>
<tr>
<th><strong>Behavior</strong></th>
<th><strong>Definition</strong></th>
<th><strong>Unit</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>First movement</td>
<td>The first movement, i.e. the first time the dog changed its body position or activity</td>
<td>Duration</td>
</tr>
<tr>
<td>Other</td>
<td>Other behavior not included in this ethogram</td>
<td>Duration/Frequency</td>
</tr>
</tbody>
</table>
Table 3. Ethogram used when observing reunion between dog and owner, in addition to Table 2 (Rhen et al. 2014; Rhen and Keeling 2011; Rooy et al. 2018; Scaglia et al. 2013; Parthasarathy and Crowell-Davies 2006; Prato-Previde et al. 2003).

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Definition</th>
<th>Duration/ frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Proximity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximity owner</td>
<td>Head within one body length from the owner</td>
<td>Duration</td>
</tr>
<tr>
<td><strong>Gazing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gazing owner</td>
<td>Head directed towards the body of the owner</td>
<td>Duration</td>
</tr>
<tr>
<td><strong>Body position</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jumping owner</td>
<td>The dog is jumping (standing on its hind legs) at and leaning with front legs on the owner</td>
<td>Duration</td>
</tr>
<tr>
<td><strong>Social</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dog physical contact</td>
<td>Physical contact between dog and owner, initiated by the dog, or physical contact where the dog's attention is directed towards the owner (i.e. the dog's head is directed towards the owner)</td>
<td>Duration</td>
</tr>
<tr>
<td>Seeking contact</td>
<td>The dog is pushing the owner with its snout/head (often when the owner stops physical contact, and in combination with whining) or the dog is moving towards the owner at the same time as it is gazing towards the owner (i.e. the head is directed towards the owner)</td>
<td>Frequency</td>
</tr>
<tr>
<td>Withdrawing owner</td>
<td>The dog is avoiding interaction with the owner by walking away, turning away, looking away or refuse interaction initiated by the owner</td>
<td>Frequency</td>
</tr>
<tr>
<td>Attention elsewhere</td>
<td>The dog's attention is not directed towards the owner, i.e. the dog is performing other activity such as exploring, walking/running around in the arena</td>
<td>Duration</td>
</tr>
</tbody>
</table>

3.5 Statistical analyses

Distribution of the data where visually determined by looking at histograms for all behaviors. For normally distributed data, a paired sample t-test was performed for comparison of dogs when they had been calm or played before the separation. When the data instead was considered non-parametric, this comparison was made using a Wilcoxon signed-rank test. All tests that were performed for related samples are shown in Appendix 1-3. To see if gender affected the behaviors, an independent sample t-test was performed for all behaviors considered normally distributed, and a Mann-Whitney U test was performed for all behaviors considered non-parametric. The behaviors were compared within each phase, i.e. in the i) separation, ii) pre-reunion, and iii) reunion.
phase. For each behavior, both duration or frequency and latency were compared. P-values $\leq 0.05$ was considered significant for all tests.

To evaluated which behaviors that were most common during the separation phase, the percentage of time these behaviors occurred was calculated for the duration behaviors. For the event behaviors, the mean number of times the behavior occurred was instead used to make this evaluation.

4 Results

4.1 Separation behaviors

The dogs spent most of their time during separation from the owner gazing the corner where the owner left and in proximity to the gate (Table 4). In both the calm- and play treatement the dogs’ body position was most of the time standing, followed by sitting (Table 4), where seven out of twelve dogs sat down at some point during separation. Less common behaviors were lying down (four dogs), jumping (three dogs), tail wagging (five dogs) and escape attempt (two dogs).

The most common point event behaviors performed by the dogs during separation was whining, which occurred around four times as much as barking. All dogs whined at some point during separation, whereas only six dogs barked. Lip licking was performed by eleven dogs, but performed least frequently compared to whining and barking (Table 5).
Table 4. Percentage of time the dogs’ state behaviors occurred during a separation phase. Behaviors presented for both treatments, calm and play, which occurred right before the separation. Percentage based on mean.

<table>
<thead>
<tr>
<th></th>
<th>Calm % mean time (±SE)</th>
<th>Play % mean time (±SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gazing owner/corner</td>
<td>75.4 (3.6)</td>
<td>Proximity corner/gate</td>
</tr>
<tr>
<td>Proximity corner/gate</td>
<td>68.7 (10.3)</td>
<td>Gazing owner/corner</td>
</tr>
<tr>
<td>Standing</td>
<td>51.7 (9.3)</td>
<td>Standing</td>
</tr>
<tr>
<td>Sitting</td>
<td>24.7 (8.8)</td>
<td>Sitting</td>
</tr>
<tr>
<td>Locomotion (walking + running)</td>
<td>12.8 (2.6)</td>
<td>Panting</td>
</tr>
<tr>
<td>Panting</td>
<td>11.9 (8.3)</td>
<td>Lying alert</td>
</tr>
<tr>
<td>Walking</td>
<td>10.3 (2.1)</td>
<td>Locomotion (walking + running)</td>
</tr>
<tr>
<td>Exploring</td>
<td>8.5 (2.1)</td>
<td>Walking</td>
</tr>
<tr>
<td>Lying alert</td>
<td>7.3 (5.2)</td>
<td>Exploring</td>
</tr>
<tr>
<td>Tail wagging</td>
<td>5.5 (3.7)</td>
<td>Gazing researcher</td>
</tr>
<tr>
<td>Running</td>
<td>2.5 (1.1)</td>
<td>Lying resting</td>
</tr>
<tr>
<td>Gazing researcher</td>
<td>2.1 (0.6)</td>
<td>Running</td>
</tr>
<tr>
<td>Jumping</td>
<td>1.9 (1.5)</td>
<td>Jumping</td>
</tr>
<tr>
<td>Lying resting</td>
<td>1.7 (1.7)</td>
<td>Escape attempt</td>
</tr>
<tr>
<td>Escape attempt</td>
<td>0.3 (0.2)</td>
<td>Tail wagging</td>
</tr>
</tbody>
</table>

Table 5. Most common event behaviors performed by the dogs during a separation phase. Behaviors is presented in frequency; the mean number of times the behaviour occurred during a 180 seconds separation phase.

<table>
<thead>
<tr>
<th></th>
<th>Calm Frequency (± SE)</th>
<th>Play Frequency (± SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whining</td>
<td>48.5 (10.3)</td>
<td>Whining</td>
</tr>
<tr>
<td>Barking</td>
<td>12.3 (5.8)</td>
<td>Barking</td>
</tr>
<tr>
<td>Lip licking</td>
<td>4.5 (1.7)</td>
<td>Lip licking</td>
</tr>
</tbody>
</table>

4.2 Play pre-separation

During separation from the owner, the dogs were running for a significantly longer duration of time when they had been calm, compared to when they had played before the separation (Wilcoxon signed-rank
test: $Z = -2.201$, $N = 12$, $p = 0.03$, Figure 3). When the dogs had played before the separation there was a significantly longer latency before their first movement (Wilcoxon signed-rank test: $Z = -2.589$, $N = 12$, $p = 0.01$) and a significantly longer latency before they walked (Wilcoxon signed-rank test: $Z = -2.040$, $N = 12$, $p = 0.04$), compared to when they had been calm before the separation (Figure 4).

**Figure 3.** The mean ($\pm$ SE) duration dogs spent on running during separation from their owner, comparing dogs that had been calm or played right before the separation. Statistical significance is marked with * ($p \leq 0.05$).

**Figure 4.** The mean ($\pm$ SE) latency to the first movement and walking in dogs during separation from the owner. Statistical significance is marked with * ($p \leq 0.05$).
When the dogs were calm before separation, females were significantly
gazing more towards where the owner left compared to males
(independent sample t-test: t_{7.6} = -2.334, N_1 = N_2 = 6, p = 0.05). Females
in the calm treatment did also have a significantly longer latency to lip
licking than males (Mann-Whitney U test: U = 5, N_1 = N_2 = 6, P = 0.04). However, no significant difference was found for these behaviors
duration gazing owner, latency lip licking) in the play treatment.

During the pre-reunion phase, dogs spent significantly more time in
proximity to the gate of the test-arena when they had been calm before
separation, compared to dogs that had played before separation
(Wilcoxon signed-rank test: Z = -2.314, N = 12, P = 0.02). Furthermore, calm dogs also had a significantly shorter latency to be in proximity to
the gate (Wilcoxon signed-rank test: Z = -1.992, N = 12, P = 0.05).

When the dogs had played before the separation, they had a significantly
longer duration of tail wagging during reunion with the owner, compared
to when they had been calm before the separation (Wilcoxon signed-rank
test: Z = -1.988, N = 12, P = 0.05, Figure 5). When the dogs had played
pre-separation they did also have significantly a shorter latency to tail
wagging (Wilcoxon signed-rank test: Z = -2.336, N = 12, P = 0.02) and a
significantly longer latency to lip licking (Wilcoxon signed-rank test: Z =
-2.191, N = 12, P = 0.03, Figure 6) when reunited with the owner,
compare to when they had been calm pre-separation.

All p-values and test-statistics for all remaining behavioral variables
tested can be seen in Appendix 1-3.
Figure 5. The mean (± SE) duration of tail wagging during reunion between dog and owner when the dogs had been playing or been calm before a separation phase. Statistical significance is marked with * (p ≤ 0.05).

Figure 6. The mean (± SE) latency to tail wagging and lip licking when dogs were reunited with their owner after a short separation, comparing when the dogs had played or been calm before the separation. Statistical significance is marked with * (p ≤ 0.05).
5 Discussion

During separation, the dogs in the present study spent most time gazing towards where the owner left and being in proximity to the entrance of the test-arena. The dogs in the present study did also stand and sit most of the time, and whining was the behavior that occurred most frequently. When the dogs had played pre-separation, they were running around less and had a shorter latency to the first movement during separation, compared to when they had been calm before separation. During reunion with the owner, when dogs had played pre-separation they had a longer latency to lip licking, compared to when they had been calm pre-separation.

Previous studies have shown that dogs reported to suffer from separation anxiety spent most of their time being oriented to the environment and vocalizing (barking, whining and howling) when left alone at home (Cannas et al. 2014; Palestrini et al. 2010). Dogs without separation anxiety, however, were lying down most of the time when they were alone (Cannas et al. 2010, Rhen and Keeling 2011; Scaglia et al. 2013). Dogs without separation anxiety did also spend about 50% of their time left alone in proximity to the entrance door (Rhen and Keeling 2011). These findings are in line with the results in the present study, where dogs not suffering from separation anxiety spent most of their time in proximity to the gate of the test-arena. The dogs in this study did also spend most time on standing and sitting, opposed to lying. In the present study, however, the separation phase lasted for only three minutes, and did not take place in a home environment, unlike the previous studies where dogs were left alone at home for at least 30 minutes (Rhen and Keeling 2011; Scaglia et al. 2013). If the dogs in the present study had been left alone for a longer period of time they might have settled down and thus been lying down more. The fact that the dogs in this case were left in a somewhat unfamiliar environment could also affect the duration of lying. This has been shown in another study (Konok et al. 2011), where dogs without separation anxiety were more active (running around) than passive (lying down) during a three-minutes separation in an unfamiliar environment. Furthermore, these dogs became less active with a longer separation period (Konok et al. 2011).

Exploring was exhibited for approximately 8% of the separation period in the present study. Explorative behaviors are often exhibited to gather information about elements in the environment and often based on new stimuli, such as a new environment (Crusio 2001; Horwitz 2002 cited by Scaglia et al. 2013). One can therefore expect explorative behaviors to occur in the current study. Other studies have also shown that explorative
behaviors occur during separation (Cannas et al. 2014; Palestrini et al. 2010; Rhen and Keeling 2011; Scaglia et al. 2013). However, the percentage of time spent on exploring was lower in studies on dogs with separation anxiety, compared to the present study (Cannas et al. 2014; Palestrini et al. 2010). This might be because explorative behaviors can be inhibited during anxiety (Ohl et al. 2008; Shuhama et al. 2007), and that the separation phase in the present study did not cause the dogs severe anxiety as they did not suffer from separation anxiety.

Barking is often associated with separation anxiety in dogs (Overall et al. 2001; Appleby and Pluijmakers 2004; van Rooy et al. 2018), which could be because it is a loud noise, compared to whining, and therefore it is noticed by owners or neighbors (Lund and Jørgensen 1999). One study showed that whining, however, is more related to anxiety than barking, especially an early onset of whining after the owner’s departure (Pongracz et al. 2017). In the present study, all dogs whined, and did so about four times as much as barked. Whining has been speculated to be a contact/comfort seeking behavior in puppies (Panksepp et al. 1978 cited by Pongracz et al. 2017) and to be re-directed towards the owner in adult dogs (Pongracz et al. 2017). Lip licking and tail wagging are suggested to be social behaviors in dogs (Beerda et al. 1998; Konok et al. 2011; Rhen and Keeling 2011; Rhen et al. 2014). These behaviors occurred to a small extent in the present study, which might be because dogs left alone lack motivation to perform these behaviors, as the receiver of the signal are not present.

The dogs were running more during separation from the owner when they had been calm pre-separation, compared to when they had played. This finding is not in line with a previous study that investigated the effect of play on shelter dogs’ behaviors (Protopopova et al. 2018). It was shown that exercising (defined by play or running) dogs spent more time on back and forth movements in the kennel, compared to just prior treatment. However, this study did not aim to look at separation behavior, and these dogs was videotaped by an experimenter that approached the dogs, like a potential adopter would (Protopopova et al. 2018). Play has been associated with positive affect in dogs (Bradshaw et al. 2015; Sommerville at al. 2017). Therefore, one can suggest that the dogs might had a more positive underlying mood during, or at least in the beginning of, the separation. This might then result in less locomotion, a behavior associated with distress (Scaglia et al. 2013). In the present study, dogs that had played before separation did also have a longer latency to first movement and walking, after the owners’ departure. If dogs that had played were in a more positive mood (Bradshaw et al. 2015; Sommerville
at al. 2017), one can speculate that they were more optimistic about the separation, thinking that the owner was still playing and would come back. The result of this could be that it took the playing dogs a longer time before they started to move post departure.

During pre-reunion, when the owner was approaching the dog, dogs were in proximity to the gate more when they had been calm before separation than when they had played before separation. The latency to be in proximity to the gate was also shorter when the dogs were calm, compared to played, pre-separation. At the beginning of these 10 seconds of pre-reunion the dogs could hear, or both hear and see, the owner approaching. Once they saw and walk up to the gate, they tended to stay in proximity to the entrance. This means that the duration of being in proximity to the gate was dependent on the latency. The latency can also depend on the owners’ different walking speed, where the dogs in some cases might have seen the owner earlier and therefore walked up to the gate sooner.

During reunion with the owner, when dogs had played before separation they were wagging their tail more, and had a shorter latency to do so, compared to when they had been calm before separation. The latency to lip licking was however longer when the dogs had played compared to been calm before separation. Both tail wagging and lip licking are common greeting behaviors upon reunion with the owner (Rhen and Keeling 2011; Konok et al. 2011) and were therefore expected to occur. Lip licking have been associated with negative stress and submissive behavior (Beerda et al. 1998), but another study suggests that lip licking might act as a reinstatement behavior, or be related to an increased positive arousal (Rhen and Keeling 2011). Both lip licking and tail wagging are part of an active submission behavior, which is a key component in greeting behaviors (Schenkel 1967). It has been suggested that submission is an effort to a friendly social interaction, often between individuals that are attached to one another (Schenkel 1967). As play is associated with positive affect (Bradshaw et al. 2015; Sommerville at al. 2017), one could suggest that when dogs had played before separation they wagged their tail more in an effort to a friendly interaction.

A limitation for the present study was that a small sample of dogs (N = 12) of different ages and breeds was investigated. Because of this, factors such as age, gender or treatment order could not be taken in to account when performing the statistical tests. The results in this study should therefore not be generalized for the whole population.
5.1 Societal and ethical aspects

Many dogs suffer from separation anxiety, a behavioral problem that might not even be detected by the dog owner, as they might not know what their dog is doing when it is left alone. This makes separation anxiety an important welfare problem, as it is common that dogs are left alone in their normal everyday life. In addition to this, dogs with separation-related problems are more likely to be more fearful, a behavior/personality that has been linked to aggressiveness in dogs (Tiira et al. 2016). More knowledge about this behavioral problem could also be useful when studying the genetics behind it, and further when developing breeding plans.

The dog owners were informed about the trial via e-mail, and chose themselves if they wanted to participate in the study or not. The participating dogs in this study were left alone by their owner, which can be an uncomfortable and stressful situation for many dogs. However, the aim of this study was to look at dogs that are not suffering from separation anxiety and the dogs were only separated from their owner for three minutes. Therefore, the dogs’ suffering was considered small. To make sure no dogs experienced the separation phase as too stressful, the dogs were observed by the author during separation.

5.2 Conclusion

During a short separation from the owner, dogs spent most of their time gazing after the owner and in proximity to the entrance. Their body position was most of the time standing, followed by sitting. All dogs were whining during separation, which occurred about four times as much as barking. The behaviors seen during separation in the present study has also been shown in several other studies. Therefore, the ethogram in the present study seems to sum up the most common separation-behaviors in dogs without separation anxiety.

When the dogs played pre-separation, they were running less during separation, and had a longer latency to first movement, compared to when they were calm pre-separation. During reunion with the owner did dogs that had played pre-separation exhibit more tail wagging and had a longer latency to lip licking. These results suggest that play pre-separation might have some effect on separation- and greeting behaviors in dogs.

One can speculate if an positive affect induced by play might be the underlying cause for these findings. However, the sample size in the present study was small and the dogs were only allowed to play for 30
seconds pre-separation. A bigger sample size and a longer duration of play before the separation might give another, more accurate, result.

6 Acknowledgement

A great thank you to the dog owners that participated in this study, for giving their time and effort. I would also like to thank the dog trainer Annelie Andersson and her coworkers working at Hundens och Djurens Beteendecenter in Linköping, for letting me use their facility when video recording the dogs. Lastly, I want to thank my supervisors Per Jensen and Mia Persson, for all help and support, and my examiner Matthias Laska.

7 References


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8 Appendix

8.1 Appendix 1

Table over mean ± SE, test statistics and p-values for all tests performed for the separation phase (total duration 180 seconds). Paired sample t-tests were performed for parametric data, Wilcoxon signed-rank tests for non-parametric data.

<table>
<thead>
<tr>
<th>Separation</th>
<th>Calm Mean (± SE)</th>
<th>Play Mean (± SE)</th>
<th>df</th>
<th>t</th>
<th>Z</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Duration</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gazing owner/gate corner</td>
<td>135.7 (6.4)</td>
<td>137.5 (7.2)</td>
<td>11</td>
<td>-0.27</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>Gazing researcher</td>
<td>3.8 (1.1)</td>
<td>10.9 (4.8)</td>
<td></td>
<td>-1.41</td>
<td>0.16</td>
<td></td>
</tr>
<tr>
<td>Proximity gate</td>
<td>123.7 (18.5)</td>
<td>138.1 (15.0)</td>
<td></td>
<td>-0.53</td>
<td>0.59</td>
<td></td>
</tr>
<tr>
<td>Standing</td>
<td>93.1 (16.7)</td>
<td>95.9 (19.6)</td>
<td>11</td>
<td>-0.29</td>
<td>0.77</td>
<td></td>
</tr>
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<td>Sitting</td>
<td>44.4 (15.8)</td>
<td>46.4 (17.0)</td>
<td></td>
<td>-1.57</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td>Locomotion</td>
<td>23.0 (4.6)</td>
<td>15.8 (3.9)</td>
<td></td>
<td>1.78</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Walking</td>
<td>18.5 (3.7)</td>
<td>14.8 (3.9)</td>
<td></td>
<td>1.20</td>
<td>0.26</td>
<td></td>
</tr>
<tr>
<td>Running</td>
<td>4.5 (1.8)</td>
<td>1.0 (0.5)</td>
<td></td>
<td>-2.20</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>Exploring</td>
<td>15.2 (3.8)</td>
<td>14.4 (7.1)</td>
<td></td>
<td>-0.78</td>
<td>0.43</td>
<td></td>
</tr>
<tr>
<td>Tail wagging</td>
<td>10.0 (6.6)</td>
<td>6.4 (4.0)</td>
<td></td>
<td>-0.94</td>
<td>0.35</td>
<td></td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barking</td>
<td>12.3 (5.8)</td>
<td>9.3 (3.9)</td>
<td></td>
<td>-1.15</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>Whining</td>
<td>48.5 (10.3)</td>
<td>46.8 (12.0)</td>
<td>11</td>
<td>0.41</td>
<td>0.69</td>
<td></td>
</tr>
<tr>
<td>Lip licking</td>
<td>4.5 (1.7)</td>
<td>5.8 (1.3)</td>
<td>11</td>
<td>-0.70</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td><strong>Latency</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gazing researcher</td>
<td>69.3 (18.4)</td>
<td>47.4 (12.4)</td>
<td></td>
<td>-0.94</td>
<td>0.35</td>
<td></td>
</tr>
<tr>
<td>First movement</td>
<td>5.1 (2.1)</td>
<td>17.1 (6.6)</td>
<td></td>
<td>-2.59</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Sitting</td>
<td>100.1 (22.1)</td>
<td>100.1 (24.1)</td>
<td></td>
<td>-0.17</td>
<td>0.87</td>
<td></td>
</tr>
<tr>
<td>Walking</td>
<td>9.9 (5.3)</td>
<td>41.1 (18.9)</td>
<td></td>
<td>-2.04</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>Running</td>
<td>100.2 (24.3)</td>
<td>128.0 (22.8)</td>
<td></td>
<td>-1.15</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>Exploring</td>
<td>33.9 (13.7)</td>
<td>40.1 (14.8)</td>
<td></td>
<td>-0.24</td>
<td>0.81</td>
<td></td>
</tr>
<tr>
<td>Tail wagging</td>
<td>115.9 (24.1)</td>
<td>124.0 (24.2)</td>
<td></td>
<td>-0.73</td>
<td>0.47</td>
<td></td>
</tr>
<tr>
<td>Barking</td>
<td>104.9 (23.8)</td>
<td>100.7 (24.0)</td>
<td></td>
<td>-0.11</td>
<td>0.92</td>
<td></td>
</tr>
<tr>
<td>Whining</td>
<td>42.0 (15.4)</td>
<td>36.7 (13.6)</td>
<td></td>
<td>-0.47</td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td>Lip licking</td>
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<td></td>
<td></td>
<td>-1.60</td>
<td>0.11</td>
<td></td>
</tr>
</tbody>
</table>
8.2 Appendix 2

Table over mean ± SE, test statistics and p-values for all tests performed for the pre-reunion phase (total duration 10 seconds). Paired sample t-tests were performed for parametric data, Wilcoxon signed-rank tests for non-parametric data.

<table>
<thead>
<tr>
<th>Pre-reunion</th>
<th>Calm Mean (± SE)</th>
<th>Play Mean (± SE)</th>
<th>df</th>
<th>t</th>
<th>Z</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Duration</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gazing owner/gate corner</td>
<td>10.0 (0.0)</td>
<td>9.8 (0.2)</td>
<td></td>
<td>-1.34</td>
<td>0.18</td>
<td></td>
</tr>
<tr>
<td>Proximity gate</td>
<td>8.5 (1.0)</td>
<td>6.1 (1.2)</td>
<td></td>
<td>-2.31</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>Standing</td>
<td>4.8 (1.1)</td>
<td>4.4 (0.9)</td>
<td>11</td>
<td>0.11</td>
<td></td>
<td>0.91</td>
</tr>
<tr>
<td>Sitting</td>
<td>2.7 (1.2)</td>
<td>1.9 (0.9)</td>
<td></td>
<td>-0.68</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>Tail wagging</td>
<td>2.3 (1.0)</td>
<td>2.0 (0.9)</td>
<td></td>
<td>-0.11</td>
<td>0.92</td>
<td></td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lip licking</td>
<td>1.8 (0.7)</td>
<td>2.8 (0.7)</td>
<td>11</td>
<td>-1.61</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td><strong>Latency</strong></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximity gate</td>
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<td></td>
<td>-1.99</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>First movement</td>
<td>5.8 (1.1)</td>
<td>4.7 (1.0)</td>
<td>11</td>
<td>0.80</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td>Standing</td>
<td>4.0 (1.2)</td>
<td>3.8 (1.2)</td>
<td>11</td>
<td>0.11</td>
<td>0.91</td>
<td></td>
</tr>
<tr>
<td>Sitting</td>
<td>5.8 (1.5)</td>
<td>7.2 (1.3)</td>
<td></td>
<td>-0.74</td>
<td>0.46</td>
<td></td>
</tr>
<tr>
<td>Tail wagging</td>
<td>7.4 (1.1)</td>
<td>7.4 (1.1)</td>
<td></td>
<td>-0.52</td>
<td>0.60</td>
<td></td>
</tr>
<tr>
<td>Lip licking</td>
<td>5.2 (1.1)</td>
<td>5.1 (1.2)</td>
<td>11</td>
<td>0.14</td>
<td>0.89</td>
<td></td>
</tr>
</tbody>
</table>
8.3 Appendix 3

Table over mean ± SE, test statistics and p-values for all tests performed for the reunion phase (total duration 25 seconds). Paired sample t-tests were performed for parametric data, Wilcoxon signed-rank tests for non-parametric data.

<table>
<thead>
<tr>
<th>Reunion</th>
<th>Calm Mean (± SE)</th>
<th>Play Mean (± SE)</th>
<th>df</th>
<th>t</th>
<th>Z</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Duration</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gazing owner</td>
<td>14.6 (1.7)</td>
<td>16.1 (2.3)</td>
<td>11</td>
<td>-0.75</td>
<td></td>
<td>0.47</td>
</tr>
<tr>
<td>Proximity owner</td>
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<td>24.3 (0.4)</td>
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<td>-1.41</td>
<td></td>
<td>0.16</td>
</tr>
<tr>
<td>Standing</td>
<td>6.3 (2.4)</td>
<td>11.7 (2.5)</td>
<td>11</td>
<td>-1.62</td>
<td></td>
<td>0.13</td>
</tr>
<tr>
<td>Locomotion</td>
<td>7.5 (1.6)</td>
<td>8.0 (2.0)</td>
<td>11</td>
<td>-0.13</td>
<td></td>
<td>0.90</td>
</tr>
<tr>
<td>Jumping owner</td>
<td>3.4 (1.0)</td>
<td>3.0 (1.1)</td>
<td>11</td>
<td>0.53</td>
<td></td>
<td>0.61</td>
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