

Dog behavior in the Ainsworth Strange Situation Test during separation from the owner and from the cohabitant dog

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Abstract: Dogs are known to form strong relationships towards subjects of their own kind and of other species. The aim of this research was to compare dog behavior when separated from a human and a canine companion. Sixteen dogs (9 females and 7 males, 49.8 ± 54.3 month old, belonging to different breeds) were observed during the 2-minute isolation episode of the Ainsworth Strange Situation Test. Each dog was tested twice: once the dog was separated from the owner and once from a cohabitant dog. The duration of 19 behaviors was measured in both conditions and compared using the Mann-Whitney test ($p < 0.05$).

Proximity to the door (medians: 95.5 versus 54.5; $Z = 2.38$; $p = 0.017$), behaviors against the door (7.0 versus 0.0; $Z = 2.13$; $p = 0.033$), barking (0.0 versus 0.0; $Z = 2.37$; $p = 0.017$), and trying to escape from the experimental room (0.0 versus 0.0; $Z = 1.83$; $p = 0.067$) were statistically higher when dogs were separated from the conspecific compared to when separated from the owner; whilst passive behavior was higher when isolated from the owner (13.0 versus 0.0; $Z = 3.18$; $p = 0.001$).

Results suggest that dogs showed a higher protest at separation when isolated from a cohabitant dog. Although it may be interpreted as a display of a higher intraspecific attachment, the higher stress may be due to the separation from the conspecific summed to a condition where the owner was not present. It is possible that multi-household dogs have less opportunities to be left alone and therefore to get used to isolation. Thus, it may have important consequences on dog welfare.

Key Words: dog; attachment; behavior; Ainsworth strange situation test; stress; separation.

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Introduction

Canis familiaris is a highly social species (Tuber et al., 1996) and its social behaviors start at birth, becoming more complex as the puppy gets older (Beaver, 2009). As the ecological niche of domestic dogs is the human social environment (Kubinyi et al., 2007), a variety of studies concerning dog behavior in relation to humans were developed.

In the 1950's John Bowlby (1988), starting from psychoanalytic concepts (Harlow, 1958) and ethology (Lorenz, 1961), elaborated a theory of attachment that was valid for all mammals. Attachment bonds, defined as an affectional tie enduring over time, is formed by one person or animal between himself and another specific one (Ainsworth & Bell, 1970).

Relevant characteristics of this bond are: contact maintenance effect, that leads the subject to maintain physical contact and proximity with the attachment figure; searching response (which is also called protest at separation and separation anxiety, the latter not to be confused with the canine behavioral disorder), when far from the attachment figure and secure base effect, i.e. the attachment figure represents a base from which to explore the world (Ainsworth, 1969; Bowlby, 1988).

The behavioral test commonly used to study child attachment to the mother is called Ainsworth's strange situation test (ASST; Ainsworth & Bell, 1970). This test is built in order to mildly stress chil-

dren, through the separation from the mother, in an unfamiliar environment, and therefore activating the attachment system. The observation of the child behavior when alone, with the mother and with a stranger allows psychologists to understand the kind of attachment that the child has towards the mother. The same test, suitably adapted, has been used by many authors to test dog attachment to man (Topál et al., 1998; Prato-Previde et al., 2003; Fallani et al., 2006; Palmer & Custance, 2008; Mariti et al., 2013a, 2013b) and only rarely to test intraspecific attachment in dogs, in puppies by Prato-Previde et al. (2009) and in adult dogs (Mariti et al., 2014; Mariti et al., 2017).

The aim of the current study was to compare the effect of separation from a human and a canine companion on the behavior of adult domestic dogs.

Materials and methods

Sixteen dogs, of both sexes (7 males and 9 females), of different age (49.8 ± 54.3 month old) and breed, were studied. The inclusion criteria were: being more than 14 months old, having lived with the other dog and the owner for at least 9 months, being used to a wide variety of different environments and people (i.e. not being fearful nor aggressive to strangers, for safety reasons). Separation related problems of dogs acting as the attachment figure were excluded throughout a behavioral consultation performed by a veterinary behaviorist.

Dog behavior was analyzed in two modified versions of the Ainsworth strange situation test. In detail, each dog was tested twice, once for intraspecific attachment and once for interspecific attachment. The stranger was played by a young woman unfamiliar to the dogs. For the intraspecific test the presumed attachment figure was played by another dog living in the same household, whilst for the interspecific test, the presumed attachment figure was played by the owner. To avoid a possible order effect, half of the dogs underwent the intraspecific test first, and the other half underwent the interspecific test first. The 2 tests were separated at least 35 days one from the other.

As described in the Ainsworth strange situation, tests were carried out in an isolated room that was unfamiliar to the dogs. The tests were recorded by two video cameras, one oriented to the whole room and the other to the door.

Table 1. The seven episodes of Ainsworth strange situation. In bold the episodes analyzed in the present study.

EPISODES	DESCRIPTION	
1	DOG 1 + DOG 2 free in the room	DOG 1 + OWNER
	A strange person enters the room	
2	DOG 1 + DOG 2 + STRANGER.	DOG 1 + OWNER+ STRANGER
	The stranger goes to the chair and can greet the dogs, then she has to ignore them	
3	Dog 2 leaves the room	The owner leaves the room
	DOG 1 + STRANGER	
4	Dog 2 enters the room	The owner enters the room
	DOG 1 + DOG 2	
5	Dog 2 leaves the room	The owner leaves the room
	DOG 1 ALONE	
6	In case the dog is too stressed for more than 60 s, the stranger can enter	
	A strange person enters the room	
7	DOG 1 + STRANGER	
	The strange person leaves the room	
7	Dog 2 enters the room	The owner enters the room
	DOG 1 + DOG 2	
	DOG 1 + OWNER	

The protocol followed the original one proposed by Ainsworth. The dogs were led into the experimental room and left free to move about. There are 7 episodes (Table 1), each lasting 2 minutes, in which the examined dog stayed in the room alternatively with the owner or with the other dog (called Dog 2), with the stranger, with both of them or alone.

The test has been structured by Ainsworth in this way in order to study the three main characteristics of attachment, that are: protest at separation, contact maintenance effect and secure base effect. As a matter of fact, an individual that is involuntarily separated from the attachment figure is emotionally distressed, and therefore he displays signs of protest and tries to regain proximity. In dogs these states are mainly represented by: staying close to the door, showing behaviors against the door and vocalizing.

For this study, the analysis was focused on episode 5, when dogs were alone, but also episodes 3 and 4 were examined. In tables 2 and 3, the analyzed behaviors are reported.

Table 2. Social behaviors analyzed in the Ainsworth strange situation test.

SOCIAL BEHAVIORS	REFERENCES
Attention seeking	Mariti et al., 2011; Ricci et al., 2010
Contact: - primary - secondary	Mariti et al., 2014
Proximity: - primary - secondary	Mariti et al., 2014
Following	Palestrini et al., 2005
Approach	Prato Previde et al., 2003.
Visual orientation	Modified by Prato Previde et al., 2003
Social exploration	Mariti et al., 2014

Table 3. Non social behaviors analyzed in the Ainsworth strange situation test.

NON SOCIAL BEHAVIORS	REFERENCES
Exploration	Topàl et al., 1998; Prato Previde et al., 2003
Locomotion	Modified by Prato Previde et al., 2003
Passive behavior	Modified by Prato Previde et al., 2003
Close to door	Modified by Topàl et al., 1998
Behavior against door	Prato Previde et al., 2003; Palestrini et al., 2005.
Visual orientation to door	Prato Previde et al., 2003; Palestrini et al., 2005.
Barking	Palestrini et al., 2010
Whining	Modified by Prato Previde et al., 2003

The social behaviors could be displayed towards the stranger, the owner or dog 2, while non-social behaviors could be signs of stress (behaviors against the door, whining) or of calm (exploration and passive behavior).

Behaviors were observed through a continuous sampling and they were not mutually exclusive, as dogs could stay close to the door, scratch at the dog and barking at the same time.

Data was analyzed using a Friedman and then a Wilcoxon test through the SPSS® software.

Differently from other studies using the ASST, the toys were not used, because their presence amongst dogs, especially when left alone, may have led to aggression.

The peculiarity of studying the intraspecific bond is that the attachment figure is played by

a dog and not by a person, so his/her behavior could not be standardized. For this reason, the stranger was helped by another person in managing the entrance and exit of Dog 2.

Results and discussion

The comparison of dogs' behavior in episode 5, when the animals were examined individually alone, provided many differences between being separated from the human companion and from the canine companion. Proximity to the door ($Z=-2.38$; $p=0.017$), behaviors against the door ($Z=-2.13$; $p=0.033$), barking ($Z=-2.37$; $p=0.017$), and trying to escape from the experimental room ($Z=-1.83$; $p=0.067$) were statistically higher when dogs were separated from the conspecific compared to when separated from the owner (Fig. 1).

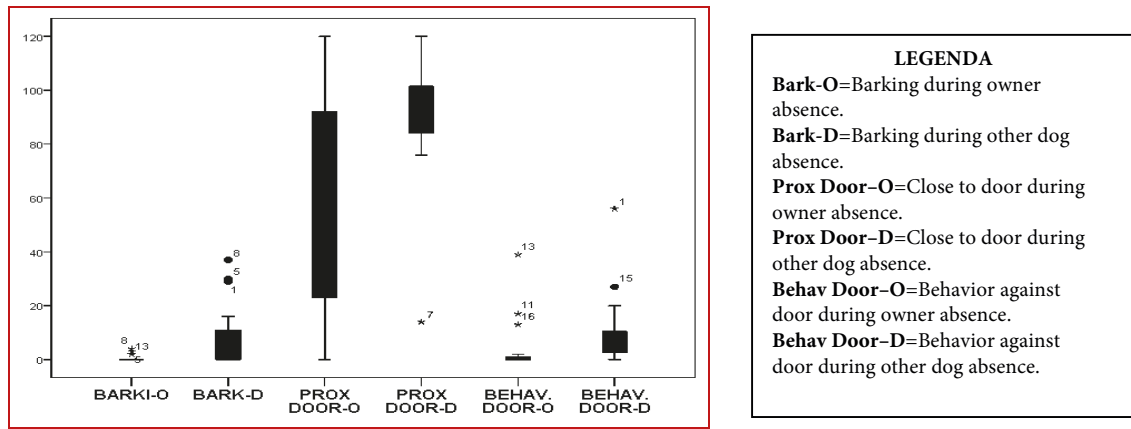


Figure 1. Dog behaviors in episode 5.

These results suggest that dogs showed a higher stress level when separated from a cohabitant dog than when they were separated from the owner. Although this may be interpreted as a display of a higher intraspecific attachment compared to the interspecific attachment, other analyses are needed. In fact, to get a better understanding of these findings, dogs' behavior was analyzed in other two episodes of the Ainsworth strange situation test.

In episode 3 the dog was in the presence of the stranger, and the owner or the other dog had just left the room.

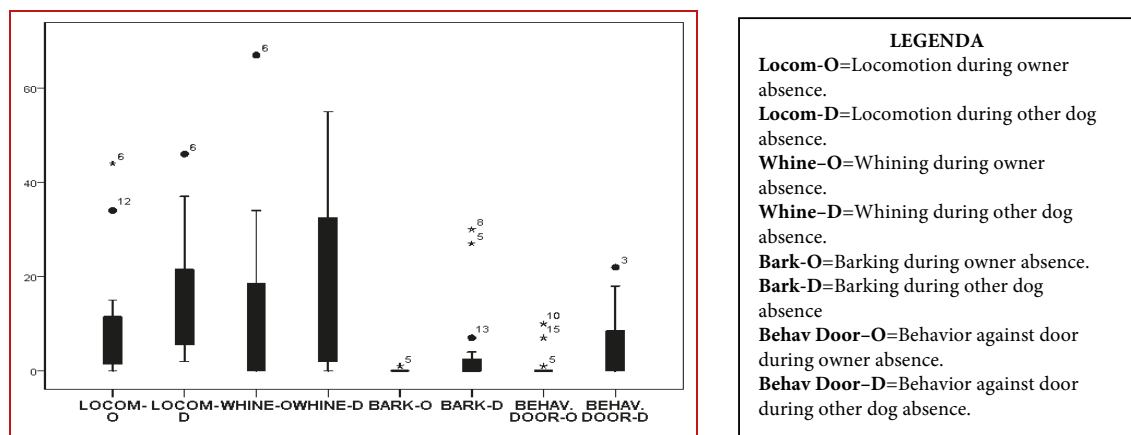


Figure 2. Dog behaviors in episode 3.

The dogs spent more time barking ($Z=-2.023$; $p=0.043$), whining ($Z=-1.727$; $p=0.084$), moving ($Z=-2.303$; $p=0.021$), and displaying behaviors against the door ($Z=-2.395$; $p=0.017$) when the cohabitant dog left rather than when the owner left: in other terms, the dogs showed more protest at separation in the absence of the other dog.

Social behaviors towards the stranger were, in general, higher after the dog left than the owner left, as shown in Fig. 3. Social exploration ($Z=-2.68$; $p=0.007$) and approach ($Z=-2.392$; $p=0.017$) resulted in fact statistically different.

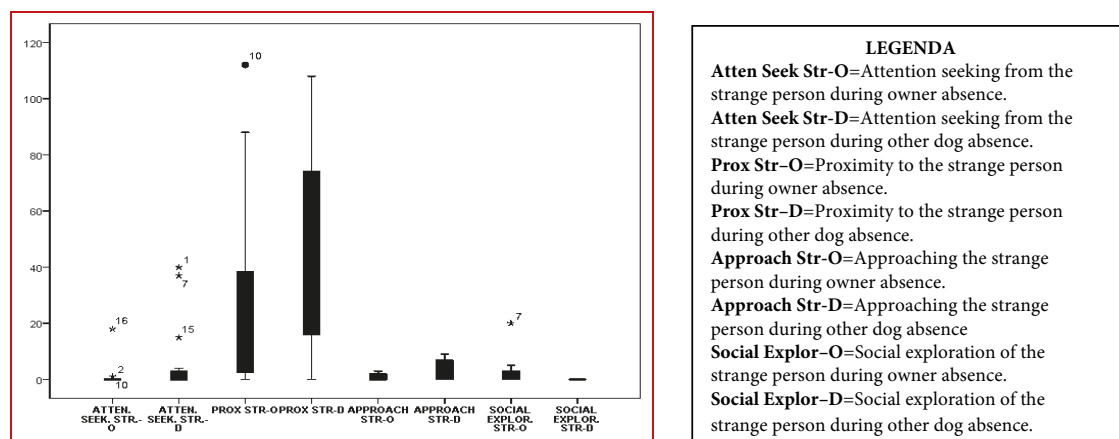


Figure 3. Social behaviors towards the stranger in episode 3.

This can be interpreted as the need for dogs to seek comfort from the stranger, whilst passive behavior was higher when separated from the owner (13.0 versus 0.0; $Z=3.18$; $p=0.001$).

So, considering the findings of episode 3 together, dogs showed more stress when Dog 2 left than when the owner left and this confirms what the results of episode 5, when examined dogs were completely alone.

Concerning episode 4, when the owner or the other dog re-entered the room, if dogs were more attached to the other dog, they should reduce their stress and show affiliative behaviors in the presence of Dog 2 more than in the presence of the owner. Actually (Fig. 4), the dogs spent more time whining ($Z=-2.485$; $p=0.013$), oriented to the door ($Z=-3.205$; $p=0.002$), close to the door ($Z=-2.845$; $p=0.004$), and displaying behaviors against the door ($Z=-2.207$; $p=0.027$) when in company of the other dog than when in the company of the owner. Moreover, dogs displayed more social exploration towards the owner ($Z=-2,374$; $p=0.018$) than towards Dog 2.

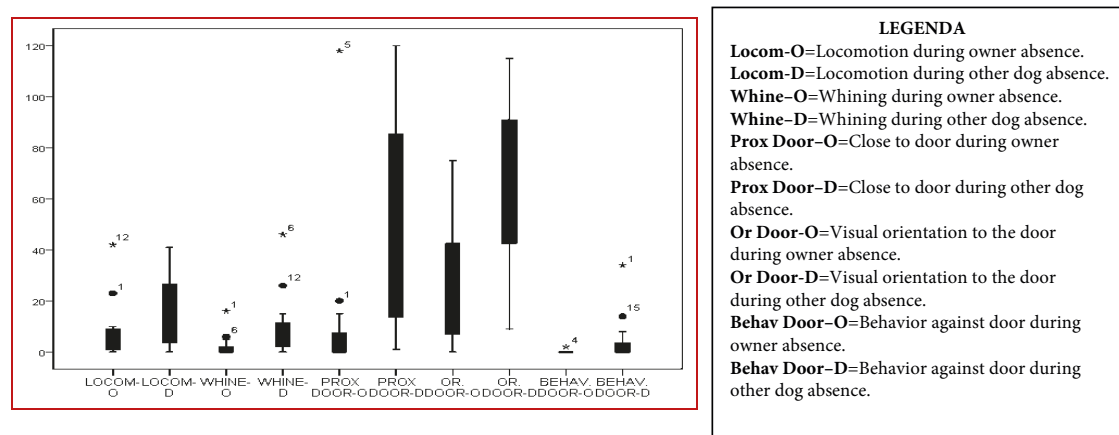


Figure 4. Dog behaviors in episode 4.

Considering all the findings of episode 4 together, dogs showed more stress and less affiliation when the cohabitant dog was present than when the owner was present; this apparently contradicts previous results on the higher stress level at separation from the cohabitant dog.

In order to understand these controversial findings, the tests for intraspecific and interspecific attachment were separately analyzed and episode 5 was compared to episode 3 and 4 within the same test (Tab. 4).

Tab. 4. Comparison of behaviors among episodes 3, 4, and 5 in intraspecific and interspecific ASST.

BEHAVIOR	Episode 3 vs 5	Episode 4 vs 5	Episode 3 vs 4
INTRASPECIFIC ASST			
Behavior against the door	Z=-2.205 p=0.027	Z=-3.066 p=0.002	n.s.
Close to door	Z=-3.408 p=0.001	Z=-3.00 p=0.003	n.s.
Whining	n.s.	Z=-2.90 p=0.004	Z=-2.01 p=0.044
Barking	Z=-2.197 p=0.028	n.s.	n.s.
INTERSPECIFIC ASST			
Exploration	Z=-2.018 p=0.044	Z=-2.276 p=0.023	n.s.
Whining	n.s.	Z=-3.182 p=0.001	Z=-2.431 p=0.015
Close to door	n.s.	Z=-3.298 p=0.001	Z=-2.23 p=0.026
Visual orientation to the door	n.s.	Z=-3.465 p=0.001	Z=-3.181 p=0.001

Looking at the interspecific tests, the dogs, not surprisingly, displayed more signs of stress when left alone than in the presence of the owner and more signs of stress when in the presence of the stranger than in the presence of the owner and more social behaviors towards the owner than towards the stranger, as expected from previous studies on child-mother and dog-owner attachment. So there was a greater difference between staying with the owner on one hand and staying alone or with the stranger on the other hand, as expected for an attachment bond.

Considering the intraspecific tests, dogs showed more stress when left alone than in the presence of the other dog, but the difference between staying with the other dog or with the stranger was less pronounced. In this case there was a greater difference between staying alone on one hand and staying with the other dog or with the stranger on the other hand. In other words, for the interspecific test the relevant point was the owner, and for the intraspecific test the relevant point was being alone.

Conclusions

In conclusion, the results of the current study confirm what was previously found analyzing intraspecific attachment, that both a cohabitant dog (being the mother or not, respectively: Mariti et al., 2017 and Mariti et al., 2014) and an unfamiliar person have a strong ameliorative effect on the stress due to isolation. However, being separated from a canine companion is even more stressful

than being separated from a human companion in an unknown environment. The higher stress level displayed by dogs during the Ainsworth strange situation test for analyzing intraspecific attachment can be explained as being separated by the cohabitant dog summed to a condition where the owner is not present.

Further research is needed to better understand the attachment bond between adult dogs.

It is also possible that multi-household dogs have less opportunity to be left alone than single dogs, and therefore they are not used to isolation and this may have an important impact on dog welfare.

Generalization of these results should be done cautiously, due to the inclusion criteria of the sample used. However, this study seems to suggest that future research in this field may help the prevention and treatment of separation related problems, and also of problems related to the loss of a canine companion in dogs.

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Il comportamento del cane nell'Ainsworth Strange Situation Test durante la separazione dal proprietario e dal cane coabitante

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Sintesi

È noto che i cani sviluppano una forte relazione con soggetti della propria specie e di altre specie.

Lo scopo di questa ricerca è stato quello di confrontare il comportamento del cane separato dall'essere umano e dal cane convivente.

Sedici cani (9 femmine e 7 maschi, $49,8 \pm 54,3$ mesi di età, appartenenti a diverse razze) sono stati osservati durante l'isolamento di due minuti dell'Ainsworth Strange Situation Test.

Ogni cane è stato testato due volte: in un'occasione il cane era separato dal proprietario e in un'altra dal cane convivente. La durata di 19 comportamenti è stata misurata in entrambe le condizioni e confrontata usando il Mann-Whitney test ($p < 0,05$).

La vicinanza alla porta (mediane: 95,5 versus 54,5; $Z = -2,38$; $p = 0,017$), i comportamenti contro la porta (7,0 versus 0,0; $Z = -2,13$; $p = 0,033$), abbaiare (0,0 versus 0,0; $Z = 2,37$; $p = 0,017$), e tentare di scappare dalla stanza sperimentale (0,0 versus 0,0; $Z = -1,83$; $p = 0,067$) erano statisticamente più alte quando i cani erano separati dal cospecifico, in confronto a quando erano separati dal proprietario; i comportamenti passivi erano più alti quando i cani erano separati dal proprietario (13,0 versus 0,0; $Z = -3,18$; $p = 0,001$).

I risultati suggeriscono che i cani mostrano una protesta più forte alla separazione quando sono isolati dal cane coabitante. Sebbene questo fatto possa essere interpretato come segno di un più forte attaccamento intraspecifico, l'elevato livello di stress può essere dovuto alla separazione dal cospecifico, sommato alla condizione dove il proprietario non era presente. È anche possibile che cani che vivano insieme a cospecifici abbiano meno opportunità di stare da soli e perciò siano meno abituati a restare in solitudine. Questo fatto può avere importanti conseguenze sul benessere del cane.