Dog attachment to man: A comparison between pet and working dogs

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Dog attachment to man: A comparison between pet and working dogs

Chiara Mariti, Eva Ricci, Beatrice Carlone, Jane L. Moore, Claudio Sighieri, Angelo Gazzano

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Abstract Shared activities are known to create a good relationship between dog and man. Therefore, it can be expected that animals working in harness with their handlers, such as search and rescue dogs, show a higher attachment to man.

The aim of the current research was to assess whether there are differences between pet and working dogs in the attachment to owners/handlers.

Forty dogs were involved, 26 pets and 14 search and rescue dogs (taken home when not working). Their attachment to owners/handlers was analyzed by using a modified version of the Ainsworth Strange Situation Test and a recall test, while owners and handlers filled in a questionnaire and were scored on the Lexington Attachment to Pets Scale.

Statistical analysis revealed no statistically significant differences between pet and working dogs for behaviors indicating an attachment bond: behavior oriented to door/chair/shoe during the absence of owner/handler (which represents “search of absent person”; \( U = 132.000, P = 0.156 \)), contact with/proximity to owner/handler (i.e., “contact maintenance effect”; \( U = 157.000, P = 0.478 \)), whining during owner’s/handler’s absence (“protest at the separation”; \( U = 147.000, P = 0.288 \)), and individual play (\( U = 146.000, P = 0.288 \)) and exploration (\( U = 138.500, P = 0.215 \)) in presence of owner/handler, representing the “secure base effect.”

Despite the lack of statistical differences, the formulated hypothesis may be not completely rejected, as a trend of a higher attachment in search and rescue dogs existed. It can be concluded that in carefully owned dogs, the level of attachment is increased by working as a search and rescue dog, but the difference does not lead to statistically relevant results.

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Introduction

The working dog

In many countries, the majority of dogs that live with people are classified as companion animals (Hart, 1995). Companionship is among the main reasons motivating people to own a dog, and, besides the love and affection they can provide, studies have shown that dogs may help relieve...
stress and have a positive effect on the owner’s psychophysical welfare (Stafford, 2006). Moreover, pet dogs are often described by owners as children, friends, partners, and confidants, and they appear to be a source of social and emotional support; consequently, dogs can elicit strong feelings of attachment from their owners (Lagoni et al., 1994; see also Voith, 1987; Kurdek, 2008, 2009).

Furthermore, for centuries, dogs have been used for tasks such as hunting, guarding, defending, livestock guarding, and pulling sleds (Coppinger and Schneider, 1995), and, more recently, as guides for the blind, service dogs, assistance dogs, dogs that search airplanes for explosives, and search and rescue dogs looking for people who are lost in avalanches, in the wilderness, and in natural or man-made disasters (Olson, 2002).

Characteristics that are common to all working dogs are sociability, self-confidence, courage, adaptability, trainability, stamina, and confidence to approach strangers and to move in different situations, as suggested by several authors (Hebard, 1993; Koda, 2001; Beata, 2006; Svartberg, 2006).

The importance of dogs in many human activities is stressed in some studies concerning the relationship between working dogs and their handlers.

Bryson (2002) pointed out that police dogs and search and rescue dogs learn to focus on the handler’s commands rather than relying on patterned behaviors that, in unusual circumstances, could leave them clueless.

Lefebvre et al. (2007) suggested that an enhanced dog–handler relationship can be achieved by taking the dogs home and participating in sport together: in their study, military dogs managed this way have been shown to be more obedient, less aggressive, and more sociable than those kept in the military facilities.

Moreover, dog–handler relationship and performance can be improved by certain methods, for example, regular exercise with emphasis on obedience and the use of positive training techniques, more efficient than aversive methods (Haverbeke et al., 2008).

Dogs are also used as guides for the blind; with their assistance, the visually impaired can gain independence, being able to walk confidently and in complete synchrony with the dog. In other words, the relationship between the blind person and his/her guide dog is a bond of reciprocal trust (Gazzano et al., 2008a).

Attachment bond

A specific feature of the dog–man dyad relationship is the attachment bond that may link them. Bowlby (1958) was one of the first authors who tried to pool the results of research on the bond between young animals and their mother, regardless of the species they belonged to. He linked psychoanalysis to ethological findings on imprinting and following behaviors (Lorenz, 1949) and the psychological research carried out on young Macaques’ attachment to their mother (Harlow, 1958); consequently, Bowlby formulated a theory of attachment that was valid for all mammals. Relevant characteristics of this bond are contact maintenance effect that leads the subject to maintain physical contact and proximity with the attachment figure, protest at separation and separation anxiety when the subject is far from the attachment figure, and secure base effect, that is, the attachment figure represents a base from which to explore the world (Ainsworth, 1969; Ainsworth and Bell, 1970; Bowlby, 1988; Attili, 2007).

The behavioral test commonly used to study child attachment to the mother is called the Ainsworth Strange Situation Test (ASST). Modified versions of the same test have also been used for chimpanzees (Bard and Nadler, 1983; Bard, 1991; Miller et al., 1986, 1990), with findings similar to those observed in children. Hypothesizing the similarity with the child–mother relationship, in recent years, some studies have investigated the relationship between dogs and their owners as an attachment bond. A study by Topál et al. (1998) was the first to analyze the dog–human bond as one of attachment by using a modified version of the ASST. The authors mainly observed a preference of the dog toward the owner compared with a stranger. Prato-Previde et al. (2003) observed that a strong affective bond linking dog to owner does exist, whereas Palmer and Custance (2008), using a counterbalanced version of ASST, confirmed that owners act as a secure base for their dogs.

Further studies on dogs’ attachment to humans have been carried out: Palestrini et al. (2005) found behavioral and heart rate changes indicating stress in dogs during ASST; Marinelli et al. (2007) used the test in a study concerning both dog and owner characteristics and how they could influence dogs’ quality of life; Topál et al. (2005)
compared the attachment to man of dog puppies (*Canis familiaris*) with that of hand-reared wolf puppies (*Canis lupus*); Gácsi et al. (2001) evaluated the ability of adult dogs in shelters to form new attachment bonds to humans; Parthasarathy and Crowell-Davis (2006) used a modified version of ASST to study the relationship between attachment to owner and separation anxiety in pet dogs. Regarding working dogs, an attachment bond has also been observed in future guide dogs toward their puppy walkers, toward their trainers during training, and in guide dogs toward visually impaired owners, although behaviors were expressed at different degrees (Fallani et al., 2006, 2007).

The aim of the current study was to investigate whether search and rescue dogs show a different level of attachment toward their handlers from that of pet dogs toward their owners. In detail, it was expected that working with the owner could increase the dog’s attachment strength.

To accomplish this, all dogs were observed using a modified version of ASST and a recall test. In addition to participating in these tests, each owner/handler filled in a questionnaire developed to gather information regarding their relationship with the dog under examination (a method reliably used by Marinelli et al., 2007, Gazzano et al., 2008a,b).

### Methods

#### Subjects

Forty dogs, divided into 2 groups, participated in the study.

The first group of 26 pet dogs consisted of 12 female (3 spayed) and 14 male (3 neutered) dogs, with a mean age of 38.5 ± 27.8 months, including 7 Labrador retrievers, 2 German shepherds, 2 Border collies, 1 golden retriever, 1 flat-coated retriever, 1 Belgian shepherd Groenendael, 1 beagle, 1 Doberman, 1 English springer spaniel, 1 Irish setter, 1 Jack Russell, 1 pit bull, and 6 mixed-breeds. Each pet dog was accompanied by his/her owner (16 women and 10 men, mean age: 27.9 ± 6.6 years).

The second group consisted of 14 working dogs, 5 female (2 spayed) and 9 male (all intact) dogs, with a mean age of 46.6 ± 27.1 months, including 6 Labrador retrievers, 3 German shepherds, 1 Border collie, 1 Belgian shepherd Malinois, 1 beagle, and 2 mixed-breeds. Each dog was accompanied by his/her handler (4 women and 10 men, mean age: 39.9 ± 8.7 years). All the dogs were employed as search and rescue dogs and lived at home with their handlers even when not working.

None of the female dogs were in estrus, nor were they pregnant at or around the time of observation.

Owners and handlers were all volunteers recruited through personal contacts.

All dogs were 1 year old or more and had been living (for pet dogs) with their owners and working (for search and rescue dogs) with their handlers for at least 6 months, they were used to being taken out and being left alone and had been well socialized to people. Before the test, the dogs underwent a behavioral consultation to exclude the presence of disorders that could have an effect on results.

### Experimental setting

The experimental environment was a relatively bare room, unfamiliar to the dogs, at the Department of Physiological Sciences, University of Pisa (Italy). The room (4.50 × 4.30 m) was prepared to match the requirements described in the ASST (Ainsworth and Bell, 1970) as far as possible, especially in the version modified for dogs (Topál et al., 1998; Prato-Previde et al., 2003; Palestrini et al., 2005). The room was equipped with 2 chairs, 1 for the owner/handler and 1 for the stranger; a water bowl; 3 dog toys (a Kong, a puppet, and a rope); a table to leave the leash on; a single door around which a 1-m-radius semicircle had been drawn; and 2 video cameras (JVCeverio GZ-MG 130E, Yokohama, Japan) to record the whole test. One video camera was oriented to the door and the surrounding area, whereas the other one recorded the whole room. To avoid external noise, tests were conducted during the weekend, when the building was not in use, for a period of 4 months.

All owners and handlers signed a form authorizing the use of the data collected in accordance with the Italian National Privacy Law (Legislative Decree n. 196, June 30, 2003).

#### Procedure

The owner or the handler, the dog, and a stranger, who was always played by the same woman and who had never met the dog before, participated simultaneously in the test. The stranger also acted as test leader, guiding other participants throughout the entire test.

Procedures previously used to study dog attachment to people slightly differed from one another (Topál et al., 1998; Prato-Previde et al., 2003; Palestrini et al., 2005). Slight changes were also applied for the protocol carried out for the current study, which is described later in the text.

The owner/handler and the stranger supplied a shoe as a personal object. Before the experiment began, each participant’s shoe was put in a plastic bag on the chair of the other person.

The participants were asked not to attract the dog’s attention and to remain seated during the whole procedure, except when they had to leave or come back into the room and when they were asked to stimulate the dog to play.

The entire procedure comprised a pre-experimental and an experimental phase, the latter divided into 7 episodes plus an introductory episode.

In the pre-experimental phase, the owner/handler was escorted by a helper to a waiting room and asked to fill in a questionnaire to gather background information regarding characteristics of the owner/handler, the dog, and the
environment where he/she was living; the kind of activity involving the 2 individuals; dog management; and the Lexington Attachment to Pets Scale (LAPS) (Johnson et al., 1992; Marinelli et al., 2007). The procedure was briefly described to the owner/handler, but the specific goal of the study was not disclosed; instead, owners/handlers were told that the aim of the study was to investigate the exploratory behavior of dogs in an unfamiliar environment (as suggested by Topál et al., 1998; Prato-Previde et al., 2003).

The experimental phase was divided into the following episodes:

Introductory episode: Owner/handler, stranger, and dog entered the experimental room. The dog was unleashed and set free to explore the room. The leash was placed on the table. Participants sat on the chairs, as previously established.

Episode 1: Owner/handler, stranger, and dog (3 minutes). Participants could talk to each other and interact with the dog only if he/she performed attention-seeking behaviors. At the end of the third minute, the owner/handler left the room.

Episode 2: Stranger and dog (2 minutes plus time needed to stimulate the dog to the social play). The owner/handler was out of the room. In the first minute, the stranger had to ignore the dog, even if he/she was seeking attention. In the second minute, the stranger pulled out owner’s/stranger’s shoe from the plastic bag and put it on the empty chair. The stranger could only interact with the dog if he/she was seeking attention. At the end of the second minute, the stranger tried to stimulate the dog to play, with a maximum of 3 trials (1 for each toy in the room). As soon as the dog started playing, or at the end of the third trial, the stranger called the owner/handler back into the experimental room.

Episode 3: Owner/handler, stranger, and dog (2 minutes plus time needed to stimulate the dog to the social play). The owner/handler came back into the room. In the first minute, the owner/handler knocked on the door and stayed behind it for 10 seconds. After 10 seconds, the person entered the room and stayed for 50 seconds within 1 m of the door to allow the dog to greet her. If the dog initiated interaction, the stranger greeted and comforted the animal, but if the dog did not approach her, she had to wait until the end of 50 seconds in proximity of the door without attracting the dog’s attention. Meanwhile, the owner/handler must not interact with the dog. In the second minute, the stranger who had just entered took the shoe off the chair and sat down. Participants could talk to each other and interact with the dog only if the animal was seeking attention. At the end of the second minute, the stranger tried to stimulate the dog to play, with a maximum of 3 trials (1 for each toy present in the room). As soon as the dog started playing, or at the end of the third trial, the stranger declared the episode finished and left the room.

Episode 4: Owner/handler and dog (2 minutes plus time needed to stimulate the dog to the social play). The stranger was out of the room. In the first minute, the owner/handler had to ignore the dog, even if he/she performed attention-seeking behaviors. In the second minute, the owner/handler pulled out the stranger’s shoe from the plastic bag and put it on the empty chair. The owner/handler could only interact with the dog if he/she was seeking attention. At the end of the second minute, the owner/handler tried to stimulate the dog to play, with a maximum of 3 trials (1 for each toy in the room). As soon as the dog started playing, or at the end of the third trial, the owner/handler called the stranger back into the experimental room.

Episode 5: Owner/handler, stranger, and dog (2 minutes plus time needed to stimulate the dog to the social play). The stranger came back into the room. In the first minute, the stranger knocked on the door and stayed behind it for 10 seconds. After 10 seconds, the person entered the room and stayed for 50 seconds within 1 m of the door to allow the dog to greet her. If the dog initiated interaction, the stranger greeted and comforted the animal, but if the dog did not approach her, she had to wait until the end of 50 seconds in proximity of the door without attracting the dog’s attention. Meanwhile, the owner/handler must not interact with the dog. In the second minute, the stranger who had just entered took the shoe off the chair and sat down. Participants could talk to each other and interact with the dog only if the animal was seeking attention. At the end of the second minute, the stranger tried to stimulate the dog to play, with a maximum of 3 trials (1 for each toy present in the room). As soon as the dog started playing, or at the end of the third trial, the stranger declared the episode finished and the owner/handler and the stranger left the room.

Episode 6: Dog alone (1 minute). The dog was left alone in the room.

Episode 7: Owner/handler, stranger, and dog. The owner/handler and the stranger came back into the room (1 minute). If the dog initiated interaction, the persons could greet the dog. The participants sat in the same chairs as before and made conversation, interacting with the dog only if he/she performed attention-seeking behaviors.

Instructions during the test were announced by the stranger, using a chronometer to keep time. When the stranger was outside the room, she gave instructions in a quiet voice.

At the end of each test, the experimental room’s floor was washed using a nontoxic weakly scented disinfectant.
After the modified ASST, a recall test was carried out. In an open space, the owner/handler and the stranger stood in front of the dog at a distance of 5 m, and a third person held the dog on a leash; the owner/handler and the stranger called the dog simultaneously just using their voice, with a normal tonality. There were 3 repetitions of the recall, and each time, the person toward whom the dog went was recorded. In case the dog was not clearly oriented to one person, the attempt was repeated up to 3 times, unless the dog appeared stressed by being called frequently and seemed disoriented.

### Data collection

The 40 videotaped tests were analyzed through a continuous recording method, registering the duration (in seconds) of 16 behaviors during the 7 episodes. Some of these behaviors were previously observed in studies based on the ASST, whereas others were added as considered useful for this study. The behaviors were divided into social and nonsocial; each social behavior was analyzed toward the owner, the handler, and the stranger (see Tables 1 and 2 for behaviors analyzed in the ASST, associated to relative definitions and references).

Some behaviors have been grouped to create the following behavioral categories:

- contact/proximity (referred to each participant present in the room), formed by attention seeking, physical contact with a person, following, approach, attention oriented to a person, proximity, and social wagging;
- door/chair/shoe, formed by standing by the door, behaviors oriented to the door, attention oriented to the door when the person was absent, behaviors oriented to the chair, behaviors oriented to the shoe, and sniffing the shoe of absent person.

The duration of each category was obtained by summing the duration of the behaviors forming the category.

During the behavioral test, the following scores were also calculated after observing the dogs’ behavior:

- Social play with person score: for each stimulation, the person totalized 3 points if the dog responded at the first trial, 2 points if the dog responded at the second trial, 1 point if the dog responded at the third trial, and 0 points if the dog did not respond to stimulation. Each person tried to stimulate the dog twice, so he/she could totalize from 0 to 6 points.
- Greeting toward entering person score (see Topál et al., 1998): approach initiation (1), full approach with physical contact (2), any sign of avoidance behavior (−1).

Regarding the recall test, a score was calculated for each person: for every 1 of the 3 attempts, the participant totalized 1 point if the dog clearly moved toward him/her and 0 points if the dog did not move toward him/her.

From the questionnaire:

- LAPS: the sum of the scores of all 23 items for each person was used to evaluate the level of owner/handler attachment to the dog. The level of owner/handler attachment (Total LAPS) was evaluated low (L), medium (M), or high (H), considering the highest and the lowest obtainable score and dividing the range into thirds (0-22, 23-46, and 47-69, respectively) (Johnson et al., 1992; Marinelli et al., 2007).

### Table 1  Non-social behaviors, their definitions, and relative references

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Definition</th>
<th>Relative references</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exploration</td>
<td>Activity directed toward physical aspects of the environment, including sniffing, close visual inspection, distal visual inspection, and gentle oral examination such as licking.</td>
<td>Topál et al., 1998; Prato-Previde et al., 2003; Palestri et al., 2005</td>
</tr>
<tr>
<td>Individual play</td>
<td>Any vigorous or galloping gaited behavior directed toward a toy when clearly not interacting with any participants, including chewing, biting, shaking from side to side, scratching or batting with the paw, chasing rolling balls and tossing using the mouth.</td>
<td>Modified from Prato-Previde et al., 2003; Palestri et al., 2005</td>
</tr>
<tr>
<td>Standing by the door</td>
<td>The time spent close to the door (&lt;1 m) regardless of whether the face was oriented to the exit.</td>
<td>Modified from Topál et al., 1998</td>
</tr>
<tr>
<td>Behaviors oriented to the door</td>
<td>All active behaviors resulting in physical contact with the door, including scratching the door with the paws, jumping on the door, pulling on the door handle with the forelegs or mouth.</td>
<td>Modified from Prato-Previde et al., 2003</td>
</tr>
<tr>
<td>Attention oriented to the door</td>
<td>Staring fixedly at the door, either when close to it or from a distance.</td>
<td>Prato-Previde et al., 2003; Palestri et al., 2005</td>
</tr>
<tr>
<td>Behaviors oriented to the chair</td>
<td>All active behaviors resulting oriented to owner/handler’s or stranger’s empty chair.</td>
<td>Modified from Prato-Previde et al., 2003</td>
</tr>
<tr>
<td>Behaviors oriented to the shoe</td>
<td>All behaviors resulting oriented to the shoe during shoe owner absence, including staring at the shoe, biting, shaking, dragging.</td>
<td>Modified from Prato-Previde et al., 2003</td>
</tr>
<tr>
<td>Sniffing the shoe</td>
<td>Sniff at the shoe during shoe owner absence.</td>
<td>Current study Parthasarathy and Crowell-Davis, 2006; Palestri et al., 2010</td>
</tr>
<tr>
<td>Whining</td>
<td>High-pitched vocalization.</td>
<td>Current study Parthasarathy and Crowell-Davis, 2006; Palestri et al., 2010</td>
</tr>
</tbody>
</table>
behavioral categories and the coxon test (c toward the stranger in their presence/absence, using the Wilcoxon test) and to make a comparison between the behaviors shown toward dogs (26 pet dogs plus 14 working dogs) was considered to make a comparison between the behaviors shown toward owners/handlers (below called “attachment figure”) and to make a comparison between the behaviors shown toward owners/handlers and to make a comparison between the behaviors shown toward owners/handlers.

Statistical analysis

All statistical analyses were run with the software SPSS Statistic 17.0 (Chicago, IL).

In the first step of the analysis, the whole sample of 40 dogs (26 pet dogs plus 14 working dogs) was considered to make a comparison between the behaviors shown toward owners/handlers (below called “attachment figure”) and toward the stranger in their presence/absence, using the Wilcoxon test ($P < 0.05$) for the duration of behaviors and behavioral categories and the $\chi^2$ test ($P < 0.05$) for the recall test. Statistical analysis concerned:

- duration of exploration while in presence of owner/handler or stranger and when dog was alone: episode 4 versus episode 2 and episode 2 versus episode 6 (secure base effect);
- duration of individual play while in presence of owner/handler or stranger and when dog was alone: episode 4 versus episode 2 and episode 2 versus episode 6 (secure base effect);
- duration of whining during owner/handler’s or stranger’s absence and when dog was alone: episode 2 versus episode 4 and episode 2 versus episode 6 (protest at the separation);
- behavioral category “contact/proximity” while in presence of owner/handler or stranger: episodes 1, episode 2 versus episode 4, episode 3 versus episode 5, and episode 7 (contact maintenance);
- behavioral category “door/chair/shoe” while owner/handler or stranger were absent and while dog was alone: episode 4 versus episode 2 and episode 2 versus episode 6 (search of absent person);
- recall test score.

In the second step of the analysis, a comparison was made between owners and handlers using the samples of pet dogs ($n = 26$) and working dogs ($n = 14$). The analysis concerned:

- duration of exploration while in presence of owner and of handler: episode 4;
- duration of individual play while in presence of owner and of handler: episode 4;
- duration of whining during owner’s and handler’s absence and when dog was alone: episodes 2 and 6;
- behavioral category “contact/proximity” with owner and with handler: episodes 1, 3, 4, and 7;
- behavioral category “door/chair/shoe” while owner and handler were absent and while the dog was alone: episodes 2 and 6;
- recall test score (see Table 4 for data used in statistical analysis);
- social play with person score (see Table 4 for data used in statistical analysis);
- greeting toward entering person score (see Topál et al., 1998): approach initiation (1), full approach with physical contact (2), any sign of avoidance behavior (−1) (see Table 4 for data used in statistical analysis);
- LAPS;
- questionnaire (see Table 4 for data used in the statistical analysis).

For exploration, individual play, whining, contact/proximity, and door/child/shoe, the statistical analysis was executed with the Mann–Whitney $U$ test ($P < 0.05$). For social play, greeting, and recall and questionnaire scores, the $\chi^2$ test ($P < 0.05$) was used, whereas for the LAPS scores, the Student $t$ test was used ($P < 0.05$). As episodes 2 and 6 had different lengths, seconds spent by dogs in displaying behaviors in episode 6 were doubled (for both steps of the analysis).

Results

Comparison between attachment figures and stranger

The results obtained from the Wilcoxon test for exploration and individual play (secure base effect), whining (protest at the separation), door/child/shoe (search of absent person),

<table>
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<tr>
<th>Table 2</th>
<th>Social behaviors, their definitions, and relative references</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavior</td>
<td>Definition</td>
</tr>
<tr>
<td>Attention seeking</td>
<td>Seeking attention from a person to play, be patted, etc.</td>
</tr>
<tr>
<td>Physical contact with a person</td>
<td>Being in physical contact with the owner/handler or the stranger</td>
</tr>
<tr>
<td>Following Approach</td>
<td>Following the person around the room or to the door.</td>
</tr>
<tr>
<td>Attention oriented to a person</td>
<td>Staring fixedly at the owner/handler or the stranger, regardless of whether the behavior was reciprocated</td>
</tr>
<tr>
<td>Proximity</td>
<td>Close to (not in physical contact) the owner/handler or the stranger at least for 3 s.</td>
</tr>
<tr>
<td>Social wagging</td>
<td>Wagging while dog interacts with owner/handler or stranger.</td>
</tr>
</tbody>
</table>

• Questionnaire: in each questionnaire, the items concerning dog management were considered, that is, “Mainly who: -feeds the dog? -takes the dog out? -plays with the dog? -trains the dog?” Possible answers for each question were: me (score = 2), someone else (score = 0), or both (score = 1).
and contact/proximity (contact maintenance) were comparable with general results emerging from other studies focused on the dog–owner attachment bond (see Topa´l et al., 1998; Prato-Previde et al., 2003; Palestrini et al., 2005; Palmer and Custance, 2008) and on the child–mother attachment bond (see Ainsworth, 1969; Ainsworth and Bell, 1970; Bowlby, 1988; Attili, 2007). See Table 3 for a summary of results. A strong preference for the attachment figure, that is, the owner or the handler, emerged from the data.

In the recall test, the dogs moved toward the attachment figure significantly more than toward the stranger ($\chi^2$ test: $df = 1, \chi^2 = 48.920, P = 0.000$), consistent with the results of the ASST.

**Comparison between owners and handlers**

Comparisons between the behaviors referred to owners and those referred to handlers were run with the Mann–Whitney $U$ test. During episode 4, the time spent in exploration by pet dogs in the presence of their owner and by working dogs in the presence of their handler was comparable ($U = 138.500, P = 0.215$); also, the time spent in individual

<table>
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<th>Table 3</th>
<th>Summary of results of attachment figure–stranger comparisons</th>
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<tr>
<td>Behavior</td>
<td>Comparison</td>
</tr>
<tr>
<td>Exploration</td>
<td>ep. 4 vs. ep. 2: AF present vs. S present</td>
</tr>
<tr>
<td></td>
<td>ep. 2 vs. ep. 6: AF absent vs. dog alone</td>
</tr>
<tr>
<td>Individual play</td>
<td>ep. 4 vs. ep. 2: AF present vs. S present</td>
</tr>
<tr>
<td></td>
<td>ep. 2 vs. ep. 6: AF absent vs. dog alone</td>
</tr>
<tr>
<td>Whining</td>
<td>ep. 2 vs. ep. 4: AF absent vs. S absent</td>
</tr>
<tr>
<td></td>
<td>ep. 2 vs. ep. 6: AF absent vs. dog alone</td>
</tr>
<tr>
<td>Contact/proximity</td>
<td>ep. 1: AF vs. S (both present)</td>
</tr>
<tr>
<td></td>
<td>ep. 2 vs. ep. 4: S present vs. AF present</td>
</tr>
<tr>
<td></td>
<td>ep. 3 vs. ep. 5: AF enters vs. S enters</td>
</tr>
<tr>
<td></td>
<td>ep. 7: AF vs. S (both present)</td>
</tr>
<tr>
<td>Door/chair/shoe</td>
<td>ep. 2 vs. ep. 4: AF absent vs. S absent</td>
</tr>
<tr>
<td></td>
<td>ep. 2 vs. ep. 6: AF absent vs. dog alone</td>
</tr>
</tbody>
</table>

AF, attachment figure (owners or handlers); S, stranger; ep., episode.

$^a$Significant difference.

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Scores used for the analysis of social play, greeting, recall, and questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social play</td>
<td>Owners whose score was equal to or inferior than stranger’s score</td>
</tr>
<tr>
<td></td>
<td>Owners whose score was equal to or inferior than stranger’s score</td>
</tr>
<tr>
<td></td>
<td>Owners whose score was equal to or inferior than stranger’s score</td>
</tr>
<tr>
<td>17</td>
<td>9</td>
</tr>
<tr>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>57.1%</td>
<td>65.4%</td>
</tr>
<tr>
<td>Greeting</td>
<td>Owners whose score was equal to or inferior than stranger’s score</td>
</tr>
<tr>
<td></td>
<td>Owners whose score was equal to or inferior than stranger’s score</td>
</tr>
<tr>
<td></td>
<td>Owners whose score was equal to or inferior than stranger’s score</td>
</tr>
<tr>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>50.0%</td>
<td>57.1%</td>
</tr>
<tr>
<td>Recall</td>
<td>Times dogs went toward the owner</td>
</tr>
<tr>
<td></td>
<td>Times dogs went toward the owner</td>
</tr>
<tr>
<td>70</td>
<td>9</td>
</tr>
<tr>
<td>77.2%</td>
<td>95.2%</td>
</tr>
<tr>
<td>Questionnaire</td>
<td>Maximum expected total score for owners</td>
</tr>
<tr>
<td></td>
<td>Maximum expected total score for owners</td>
</tr>
<tr>
<td>199</td>
<td>208</td>
</tr>
<tr>
<td>112</td>
<td>95.7%</td>
</tr>
</tbody>
</table>
play by pet and working dogs in the same episode was not significantly different \( (U = 146.000, P = 0.288) \).

The duration of whining revealed no statistical difference both in episode 2, during owner and handler absence \( (U = 147.000, P = 0.288) \), and in episode 6, when the dogs were alone \( (U = 172.000, P = 0.772) \).

The analysis of the amount of time spent in contact/proximity with owners by pet dogs and with handlers by working dogs revealed that they were comparable in all situations: when dogs were with owners or handlers without the stranger (episode 4: \( U = 159.500, P = 0.523 \)), when owners or handlers and the stranger were in the room with the dogs (episode 1: \( U = 140.500, P = 0.239 \); episode 7: \( U = 125.500, P = 0.109 \)), and when owners or handlers entered the room (episode 3: \( U = 157.000, P = 0.478 \)).

The duration of behaviors oriented toward the door, the shoe, and the chair was not significantly different between pet dogs and working dogs during owner’s or handler’s absence (episode 2) \( (U = 132.000, P = 0.156) \), neither was it in episode 6 (dogs alone) \( (U = 167.000, P = 0.670) \).

A representation of the median values and results of the comparison between pet dogs and working dogs is shown in the Figure.

Data regarding social play, greeting, and recall and questionnaire scores are summarized in Table 4.

The scores obtained by owners and handlers for social play were not significantly different \( (\chi^2{}^2 \text{ test: } df = 1, \chi^2{} = 0.030, P = 0.864) \), nor were the scores obtained by owners and handlers during greeting \( (\chi^2{}^2 \text{ test: } df = 1, \chi^2{} = 0.010, P = 0.921) \).

No significant differences were found for owners’ and handlers’ scores in the recall test \( (\chi^2{}^2 \text{ test: } df = 1, \chi^2{} = 1.870, P = 0.172) \).

No significant differences between the owner group and the handler group were found for the management scores \( (\chi^2{}^2 \text{ test: } df = 1, \chi^2{} = 0.000, P = 0.971) \).

The analysis of LAPS revealed that the majority of owners totaled a high score (84.62%), although some of them obtained a medium score (15.39%), whereas all the handlers obtained a high score. The comparison between owners’ and handlers’ scores did not show significant differences \( (\text{Student } t \text{ test: } 55.39 \pm 8.89 \text{ vs. } 58.14 \pm 5.30; df = 38, t = -1.060, P = 0.296) \).

Discussion

The aim of the current research was to assess possible differences between the attachment bond of pet dogs toward their owners and of working dogs toward their handlers. Previous studies on the attachment of working dogs tested guide dogs \( (\text{Fallani et al., 2006, 2007}) \), whereas in the current research, search and rescue dogs were involved. A modified version of ASST was used, similar to those used in previous studies on dog attachment to human beings \( (\text{Topál et al., 1998; Prato-Previde et al., 2003; Palestrini et al., 2005; Palmer and Custance, 2008}) \). The attachment was assessed considering the presence of maintenance contact effect (behavioral category called contact/proximity to a person), protest at separation and research of absent person (whining and behavioral category door/chair/shoe), and secure base effect (exploration and individual play when the attachment figure is present).

Results obtained assessing all subjects without distinguishing between groups (pet plus search and rescue dogs) reflect the findings of previous studies concerning child–mother attachment \( (\text{Ainsworth, 1969; Ainsworth and Bell, 1970; Bowlby, 1988}) \). In this study, further results emerged compared with those obtained in previous studies on dog attachment to man owing to methodological differences. The main points differentiating the current study from the previous ones are as follows: distinguishing whining from other kinds of vocalization, as barking is related to high arousal and frustration \( (\text{Lund and Jørgensen, 1999}) \), whereas whining is a social signal of distress and may be related to fear and anxiety \( (\text{Lund and Jørgensen, 1999; Palestrini et al., 2010; Partasarathy and Crowell-Davis, 2006}) \); “social wagging” was included in this research, based on the observation that tail wagging in dogs conveys affiliative intentions \( (\text{Bonanni et al., 2010}) \); a continuous recording, rather than a focus sampling, was used, thus the collection of sufficient data for statistical analysis regarding behaviors such as exploration and individual play was possible \( (\text{versus study of Prato-Previde et al., 2003}) \).

Analysis of the whole sample showed that dogs, like children, showed more whining and a higher degree of searching for the attachment figure (owner or handler) when he/she was absent, compared with the stranger (protest at separation); furthermore, they showed a higher tendency to explore and play individually when the attachment figure was present (secure base effect); also, regarding contact/proximity seeking (called by Bowlby and Ainsworth the maintenance contact effect), the person toward whom dogs showed higher levels of affiliative behaviors was the attachment figure. This confirms that dogs establish a real attachment bond toward their owners/handlers \( (\text{as suggested by Topál et al., 1998; Palmer and Custance, 2008; Mariti et al., 2010}) \).

Regarding the comparison between pet and working dogs, no statistically significant differences were found. Contrary to the hypothesis based on previous studies regarding dog–handler relationships \( (\text{e.g., Jones and Joseph, 2006; Lefebvre et al., 2007; Marshall-Pescini et al., 2009}) \), and above all on guide dogs’ attachment toward trainers and visually impaired owners \( (\text{Fallani et al., 2006, 2007}) \), results did not show that working dogs were more strongly attached toward their handlers compared with pet dogs toward their owners.

The disagreement with Fallani et al.’s findings \( (2006, 2007) \) can be explained by the following methodological differences.

Fallani et al. \( (2006) \) observed guide dogs for the blind, dogs that have to be willing to keep proximity with their
visually impaired owners/handlers (Koda, 2001). The dogs undergo highly specific training, especially designed to teach animals to maintain close physical contact with the visually impaired owner; this is probably the reason that more pronounced differences were found comparing guide dogs with pet dogs regarding maintenance contact and proximity seeking toward the attachment figure. Another goal of a guide dog’s training is to reduce the exhibition of behavioral reactions related to excitability; Fallani et al. (2007) observed that although emotional responses (quantified by heart rate variation) were comparable with those observed in pet dogs, guide dogs showed a more self-controlled reaction during separation from their owner. This more controlled behavioral response could be due to both the training and the selection of guide dogs (Fallani et al., 2007); the selection is not institutionalized for search and rescue dogs, and therefore, it may have a smaller influence on this behavioral feature.

Fallani et al. (2006) found differences in social play, which was inferior in guide dogs compared with pet dogs, whereas no differences emerged in the current research. This could be explained by the fact that guide dogs are not used to play with their visually impaired owners (owing to their obvious constraints in playing, as suggested by Fallani et al., 2006); on the contrary, search and rescue dogs, as pets, usually play a lot with their handlers: in fact, play is a commonly used reward in training (Svarberg, 2006).

It is important to note that although no significant differences emerged from the statistical analysis, a trend of higher values and scores toward handlers versus owners was observed in most of the examined behaviors. This trend could have led to differences not statistically significant because both pet and working dogs were attached to their owner/handler; in fact, the working dogs in this study were also pets, living with their handlers and their families, in a family environment (see Lefebvre et al., 2007), and the pet dogs were carefully managed by their owners. Generally speaking, owners who agreed to participate in the research paid great attention to their pet’s welfare. Owners stated that they regularly shared activities (although not at a working level) with their dogs, such as playing and walking; both activities are known to strengthen the dog–owner relationship, which is more affected by the quality of the relationship rather than the amount of time spent together (Scott and Fuller, 1965; O’Farrell, 1992; Rooney and Bradshaw, 2003). It means that virtually the only difference in the management of the 2 groups consisted in working as a search and rescue dog or not. The results seem to suggest that this factor is not sufficiently strong to lead to a remarkable increase in the dog’s attachment to his/her owner.

A relevant factor to be taken into account is that all the working dogs in this sample were trained with gentle methods (i.e., based on positive reinforcement), which, unlike aversive methods, do not lead to serious negative consequences (Tortora, 1983; Roll and Unshelm, 1997; Beorda et al., 1998; Hiby et al., 2004; Schilder and Van der Borg, 2004). The gentle methods used in training make use of anything that can be perceived as a reward for the trainee, including affiliative behaviors, such as grooming, that can be a reinforcer in operant conditioning of dogs (Fonberg et al., 1981) and help in establishing intraspecific social bonds (Taira and Rolls, 1996). In general, the relationship between person and dog is improved by appetitive interactions and broken down by aversive ones (MacKellar, 2004); the use of different methods consisting of aversive interactions and positive punishment leads to many problems (Rooney et al., 2009), and the inclusion in the study of dogs trained with nongentle methods would be expected to produce different results.

The kind of training and the behavioral peculiarities of search and rescue dogs, among which are the tendency to hunt by smell alone, obedience, and responsiveness to commands (Hebard, 1993; Rooney et al., 2004), can explain differences in this type of working dog compared with guide dogs and pets. The influence that training can have on a dog’s behavior and sociocognitive performances is relevant: dogs trained for search and rescue work tend to look at the handler and bark at them more often than untrained dogs, perhaps because the final step of the search and rescue procedure is to alert the handler by standing next to and barking at the missing person (Lit and Crawford, 2006; Marshall-Pescini et al., 2009).

Regarding behaviors related to searching for the absent person and whining, it can be hypothesized that pet dogs showed them at a high level, comparable with working dogs, because in the group, there were subjects who had undergone the break of a bond, having been rehomed, which is known to modify some behaviors during the ASST (see Prato-Previde et al., 2003) and tends to increase anxiety during separation from the owner (Prato-Previde and Valsecchi, 2007).

Finally, Fallani et al. (2006, 2007) analyzed only golden and Labrador retrievers, whereas in the current research, the sample was formed of a greater number of breeds and mixed-breeds. This could have led to different results, as differences among breeds seem to affect dog–human attachment (Marinelli et al., 2007).

**Conclusion**

Our results did not provide statistical support for the original hypothesis that working dogs would show a different (higher) attachment toward their trainers compared with pet dog–owner dyads. However, this hypothesis should not be completely rejected, as a trend of higher attachment in working dogs was observed for all the analyzed behaviors. It can be concluded that in carefully owned dogs, the level of attachment may be increased by working as a search and rescue dog, but the difference was not statistically significant in our study.
References


