Applied Animal Behaviour Science xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim

Benefits of intraspecific social exposure in adult Swiss military dogs

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ARTICLE INFO

Keywords:
Working dogs
Socialisation
Social enrichment
Kennel housing
Animal welfare

ABSTRACT

Domestic dogs (*Canis* familiaris) are social animals and, therefore, social interactions with conspecifics are crucial for their welfare. However, in kennelled dogs, the ability to interact with conspecifics may be limited. Swiss military dogs, for instance, are kept individually without direct contact to conspecifics. Here we asked whether short-term exposure to conspecifics may be beneficial for dogs kept in isolation. The treatment lasted for eight weeks and consisted of one session weekly of three hours of social exposure. During social exposure, focal dogs were allowed direct contact with conspecifics but were supervised by the experimenter who intervened when necessary to prevent dogs from attacking one another. Immediately before and after the treatment phase, the dogs' reactions towards unfamiliar objects (including a dog model) and an unfamiliar male dog (stimulus dog) were assessed both in experimental dogs (*with* social exposure, n = 29) and control dogs (*without* social exposure, n = 27). We predicted a positive effect of the social exposure, i.e. less offensive and defensive behaviours shown towards both the unfamiliar dog model and stimulus dog. In accordance with our predictions, experimental dogs showed a greater decrease in offensive and defensive behaviours compared to control dogs. Although none of these dogs had been socialised conventionally like family dogs are, we found a clear positive effect of social exposure in adult dogs on their social behaviour. Thus, working dogs, which are otherwise kept singly, may benefit from temporary social exposure in terms of both their working ability and their wellbeing.

1. Introduction

Domestic dogs (*Canis familiaris*) show social interactions with both conspecifics and humans (Coppinger and Coppinger, 2002). The first six months of life, when they start to form social relationships (Hubrecht, 1995; Serpell and Jagoe, 1995; Boxall et al., 2004), are considered to be particularly critical for their socialisation (Freedman et al., 1961; Appleby et al., 2002). However, socialisation may continue throughout the dogs' lives (Howell et al., 2015). Well-socialised dogs, that reacted more appropriately to environmental stimuli, were found to be more approachable (Hubrecht, 1995), to show reduced measures of stress, and to behave more consistently and calmer than less well socialised dogs (Boxall et al., 2004). Adverse and potentially stressful social experiences within the first six months can have sustained negative effects on social behaviour such as enhanced aggression, fear of people, objects, or situations, separation anxiety, abnormal sexual behaviour or territorial aggression (Serpell, 1996). Further, dogs with previously restricted social exposure to conspecifics were more likely to be aggressive during the first eight weeks of public social exposure than dogs with unrestricted contact with conspecifics (Wormald et al., 2016). Batt et al. (2008) studied the effect of socialisation on later success as guide dogs by comparing a socialisation group, where puppies received socialisation training of one hour per week from weeks 12 to 16, to a control group. They found no effect on the dogs' success as guide dogs later in life (Batt et al., 2008). Moreover, additional socialisation during the early life of a puppy did not alter the response to social stimuli (Seksel et al., 1999). Thus, socialisation training may affect social behaviour towards conspecifics (Wormald et al., 2016), but does not seem to affect the working ability of dogs (Batt et al., 2008).

Working dogs, such as police or military dogs, are often kept singly in kennels, either permanently or at least temporarily. Hence their social experience may be compromised compared to pet dogs. Effects of several forms of social enrichment on behaviour and welfare have been studied in kennelled dogs. As a result, visual contact with other dogs has been recommended for singly housed dogs (Wells, 2004). However, the benefits of visual and auditory contact without the possibility for proper physical interactions are unclear, and it has been suggested that it may even induce frustration (McAfee et al., 2002; Mills and Davenport, 2002). For example, when dogs hear another dog barking, they often start barking as well, which has been interpreted as a sign of frustration (Adams and Johnson, 1994; Ledger et al., 1996; Solarz, 1970).

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https://doi.org/10.1016/j.applanim.2017.12.016
Received 8 August 2017; Received in revised form 12 December 2017; Accepted 17 December 2017

It is important that the housing conditions of working dogs do not compromise the dogs' motivation and ability to work. As chronic stress, which may lead to ill health (Clark et al., 1997), may interfere with the dogs' working ability, housing conditions promoting good welfare are likely to enhance the dogs' working ability (Rooney et al., 2005, 2007). For example, a link between measures of welfare and working ability was demonstrated in guide dogs, where stress was indicated by increased heart rate, which was associated with a failure of guiding performance (Vincent and Leahy, 1997). Poor performance in dog trainings and reduced learning ability have been suggested to be linked to high stress levels (Hiby, 2005; Rooney et al., 2005). Further, problems such as frequent bite accidents (Haverbeke et al., 2005; Lefebvre et al., 2007), fearful behaviour (Lefebvre et al., 2007), and low performance during obedience exercises (Haverbeke et al., 2008) in kennelled Belgian military dogs affected the efficiency of dog-handler teams, the security of staff, and the dogs' welfare. Similar behavioural problems have been observed among shelter and laboratory dogs that lived in an impoverished environment (Van der Borg et al., 1991; Wells and Hepper, 2000).

To ameliorate these problems, a test group of Belgian military's dogs attended a human familiarisation and training programme (HFTP) where the dogs lived at home with their handlers instead of being kennelled. These dogs showed less aggressive behaviour and fearfulness towards humans in an aggression test than dogs that were housed in kennels without additional training or social contacts with humans or conspecifics (Haverbeke et al., 2010a). These results suggest that HFTP can increase the dog-handlers' efficiency as well as the dogs' welfare.

In Switzerland, military dogs are used either for protection (people, buildings or objects), rescue (e.g. after an earthquake) or detection of explosive agents. These dogs are kept individually in indoor and outdoor kennels. There is no acoustic barrier between the kennels, but the dogs can only see conspecifics when they are walked by a human handler. Often, they are barking towards the dog next to their home kennel or when other dogs are walked by. The aim of our study was to investigate whether exposure to conspecifics of adult Swiss military dogs might positively affect their social behaviour towards conspecifics.

Specifically, we examined how a treatment of eight weeks of three hours of social exposure to conspecifics once a week, will affect the dogs' responses to a stooge and an unfamiliar conspecific. Although the dogs were already adult, we predicted that they would benefit from such social exposure (cf. Haverbeke et al., 2010b). In particular, we predicted that they would show less offensive and defensive behaviours when confronted to the stooge and an adult male conspecific.

2. Methods

2.1. Experimental subjects

We used Swiss military dogs (n = 65) of various breeds (Table 1) originating from different dog handlers. They were tested between 2014 and 2016, at 14–55 months of age (median: 22 months). All dogs were housed individually in indoor and outdoor kennels (minimum of 8 m^2), and they had daily trainings (from 0800 to 1200 and from 1300 to 1700) for their future work as protection or rescue dogs. During the daily trainings, each dog was trained individually. The dogs were fed twice a day, and at least three times a week they received a bone.

Upon arrival at the Swiss military station, the dogs were randomly assigned to two treatment groups, *Experience* (n = 35) and *Control* (n = 30), regardless of their sex and breed. Six out of the 35 Experience dogs (five because of injury or surgery, and one because of displacement), and three out of the 30 Control dogs (one because of injury, and two because of displacement) were excluded from the analysis because they could be tested only once. Therefore, the final sample size was 29 Experience dogs and 27 Control dogs. The project was authorised by the Swiss military (license 15.001841).

Table 1
Allocation of dogs of different sex and breed to the Experience and Control groups.

	Experience		Control	
Breed	Female	Male	Female	Male
Malinois	3	13	1	20
Tervueren	1	4	0	2
German Shepherd	2	4	0	0
Holland Shepherd	0	1	0	1
Labrador Retriever	0	1	0	2
Springer Spaniel	0	0	0	1

2.2. Social exposure

In the mornings, the dogs had their daily military trainings as usual, after which they could rest in their home kennels for one hour. The social exposure of Experience dogs lasted for three hours and took place once a week (each Thursday) for eight consecutive weeks, in a fenced area (8 m × 20 m) that was adjacent to four small kennels (3 m × 3 m) (ESM Fig. 2). Thus, each dog had the opportunity to either have contact with kennelled dogs through the fence, or they were in direct contact with conspecifics within the fenced area. All dogs of the Experience group were once in a small kennel (with contact through the fence) and once in the fenced area (with direct contact) during the three hours of each social exposure. Dogs from the Experience group as well as dogs that were already tested twice acted as social partners during the social exposure.

The experimenter (NG) first observed each dog's behaviour towards conspecifics (dogs of the Experience group) when it was on a leash outside of the fenced area. Then, it was put in a kennel where it could have contact with conspecifics through the fence. If a dog behaved neutrally or friendly towards dogs outside its kennel, it was immediately included in the social sessions with other dogs of the Experience group. If a dog showed aggressive behaviour towards dogs outside its kennel, it was first brought together with a spayed female (the experimenter's dog) to assess how it behaved in direct physical contact. Then, all dogs were integrated to the group consisting of other military dogs. In a first phase, the experimenter controlled the dog with a leash while direct contact with conspecifics was allowed.

In a first phase of social sessions, all dogs wore a muzzle to ensure that no dog could get harmed. First, all dogs had learnt to walk past a conspecific and to walk at a distance of 1 m together with a conspecific in the fenced area. Direct contact to conspecifics was tolerated but not all focal dogs could move off leash during the eight social exposures. To avoid skirmish, the training had to be adapted to each individual; some dogs could be let off the leash early, others later or not at all (n = 6). The experimenter guided all trainings and decided which dog wore a muzzle or when a dog could be off leash. In addition to the experimenter there was at least one trainer from the Swiss military present during the social exposure. These people interrupted the interactions when the dogs started to fight, or when a dog was apparently afraid or oppressed by another dog.

2.3. Experimental procedure

After the arrival at the military station, i.e. before the social exposure began, and again nine weeks later, i.e. after the eight weeks of social exposure, all dogs (Experience and Control group) were exposed to a stooge (plastic Beagle) and to a real conspecific, where their offensive and defensive behaviours were assessed.

2.3.1. Behaviour test

The behaviour test consisted of three subtests presented to all dogs

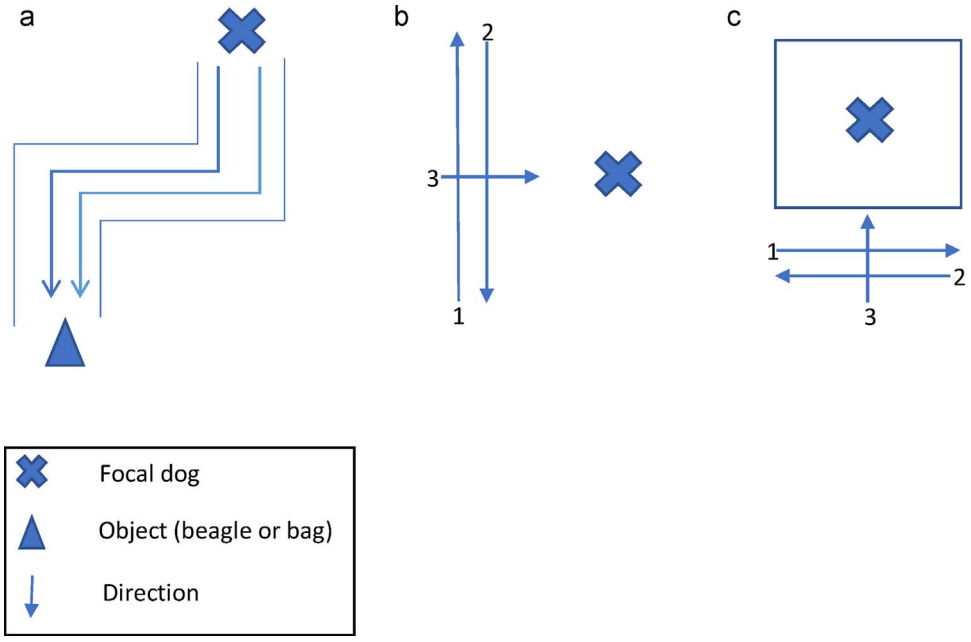

Fig. 1. Behaviour tests. a: Focal dog is walked through a mace twice with either a plastic bag or a plastic beagle at the end. b: Focal dog is leashed to a pole and the experimenter walks either past or towards it with a stimulus dog. c: Focal dog is in a kennel and the experimenter walks either past or towards it with a stimulus dog.

in the same order. First, the dog was twice walked on the leash through a maze by the experimenter without giving any command, once with a plastic bag and once with a plastic dog (Beagle) at the end of the maze, whereby the order of the two objects was counterbalanced across dogs (Fig. 1a, ESM Fig. 1a). Second, the focal dog was attached to a pole with a 1.5 m leash and the experimenter walked by twice with an unfamiliar stimulus dog (11–12 years old, castrated male, neutral behaviour towards other dogs) at a distance of 2 m, (once from right to left and once from left to right). Then the unfamiliar stimulus dog was walked towards the attached dog up to a minimal distance of 1 m (Fig. 1b, ESM Fig. 1b). Finally, the focal dog was put in a kennel (3 × 3 m) and the experimenter walked by with the same stimulus dog at a distance of 0.5 m from the fence in both directions, and towards the focal dog up to the fence (Fig. 1c, ESM Fig. 1c). The test was videotaped for later recording of the focal dogs' behaviour towards the objects and stimulus dog.

2.3.2. Behaviour evaluation

All videos were coded twice by the experimenter who was not blind to the treatment of the dogs, but was blind to whether it was the first or the second test session. We had run a pilot study with different dogs which revealed what kind of behaviours could be expected during the test. Behaviour of the dogs was categorised into offensive and defensive behaviours and rated according to Table 2. For each subtest, the behaviour with the highest score was used for the analysis. As an example, if a dog once showed an attack (5) but otherwise a score of 2, we coded a 5.

2.4. Statistical analysis

Intra-rater reliability was assessed using Cohens Kappa test where values between 0.81 and 1.00 describe almost perfect agreement. For the statistical analysis of the behavioural tests, the scores of the test performed before the socialisation training were subtracted from the scores of the test performed after the socialisation training. These differences (delta values) were compared between the Experience and Control groups using Mann-Whitney *U* tests (alpha = 0.05). All tests were conducted in R (R Development Core Team; version 2.5.3).

3. Results

Intra-rater reliability tests indicated almost perfect agreement (Cohen's Kappa of all videos; n = 968 scores, Kappa = 0.992, z = 39.4, $p < .001$, ESM: Table 1).

Table 2
Coding scheme for the assessment of offensive (a) and defensive (b) agonistic behaviours in dogs.

Rating (a)	Offensive Behaviours
0	No apparent tension, no contact (eye contact, sniffing) to stimulus object or dog
1	Neutral or friendly behaviour: eye contact or sniffling towards the stimulus object or dog without apparent tension, open muzzle, possible low tail wagging
2	Change from neutral behaviour to stiff positions with tension: closed muzzle, tight muscles, eyes fixed on the stimulus object or dog
3	Stiff positions with short attacks against stimulus object or dog
4	Stiff positions with short attacks and repeatedly showing signals of offensive threat: eyes fixed on the stimulus object or dog with ears put forward, growling, showing the teeth
5	Offensive threat with attacks
Rating (b)	Defensive Behaviours
0	No tension, no interest
1	Apparent hesitation to diminish distance to object or stimulus dog, sometimes appeasement: lip licking, turning away the head or body (when being directed toward the stooge or stimulus dog), and blinking
2	Signals of defensive position: tucked tail, ears directed backwards, pupils dilated, nose wrinkled, and a lowered body position

Table 3
Test statistics and *P*-values of the Mann-Whitney *U* tests comparing the changes in agonistic behaviour between the first (before socialisation training) and second test (after socialisation training) between the Experience and the Control group in the four test situation. Significant values are highlighted in bold. NA: none of the focal dogs showed defensive behaviour against the bag.

Rated subtest	W	p- values
Bag offensive	377	.642
Bag defensive	391	NA
Beagle offensive	189.5	< .001
Beagle defensive	283	.043
Attached offensive	169.5	< **.001**
Attached defensive	300	**.009**
Free offensive	264.5	**.006**
Free defensive	378	.353

There was no significant difference between the Experience and the Control groups when the dogs were confronted with a plastic bag at the end of the maze (Table 3, Appendix A: Fig. A1). None of the dogs showed defensive behaviour towards the plastic bag. By contrast, there were significant differences in both offensive and defensive responses to the plastic beagle (Table 3, Fig. 2), whereby the dogs from the Experience group showed a greater reduction of both types of behaviours compared to dogs from the Control group (Appendix A: Fig. A1).

There was a significant difference in the responses to the stimulus dog when the focal dogs were attached to the pole (Table 3, Fig. 2), again with a greater reduction of both types of responses in the Experience group than in the Control group (Appendix A: Fig. A1). When the focal dogs could move freely in the kennel, the dogs from the Experience group also showed a greater reduction in offensive behaviours

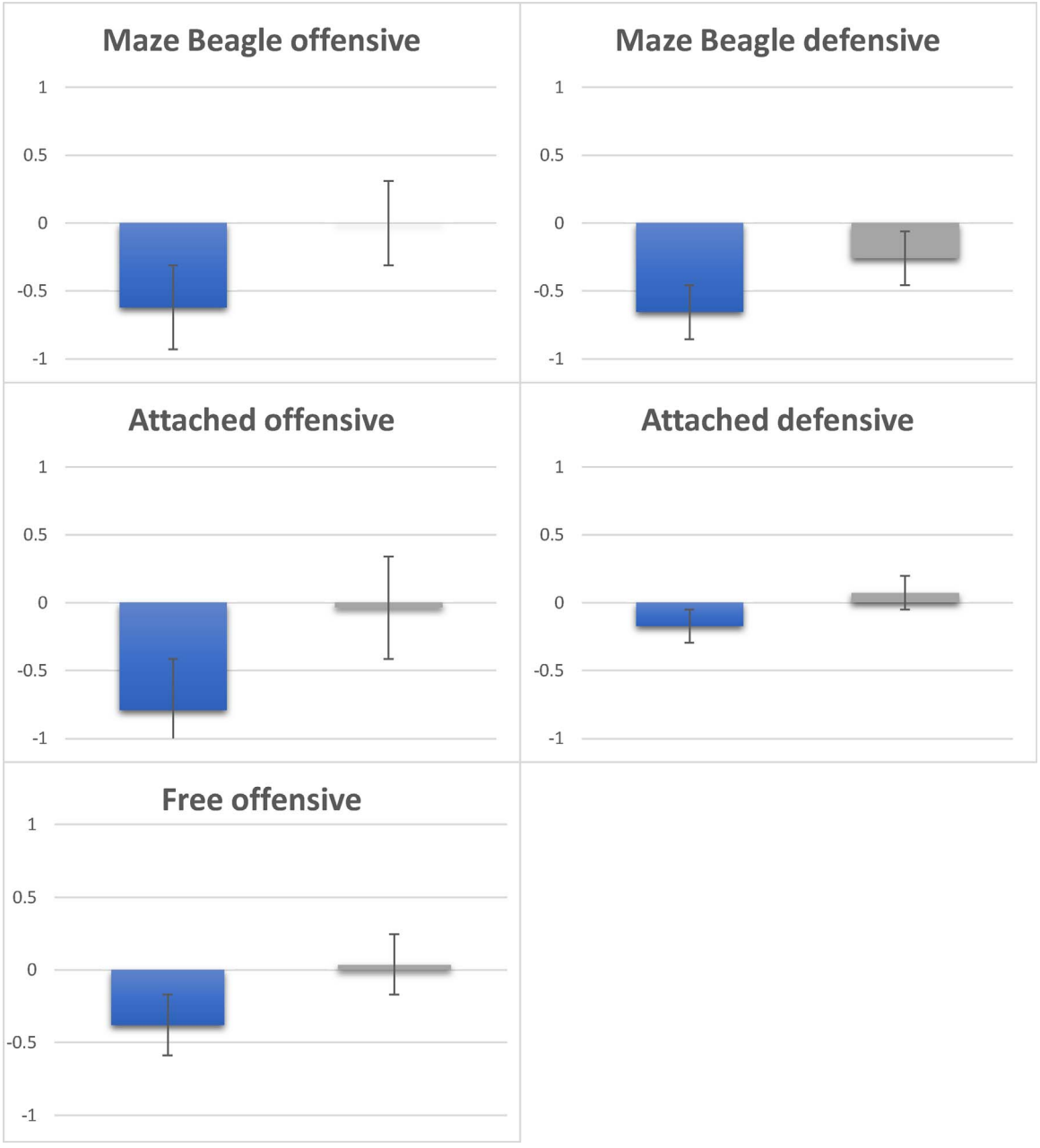

Fig. 2. Significant differences between the Experience (blue) and the Control (grey) group in the different subtests. Mean values of the delta values (with standard errors) of the five different subtests are shown where we measured a significant difference between the Experience and the Control group. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

than the Control dogs, whereas there was no significant difference in changes in defensive behaviours (Table 3, Fig. 2; Appendix A: Fig. A1).

4. Discussion

Dogs with restricted social experience with conspecifics generally show higher levels of aggression (Wormald et al., 2016). However, the results presented here indicate that adult Swiss military dogs housed singly in kennels benefited from a social exposure programme. In comparison to control dogs they showed a reduction in offensive and defensive behaviours when exposed to both an inanimate (plastic Beagle) and a real stimulus dog. There is a clear difference between a controlled training programme and pair or group housing. In the social exposure programme used in the present study, the interactions between the dogs were supervised by human trainers who interfered when necessary. Interference was necessary at least once during each social exposure. When dogs with either no or poor socialisation with conspecifics are put together with unfamiliar conspecifics in a kennel (pair or group housing), most of them would end up fighting (Feddersen-Petersen, 2001; Bruno, 2004). Hence it would have been impossible to put our test subjects together in groups in kennels without supervision.

Socialisation is particularly important during the early ontogeny of dogs (Freedman et al., 1961; Appleby et al., 2002). However, in line with an earlier study (Haverbeke et al., 2010a) our data indicate that even in adult dogs, social exposure can positively affect social behaviour. In general, mixed groups of males and non-oestrous females are best to minimize aggression and excessive attention towards females (Mertens and Unshelm, 1996; Sonderegger and Turner, 1996). However, such an arrangement is not always possible. For instance, the population of Swiss military dogs is heavily male biased.

Our results are particularly remarkable because the dogs received only one afternoon (3 h) of social exposure per week, which clearly reduced both offensive and defensive behavioural responses towards unfamiliar dogs. A previous study with Belgian military dogs went through a much more extensive familiarisation and training programme (Haverbeke et al., 2010a, 2010b). In general, the social exposure can be seen as a form of social enrichment for the dogs, with positive effects on their well-being (Rooney et al., 2009).

Furthermore, our social exposure did not compromise the working performance of the dogs. There was neither reduced motivation nor a decrease in working ability of the dogs that participated in the social exposure (personal communication of the dog trainers of the Swiss military). In contrast, a positive effect of the socialisation training was that the dog trainers were able to work with multiple dogs in the same area, and that the dogs appeared more focused on their work and less distracted by conspecifics during their working time. A follow-up study might focus on the effect of such a social exposure on the working ability of working dogs.

5. Conclusions

A temporary social exposure in adult Swiss military dogs reduced both offensive and defensive behaviours towards inanimate objects as well as unfamiliar dogs, compared to control dogs without social exposure. This shows that even limited social exposure in adulthood can positively affect the social behaviour of dogs.

Acknowledgements

We thank the Swiss military service for allowing us to work with their dogs and Daniela Rieder for support in constructing the testing setup. A special thank goes to all the dog trainers from the Swiss military that supported the experimenter during the social exposure, to Stefanie Riemer and Danielle Bonfils for helpful comments on the manuscript, and to the Hasli people for discussion. Further, we thank the Albert-Heim Foundation, the Haldimann Foundation, and the Margaret and Francis Fleitmann Foundation for their financial support.

Appendix A

Fig. A1. Delta values of offensive and defensive behaviour ratings (y-axis) in the four test situations. Delta values for the Experience group (n = 29, blue) and for the Control group (n = 27, orange) are presented on the x-axis. The bag and beagle are plastic objects. In the attached condition, the dogs were attached on a leash and in the free condition, the dogs were in a kennel where they could freely move. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Appendix B. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.applanim.2017.12.016.

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