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Are Animal Assisted Activities dogs different from pet dogs? A comparison of their sociocognitive abilities

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1 **Are Animal Assisted Activities dogs different from pet dogs? A comparison of their**
2 **sociocognitive abilities**

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24 Abstract

25 Animal assisted activities (AAA) refer to a variety of interactions between animals and humans,
26 intended to improve people's wellbeing providing recreational or educational opportunities.
27 Domestic dogs are one of the most commonly used animals for these kinds of interventions,
28 given their trainability and the positive effects of dog-human interactions. Nevertheless, the
29 selection of participating animals is mainly unsystematic and training is not required for dogs to
30 take part in AAA. Previous studies suggest that high sociability as well as reduced fear and
31 aggression are desirable traits in AAA dogs. Yet, to our knowledge, there are no previous studies
32 assessing the specific characteristics of dogs participating in AAA. The aim of this study is to
33 compare the performance of AAA and pet dogs that live in the same household but do not
34 participate in AAA. We assessed 17 dogs (9 participating in AAA in hospital settings, and 8 pets
35 living in the same household – control group) with a test battery comprising three behavioral
36 tasks (sociability test, gazing test, and A-not-B task), and owner rated questionnaires (Dog
37 Impulsivity Assessment Scale, 'DIAS', and 4 subscales: Trainability, Fear to Strangers,
38 Nonsocial fear and Attachment/Attention seeking of the Canine Behavioral Assessment and
39 Research Questionnaire, 'C-BARQ'). Results of the gazing test indicate that, when dogs were
40 not reinforced for looking at the human face, AAA dogs gazed longer at an unknown
41 experimenter than pet dogs. Therefore, they showed an increased tendency to gaze at humans
42 and persist on this communicative attempt when this response was not successful. Additionally,
43 according to the DIAS score, AAA dogs would be less impulsive than the control group. No
44 significant differences were found on the A-not-B task, the sociability test or C-BARQ
45 questionnaire. In conclusion, since these AAA dogs had not undergone specific training, the
46 effects observed in the present work may be attributed, at least partially, to the learning

47 experiences they had during AAA work. Overall, it would be important to take into account
48 these characteristics for both the selection and training of these animals.

49

50 Keywords: Animal Assisted Activities; Domestic Dogs; Gazing Test; Inhibitory Control

51

52 **Introduction**

53 Animal Assisted Interventions (AAI) entail interactions between animals and humans in a
54 variety of areas such as health, education or psychosocial rehabilitation, in order to improve
55 people's wellbeing. Animal Assisted Activities (AAA) are a type of AAI that provide
56 motivational, educational or recreational opportunities, and both professionals and volunteers
57 carry them out. Furthermore, they prioritize spontaneity, are not considered a treatment and thus
58 do not have specific goals (Kruger & Serpell, 2010).

59 Bert et al. (2016) pointed out that dogs seem to be the most common animals employed
60 for these interventions. Dogs are optimal candidates for AAI since they are relatively easy to
61 train (Jofre, 2005), have remarkable abilities to respond to human communicative clues (e.g.,
62 Miklósi et al., 2003; Hare & Tomasello, 2005), share a close relationship with people (e.g.,
63 Bentosela & Mustaca, 2007; Udell et al., 2010), and dog-human interactions have numerous
64 advantageous physiological and psychological effects for both species (e.g., Odendaal &
65 Meintjes, 2003; Nagasawa et al., 2009; Cirulli, Borgi et al., 2011).

66 Describing the typical behaviors and characterizing the temperamental traits of dogs that
67 participate in AAI could help improve the selection of animals for this role and contribute to our
68 understanding of the mechanisms responsible for their therapeutic effects (Serpell et al., 2017).

69 However, few studies have focused on the assessment of these aspects. Mongillo et al.
70 (2015), in order to standardize a selection protocol for AAI dogs, carried out two tests:
71 behavioral examination and role playing simulating an AAI session. Dogs were evaluated on
72 certain behavioral prerequisites such as controllability, predictability, and reliability of their
73 social behavior, in order to judge whether they were suitable for AAI work. The authors found
74 that the dogs which were deemed suitable according to the examination performed better on the
75 role playing task, significantly showing less negative interactions, fear, and aggression. In
76 another study (Mongillo et al., 2017), dogs trained for AAI were found to gaze more frequently
77 and sustain their attention on their owners more than pet dogs and agility dogs. This increase in
78 the attentional abilities of AAI dogs toward their owners could be explained by the fact that,
79 when faced with unpredictable situations such as working with unknown people, dogs may rely
80 on the owner/guide for support and clues to adjust their behavior.

81 Particularly in AAA, there is much variability regarding the animals used. In most cases,
82 their selection is neither systematic nor do they need thorough training to participate in them (in
83 contrast to Animal Assisted Therapy). These features make AAA animals a group of particular
84 interest, given that otherwise any differences found between pets and working dogs could be
85 attributed to previous selection or specific training.

86 Therefore, the aim of this study is to compare the performance of AAA and pet dogs
87 living in the same household but not participating in such tasks. Dogs were tested on several
88 sociocognitive skills relevant for their work. These abilities include sociability, defined as the
89 tendency to approach and interact with people (Svartberg, 2005), and the learning of the
90 communicative response of gazing at the human face to ask for inaccessible food. Additionally,
91 another task measured behavioral inhibition and self-control in a social context, which implies

92 the capability to inhibit preponderant and immediate but counteractive responses in order to get
93 better future consequences (MacLean et al., 2014). Finally, two written scales were used to
94 record the owner's evaluation of their social behavior and impulsivity levels. These skills are of
95 great importance for AAI dogs, as they have to interact with unfamiliar people of different age
96 ranges, who have varying degrees of mobility and ability to work in unpredictable settings such
97 as hospitals, schools or prisons. Furthermore, it is important that dogs working in AAA have
98 adequate impulse inhibition skills so that they do not hinder medical care in hospital settings or
99 obstruct the normal operations of educational or rehabilitation centers.

100 In the sociocognitive tasks considered, AAA dogs are expected to perform better than
101 family dogs living with them. We predict AAA dogs to be more sociable and communicative
102 than pet dogs, as well as less impulsive and fearful, as they are exposed to a greater number and
103 variety of interactions with people and other dogs.

104

105 **Methodology**

106 **Subjects**

107 We assessed 18 domestic dogs (*Canis familiaris*). One dog was excluded from our study
108 due to its excessive fearfulness. The final sample consisted of 17 adult dogs between 1 and 10
109 years of age (mean age = 5.16, SD \pm 2.18), 9 males and 8 females of various breeds and mixes.
110 The AAA group ($N = 9$) was recruited from groups of volunteers working in different units of
111 patients (palliative care, physical rehabilitation and psychiatry). AAA sessions were carried out
112 weekly and involved interactions with unfamiliar people of different ages. The pet dogs (PD)
113 group ($N = 8$) consisted of dogs living in the same household than the dogs in the AAA group,
114 but not participating in such work. Due to technical difficulties, one AAA dog did not complete

115 the A-not-B task, and one PD did not complete the gazing test. Thus, data from these dogs in the
116 mentioned tasks were not used in the analysis. All dogs lived (and worked, in the case of AAA
117 dogs) with their owners. Dogs had at least 3 hours of fasting before the test and water was
118 available ad libitum.

119

120 **General Procedure**

121 The dogs underwent a battery of tests comprising three behavioral tasks (sociability test,
122 gazing test, and A-not-B task), and two owner rated questionnaires (Dog Impulsivity Assessment
123 Scale, 'DIAS', Wright, Mills & Pollux, 2011; & 4 subscales -Trainability, Fear to Strangers, and
124 Attachment/Attention seeking- of the Canine Behavioral Assessment and Research
125 Questionnaire, 'C-BARQ', Hsu & Serpell, 2003).

126 All dogs were tested in a quiet room at their home. The experimenters (Es) were three
127 females, unknown to the animals. All sessions were videotaped, with a SONY DCR 308 video
128 camera placed on a tripod in a corner of the room for the sociability and A-not-B tests, and
129 handheld by an E for the gazing test.

130 The food rewards were pieces of cooked liver. The behavioral tests were carried out in
131 two sessions, so that the two tasks including food (gazing test and A-not-B task) were done
132 separately in order to avoid satiation.

133 Order of sessions was counterbalanced across subjects: Seven dogs had the sociability
134 and gazing tests on the first session, whereas eight started with the A-not-B task. The sociability
135 test was always carried out first within a session, to avoid the association between the food and
136 the Es. A printed version of the questionnaires was given to the owners during the first visit, and
137 it was picked up on the second one.

138

139 1. Sociability test.**140 Materials**

141 The set up consisted of a chair placed against a wall. Tape marks on the floor 1 m away
142 from it were used to analyze the time the dog spent near the E. Only one E and the dog were
143 present during testing.

144 Procedure

145 The procedure was the same as Jakovcevic et al. (2012). The dog was allowed to explore
146 the room for about 5 min. The test phase began immediately after. It was divided into two phase
147 of 2 minutes: (a) Passive phase: E entered the room and sat on the chair pretending to be
148 distracted reading a book. If the dog made physical contact with her, E petted it only once and
149 then withdrew her hand. During this phase visual contact was avoided. After 2 min, the second
150 phase began, (b) Active phase: E stood up, left the book on the chair, made visual contact with
151 the dog and called it by its name (whether it was near or far). If the dog approached her, E
152 interacted by petting and talking to it. If the dog did not approach, E called it up to three times. If
153 the dog approached her and then went away, E also called it up to three times. During this second
154 phase, E stayed still in the same place, usually sitting on the floor, to avoid possible fear
155 reactions in the dog.

156 The following variables were registered continuously both during the active and passive
157 phases: Time Close (TC): Time (s) the dog stayed close to E (<1 m distance). Physical contact
158 (PC), duration (s) of the physical contact between the E and the dog.

159

160 2. Communicative learning task: Gazing test

161 Materials

162 Food rewards were placed in a container located on a high surface, so it was visible to the
163 animals but out of their reach. There were two Es present, one standing next to the food
164 container and another recording the situation. This last E was located diagonally behind the E, to
165 be able to film the direction of the dog's head and gaze.

166

167 Procedure

168 The procedure was the same as Bentosela et al. (2008). It consisted of four phases:
169 baseline, acquisition, extinction and reacquisition, with a 2 min interval between them. Each trial
170 lasted 2 min with an intertrial interval of approximately 2 min. After each trial, the E left the
171 training area taking the food container with her.

172 Before the beginning of the test, the animals received a warm up in order to assess their
173 motivation for food. The E called the dogs by their names and actively sought physical contact
174 with them. During this interaction, the dogs received three pieces of liver, directly from the hand
175 of E.

176 *Baseline:* Immediately after warm up, the dogs received 1 baseline trial. The trial started with E
177 standing by the food container, calling the dog by its name and giving it a single piece of food,
178 after which she stood gazing at the dog's face without further movement, trying to maintain eye
179 contact.

180 *Acquisition:* Afterwards, the dogs received 3 trials of reinforcement of the gazing response
181 towards the E. Acquisition trials began with E standing by the food container, calling the dog's
182 name and giving it a piece of food. From then on, dogs were reinforced each time they gazed at
183 E's face for at least one second.

184 *Extinction*: Next came 3 extinction trials, in which the gazing response was not reinforced
185 anymore. This phase was identical to the baseline.

186 *Reacquisition*: Finally, the dogs received 1 trial of reacquisition, identical to the acquisition
187 trials. This phase discarded potential satiety or fatigue effects.

188 Gaze duration (s) was measured as the dependent variable. The cumulative duration of
189 visual contact of the dog toward the E was scored continuously on all trials.

190

191 **3. A-NOT-B task.**

192 **Materials**

193 Three opaque expanded plastic cups, of 8.5 cm diameter and 10 cm height were used for
194 this task. The cups were spread with liver to control for odor cues. There were two Es present,
195 one doing the demonstration and another handling the dog by the leash (H).

196 **Procedure**

197 The procedure was the same as Fagnani et al. (2016). There were three opaque aligned
198 cups (A, M and B) and a reward was placed in one of the cups located at the far end of the array,
199 while the middle cup (M) and the cup at the other end remained empty. The aligned cups were
200 separated 1.20 m from each other and placed at 2.10 m from the starting line where the dog and
201 H were waiting. The procedure comprised three phases:

202 *Pre training*: the purpose of this phase was to allow the dogs to learn that the cups were baited
203 with food. E held a reward in one hand and brought it close to the dog's nose, so that the animal
204 could see and smell it. Then E approached cup A, showed the reward in her hand to the dog, bent
205 down, placed the reward in cup A and stood up. After standing still for 2 s, E turned her back to
206 the dog and H. Immediately, H dropped the leash to allow the dog to choose one of the cups. It

207 was considered a correct response when the dog touched the baited cup with its snout, in which
208 case H lifted the cup to allow it to eat the reward and verbally reinforced it by saying “very
209 well”. Responses were considered incorrect when the dog selected one of the two unbaited cups,
210 in which case H said “no” and took it back to the starting line. In this case, E removed the reward
211 from the baited cup without the dog seeing her. A response was also computed as Incorrect if
212 after 30 s the dog did not choose a cup. This procedure was repeated for the three cups A, M, and
213 B, until the dog managed to retrieve the reward correctly from each container as a first choice.
214 Trials were continuous with no intervals. After 1 m, the next phase started.

215 *Training:* The procedure of the training phase was identical to the pre training, except that E
216 always placed the reward in cup A. The subjects were required to retrieve the reward in 5 trials
217 out of a maximum of 10 to move onto the next phase. Intervals between trials were of 20 s.

218 *Test:* The procedure was similar to training, except that once the subjects watched E baiting cup
219 A, E removed the bait and, in full view of the subject, took it to the cup located at the other end
220 of the array (cup B). This phase consisted of 15 trials, with 20 s intervals between trials. It was
221 considered a correct response when the dog first chose the cup B. The location of cup A and B
222 (right or left) was counterbalanced across dogs.

223 Two variables were scored during the test phase: the number of trials before the first
224 correct response, and the frequency of errors (i.e., approaching cups A or M, or not choosing any
225 cup).

226

227 **4. Canine Behavioral Assessment and Research Questionnaire (C-BARQ)**

228 We administered a Spanish translated version of Hsu and Serpell (2003)’s C-BARQ. This
229 questionnaire identifies a total of 11 subcategories, seven of which have been validated as

230 diagnostic categories (stranger directed aggression; owner directed aggression; dog directed
231 aggression/fear; stranger directed fear; nonsocial fear; separation related behavior;
232 attachment/attention seeking) and the remaining four refer to specific experiences in the dogs'
233 life (trainability; chasing; excitability; touch sensitivity).

234 Of these subcategories, we chose to focus on four that were particularly relevant to our
235 study:

236 *Trainability*: related to the readiness to obey to the owner, follow simple commands, return
237 objects, respond positively to corrections and ignore distracting stimuli.

238 *Fear to strangers*: referred to the dog's reactions when directly approached by an unknown
239 person.

240 *Nonsocial fear*; defined as the tendency to react with fear to sudden or loud noises, and
241 unfamiliar objects or situations

242 *Attachment/attention seeking*: related to the tendency to keep closeness to the owner and to other
243 members of the family, ask for affection and attention and become agitated when the owner
244 shows affection to others.

245 To calculate the score of these four subscales, the value of each item was added and the total was
246 divided by the number of answered items of the subscale.

247

248 **5. Dog Impulsivity Assessment Scale (DIAS)**

249 We administered a Spanish translated version of Wright et al. (2011)'s DIAS. This scale
250 assesses impulsivity in domestic dogs based on the owner's report and yields an overall score
251 and three factors: 1) behavioral regulation, 2) aggression and response to novelty, and 3)
252 responsiveness. The DIAS comprises 18 statements answered with a Likert type 5point scoring

253 scale that have proved to be reliable and valid in the UK (Wright et al., 2011; Riemer, et al.,
254 2013).

255 The score interpretation presented by the authors is that a higher score in the Overall
256 Questionnaire Score (OQS) represents higher impulsivity. Meanwhile, higher score in factor 1
257 means lower behavioral regulation (i.e. higher impulsivity and arousal); higher score in factor 2
258 refers to higher aggression/negative responses to novelty; and higher score in factor 3 implies
259 higher responsiveness (i.e. quicker responses and easier trainability) (Wright et al., 2011).

260 The overall questionnaire score (OQS) and the three factors of the DIAS (Wright et al.,
261 2011) were calculated for each dog, adding the values of each item and dividing the total by the
262 number of items answered.

263

264 **Data Analysis**

265 The performance of each group (AAA and PD) was compared for each test and
266 questionnaire administered.

267 To compare the performance of both groups of dogs in the sociability test, a repeated
268 measures ANOVA was performed for both of the variables registered (time close and time in
269 contact with the E). The phase (active/passive) and the group (AAA/PD) were introduced as
270 within and between subjects' factors respectively.

271 To analyze the data from the gazing test and to facilitate its interpretation, we first
272 calculated the mean time dogs spent gazing at the E in all three acquisition and extinction trials.
273 Second, given the relative small sample size and that not all the measures were normally
274 distributed (Shapiro-Wilk test: Mean time of gaze duration at the E during extinction phase, PD
275 group: $W=0.65$, $p<0.01$; Gaze duration during baseline trials, PD Groups: $W=0.65$, $p<0.01$, all

276 the other measures $p > 0.3$), non-parametric tests were used. We compared the time dogs spent
277 gazing at the E in each phase (Baseline, Acquisition, Extinction and Reacquisition) between
278 groups with Mann-Whitney U test. Finally, we compared the time dogs spent gazing at the E in
279 each group in the different phases with Friedman's Test, and for pair comparisons we used
280 Wilcoxon paired test.

281 For the A-not-B task, the number of trials until the first correct response and the number
282 of errors were compared between groups using an independent samples *t*-test.

283 Finally, the scores of each group in the questionnaires (C-BARQ and DIAS) were
284 compared utilizing independent samples *t*-tests.

285 All tests were two tailed ($\alpha = 0.05$). The data was analyzed with the statistics program
286 SPSS (v20). An experimenter blind to the dog's group codified data from sociability and gazing
287 tests. Additionally, one of the authors (CC) also codified 40% of those results. Inter observer
288 reliability was high (sociability test: $r_s > 0.968$ $P_s > 0.005$; gazing test: $r_s > 0.890$ $P_s > 0.005$).
289 Data from A-not-B task was scored live by two of the experimenters; agreement between them
290 was excellent as the choices were unequivocal.

291

292 **Results**

293 a. Sociability test

294 Regarding the time spent close to the E, the dogs spent significantly more time near the E
295 in the active phase than the passive one ($F(1,16) = 53.86$, $P < 0.001$). We did not find any
296 differences between groups ($F(1,16) = 0.063$, $P = 0.78$), or interactions' effects between phase by
297 group ($F(1,16) = 0.075$, $P = 0.78$). These same results were observed for the time the dogs spent

298 in contact with the E (Phase: $F(1,16)=60,83$, $P < 0.001$; Group: $F(1,16)=0.13$, $P = 0.72$; Phase
 299 by group interaction: $F(1,16)=0.003$, $P = 0.95$ – see Table 1).

300

301 Table 1: Mean and SD of the main measures of the sociability test and A-not-B task. All
 302 measures are expressed in seconds, except Trials until correct response and Number of errors.

303

TEST	PHASE	MEASURE	GROUP	
			AAA	PD
Sociability	Pasive Phase	Time close to the E	25,00 ($\pm 35,53$)	28,82 ($\pm 34,22$)
		Time in contact with E	27,90 ($\pm 45,34$)	19,51 ($\pm 31,04$)
	Active Phase	Time close to the E	93,61 ($\pm 32,29$)	95,44 ($\pm 42,84$)
		Time in contact with E	97,34 ($\pm 23,94$)	93,11 ($\pm 42,40$)
A not B		Trials until correct response	0,38 ($\pm 0,74$)	0,88 ($\pm 1,25$)
		Number of errors	2,25 ($\pm 3,33$)	3,25 ($\pm 3,28$)

304

305 Note. AAA: Dogs participating in Animal Assisted Activities, PD: pet dogs living in the same
 306 household not participating in Animal Assisted Activities.

307

308 b. Gazing test

309 AAA dogs gazed significantly more at the E than PD during the baseline ($U=12$, $p=0.02$,
 310 $Z=-2.25$), and extinction ($U=9$, $p=0.01$, $Z=-2.53$) phases. In addition, the time dogs gazed at the
 311 E varied significantly between phases in the AAA group ($X^2_3= 23.16$, $p<0.01$, $N=10$), but not in
 312 the PD group ($X^2_3= 2.31$, $p>0.51$, $N=7$). A more detailed analysis showed that dogs in the AAA
 313 group gazed significantly more at the E in the baseline phase than in the acquisition ($Z=-2.80$,
 314 $p<0.01$) and reacquisition ($Z=-2.62$, $p=0.01$) phases. Furthermore, dogs looked longer in the
 315 extinction phase than during baseline ($Z=-2.19$, $p=0.02$), acquisition ($Z=-2.80$, $p<0.01$) and
 316 reacquisition ($Z=-2.80$, $p<0.01$) phases. No differences were found between acquisition and

317 reacquisition phases ($Z=-0.51$, $p=0.95$). The other comparisons were non-significant, $p > 0.5$ (see
318 figure 1).

319

320 -----

321 INSERT FIGURE 1

322 -----

323

324 c. A-not-B task

325 There were no significant differences between groups ($t(14)=-0.6$, $P = 0.55$). There were
326 also no significant differences on the number of trials until the first correct response ($t(14)=-0.97$,
327 $P = 0.34$ – see Table 1).

328

329 d. C-Barq

330 There was a tendency for PD to score higher on the *Fear to strangers* subscale than AAA
331 dogs ($t(15)=-2.04$, $P = 0.059$). No other significant differences were found (See Table 2).

332

333 e. DIAS

334 PD scored higher than AAA dogs on the overall questionnaire score ($t(15)=-2.41$, $P =$
335 0.0029) and on factor 1 (behavioral regulation) ($t(15)=-2.32$, $P = 0.034$). No other significant
336 differences were found (See Table 2).

337

338 Table 2: Mean and SD of the scores of the C-BARQ and DIAS questionnaires.

339

QUESTIONNAIRE	MEASURE	GROUP	
		AAA	PD
C-BARQ	Trainability	2.38 ($\pm 0,42$)	2.44 ($\pm 0,77$)
	Dog-directed aggression/fear	1.00 ($\pm 0,91$)	1.53 ($\pm 1,28$)
	Stranger-directed fear	0.11 ($\pm 0,25$)	0.63 ($\pm 0,71$)
	Nonsocial fear	0.78 ($\pm 0,61$)	0.5 ($\pm 0,45$)
	Touch sensitivity	0.56 ($\pm 0,41$)	0.56 ($\pm 0,59$)
	Attachment/attention-seeking	1.81 ($\pm 0,79$)	2.15 ($\pm 0,97$)
DIAS	General Score	0.46 ($\pm 0,06$)	0.56 ($\pm 0,11$)
	Factor 1	0.37 ($\pm 0,09$)	0.53 ($\pm 0,18$)
	Factor 2	0.30 ($\pm 0,10$)	0.41 ($\pm 0,17$)
	Factor 3	0.77 ($\pm 0,12$)	0.74 ($\pm 0,12$)

340

341 **Discussion**

342 The aim of this study was to assess the performance of AAA dogs in comparison to dogs
343 living in the same household but not doing such work. Differences were found on the gazing test.
344 A number of studies have established that gazing behavior is sensitive to learning processes as it
345 increases with reinforcement and decreases during extinction when it is no longer reinforced
346 with food (Bentosela et al., 2008). In addition, it has been noted that previous training affects
347 gazing length toward a person when a reinforcer is inaccessible. For example, agility dogs gaze
348 longer than search and rescue dogs when confronted with an unsolvable task (Marshall-Pescini et
349 al., 2009), and Schutzhund trained dogs gaze more toward the owner during a walk than
350 untrained pet dogs (Bentosela et al. 2008). Furthermore, Barrera et al. (2011) found that shelter
351 dogs, having little interaction with people, gazed less than family dogs during extinction, thus
352 underlining the importance of the animals' previous experience.

353 Our results show that AAA dogs gaze longer than pets at the face of an unfamiliar person
354 during baseline and extinction phases, when they were not reinforced for looking at the human
355 face. Therefore, they showed an increased tendency to gaze at humans and persist on this
356 communicative attempt even when this response was not successful. This is of particular
357 importance for the work of AAA dogs, since participants often do not respond properly or to any
358 extent to their communication attempts. However, dogs are usually reinforced during the task,
359 both with food given by the handler and by interacting with the people present. According to the
360 above interpretation, it is possible that AAA dogs have learnt to gaze longer at participants
361 during their working sessions.

362 Mongillo et al. (2017) measured the attention patterns of dogs with different levels of
363 training (untrained pets, AAI and agility dogs) by assessing their gaze toward the owner. Dogs
364 participating in AAI monitored more their owner's behavior by showing increased gaze duration
365 at them compared with agility trained dogs and pets. The increase in attention of AAI dogs could
366 be due to their reliance on the owner as a source of support in uncertain situations, such as
367 working with unfamiliar people. It is important to note that, in this study, AAI dogs did not gaze
368 longer toward the stranger than dogs from the other groups. The authors propose that this type of
369 work may not promote a generalized increase of attention toward all people, although this could
370 be expected since they constantly interact with strangers. Those findings are contrary to the
371 conclusions of the present study, where AAA dogs showed an increased gazing response to an
372 unfamiliar person in comparison to pet dogs.

373 Several methodological differences could account for this discrepancy in results. First,
374 the presence of the owner in the Mongillo et al. (2017) study could have concentrated the whole
375 of the dog's attention during the task, thus overshadowing any significant differences in the

376 attention patterns toward the stranger. Additionally, gaze persistence during extinction could
377 indicate greater perseverance in a learned behavior or higher trainability in AAA dogs. Given
378 that we found no evidence of the “trainability” C-BARQ subscale between groups, the first
379 explanation seems more likely.

380 Furthermore, PD had significantly higher scores on the DIAS than AAA dogs, both on the
381 Overall Questionnaire Score (OQS) and on factor 1, which is related to behavioral regulation.
382 According to Wright et al. (2011), dogs scoring high in this factor have less control over their
383 responses to stimuli, are more impatient, and have higher levels of activation in general. This
384 could suggest higher impulsivity in pet dogs than in AAA dogs. Thus, AAA dogs are likely to
385 better regulate their behavior to avoid disrupting the usual activities in their working place.

386 Despite the results observed on the DIAS score, we found no differences in the dogs’
387 performance in an inhibitory test like the A-not-B task (Amici et al., 2008). Inhibitory control is
388 a complex theoretical construct which comprises diverse abilities, ranging from tolerance to
389 delayed reinforcement (e.g. Leonardi et al., 2012) to restraint of preponderant responses (Amici
390 et al., 2008) Therefore, the discrepancy between the DIAS scores and the A-not-B task
391 performance could be accounted for by the differences in the theoretical construct of impulsivity
392 underlying both tests (e.g. Bray et al., 2014; Brucks et al., 2017). In addition, as the DIAS score
393 is an owner reported questionnaire, it does not directly measure dogs’ impulsivity, but the
394 owners’ perception of this trait on their dogs. Thus, one possibility is that dogs that are perceived
395 by the owner as less impulsive are selected to participate in AAA activities, while their
396 companions perceived as more impulsive are left aside. This is important because it emphasizes
397 the need to educate owners about selection criteria to choose dogs able to participate in this kind
398 of tasks.

399 On the other hand, the fact that no differences were found between groups in the A-not-B
400 task is contrary to our predictions, as we expected higher social contact to improve AAA dog's
401 performance. In particular, previous works remarked the importance of social experiences on this
402 task, as shelter dogs that have little interaction with people had a poorer performance (Fagnani et
403 al., 2016). The lack of differences on this task suggests that the experience acquired during AAA
404 work may not be enough to modulate the inhibition of a highly preponderant behavior such as
405 approaching food.

406 In addition, we found no differences in the dogs' performance during the sociability test.
407 One possibility is that this task may not be sensitive enough to detect differences between the
408 groups. Another possible explanation is that, since the evaluated AAA dogs had received no
409 specific training, there are fewer differences with pet dogs than expected.

410 The main strength of this study lies in the fact that dogs in the pet group live in very
411 similar social conditions to the AAA dogs: they live in the same household and their daily
412 learning experiences outside the AAA work are alike. As a result, the differences found can
413 possibly be explained, at least partially, by the participation in tasks of assisted intervention.

414 Nevertheless, as we do not have measures prior to the study, we cannot exclude the
415 possibility that the evaluated AAA dogs had shown these behavioral dispositions prior to
416 participating in AAA activities, hence making the owners assume they are suitable for this type
417 of work. Moreover, these results may not be generalizable to highly selected or trained dogs.

418 In conclusion, gazing seems to be a fundamental communicative response in AAA dogs,
419 specially its persistence when it is no longer reinforced. This characteristic should be taken into
420 account for both the selection and training of these animals. In addition, there could be
421 differences in the inhibitory control abilities of both groups, as suggested by the higher scores of

422 pet dogs on the DIAS. This lower impulsivity trait could be extremely valuable for good AAA
423 performance. However, the present data does not allow us to draw final conclusions in this
424 respect and further studies are needed to assess the behavior of AAA and pet dogs in different
425 contexts requiring inhibitory control.

426

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433

434 **Ethical consideration**

435 This study complies with the current Argentinean law of animal protection (Law 14.346)
436 and was developed with the approval of the CICUAL (Institutional Commission for the Care and
437 Use of Laboratory Animals) from the Medical Research Institute IDIM CONICET (Res. Nro.
438 038-16). All owners expressed their consent for the participation of their dogs in this study.

439

440 **Authorship statement**

441 The idea for the paper was conceived by Mariana Bentosela and Susana Underwood. The
442 experiments were designed by Mariana Bentosela and Fabricio Carballo. The experiments were
443 performed by Camila Cavalli, Mariana Bentosela and Victoria Dzik. The data were analyzed by

444 Camila Cavalli and Victoria Dzik. The paper was written by Camila Cavalli, Fabricio Carballo,
445 Susana Underwood and Mariana Bentosela. All authors revised and approved the paper.

446

447 **Conflict of interest**

448 The authors declare no conflict of interest.

449

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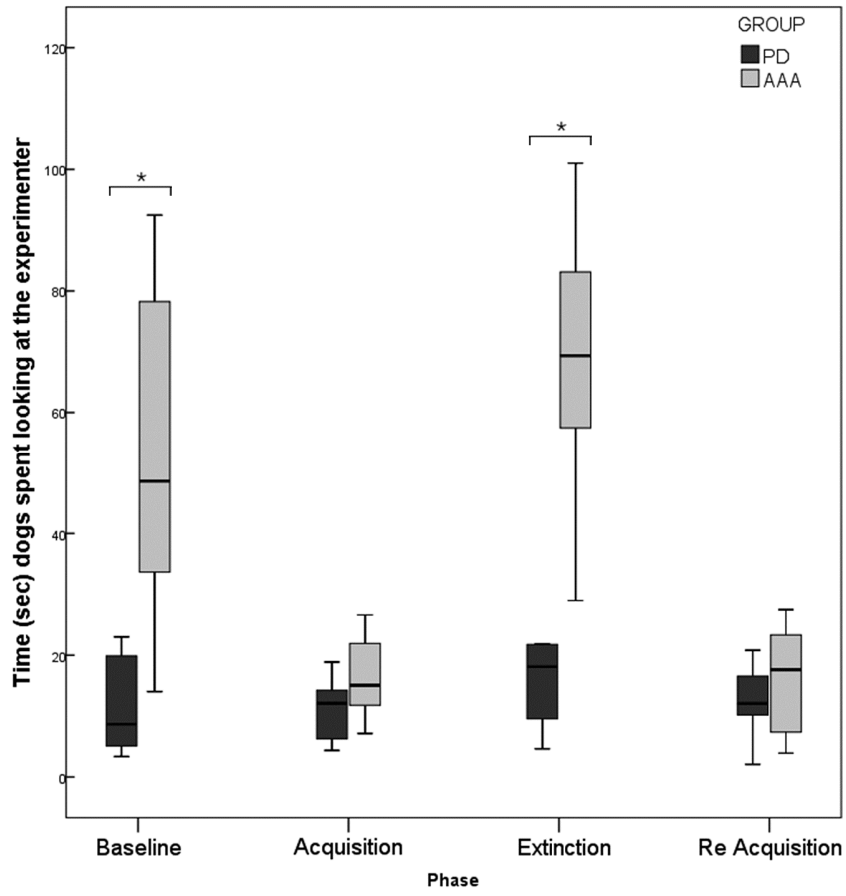
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567

568 **Figure caption**

569 Fig 1: Median and interquartile rank (sec) of the time dogs spent looking at the experimenter in
570 each phase during the gazing test. AAA: Dogs participating in Animal Assisted Activities. PD:
571 pet dogs living in the same household not participating in Animal Assisted Activities. The
572 median of the acquisition and extinction phases was calculated using the mean time dogs spent
573 looking at the experimenter during the three acquisition and extinction trials.

574



Animal assisted activities (AAA) provide recreational or educational opportunities.

We compare the performance of AAA and pet dogs in several sociocognitive tasks.

AAA dogs gazed longer at an unknown experimenter than pet dogs.

AAA dogs were less impulsive than the control group.

These results are relevant for both the selection and training of these animals.

ACCEPTED MANUSCRIPT

Ethical consideration

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