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HAL Authorization

1 **Original Article**

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4 **Dog behaviours in veterinary consultations: Part I. Effect of the owner's presence or**
5 **absence.**

6

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23 **Abstract**

24 Veterinary practices can be stressful places for dogs. Decreasing stress during veterinary
25 consultations is therefore a major concern, since animal welfare matters both for owners and
26 veterinarians. Stress can be expressed through behaviour modifications; monitoring dogs'
27 behaviour is thus one way to assess stress levels. We also know that the owner can affect dog
28 behaviour in different ways. The aim of this study was therefore to assess the effect of the
29 presence of owners on the behaviour of their dogs in veterinary consultations. We studied 25
30 dogs-owner dyads at two standardised veterinary consultations, conducted at intervals of five
31 to seven weeks; the owner was present for the first consultation and absent for the second
32 (O/NoO group, n= 12), or vice versa (NoO/O group, n= 13). A consultation consisted in three
33 phases: exploration, examination, greeting. Dog behaviours were compared between the two
34 conditions using a video recording.

35
36 Despite some limitations (e.g. no male owners, the exclusion of aggressive dogs, a
37 limited sample size, minimally invasive veterinary examinations, restricted owner-dog
38 interactions), our results showed that the presence or absence of the owner had no significant
39 effect on the stress-related behaviour of the dog or the veterinarian's ability to handle the
40 animal during the examination phase ($P > 0.05$). Nevertheless, the behaviour of the dogs
41 towards people was affected before, during, and after the veterinary examination: in the
42 presence of their owner, dogs were more willing to enter the consultation room ($P > 0.05$);
43 they appeared more relaxed during the exploration phase ($P > 0.05$); and they seemed less
44 eager to leave the room after the examination ($P > 0.1$). During the examination, dogs looked
45 in direction of their owner in both condition (respectively owner present and behind the door;
46 $P > 0.05$). These results suggest that allowing the owner to stay in the room during veterinary
47 consultations is a better option for dogs' welfare.

48

49 *Keywords:* Dog Behaviour; Owner Presence; Owner Absence; Stress; Veterinary

50 Consultation.

51 **Introduction**

52 Improving animal welfare during veterinary consultations is a key concern of
53 veterinarians, researchers and owners alike. Dogs frequently experience stress in these
54 situations (Lind, 2017; Edwards, 2019) which can be assessed by monitoring behaviour
55 (Beerda et al., 1997; Maximino et al., 2010; Koolhaas et al., 2011), for example, when
56 entering the veterinary practice (Stanford, 1981; Mariti et al., 2017), during time spent in the
57 waiting room (Mariti et al., 2015; Csoltova et al., 2017; Mariti et al., 2017), and during the
58 examination itself (Döring et al., 2009; Mariti et al., 2017). In a study by Döring et al. (2009),
59 80% of dogs showed stress-related behaviours on the examination table: 56.3% panted, 61.5%
60 shivered, and 71.9% displayed avoidance behaviour. Glardon et al. (2010) found that around
61 25% of dogs could not be handled during the examination. Studies also report physiological
62 signs of stress, such as increased plasma cortisol levels, pulse rates, and blood pressure (Kallet
63 et al., 1997; Vonderen et al., 1998).

64

65 Chronic stress can cause impaired welfare which has negative effects on health, leading
66 to reduced immune system performance (Herbert and Cohen, 1993; Stowell et al., 2001;
67 Gimsa et al., 2018), increased tumours (Riley, 1975; Dai et al., 2020), and premature aging
68 (Epel et al., 2004). Acute stress, as expected in veterinary consultations, can lead to
69 dysregulation of the stress system if it is extremely intense or recurrent (Chrapusta et al.,
70 1997; De Kloet et al., 2005; Vaessen et al., 2015). Stress also modifies the behaviour of dogs
71 and may increase aggression. When faced with a threatening situation, dogs tend to react in
72 three different ways: freeze; fight; and/or flight (Bracha, 2004). Aggression is dangerous for
73 veterinarians and owners: in Australia in 2006, 48% of veterinarians declared that they had
74 been bitten by a dog at work between one and five times in the previous 12 months (Fritschi
75 et al., 2006).

76

77 The ways in which dogs tend to react depend on their temperament (Goodloe and
78 Borchelt, 1998; Serpell and Hsu, 2001; Svartberg, 2002; Bray et al., 2017); coping style
79 (Koolhaas et al., 1999; Horváth et al., 2007; Diverio et al., 2017); genetics (Wilsson and
80 Sundgren, 1997; Saetre et al., 2006; Meyer et al., 2012; Arvelius et al., 2014; Persson et al.,
81 2015); and previous experiences (Seligman et al., 1979; Döring et al., 2009; Douglas et al.,
82 2012). According to Döring et al. (2009), even one past aversive experience increases stress-
83 related behaviour in dogs, thus modifying their behaviour at future visits to the veterinarian.

84

85 Many factors can be stressful for dogs in a veterinary practice (Edwards, 2019):
86 transportation between home and the practice (Beerda et al., 1997); the novelty of the place
87 (Beerda et al., 1997); the “white coat effect” (Kallet et al., 1997; Belew et al., 1999); the
88 presence of new people and animals (Scotney, 2010); and unusual sounds and bustle (Beerda
89 et al., 1997; Wells et al., 2002). Even smells such as those released by stressed people and
90 animals can be stressful for dogs (Graham et al., 2005; Siniscalchi et al., 2011; Siniscalchi et
91 al., 2016). In addition, dogs can be fearful when entering a veterinary practice due to previous
92 experiences (Döring et al., 2009; Ziv, 2017). Veterinarians may also use gestures or postures
93 that are stressful for dogs (Mariti et al., 2017; Edwards, 2019), such as bending over them
94 (Vas et al., 2005; Györi et al., 2010; McGreevy et al., 2012); touching them (Payne et al.,
95 2015); placing them on the examination table (Döring et al., 2009); restraining them by force
96 (Beerda et al., 1997); holding their collar or closing their mouth (Kuhne et al., 2014); looking
97 at them directly in the eyes (Györi et al., 2010); or bringing their face close to the dog’s head
98 (Rezac et al., 2015). As a result, veterinary practices may be fearful places for dogs.

99

100 Other stressful factors originate from the owner (Lind, 2017). Studies focused on dog-
101 owner attachment have shown that dogs can behave differently depending on whether their
102 owner is present or absent (Topál et al., 1998). In particular, when dogs are left in a novel
103 place without a familiar caregiver, they show higher activity (Tuber et al., 1996); higher
104 glucocorticoid levels (Tuber et al., 1996; Palestrini et al., 2005); higher heart rate levels
105 (Palestrini et al., 2005); and higher anxiety (Prato-Previde et al., 2003; Palestrini et al., 2005;
106 Parthasarathy and Crowell-Davis, 2006), even if an unknown person is present (Parthasarathy
107 and Crowell-Davis, 2006). Miklosi et al. (2003) showed that dogs looked at their owner when
108 facing an unsolvable task, and Kerepesi et al. (2015) demonstrated that dogs moved closer to
109 their owner but not towards other individuals, even familiar ones, in situations provoking
110 anxiety or fear. Other studies have shown that dogs react in the same way as their owner
111 when confronted with a strange object (Merola et al., 2012) or an unknown person (Duranton
112 et al., 2016).

113

114 Owners can thus potentially modify the behaviour of their dog in a veterinary
115 consultation. This hypothesis has been observed anecdotally by veterinarians in the field.
116 Some believe that the very presence of owners can calm down their dog, whereas others
117 maintain that dogs are easier to handle in the absence of their owner. Only a study by Stellato
118 et al. (2020) focused on this question, and showed positive effects of owner presence on
119 behavioural and physiological measures of fear in dogs during veterinary consultation.

120

121 In Part I of our study, we examined the effect of owner presence or absence on the
122 behaviours of dogs during a veterinary consultation, regardless of the owners' actions. Based
123 on the abovementioned literature, we expected the owner's presence to decrease stress-related
124 behaviours of dogs during the veterinary examination and hence facilitate their handling by

125 the veterinarian. In Part II of the study (see Helsly et al., under review), using the raw data
126 from consultations with the owner present, we explored whether owners' actions affect dog
127 behaviours by observing dog-owner dyads.

128

129 **Materials and methods**

130 *Participants*

131 A total of 32 dog-owner dyads were recruited. Four dogs were excluded due to the
132 owner's withdrawal between the two appointments, another one due to aggressive behaviour
133 and two due to protocol deviation. The final study included 25 owner-dog dyads. All
134 participants were volunteers and were recruited via social media. The owners (all women) and
135 dogs meeting the following criteria were selected: adult dogs between 12 months and 10 years
136 old and unfamiliar with the researchers, measuring less than 70 cm at the withers in order to
137 be easily lifted and examined on the table, in good general health, and nonaggressive towards
138 humans to avoid the use of a muzzle that could modify their behaviour; owners not working
139 as a veterinarian, assistant, or veterinary student.

140 Participant demographics are shown in Table 1.

141

142 *Experimental procedure*

143 The study protocol was approved by the ethical committee SSA (Science et Santé
144 Animale) n°115 (SSA_2018_008) on 18 July 2018. The experiment took place in an
145 examination room at the National Veterinary School of Toulouse (ENVT), France (Fig. 1).
146 All dogs underwent two videotaped veterinary consultations at an interval of five to seven
147 weeks (Table 1), one in the presence of their owner and the other in their absence. Prior to
148 each consultation, all owners were told how to behave with their dogs. The veterinary
149 consultations were all carried out by the same two researchers: two female veterinary

150 students, one in the role of the veterinarian (C. G.) and the other in the role of the assistant
151 (M. H.). During the consultations, the researchers conducted the veterinary examination using
152 as neutral a disposition as possible: the researchers stayed still and did not talk to the dogs, pet
153 them, make eye contact with them, or punish them. The veterinary consultation was divided
154 into three main phases: phase 1: exploration; phase 2: examination; and phase 3: greeting. We
155 consider a “consultation” to include all events between the times when the dog entered and
156 exited the examination room, whereas an “examination” includes only the phase where the
157 dog was examined (see “Standardised protocol for the veterinary consultations” below). Dogs
158 were randomly distributed into two groups using AB/BA crossover design: in the O/NoO
159 group ($n = 12$), the owner was present for the first veterinary consultation and absent for the
160 second, and vice versa in the NoO/O group ($n = 13$). Consultations were arranged by
161 appointment according to the availability of owners.

162

163 Raw data collected for this study was also used in Part II (Helsly et al., under review).
164 Part II only focuses on data collected during consultations with the owner present. Four
165 additional dogs were included in Part II but not in Part I because the dyads did not attend the
166 second consultation with the owner absent.

167

168 *Data collection and analysis*

169 Consultations were videotaped from when the dog entered the consultation room until
170 the end of the greeting phase. We used two cameras (a Canon Legria HF S21 and a Panasonic
171 HC-WX970 with a Panasonic vW-W4907H wide-viewing angle) situated in two corners of
172 the room and facing the examination table. The recorded videos from the two cameras were
173 synchronised and assembled into a single video (Fig. 1).

174

175 The variables we studied, described below, differed depending on the phase of the
176 consultation. A summary of all studied variables and their availability for the three phases is
177 described in Appendix B: Supplementary material. Dog behaviour was analysed using the
178 Solomon Coder beta 17.03.22 program¹ and the behavioural repertoire adapted from the
179 literature (Beerda et al., 1998; Mills et al. 2006; Deldalle and Gaunet, 2014; Csoltova et al.,
180 2017; see Table 2). Stress-related behaviours are described in Table 2. As the phase durations
181 were variable, the durations of behaviours were converted into a time percentage (behaviour
182 duration/phase duration) for all behaviours. Behavioural indices were further computed as
183 detailed in Table 3. The Emotional State of the dog is a subjective rate assessing stress, scored
184 by using a three-point scale defined as follows: relaxed, aroused, anxious, see definitions in
185 Table 4. The dogs' apparent comfort in entering the room and the greeting intensity of the
186 dogs towards their owner and of owners towards dogs were evaluated using a five-point scale
187 defined in Table 5. The level of physical restraint was scored using a three-point scale defined
188 as follows: low, medium, high. All definitions are given in Table 6. The success and difficulty
189 of the manipulations were evaluated using a scale defined in Table 7.

190

191 *Standardised protocol for the veterinary consultations*

192 Owner: present condition

193 Exploration phase (phase 1): The owner entered the room with her dog on a leash and
194 sat on a chair (Fig. 2). The leash was dropped, and the dog explored the room freely for 2
195 minutes and 30 seconds. Neither the owner nor the researcher spontaneously interacted with
196 the dog; the owner could nevertheless respond to the dog's requests (physical, verbal and
197 visual interactions were allowed). The researchers asked questions similar to those asked in a
198 standard veterinary consultation.

¹ See : Solomon Coder, András Péter, <https://solomoncoder.com> (accessed 10 September 2020).

199

200 Examination phase (phase 2): The dog was put on the examination table by the
201 researchers; the owner stood one metre away from the table in a designated spot, facing the
202 dog. The veterinarian began a standardised veterinary examination following this predefined
203 sequence: examination of eyes; ears; teeth; mouth mucosa; palpation of lymph nodes;
204 examination of scapular skin fold; abdominal palpation; heart and lung auscultation;
205 measurement of rectal temperature; and paw palpation. The assistant held the dog using a
206 standardised restraint (Fig. 3): one hand on the chest and another on the base of the tail, using
207 the minimal necessary strength to keep the dog sitting or standing on the table. If a particular
208 manipulation failed because the dog was not cooperative for five seconds (for example, the
209 dog struggled, resisted, or tried to escape), the veterinarian did not repeat the manipulation
210 and continued with the next one. During the examination phase, the owner was only allowed
211 to talk to or look at her dog (verbal and visual interactions were allowed). If the dog showed
212 any sign of aggression toward the researchers or behaviour endangering them (for example,
213 growling, showing teeth, or trying to bite), the procedure was terminated, and the dog was
214 excluded from the study.

215

216 Greeting phase (phase 3): This phase started when the dog was on the floor and the
217 owner in the room and lasted exactly 20 second. The dog was indeed taken down from the
218 table by the researchers, and the leash was given back to the owner. The researchers then
219 stepped aside and filled in forms in order to allow the owner and the dog to interact freely
220 (physical, verbal and visual interactions were allowed).

221

222 Owner: absent condition

223 The procedure was the same as with ‘Owner: present condition’, except that the owner
224 waited outside the room during the exploration and examination phases and only entered the
225 room for the greeting phase. During the exploration phase, the owner accompanied the dog to
226 the open door, gave the leash to the assistant and was free to interact with the dog in order to
227 encourage the dog to enter the room. The dog explored the room freely for 2 minutes and 30
228 seconds while still on the leash. During this phase, the researchers did not interact with the
229 dog and spoke in a neutral tone. The procedure of the examination phase was the same as
230 described in ‘Owner: present condition’. During the greeting phase, the dog was taken down
231 from the table by the researchers. Then, the assistant went outside to fetch the owner, and the
232 leash was given back to the owner when she came back in the room without specific
233 instructions. The end of this phase was the same as described in ‘Owner: present condition’
234 after having given the leash back to the owner.

235

236 *Interobserver agreement*

237 Three assessors participated in the video analysis. The two researchers coded all the
238 behaviours in all the videos: half of the behaviours were coded by one researcher and the
239 other half by the second researcher. To assess the reproducibility of the behavioural analysis,
240 a third assessor who was unaware of the study hypotheses and aims coded 30% of the
241 behaviours in a random subset of 30% of the videos. Considering that a concordance, and not
242 only a correlation, was needed to assess the interobserver reproducibility, Lin’s concordance
243 correlation test was used (Lawrence et al., 1989; Barnhart et al., 2002; Barnhart et al., 2007).
244 Interobserver agreement between the two assessors was determined by calculating ρC values
245 and rated according to Landis and Koch (1977) ($\rho C = 0 - 0.2$: slight agreement, $\rho C = 0.21 -$
246 0.4 : fair agreement, $\rho C = 0.41 - 0.60$: moderate agreement, $\rho C = 0.61 - 0.8$: substantial
247 agreement, $\rho C > 0.81$: excellent agreement). Lin’s concordance correlation coefficients were

248 excellent ($\rho C > 0.98$) for whining, tail between the legs, and moving and gazing at the owner,
249 and substantial for contact with the assistant ($\rho C = 0.71$) and sniffing ($\rho C = 0.69$). Physical
250 restraint was evaluated by the assistant, the success and difficulty of the manipulations were
251 assessed by the veterinarian, and the other scores were rated by the three assessors.

252

253 *Statistical analysis*

254 The exploration, examination, and greeting phases were analysed separately.
255 Comparisons were carried out for each behaviour or behavioural index with the owner absent
256 or present conditions. A paired Student's *t* test was performed for the O/NoO and NoO/O
257 groups using R software².

258

259 **Results**

260 On average, the exploration phase lasted 155.43 ± 9.54 seconds and the examination
261 phase 142.53 ± 16.4 seconds. The greeting phase, standardised in the study, lasted 20 seconds.
262 The sample is described in Appendix A: Supplementary material.

263

264 *Exploration phase (phase 1)*

265 Entering the room

266 Dogs appeared to enter the room more readily when the owner was present rather than
267 absent, and the difference was significant ($P < 0.05$; see Table 8, Video 1).

268

269 Emotional state

270 Dogs had a significantly lower score for emotional state during the exploration phase
271 when the owner was present rather than absent ($P < 0.05$; see Table 8, Video 2).

² See: The R Project for Statistical Computing. <http://www.R-project.org>. (accessed 24 May 2017)

272

273 *Examination phase (phase 2)*

274 Stress-related behaviour

275 No differences were observed regarding the stress-related behaviours or Total Stress
276 (defined in Table 3) during the examination phase in the presence or absence of the owners
277 ($P>0.05$).

278

279 Behaviour towards the veterinarian and assistant

280 The dogs' contact with the veterinarian and/or assistant lasted significantly longer
281 during the examination phase if the owner was present rather than absent ($P< 0.05$; Table 9).

282

283 Behaviour (gaze) towards the owner and/or door

284 During the examination phase, dogs looked straight ahead toward the assigned place
285 of the owner significantly more if the owner was present rather than absent. ($P< 0.05$; Table
286 9, Video 3). Furthermore, dogs looked at the door significantly less when their owner was
287 present rather than absent ($P< 0.05$; Video 3).

288

289 Dogs' handling

290 No difference was observed regarding the restraint and the success and difficulty
291 scores of manipulations in the presence or absence of the owners ($P> 0.05$).

292

293 *Greeting phase (phase 3)*

294 Intensity of greeting

295 When the dog and owner were reunited after the examination phase, dogs greeted their
296 owners for a significantly shorter period of time ($P< 0.05$) and showed a lower reunion score

297 ($P < 0.05$) if the owner was present rather than absent during the examination phase (Video 4).
298 Nevertheless, the scores of owner behaviour towards their dog were similar regardless of
299 whether the owner was present or not in the previous phase ($P > 0.05$).

300

301 Door-directed gaze

302 Finally, dogs gazed at the door slightly less often when the owner was present rather
303 than absent ($P < 0.1$; Table 10, Video 5).

304

305 **Discussion**

306 This experiment aimed at investigating whether the presence or absence of a dog's
307 owner influences dogs' behaviours in veterinary consultations. Overall results suggest that
308 allowing the owner to stay in the room during veterinary consultations is a better option for
309 dogs' welfare: During the exploration phase, in the presence of their owner, dogs were more
310 willing to enter the consultation room and appeared more relaxed. During the examination
311 phase, dogs looked in direction of their owner in both condition: when their owner was
312 present (standing in front of the dog), dogs looked straight ahead more often and at the door
313 less often than in the absence of their owner. When the owner was absent (she had left the
314 room through the door), the dogs looked at the door more often and less straight ahead than in
315 the presence of the owner. Physical contacts engaged by dogs with the researchers lasted
316 longer when their owners were present rather than absent. Our results also indicate that the
317 presence or absence of the owner had no significant effect on the stress-related behaviour of
318 the dog or the veterinarian's ability to handle the animal during the examination phase.
319 Finally, during the greeting phase, our results showed that the dogs exhibited less greeting
320 behaviour and tended to look at the door less often if the owner had never left the room than if
321 the owner had been absent.

322

323 Only a study by Stellato et al. (2020) focused on the effect of the presence or absence
324 of the owner on dog behaviour in veterinary practices, comparing two standardized veterinary
325 consultation with owner present or absent. They showed that dogs had a lower rate of
326 vocalisation, higher rate of yawning and lower mean axillary temperature in the presence of
327 the owner. Thus, they encouraged owner to remain with their dog during routine veterinary
328 examination. Note that we did not find such a difference for vocalisation and yawning, but we
329 did find significant differences for other parameters. A study by Csoltova et al. (2017)
330 focused on the active or passive support of the owner during veterinary examinations. The
331 authors compared behavioural and physiological measures of dogs during a veterinary
332 examination in two conditions: the active presence of the owner (talking and petting), and the
333 passive presence of the owner (sitting quietly next to the examination table). They found heart
334 rate and internal temperature variations showing a beneficial effect of dog-owner interaction
335 on the dogs' well-being but no significant behavioural changes. As mentioned in the
336 introduction, owners can have various effects on the behaviour of their dog. Studies have
337 shown that dogs adjust their behaviour to their owner's overall emotional body posture (Vas
338 et al., 2005; Custance and Meyer 2012), to the owner's behaviours (Millot, 1994; Merola et
339 al., 2012; Horn et al., 2012; Duranton and Gaunet, 2015); and to the owner's facial
340 expressions (Deputte and Doll, 2011). Other studies detailed in Part II have shown that
341 physical contact does not have the same effect on dog behaviour as talking (Helsly et al.,
342 under review). The effect of the presence of the owner is thus hard to accurately predict, as it
343 can depend on the owner's behaviour and mood.

344

345 In the present study, several elements can explain the absence of any significant
346 differences in stress-related behaviours during the examination phase. First, physical contact

347 between the owners and dogs was not allowed during the examination phase to control
348 parameters not being studied. Yet the Csoltova study showed a beneficial effect of contact
349 during veterinary examinations, and other studies detailed in Part II have shown that talking
350 and physical contact do not have the same effect (Helsly et al., under review). Another
351 element in our study involved the subjective evaluation of stress (emotional state). This
352 evaluation showed higher levels of stress during the exploration phase (phase 1) when the
353 owner was absent than when the owner was present. In contrast, during the examination phase
354 (phase 2), no difference was found in the subjective evaluation by the judges (emotional state)
355 or the video analyses (stress-related behaviours). A study by Firnkes et al. (2017)
356 demonstrated that some stress-related behaviours (“licking of lips” and “looking away”)
357 decrease even though the stressor intensity increases. We thus postulate that the dogs reached
358 a high threshold of stress in the ‘Owner: absent condition’ that prevented them from
359 displaying additional stress-related behaviours. Potentially, too many stressors may hide the
360 display of stress-related behaviour at some point. Alternatively, the absence of any difference
361 may show that dogs are not actually more stressed when the owner is absent during a
362 veterinary examination. In the examination phase, dogs engaged in more physical contact with
363 the researchers when their owner was present than when their owner was absent. This
364 engagement with researchers suggests that in an interventionist situation, if we had imposed
365 physical contact on the dogs to keep them on the table, the presence of the owner would act as
366 a social reference for the dog towards the veterinarian and assistant. That is, the presence of
367 the owner could help dogs to handle this difficulty. Even if no significant differences were
368 shown in terms of stress-related behaviours during examination phase, other results suggest
369 that the owner does play a role. For instance, dogs looked in the direction of their owner both
370 in the absence and in the presence of the owner. This also highlights the importance of the
371 owner’s presence to help dogs to deal with the situation (e.g. social referencing in Merola et

372 al., 2012; Duranton et al., 2016; Salamon et al., 2020; and also Part II (Helsly et al., under
373 review, for additional information). Furthermore, greeting behaviours during the two reunion
374 conditions differed. Once dogs were placed back on the floor and the leash was given back to
375 the owner, dogs showed more greetings when the owner came back than when the owner had
376 never left the room. This is in accordance with studies showing that greeting behaviour is
377 more marked when dogs spend a stressful time without their owner (Konok et al., 2011; Rehn
378 and Keeling, 2011). Dogs tended to look at the door more often during the greeting phase
379 when the owner had come back than when the owner had never left. Dogs are known to look
380 at a desirable object (Gaunet, 2008; Gaunet, 2010; Gaunet and Deputte, 2011), and thus they
381 may have been more motivated to leave the room when their owner was absent, since the time
382 they spent in the room was more stressful, in accordance with the emotional state evaluation
383 during the exploration phase. Finally, the presence of the owner had no detrimental effect but
384 some beneficial effects on dogs. Dogs were neither more stressed nor more difficult to handle
385 during examination phase and appeared less stressed during the exploration phase. In
386 conclusion, the presence of owners appears to be more beneficial than their absence during
387 veterinary examinations.

388

389 Our sample size was small, the veterinary examination was minimally invasive; puppy,
390 old dogs and dogs measuring more than 70cm were not included and aggressive dogs were
391 excluded from our study for safety reasons. Glardon et al. (2010) estimated that 16% of dogs
392 display aggressive behaviour during veterinary examinations. If these dogs had been included
393 in the study, the results may have been different, since aggressive dogs are less tolerant of
394 manipulations. Furthermore, the manipulations used in this study were standard but minimally
395 invasive. Dogs' tolerance of manipulation would have differed if we had employed more
396 invasive or painful procedures (Holton et al., 2001; Hansen, 2003), and the presence or

397 absence of the owner could have had a different effect in these cases. Owner and researcher
398 behaviour could have differed from a real-life scenario, as owners were not allowed to touch
399 their dogs during the examination phase, and researchers kept a neutral disposition and did not
400 initiate interaction toward dogs or respond to their requests for attention. In addition, the dogs
401 involved in the current study were healthy and did not need any invasive manipulation.
402 Owners may be more stressed in a real veterinary examination and therefore have a different
403 effect on dog behaviour than in the controlled experimental conditions. Furthermore, while it
404 has been shown that dogs react differently to men and women, we were not able to study the
405 gender effects of owners and researchers on the dogs' behaviours, as both the owners and
406 researchers were all women (Hennessy et al., 1998; Wells and Hepper, 1999; Deputte and
407 Doll, 2011). In the present study, we focused on canine behaviour, although physiological
408 measures such as plasma or salivary cortisol, heart rate, and infrared thermography can also
409 be used. These measures could provide additional information about the stress experienced by
410 dogs during veterinary consultations and help highlight the differences that cannot be
411 observed by behaviour analysis alone, such as behaviours with high interindividual variation
412 (Firnkes et al., 2017). We thus encourage further studies to focus on neurochemical and
413 physiological differences in conjunction with behavioural differences, to use a larger sample
414 of dogs and to study gender effect.

415

416 **Conclusions**

417 In summary, despite some limitations (e.g. no male owners, no dog above 70cm, no old
418 dogs nor puppies, no aggressive dogs, 25 dogs by condition, minimally invasive
419 examinations, restricted owner-dog interactions), the current study shows that the presence of
420 the owner in veterinary consultations (constituted by exploration, examination and greeting
421 phases) may help to reduce the stress-related behaviours of dogs before veterinary

422 examinations. During examination phase, dogs looked at their owners and appear to seek
423 social information from owner, whereas when their owners were absent, they looked for them.
424 Behaviours like greeting their owners and door-related behaviours suggest that even if no
425 significant differences were shown for stress-related behaviours in terms of the absence or
426 presence of owners, dogs were **less** stressed during examination phase when their owner was
427 present. Given these results, it seems more appropriate to allow owners to attend veterinary
428 examinations with their dog, as only positive effects were observed in terms of the dogs'
429 behaviour and well-being, in spite of the previously mentioned limitations.

430

431 **Conflict of interest statement**

432 None of the authors has any financial or personal relationships that could inappropriately
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434

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441

442 **Supplementary material**

443 Supplementary data associated with this article can be found, in the online version, at
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445

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765 **Table 1**

766 Characteristics of owners and dogs.

Dog	Experimental group	Interval between visits (weeks)	Age (years)	Sex	Breed	Age of owner
1	NoO/O	5	3	FN	Mixed Shepherd	25-40
2	NoO/O	5	1	MN	Mixed Retriever	25-40
3	NoO/O	6	4	FN	Cavalier King Charles	41-60
4	O/NoO	5	2.5	FN	Beauceron	25-40
5	O/NoO	7	3	FN	Schapendoes	<25
6	O/NoO	5	5	FE	Mixed Terrier	25-40
7	O/NoO	6	5	FN	Mixed Terrier	>60 ^a
8	O/NoO	6	5	ME	Mixed Terrier	>60 ^a
9	O/NoO	6	7.5	MN	Labrador	41-60
10	O/NoO	6	2.5	ME	Boxer	25-40
11	NoO/O	5	5	MN	Mixed Terrier	25-40 ^a
12	O/NoO	5	6	MN	Mini Australian Shepherd	25-40 ^a
13	NoO/O	7	2.5	MN	Whippet	25-40
14	O/NoO	5	2	ME	Boxer	41-60
15	NoO/O	6	2	MN	French Bulldog	41-60
16	O/NoO	5	1.5	ME	German Shepherd	41-60
17	O/NoO	7	7	FN	Spitz	25-40
18	O/NoO	6	2	FE	Boxer	41-60
19	NoO/O	7	4	MN	Whippet	>60
20	NoO/O	6	3.5	FN	Cotton Tulear	25-40
21	NoO/O	5	3.5	MN	White Swiss Shepherd	25-40

22	NoO/O	7	9	FN	Australian Shepherd	41-60 ^a
23	O/NoO	7	3	FN	Australian Shepherd	41-60 ^a
24	NoO/O	6	4	FE	Groenendael	25-40
25	NoO/O	7	5	ME	Malinois	41-60

767 NoO/O, Owner was absent for the first veterinary consultation and present for the second;
768 O/NoO, Owner was present for the first veterinary consultation and absent for the second; F,
769 Female; M, Male; N, Neutered; E, Entire. ^a Owners participating with more than one dog.

770 **Table 2**

771 Recorded dog behaviours during the examination and greeting phases and their definitions.

Observed behaviour	Description
Non-exclusive stress-related behaviours	
Scratching ^a / Sniffing ^a / Shivering ^a / Shaking ^a	The dog scratched itself / The dog sniffed the ground or straight ahead / The dog trembled / The dog shook
Low postures ^a	The dog's tail was lowered, its ears faced backwards, or its legs were bent; at least two of these postures were exhibited
Mouth (exclusive behaviours)	
Yawning ^a / Panting ^a / Licking ^a	The dog yawned / The dog panted / The dog licked its mouth
Vocalisations (exclusive behaviours)	
Whining ^a / Barking ^a	The dog whined / The dog barked
Gaze (exclusive behaviours)	
Gaze at a person	The dog gazed with its head oriented towards the owner (Gaze O), the veterinarian (Gaze V), the assistant (Gaze A), or the veterinarian and the assistant (Gaze VA)
Gaze at an object or thing	The dog gazed with its head oriented towards the door (Gaze D) or straight ahead when on the table (Gaze Ad)
Avoidance (exclusive behaviours)	
Avoidance	The dog stepped backwards away from the veterinarian or the assistant following one of their actions
Situation (exclusive behaviours)	

Situation / somebody	Half of the dog's body (head and chest) was situated less than 50 cm from the owner (Situation O) or from the veterinarian and the assistant (Situation VA)
Situation / something	Half of the dog's body (head and chest) was situated less than 1 m from the door (Situation D), or the dog was not in one of the previous locations (Situation E)
Movement (exclusive behaviours)	
Move	The dog moved its four limbs with less than 1 second between the movement of each limb
Contact (exclusive behaviours)	
Contact	The dog intentionally touched the owner (Contact O), the veterinarian (Contact V), or the assistant (Contact A)
Tail (exclusive behaviours)	
Tail wagging	Tail wagged below the spine but was not between the legs
Tail between legs ^a	Tail was between the rear limbs
Tail low	Tail was below the spine but was not wagging or between legs
Tail high	Tail was above the spine, whether wagging or not

772 ^aStress-related behaviour

773 **Table 3**

774 Behavioural indices calculated using several behaviours from Table 2.

775

Index (Unit)	Definition	Formula
Total Stress (%)	Sum of percentages of time spent yawning, panting, scratching, adopting low posture, shivering, sniffing, whining, barking and licking	Total Stress (%) = Yawning (%) + Panting (%) + Shivering (%) + Low postures (%) + Shaking (%) + Sniffing (%) + Whining (%) + Barking (%) + Licking (%)
Contact V+A (%)	Sum of percentages of time spent in contact with veterinarian (V) and/or assistant (A)	Contact V+A (%) = Contact V (%) + Contact A (%)
Gaze V+A (%)	Sum of percentages of time spent gazing at veterinarian (V) and/or assistant (A)	Gaze V+A (%) = Gaze V (%) + Gaze A (%) + Gaze VA (%)
Gaze O+Ad (%)	Sum of percentages of time spent gazing at owner (O) when present or straight ahead (Ad) when absent	Gaze O+Ad (%) = Gaze O (%) + Gaze Ad (%)
Behav. Tow. Owner (%) (dog behaviours towards owner)	Sum of percentages of time spent gazing at, having contact with, and seeking proximity to the owner	Behav. Tow. Owner (%) = Gaze O (%) + Contact O (%) + Situation O (%)

776 %, Time percentage (behaviour duration/phase duration); Yawning, The dog yawned;
 777 Panting, The dog panted; Scratching, The dog scratched itself; Low posture, The dog's tail
 778 was lowered, its ears faced backwards, or its legs were bent, at least two of these postures
 779 were exhibited; Shaking, The dog shook; Sniffing, The dog sniffed the ground or straight
 780 ahead; Whining, The dog whined; Barking, The dog barked; Licking, The dog licked its
 781 mouth; Contact V, The dog intentionally touched the veterinarian; Contact A, The dog

782 intentionally touched the assistant; Gaze V, The dog gazed with its head oriented towards the
783 veterinarian; Gaze A, The dog gazed with its head oriented towards the assistant; Gaze VA,
784 The dog gazed with its head oriented towards the veterinarian and the assistant; Gaze O, The
785 dog gazed with its head oriented towards the owner; Gaze Ad, The dog gazed with its head
786 oriented straight ahead when on the table; Contact O, The dog intentionally touched the
787 owner; Situation O, Half of the dog's body (head and chest) was situated less than 50 cm from
788 the owner.

789 **Table 4**

790 Rated emotional states of dogs during exploration, examination, and greeting phases, their
791 definition, and their score (from Mills et al., 2006).

Emotional state	Definition	Score
Relaxed	No or low frequency of movement, with no visual evidence of tension in the body	1
Aroused	Tense, with high frequency of movement, but no visual evidence of anxious behaviours	2
Anxious	Tense, with licking, yawning, crying, agitation or observable fearful posture	3

792 **Table 5**

793 Rated scores of dogs when entering the examination room (exploration phase) and reuniting
 794 with the owner after the veterinary examination (greeting phase), along with the name of the
 795 factor and the signification of the score.

Factor	Name of factor	Score (from 1 to 5)
Apparent comfort in entering the room	Entering Room	1 = Has to be drawn to enter, 5 = Enters voluntarily, pulls on leash
Greeting intensity by dog towards owner	Reunion / Dog	1 = Indifferent, 5 = Very happy, jumps on the owner, requests contact
Greeting intensity by owner towards dog	Reunion / Owner	1 = Indifferent, 5 = Talks to the dog, pets the dog a lot

796 **Table 6**

797 Rated levels of dog restraint performed by the assistant during the examination phase, along
798 with their definition and score.

Restraint	Definition	Score
Low	The assistant did not need to use force to keep the dog in the right position. The dog was voluntarily almost immobile.	1
Medium	The assistant needed to increase her restraint of the dog to keep it in the same position. The dog was agitated/moved frequently.	2
High	The assistant had to hold the dog firmly to keep it on the examination table or help the veterinarian perform the clinical examination. The dog tried to escape.	3

799 **Table 7**

800 Rated manipulations performed by the veterinarian during the examination phase and the
 801 meaning of their success and difficulty score.

Manipulation	Definition	Score and Value	
Table	Dog was picked up and lifted onto the examination table	Failure: 0 ^a Success: 1	Difficulty (from 1 to 5) 1: Easy / 5: Hard
Eye	Eye and mucosa observation	Failure: 0 Success: 1	Difficulty (from 1 to 5) 1: Easy / 5: Hard
Ear	Ear manipulation and observation	Failure: 0 Success: 1	Difficulty (from 1 to 5) 1: Easy / 5: Hard
Mouth	Examination of teeth and mouth mucosa	Failure: 0 Success: 1	Difficulty (from 1 to 5) 1: Easy / 5: Hard
Palpation	Abdominal and lymph node palpation	Failure: 0 Success: 1	Difficulty (from 1 to 5) 1: Easy / 5: Hard
Skin fold	Examination of scapular skin fold	Failure: 0 Success: 1	Difficulty (from 1 to 5) 1: Easy / 5: Hard
Auscultation	Cardiac and pulmonary auscultation	Failure: 0 Success: 1	Difficulty (from 1 to 5) 1: Easy / 5: Hard
Thermometer	Measuring rectal temperature	Failure: 0 Success: 1	Difficulty (from 1 to 5) 1: Easy / 5: Hard
Paws	Manipulating paws	Failure: 0 Success: 1	Difficulty (from 1 to 5) 1: Easy / 5: Hard

802 ^a Each dog received a score of 0 or 1, these scores were used to calculate the percentage of
 803 success of all 25 dogs.

804 **Table 8**

805 Emotional state of dogs in a veterinary practice with the presence or absence of the owner
 806 during the exploration phase. Results are expressed as the standard error of the mean.

Behaviours (units)	Owner: present condition	Owner: absent condition	t	<i>P</i>	1-β (%)
Entering room (score)	3.24 ± 0.76	2.72 ± 1.27	-2.7	0.012	100
Emotional State (score)	1.76 ± 0.63	2.22 ± 0.69	3.682	0.001	69.2

807 Entering room, Rated apparent comfort in entering the room (1 = Dog has to be drawn to
 808 enter, 5 = Dog enters voluntarily, pulls on leash; also see Table 5); Emotional State, Rated
 809 emotional states of dogs (1 = Relaxed: No or low frequency of movement, with no visual
 810 evidence of tension in the body, 2 = Aroused: Tense, with high frequency of movement, but
 811 no visual evidence of anxious behaviours, 3 = Tense, with licking, yawning, crying, agitation
 812 or observable fearful posture; also see Table 4).

813 **Table 9**

814 Behaviour of dogs in a veterinary practice with the presence or absence of the owner during
 815 the examination phase.

Behaviours (units)		Owner: present condition	Owner: absent condition	t	P	1-β (%)
Behaviour towards veterinarian and/or assistant						
Contact - V+A	Duration (% time)	2.33 ± 4.91	1.34 ± 3.86	-2.187	0.039	12.2
Behaviour towards owner and/or door						
Gaze - Door	Duration (% time)	12.46 ± 9.56	25.15 ± 13.52	3.813	0.0008	96.9
Gaze O+Ad	Duration (% time)	37.32 ± 19.33	21.64 ± 12.17	3.342	0.0008	93

816 Contact V+A, Sum of percentages of time spent in contact with veterinarian (V) and/or
 817 assistant (A); Gaze O+Ad, Sum of percentages of time spent gazing at owner (O) when
 818 present or straight ahead (Ad) when absent; % time, Percentage of time (behaviour
 819 duration/phase duration; also see Table 3). Results are expressed as the standard error of the
 820 mean. Non-significant results are not presented.

821 **Table 10**

822 Behaviour of dogs in a consultation room with the presence or absence of the owner during
 823 the greeting phase.

Behaviours (units)		Owner: present condition	Owner: absent condition	t	P	1-β (%)
Behav. Tow. Owner	Duration (% time)	129.24 ± 50.70	170.76 ± 49.70	3.455	0.002	83.3
Reunion / Dog	Score	3.11 ± 1.29	4.24 ± 0.79	5.106	0.00003	96.2
Gaze - Door	Duration (% time)	8.12 ± 8.95	12.32 ± 13.50	1.818	0.081	25.4

824 Behav. Tow. Owner, Behaviour Towards Owner, Sum of percentages of time spent gazing at,
 825 having contact with, and seeking proximity to the owner (also see Table 3); Reunion / Dog,
 826 Rated greeting intensity by dog towards owner (1 = indifferent, 5 = very happy, jumps on the
 827 owner, seeks contact; also see Table 5); % time, Percentage of time (behaviour duration/phase
 828 duration); Gaze – Door, Percentage of time spent gazing at the door. Results are expressed as
 829 the standard error of the mean. Non-significant results are not presented.

830 **Figure legends**

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832 Fig. 1. Image of the experimental room, with the two videos assembled in a single image.

833 Left: 'Owner: absent condition'. Right: 'Owner: present condition'

834

835 Fig. 2. Layout of the experimental room. A: veterinarian's chair, B: assistant's chair, C:

836 owner's chair, X: owner's position during the veterinary examination

837

838 Fig. 3. Image of the standardised restraint by the assistant on the examination table. One hand

839 on the chest and another on the base of the tail, with the minimal necessary strength to keep

840 the dog sitting or standing on the table.

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843 **Appendix A**

844 Sex of dogs

	Number of female	Number of male	Total
Number of neutered dog	9 (36 %)	8 (32 %)	17 (68%)
Number of entire dog	3 (12 %)	5 (2 %)	8 (32 %)
Total	12 (48 %)	13 (52 %)	25 (100%)

845

846 Age of dogs

	Number of dogs
1 to 3 years	12 (48 %)
4 to 6 years	10 (40 %)
7 to 9 years	3 (12 %)

9 to 12 years	0 (0%)
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847

848 Sex of owners

	Number of owners
Female	21 (100 %)
Male	0 (0 %)
Total	21 (100 %)

849

850 Age of owners

	Number of owners
Under 25 years	1 (5%)
25 to 40 years	10 (47 %)
41 to 60 years	8 (38 %)
Over 60 years	2 (10%)
TOTAL	21 (100%)

851 Three owners participated with more than one dog.

852

853 **Appendix B**

854 Summary of all studied variables and their availability for the three phases.

Variable	Available in	Available in	Available
	phase 1: exploration	phase 2: examination	in phase 3: greeting
Recorded behaviours			
Scratching	no	yes	yes

Sniffing	no	yes	yes
Low Postures	no	yes	yes
Mouth behaviours	no	yes	yes
Vocalisations	no	yes	yes
Gaze	no	yes	yes
Avoidance	no	yes	no
Situation	no	yes	yes
Movement	no	no	yes
Contact	no	yes	yes
Tail behaviours	no	yes	yes

Behavioural indices

Total Stress	no	yes	yes
Contact V+A	no	yes	yes
Gaze V+A	no	yes	yes
Gaze O+Ad	no	yes	no
Behav. Tow. Owner	no	no	yes

Scores

Emotional State	yes	yes	yes
Entering room	yes	no	no
Reunion/Dog	no	no	yes

Reunion/Owner	no	no	yes
Restraint	no	yes	no
Success of manipulation (eye, ear, mouth, palpation, skin fold, auscultation thermometer, paws)	N/A	yes	N/A
Difficulty of manipulation (eye, ear, mouth, palpation, skin fold, auscultation thermometer, paws)	N/A	yes	N/A

855 Contact V+A, Sum of percentages of time dog spent in contact with veterinarian (V) and/or assistant
856 (A); Gaze V+A, Sum of percentages of time dog spent gazing at veterinarian (V) and/or assistant (A);
857 Gaze O+Ad, Sum of percentages of time spent gazing at owner (O) when present or straight ahead (Ad
858) when absent; Behav. Tow. Owner, Sum of percentages of time dog spent gazing at, having contact
859 with, and seeking proximity to the owner; Emotional State, Rated emotional states of dogs (1 =
860 Relaxed: No or low frequency of movement, with no visual evidence of tension in the body, 2 =
861 Aroused: Tense, with high frequency of movement, but no visual evidence of anxious behaviours, 3 =
862 Tense, with licking, yawning, crying, agitation or observable fearful posture); Entering room, Rated
863 apparent comfort in entering the room (1 = Dog has to be drawn to enter, 5 = Dog enters voluntarily,
864 pulls on leash); Reunion / Dog, Rated greeting intensity by dog towards owner (1 = indifferent, 5 =
865 very happy, jumps on the owner, seeks contact); Reunion/Owner, Rated greeting intensity by owner
866 towards dog (1 = Indifferent, 5 = Talks to the dog, pets the dog a lot); Restraint, Rated levels of dog
867 restraint performed by the assistant (1=Low, 3=High);

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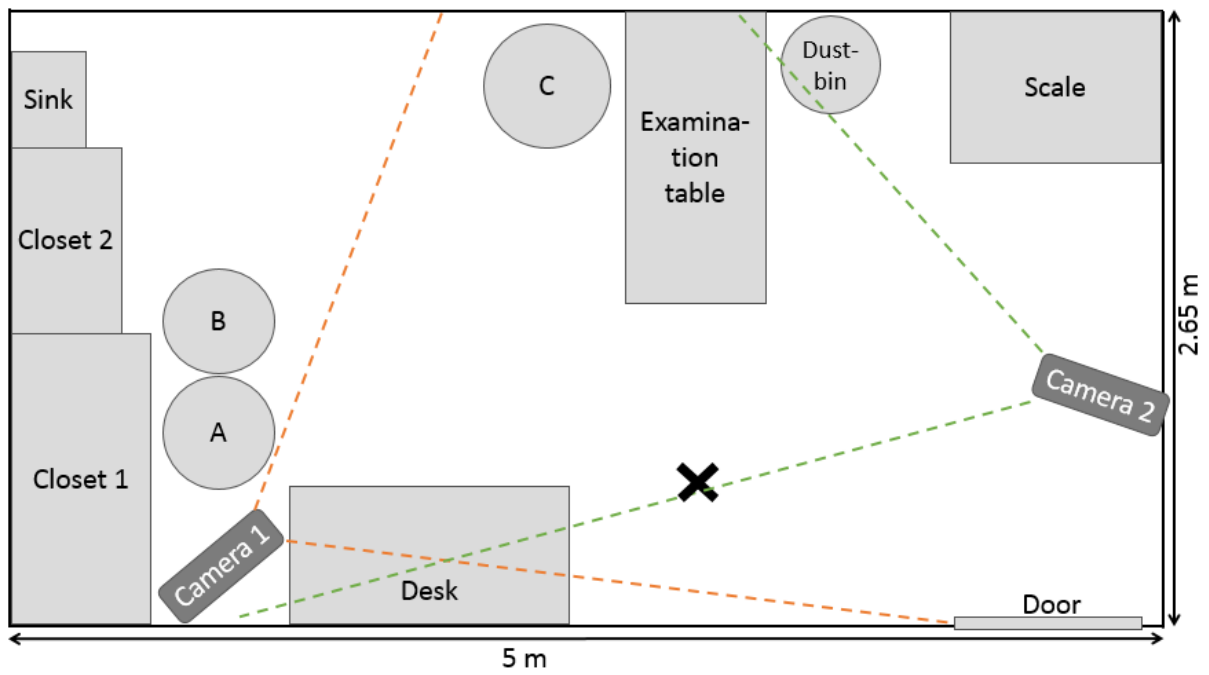
881 Figure 1



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884 Figure 2

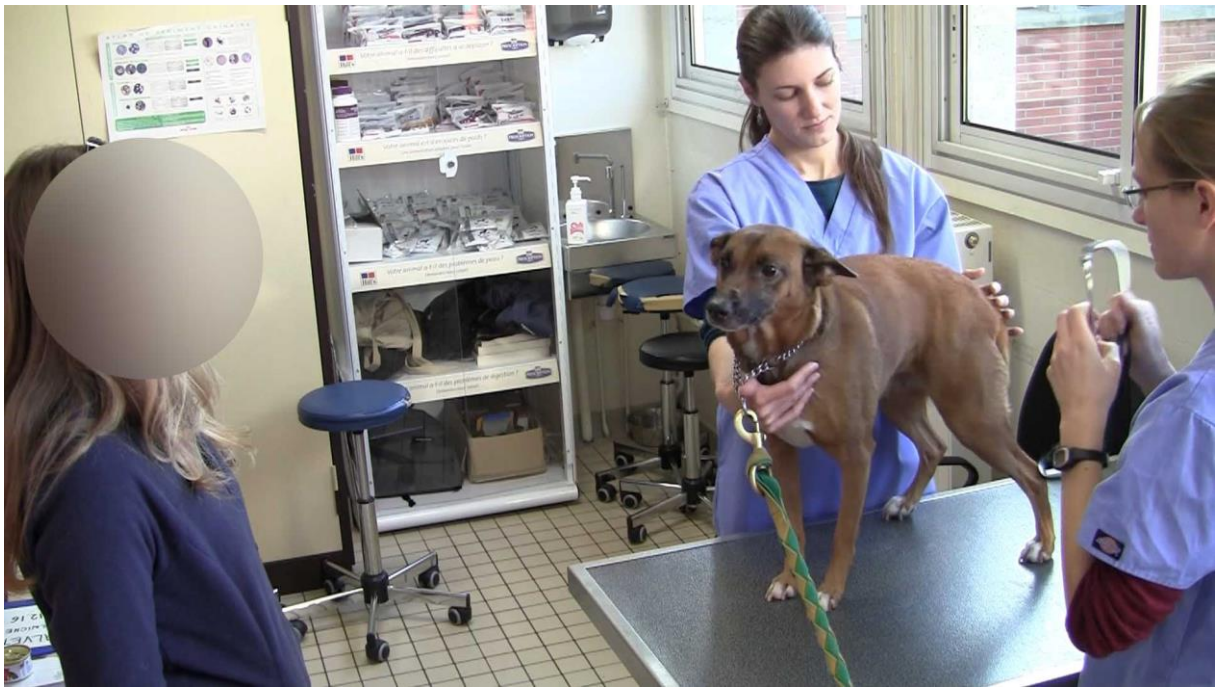


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888 Figure 3



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