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► **To cite this version:**

M. Helsly, N. Priymenko, C. Girault, C. Duranton, F. Gaunet. Dog behaviours in veterinary consultations: Part II. The relationship between the behaviours of dogs and their owners. *Veterinary Journal*, 2022, 281, pp.105789. 10.1016/j.tvjl.2022.105789 . hal-03823551

HAL Id: hal-03823551

<https://hal.science/hal-03823551v1>

Submitted on 21 Oct 2022

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1 **Original Article**

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4 **Dog behaviours in veterinary consultations: Part II. The relationship between the**
5 **behaviours of dogs and their owners**

6

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22 **Abstract**

23 Dogs synchronise their behaviour with those of their owners when confronted with an
24 unfamiliar situation and interactions with their owners have been shown to decrease the dogs'
25 stress levels in some instances. However, whether owners may help manage dogs' anxiety
26 during veterinary consultations remains unclear. In Part I, we compared the behaviour of dogs
27 in the presence or absence of their owners during consultations, which consisted in three
28 phases: exploration, examination, and greeting. Our findings suggest that allowing owners to
29 attend consultations may be beneficial for dogs. In Part II, we investigated the direct
30 relationship between owners' actions and their dog's behaviour. Using the videos from Part I,
31 we examined whether 1) dogs interact more when their owner is more interactive; 2) owners'
32 stress scores are related to dogs' stress-related behaviour and emotional state; 3) owners'
33 actions influence dogs' stress-related behaviours, emotional state and tolerance to
34 manipulations; 4) dogs' stress-related behaviours and emotional state are associated with
35 increased eye contact with their owners. We analysed the recordings of twenty-nine dog-
36 owner dyads submitted to a veterinary consultation in Part I. The behaviours of the dogs and
37 their owners were analysed, and their emotional states were scored. The ease of manipulations
38 was also scored.

39

40 Despite limitations (e.g. no physical contact during examinations, no invasive
41 procedures, aggressive dogs excluded, no male owners, limited sample size), our study
42 showed a link between dog and owner behaviours: when owners attended an examination,
43 their negative behaviours intensified the signs of anxiety in their dogs. Additionally, visual
44 and verbal attempts to comfort their dog had no significant effect. However, we observed that
45 the more dogs displayed stress-related behaviours, the more they established eye contact with
46 their owners, suggesting that dogs seek information (through social referencing) or
47 reassurance from their owners.

48

49 *Keywords:* Behaviour; Dog; Owner-dog interaction; Stress; Veterinary examination

50 **Introduction**

51 Recent studies have shown that the behaviour of owners can directly influence the
52 actions of their dog through synchronisation and social referencing (Merola et al., 2012a;
53 Duranton and Gaunet, 2015; Duranton et al., 2017; Duranton et al., 2018). Two individuals
54 are said to be synchronised when they change their actions at the same time (temporal
55 synchrony), when they perform the same action within a short lapse of time (activity
56 synchrony), or when they act at the same time in the same location (local synchrony)
57 (Duranton and Gaunet, 2015). In various studies, dogs have shown synchronised behaviour by
58 staying still and then moving when their owners were still and then moved, mostly while the
59 dogs were near their owner (Duranton et al., 2017; Duranton et al., 2018). Dogs have also
60 been found to gaze in the same direction as their owners (Duranton et al., 2017).

61
62 Dogs also synchronise their actions with their owners when facing a stressor. This
63 behaviour relies on social referencing: when confronted with an unfamiliar or stressful
64 situation, individuals seek information from others to form their own judgement and base
65 their actions (Merola et al., 2012a). This process has two components: alternating gazes
66 between the stimulus and the informing individual, and behavioural synchronisation. Dogs
67 gaze alternately between an unfamiliar object or person and their owner (Merola et al. 2012a,
68 b; Duranton et al. 2016). Moreover, dogs move closer to an object or person when their owner
69 display a positive emotional message and approaches it themselves rather than when they
70 display a negative emotional message and move away from it (Merola et al. 2012a, b;
71 Duranton et al. 2016). Thus, when dogs face a stressor, their owners can play a key role in
72 determining their reactions.

73

74 In veterinary practice, the vast majority of dogs show a behavioural stress response
75 (Stanford, 1981; Beaver, 1999; Döring et al., 2009, Mariti et al., 2017) during examination,

76 which we believe is important to alleviate. When dogs are stressed, they cannot be easily
77 handled or examined properly. Veterinarians and owners may also be injured. In two previous
78 studies, it was shown that almost one in four dogs only underwent a partial examination due
79 to their behaviour, while 16 to 18% of dogs demonstrated aggressive behaviour during
80 examination (Stanford, 1981; Glardon et al., 2010). In Australia, 48% of veterinarians
81 declared that they had been bitten by a dog at work between one and five times in the
82 previous 12 months (Fritschi et al., 2006).

83

84 It is unclear whether owner's actions can facilitate the work of veterinarians; little
85 research has been conducted on this subject. Scolding, punishing and physical reprimand are
86 known to increase anxiety, fear and aggression in dogs (Hsu and Sun, 2010; Ziv, 2017) and a
87 stressed owner, or punishment may increase the dog's stress levels and aggression (Herron
88 and Shreyer, 2014; Yong and Ruffman, 2014; Huber et al., 2017; Sundman et al., 2019).
89 However, the owner can also provide security and reassurance to their pet (Rehn et al., 2014b;
90 Kerepesi et al., 2015). Therefore, punishment should not be used in the veterinary context and
91 the owner should be present during examinations to positively interact with the dog (Moffat,
92 2008; Edwards et al. 2019).

93

94 To our knowledge, only two previous studies (Csoltova et al., 2017; Stellato et al.,
95 2020) have focused on the relationship between the behaviours of dogs and their owner in the
96 veterinary context. These studies showed that the dogs' heart rates and maximal ocular surface
97 temperatures increased less if their owner was allowed to talk to and pet their dog than when
98 the owner sat silently away from the examination table; dogs also tried to jump off the table
99 less often when interacting with their owners (Csoltova et al., 2017). Dogs vocalised less and
100 had decreased heart rates and lower axillary temperatures when owners attended the

101 examination, but they were not affected by verbal and physical interactions with the owner
102 (Stellato et al., 2020). In spite of their methodological differences, these two studies support
103 the idea that the owner's presence and/or actions may calm the dog during veterinary
104 consultations.

105

106 In Part I (see Girault et al., under review), we examined the effect of the owner's
107 presence or absence on the dogs' behaviours during veterinary consultations, regardless of the
108 owners' actions. Although the dogs' stress-related behaviours during examination were not
109 affected by the presence or absence of owners, our results showed that dogs looked for their
110 owner when they were absent during the examination, and the dogs displayed fewer stress-
111 related behaviours before the examination in the presence of their owner. Dogs also displayed
112 more greeting behaviours after the examination when the owner was absent, suggesting that
113 dogs endured more stress.

114

115 In this study, by extracting new data gathered during the examination and greeting
116 phases from the consultations performed in Part I, we explored whether owners' actions
117 affected their dog's behaviour in the same context. We hypothesised that 1) dogs with more
118 interactive owners would interact more with their owners; 2) owners' and dogs' stress levels
119 would be related; 3) owners' positive actions would be associated with both decreased stress
120 and increased tolerance of veterinary manipulations in dogs, and vice versa; and 4) dogs
121 displaying more stress behaviours would establish more eye contact with their owners.

122

123 **Materials and methods**

124 This study analysed raw data collected in Part I (see Girault et al., under review). The same
125 experimental procedure was used and is described below.

126

127 *Participants*

128 A total of 29 owner-dog dyads participated in the study. All voluntary owners were
129 women. Four of the dyads only took part in the consultation with the owner present and have
130 been included in this study but not in Part I. Participant demographics are shown in Table 1.

131

132 *Experimental procedure*

133 The study protocol was approved by the ethical committee SSA (Science et Santé
134 Animale) n°115 (SSA_2018_008) on 18 July 2018. The experiment took place in an
135 examination room at the National Veterinary School of Toulouse (ENVT), France (see
136 Appendix A: Supplementary material). All dogs underwent a recorded veterinary consultation
137 in the presence of the owner. The veterinary consultations were all carried out by the same
138 two researchers: two female veterinary students, one in the role of the veterinarian (C.G) and
139 the other in the role of the assistant (M.H). The consultations were divided into three main
140 phases: exploration, examination, and greeting (see Girault et al. for the detailed procedure).

141

142 *Exploration phase*

143 The dog was allowed to explore the room freely, while the owner and the researchers sat
144 on chairs and talked. Neither the owner nor the researchers interacted spontaneously with the
145 dog; the owner could nevertheless respond to the dog's requests (physical, verbal and visual
146 interactions were allowed).

147

148 *Examination phase*

149 The researchers performed a standardised examination with the owner standing one
150 metre from the table. Owners were limited to verbal and visual interactions with their dog.

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Greeting phase

The dog and the owner were free to interact (physical, verbal and visual interactions were allowed).

During the three phases, the researchers remained as neutral as possible: they stayed still, did not talk to the dogs, pet them, make eye contact with them, or punish them.

Behavioural analysis

Dog Behaviours

A behavioural repertoire was adapted from the literature to record the stress-related behaviours of dogs (Beerda et al., 1998; Mills et al. 2006; Mariti et al., 2013; Deldalle and Gaunet, 2014; Savalli et al., 2016; Csoltova et al., 2017; see Table 2). However, individuals express their emotional states in different ways (Koolhaas et al., 1999), sometimes by an association of subtle signs which cannot be assessed by the behavioural repertoire. Observer ratings are a means to take a global approach towards animal behaviours to ensure that subtle signs of response to stress are taken into account (Mills et al., 2006; Meagher, 2009). We thus used both behavioural analyses and ratings. We recorded scratching, sniffing, shivering, shaking, low postures, yawning, panting, licking and whining as stress-related behaviours. Percentages of time spent exhibiting each of these behaviours were combined to give a single index called Total Stress (Table 3). The emotional state of the dog was rated using a three-point scale defined as follows: relaxed, aroused, anxious (Table 4). All definitions are given in Tables 2, 3 and 4.

175 We assessed dogs' behaviours towards their owner by observing gazes at the owner,
176 proximity with the owner, and contact with the owner (see Table 2), as dogs display these
177 behaviours to communicate with humans (Miklósi et al., 2000; Miklósi et al., 2003; Gaunet
178 and Deputte, 2011; Gaunet and El Massioui, 2014; Savalli et al., 2014; Savalli et al., 2016) or
179 when stressed (Mariti et al., 2013; Prato-Previde et al., 2003; Palmer and Cunstance, 2008).
180 The percentages of time spent on each of these behaviours were combined into a single index
181 called Behaviours towards owner (Table 3). When reunited with their owners, pets express a
182 large variety of behaviours (Rehn et al., 2014a) which are currently not all under investigation
183 or well understood. Reunions were evaluated in a more global manner by adding a score using
184 a five-point scale as defined in Table 5.

185

186 The dogs' tolerance to veterinary manipulations was assessed with three scores: the
187 level of physical restraint, the success and the difficulty of the manipulations (Tables 6 and 7).

188

189 Owner behaviours

190 Owners spontaneously interact with their dogs by petting them, talking to them, giving
191 them commands and looking at them (Dreschel and Granger, 2005; Cimarelli et al., 2016).

192 The percentages of time that owners spent gazing at their dog, having contact with their dog,
193 and talking positively to their dog (see Table 8 for descriptions of each) were combined into a
194 single index called Positive owner behaviours (Table 3). We also recorded the time spent by
195 the owners talking to their dog in a neutral or negative manner (Table 8). Additionally, since
196 subjective observer ratings may provide a holistic evaluation of a human's emotional state
197 (Elfenbein et al., 2015; Kaurin et al., 2018), we used a five-point scale to evaluate the owner's
198 social support, the owner's stress levels and the intensity of the reunion as defined in Table 5.

199

200 Two other indices were created: Physical contact and Eye contact (Table 3). Physical
201 contact is the total time when the dog and owner were in contact: contact initiated by the
202 owner and/or contact initiated by the dog. Eye contact is the time when the dog and the owner
203 made eye contact: the gaze of the owner met their dog's.

204

205 *Data collection and analysis*

206 Consultations were recorded from the moment when the owner-dog dyad entered the
207 consultation room until the end of the greeting phase (see Girault et al). Owner and dog
208 behaviours were analysed during the examination and greeting phases using the Solomon
209 Coder beta 17.03.22 program¹ (see Appendix A: Supplementary material). The time spent (in
210 seconds) displaying each behaviour was recorded. As phase durations were variable, the
211 durations of behaviours were converted into a time percentage (behaviour duration/phase
212 duration) for all behaviours.

213

214 *Interobserver agreement*

215 Three assessors participated in the video analysis. The two researchers coded all the
216 behaviours in all the videos: half of the behaviours were coded by one researcher, and the
217 other half by the second researcher. To assess the reproducibility of the behavioural analysis, a
218 third assessor who was unaware of the study hypotheses and aims coded 30% of the
219 behaviours of a random subset of 30% of the videos. Considering that a concordance, and not
220 only a correlation, was needed to assess the interobserver reproducibility, Lin's concordance
221 correlation test was used (Barnhart et al., 2002; Barnhart et al., 2007; Lawrence et al., 1989).
222 Interobserver agreement between the two assessors was determined by calculating ρC values
223 and rated according to Landis and Koch (1977) ($\rho C = 0 - 0.2$: slight agreement, $\rho C = 0.21 -$

¹ See : Solomon Coder, András Péter, <https://solomon.andraspeter.com/> (Accessed 13 december 2021).

224 0.4: fair agreement, $\rho C = 0.41 - 0.60$: moderate agreement, $\rho C = 0.61 - 0.8$: substantial
225 agreement, $\rho C > 0.81$: excellent agreement). Lin's concordance correlation coefficients were
226 excellent ($\rho C > 0.98$) for whining, tail between the legs, moving, gazing at the owner, gazing at
227 the dog, contact with the dog and positive talk, and substantial for sniffing ($\rho C = 0.69$).

228

229 Physical restraint was subjectively scored by the assistant; the success and difficulty of
230 the manipulations were subjectively assessed by the veterinarian; and the other scores
231 (emotional states of the dogs and their owners, intensity of the reunion for both the dogs and
232 their owners, owner stress and owner support) were rated by the three assessors.

233

234 *Statistical analysis*

235 The examination and greeting phases were analysed separately. Pearson's correlation
236 tests were used to test for correlations between the behaviours of the owner and the dog using
237 R software².

238

239 **Results**

240 On average, the exploration phase lasted 156.24 ± 11.01 seconds and the examination
241 phase 139.37 ± 16.01 seconds. The greeting phase, standardised in the study, lasted 20
242 seconds. Time spent by the dyad displaying each behaviour as well as the scores are provided
243 in Table 9. Results of the correlations are shown in Table 10.

244

245 *Relationship between the behaviours of dogs and owners towards each other*

246 Examination phase

² See: The R Project for Statistical Computing. <http://www.r-project.org>. (Accessed 13 december 2021)

247 No correlations were found between the owners' positive behaviours towards their dogs
248 and the dogs' behaviour towards their owners (Table 10).

249

250 Greeting phase

251 The owners' positive actions towards their dogs were moderately correlated with the
252 dogs' behaviour towards their owners ($r = 0.52$, $P < 0.05$; Table 10, Fig. 1, and Video 1). The
253 reunion scores of both owners and dogs were also moderately correlated ($r = 0.58$, $P < 0.05$;
254 Table 10).

255

256 *Relationship between owners' and dogs' stress levels*

257 We found no evidence of a correlation between the stress levels of the owners and the
258 stress-related behaviours or emotional states of their dogs in either the examination or the
259 greeting phases (Table 10).

260

261 *Relationship between the owner's positive actions and the dog's stress and tolerance to*
262 *manipulations*

263 Examination phase

264 Neither the duration of the owners' positive behaviours nor the score of the owners'
265 support were significantly linked to their dogs' stress-related behaviours or emotional states
266 (Table 10 and Video 2). Similarly, they were not correlated with easier manipulations (success
267 and difficulty) (Table 10).

268

269 Greeting phase

270 Our data provided no evidence of a correlation between the owners' positive behaviours
271 and their dogs' stress or emotional states. Analysis showed no correlation between physical

272 contact with their owners and the dogs' stress-related behaviours or emotional states (Table
273 10).

274

275 *Relationship between the owners' neutral or negative actions and their dog's stress and*
276 *tolerance to manipulations*

277 Examination phase

278 The owners' neutral or negative verbal interactions had a moderately positive link to the
279 dogs' stress-related behaviours and emotional states ($r = 0.37, P < 0.05$ and $r = 0.38, P < 0.05$,
280 respectively; Table 10, Fig.2, and Video 3). Neutral or negative verbal interactions had no
281 influence on the dogs' tolerance to the manipulations (success and difficulty) and was not
282 related to the degree of avoidance the dogs displayed, nor the level of physical restraint
283 required (Table 10).

284

285 Greeting phase

286 Neutral or negative verbal interactions were not correlated to the dogs' stress-related
287 behaviours or emotional states during this phase (Table 10).

288

289 *Relationship between eye contact and the dogs' stress*

290 Examination phase

291 The dogs' stress-related behaviours and emotional states had a moderately positive
292 relationship to eye contact with the owner (eye contact / total stress: $r = 0.40, P < 0.05$ and
293 eye contact / emotional state: $r = 0.47, P < 0.05$, respectively; Table 10, Fig. 3, and Video 4).

294

295 Greeting phase

296 We found no evidence of correlations between the dogs' stress-related behaviours or
297 emotional states and eye contact during this phase (Table 10).

298

299 **Discussion**

300 The aim of this study was to explore the effect of dog-owner interactions on the
301 behaviour of dogs during a veterinary consultation. We investigated whether pets with
302 interactive owners would interact more with their owners; the relationships between an
303 owner's actions and their dog's stress behaviours and tolerance to manipulations; and the
304 associations between the dogs' stress levels and their eye contact with their owners.

305

306 In our study, positive actions by the owners were not associated with decreased stress-
307 related behaviours and increased acceptance of veterinary manipulations in their dogs, as has
308 been previously described (Dreschel and Granger, 2005; Csoltova et al., 2017; Stellato et al.,
309 2020, Girault et al.). This suggests that reassuring owners do not lessen the anxiety of their
310 dogs. However, the concurrent analysis of physiological parameters (Csoltova et al., 2017) or
311 indirect behaviours (Girault et al.) suggest that interactions with the owner are appeasing. In
312 our study, we instructed the owners to avoid any physical contact with their dogs, which may
313 explain the absence of a noticeable calming effect. Dogs prefer physical contact to vocal
314 praise (Feuerbacher and Wynne, 2015), and petting has been shown to decrease dogs' stress
315 levels (McGreevy et al., 2005) and blood cortisol levels more than verbal interactions alone
316 (Rehn et al., 2014a), including during medical procedures (Hennessy et al., 1998). Our results
317 revealed that visual and verbal interactions are not sufficient to noticeably relax dogs during
318 clinical examinations.

319

320 Neutral and negative verbal interactions with their owners were correlated with
321 increased stress levels in the dogs, but only during the veterinary examination. This finding is
322 consistent with other studies which show that scolding leads to anxiety and stress-related
323 behaviours in dogs (Horowitz, 2009; Mariti et al. 2017; Ziv, 2017). During veterinary
324 examinations, dogs are already placed in an anxiety-provoking situation, and the owner can
325 potentially add to their stress. Our results support the recommendations made by Moffat
326 (2008) and Edwards (2019) that owners should avoid negative interactions with their dog
327 during veterinary visits.

328
329 Another aim of the study was to investigate a possible association between dogs' stress
330 levels and eye contact with their owners. As we predicted, the more dogs were stressed, the
331 more eye contact was established with their owners; both owners and dogs looked at each
332 other during the examination phase. Gazing is widely used by dogs to communicate with
333 humans (Miklósi et al., 2000; Miklósi et al., 2003; Gaunet and Deputte, 2011; Gaunet and El
334 Massioui, 2014; Savalli et al., 2014); and dogs increase their signals when eye contact is
335 established (Gácsi et al., 2004; Savalli et al. 2016). Here, we suggest that pets were attempting
336 to communicate with their owners: dogs seek information from their owners when confronted
337 with an unexpected situation by means of referential gazing (Merola et al. 2012a, b; Duranton
338 et al. 2016). It has also been shown that animals who are less confident gaze more frequently
339 at their social referent (Merola et al., 2012a) and look at this person for a longer time when
340 they fail to understand the cue, searching for more information (Yong and Ruffman, 2015). In
341 this study, dogs were put into the unfamiliar situation of a clinical examination, so it is likely
342 that they looked at their owners to determine how to deal with this situation. Another
343 interpretation of this behaviour is that owners provide reassurance to their pet in threatening
344 situations, for example when dogs are approached by an unknown stranger (Gácsi et al., 2013;

345 Kerepesi et al., 2015). Additionally, recent studies suggest that gazing plays a role in the
346 attachment behaviour between owners and their dogs and induces a mutual release of
347 oxytocin , which has a stress-buffering effect (Nagasawa et al., 2009, 2017). Increased eye
348 contact in our study may therefore reflect a pet's attempt to seek comfort from its owner. On
349 the human side, owners recognize when their dogs are stressed (Tami and Gallagher, 2009;
350 Mariti et al., 2012) and try to comfort them in stressful situations (Dreschel and Granger,
351 2005). Here, we suggest that owners looked at their dogs frequently in order to check on their
352 emotional state and reassure them.

353

354 The behaviours that the owners and dogs displayed towards each other were related
355 during the greeting phase. A number of studies have revealed that dogs greet their owners
356 after a period of separation (Topál et al., 1998; Konok et al., 2011; Rehn et al., 2014a), and the
357 more the owners interact with their dog, the more the dogs exhibit proximity-seeking
358 behaviours and initiate contact when they are reunited (Rehn et al., 2014b). In this study, dogs
359 were physically distanced from their owners, and they experienced additional stress when
360 they underwent veterinary manipulations. After the examination, dogs and owners greeted
361 each other by approaching one another, initiating physical contact, vocalising and verbal
362 interactions. Our results provide evidence that owners and dogs synchronised their
363 behaviours. Such findings, observed during the greeting phase, were not observed during the
364 veterinary examination however, possibly due to the choice to not authorise physical contact,
365 thus restraining the dyads' behaviours.

366

367 Finally, we anticipated that the stress levels of the owners and their dogs would be
368 correlated. In one study, 26% of owners declared that thinking about bringing their dog to the
369 vet was stressful (Volk et al., 2011), and owners have been shown to transmit their stress to

370 their pet via emotional contagion (Yong, 2014; Cunningham, 2017; Huber, 2017; Katayama
371 2019; Sundman, 2019). Our findings do not reveal such an association during either the
372 examination or the greeting phase. One possible reason for this is the low stress level of the
373 owners in the context of this study. We performed simple clinical examinations on healthy
374 dogs, and owners were told prior to the consultation that the manipulations would be short
375 and painless. Owners were not given specific instructions on how to behave with their dogs,
376 except to avoid physical contact during the examination phase. As a consequence, the vast
377 majority of owners showed a low level of stress. Whether the same observation would be
378 made during real veterinary consultations on sick animals is not known. As invasive medical
379 procedures on unhealthy dogs may constitute a greater stressor for the owner, further research
380 in this context is necessary.

381

382 **Conclusions**

383 The aim of this study was to observe owner-dog dyads in veterinary consultations and
384 identify correlations between dog and owner behaviours. Although no relationship was found
385 between the stress levels of the owners and their dogs during the consultations, their
386 behaviours towards each other were linked during the greeting phase. Our findings indicate
387 that scolding by the owner during the clinical examination should be avoided as it heightens
388 the animal's anxiety. Visual and verbal positive interactions alone do not induce noticeable
389 relaxation in dogs during this phase. However, increased eye contact within the dyad suggests
390 that while they are being examined, anxious dogs look for social information or reassurance
391 from their owners. Our results therefore support the hypothesis that it is beneficial to dogs'
392 welfare when owners interact positively with their pets during veterinary consultations.

393

394 **Conflict of interest statement**

395 None of the authors has any financial or personal relationships that could
396 inappropriately influence or bias the content of this paper.

397

398 **Acknowledgment**

399 We are grateful to Elodie Losserand who helped during this study. We thank all the dog
400 owners who voluntarily participated. We are also grateful to Caniplex, Bagat-en-Quercy,
401 France, for providing thank-you gifts for all volunteers. Preliminary results were presented
402 during a confidential veterinary thesis defence at the Ecole Nationale Vétérinaire de Toulouse
403 on 13 December 2017.

404

405 **Supplementary material**

406 Supplementary data associated with this article can be found in the online version at doi: ...

407

408 **References**

- 409 Barnhart, H.X., Haber, M., Song, J., 2002. Overall concordance correlation coefficient for
410 evaluating agreement among multiple observers. *Biometrics* 58, 1020-7.
411
- 412 Barnhart, H.X., Haber, M.J., Lin, L.I., 2007. An overview on assessing agreement with
413 continuous measurements. *Journal of Biopharmaceutical Statistics* 17, 529-69.
414
- 415 Beaver, B.V., 1999. In: *Canine behavior: a guide for veterinarians*. Philadelphia: W.D.
416 Saunders Company.
417
- 418 Beerda, B., Schilder, M.B.H., Van Hooff, J.A., De Vries, H.W., Mol, J.A., 1998. Behavioural,
419 saliva cortisol and heart rate responses to different types of stimuli in dogs. *Applied*
420 *Animal Behaviour Science* 58, 365–381.
421
- 422 Cimarelli, G., Turcsán, B., Bánlaki, Z., Range, F. and Virányi, Z., 2016. Dog Owners’
423 Interaction Styles: Their Components and Associations with Reactions of Pet Dogs to
424 a Social Threat. *Frontiers in Psychology* [online], 7.
425
- 426 Cunningham, K., 2017. Hormonal Synchronization of Cortisol Levels and Emotional
427 Contagion Between Human Owners and Agility Dogs. PhD Thesis. University of
428 Nebraska at Omaha.
429

- 430 Csoltova, E., Martineau, M., Boissy, A., Gilbert, C., 2017. Behavioral and physiological
431 reactions in dogs to a veterinary examination: Owner-dog interactions improve
432 canine well-being. *Physiology & Behavior* 177, 270–281.
433
- 434 Deldalle, S., Gaunet, F., 2014. Effects of 2 training methods on stress-related behaviors of the
435 dog (*Canis familiaris*) and on the dog–owner relationship. *Journal of Veterinary*
436 *Behavior: Clinical Applications and Research* 9, 58–65.
437
- 438 Döring, D., Roscher, A., Scheipl, F., Küchenhoff, H., Erhard, M.H., 2009. Fear-related
439 behaviour of dogs in veterinary practice. *The Veterinary Journal* 182, 38–43.
440
- 441 Dreschel, N.A., Granger, D.A., 2005. Physiological and behavioral reactivity to stress in
442 thunderstorm-phobic dogs and their caregivers. *Applied Animal Behaviour Science*
443 95, 153–168.
444
- 445 Drobatz, J.K. and Smith, G., 2003. Evaluation of risk factors for bite wounds inflicted on
446 caregivers by dogs and cats in a veterinary teaching hospital. *Journal of the American*
447 *Veterinary Medical Association* 223, 312–316.
448
- 449 Duranton, C., Bedossa, T., Gaunet, F., 2016. When facing an unfamiliar person, pet dogs
450 present social referencing based on their owners’ direction of movement alone.
451 *Animal Behaviour* 113, 147–156.
452
- 453 Duranton, C., Bedossa, T., Gaunet, F., 2017. Interspecific behavioural synchronization: dogs
454 exhibit locomotor synchrony with humans. *Scientific Reports* 7.
455
- 456 Duranton, C., Bedossa, T., Gaunet, F., 2018. Pet dogs synchronize their walking pace with
457 that of their owners in open outdoor areas. *Animal cognition* 21, 219–226.
458
- 459 Duranton, C., Gaunet, F., 2015. *Canis sensitivus*: Affiliation and dogs’ sensitivity to others’
460 behavior as the basis for synchronization with humans? *Journal of Veterinary*
461 *Behavior: Clinical Applications and Research* 10, 513–524.
462
- 463 Edwards, P. T., Smith, B. P., McArthur, M. L., Hazel, S. J., 2019. Fearful Fido: Investigating
464 dog experience in the veterinary context in an effort to reduce distress. *Applied*
465 *Animal Behaviour Science* 213, 14–25.
466
- 467 Elfenbein, H. A., Barsade, S. G. and Eisenkraft, N., 2015. The social perception of emotional
468 abilities: Expanding what we know about observer ratings of emotional intelligence.
469 *Emotion*, 15, 17–34.
470
- 471 Feuerbacher, E.N., Wynne, C.D.L., 2015. Shut up and pet me! Domestic dogs (*Canis lupus*
472 *familiaris*) prefer petting to vocal praise in concurrent and single-alternative choice
473 procedures. *Behavioural Processes* 110, 47–59.
474
- 475 Firnkes, A., Bartels, A., Bidoli, E., Erhard, M., 2017. Appeasement signals used by dogs
476 during dog–human communication. *Journal of Veterinary Behavior: Clinical*
477 *Applications and Research* 19, 35–44.
478

- 479 Fritschi, L., Day, L., Shirangi, A., Robertson, I., Lucas, M., Vizard, A., 2006. Injury in
480 Australian veterinarians. *Occupational Medicine* 56, 199-203.
481
- 482 Gácsi, M., Miklósi, Á., Varga, O., Topál, J., Csányi, V., 2004. Are readers of our face readers
483 of our minds? Dogs (*Canis familiaris*) show situation-dependent recognition of
484 human's attention. *Animal Cognition* 7, 144–153.
485
- 486 Gácsi, M., Maros, K., Sernkvist, S., Faragó, T., Miklósi, Á., 2013. Human Analogue Safe
487 Haven Effect of the Owner: Behavioural and Heart Rate Response to Stressful Social
488 Stimuli in Dogs. *PLoS ONE* 8, p. e58475.
489
- 490 Gaunet, F., Deputte, B.L., 2011. Functionally referential and intentional communication in the
491 domestic dog: effects of spatial and social contexts. *Animal Cognition* 14, 849–860.
492
- 493 Gaunet, F., El Massioui, F., 2014. Marked referential communicative behaviours, but no
494 differentiation of the “knowledge state” of humans in untrained pet dogs versus 1-
495 year-old infants. *Animal cognition* 17, 1137-1147.
496
- 497 Girault, C., Duranton, C., Helsly, M., Priymenko, N., Gaunet, F. Dog behaviours in veterinary
498 consultations: Part I. Effect of owner presence or absence. Under review.
499
- 500 Glardon, O.J., Hartnack, S., Horisberger, L., 2010. Analyse du comportement des chiens et
501 des chats pendant l'examen physique en cabinet vétérinaire. *Schweizer Archiv für*
502 *Tierheilkunde* 152, 69–75.
503
- 504 Hennessy, M.B., Williams, M.T., Miller, D.D., Douglas, C.W., Voith, V.L., 1998. Influence of
505 male and female petters on plasma cortisol and behaviour: can human interaction
506 reduce the stress of dogs in a public animal shelter? *Applied Animal Behaviour*
507 *Science* 61, 63–77.
508
- 509 Herron, M. E. and Shreyer, T., 2014. The Pet-friendly Veterinary Practice. *Veterinary Clinics*
510 *of North America: Small Animal Practice* 44, 451–481.
511
- 512 Hibel, L. C. and Mercado, E., 2019. Marital Conflict Predicts Mother-to-Infant Adrenocortical
513 Transmission. *Child Development* 90, e80–e95.
514
- 515 Horowitz, A., 2009. Disambiguating the “guilty look”: Salient prompts to a familiar dog
516 behaviour. *Behavioural Processes* 81, 447–452.
517
- 518 Hsu, Y., Sun, L., 2010. Factors associated with aggressive responses in pet dogs. *Applied*
519 *Animal Behaviour Science* 123, 108–123.
520
- 521 Huber, A., Barber, A. L. A., Faragó, T., Müller, C. A. and Huber, L., 2017. Investigating
522 emotional contagion in dogs (*Canis familiaris*) to emotional sounds of humans and
523 conspecifics. *Animal Cognition* 20, 703–715.
524
- 525 Katayama, M., Kubo, T., Yamakawa, T., Fujiwara, K., Nomoto, K., Ikeda, K., Mogi, K.,
526 Nagasawa, M. and Kikusui, T., 2019. Emotional Contagion From Humans to Dogs Is
527 Facilitated by Duration of Ownership. *Frontiers in Psychology* [online], 10.
528

529 Kaurin, A., Sauerberger, K. S. and Funder, D. C., 2018. Associations between informant
530 ratings of personality disorder traits, self-reports of personality, and directly observed
531 behavior. *Journal of Personality*, 86, 1078–1101.
532

533 Kerepesi, A., Dóka, A., Miklósi, Á., 2015. Dogs and their human companions: The effect of
534 familiarity on dog–human interactions. *Behavioural Processes* 110, 27–36.
535

536 Konok, V., Dóka, A., Miklósi, Á., 2011. The behavior of the domestic dog (*Canis familiaris*)
537 during separation from and reunion with the owner: A questionnaire and an
538 experimental study. *Applied Animal Behaviour Science* 135, 300–308.
539

540 Koolhaas, J. M., Korte, S. M., De Boer, S. F., Van Der Vegt, B. J., Van Reenen, C. G.,
541 Hopster, H., De Jong, I. C., Ruis, M. A. W. and Blokhuis, H. J., 1999. Coping styles in
542 animals: current status in behavior and stress-physiology. *Neuroscience &*
543 *Biobehavioral Reviews* 23, 925–935.
544

545 Landis, J.R., Koch, G.G., 1977. The measurement of observer agreement for categorical data.
546 *Biometrics*, 159-174.
547

548 Lawrence, I., Lin, L.I., 1989. A concordance correlation coefficient to evaluate
549 reproducibility. *Biometrics* 255-268.
550

551 Mariti, C., Gazzano, A., Moore, J.L., Baragli, P., Chelli, L., Sighieri, C., 2012. Perception of
552 dogs' stress by their owners. *Journal of Veterinary Behavior: Clinical Applications*
553 *and Research* 7, 213–219.
554

555 Mariti, C., Ricci, E., Zilocchi, M., Gazzano, A., 2013. Owners as a secure base for their dogs.
556 *Behaviour* 150, 1275–1294.
557

558 Mariti, C., Pierantoni, L., Sighieri, C., Gazzano, A., 2017. Guardians' perceptions of dogs'
559 welfare and behaviors related to visiting the veterinary clinic. *Journal of Applied*
560 *Animal Welfare Science* 20, 24-33.
561

562 McGreevy, P.D., Righetti, J., Thomson, P.C., 2005. The reinforcing value of physical contact
563 and the effect on canine heart rate of grooming in different anatomical areas.
564 *Anthrozoös* 18, 236–244.
565

566 Meagher, R. K., 2009. Observer ratings: Validity and value as a tool for animal welfare
567 research. *Applied Animal Behaviour Science*, 119, 1-14.
568

569 Merola, I., Prato-Previde, E., Marshall-Pescini, S., 2012a. Social referencing in dog-owner
570 dyads? *Animal Cognition* 15, 175–185.
571

572 Merola, I., Prato-Previde, E., Marshall-Pescini, S., 2012b. Dogs' social referencing towards
573 owners and strangers. *PloS one* 7, e47653.
574

575 Miklósi, Á., Kubinyi, E., Topál, J., Gácsi, M., Virányi, Z., Csányi, V., 2003. A simple reason
576 for a big difference: wolves do not look back at humans, but dogs do. *Current*
577 *biology* 13, 763–766.
578

579 Miklósi, A., Polgárdi, R., Topál, J., Csányi, V., 2000. Intentional behaviour in dog-human
580 communication: an experimental analysis of “showing” behaviour in the dog. *Animal*
581 *cognition* 3, 159–166.
582

583 Mills, D.S., Ramos, D., Estelles, M.G., Hargrave, C., 2006. A triple blind placebo-controlled
584 investigation into the assessment of the effect of Dog Appeasing Pheromone (DAP)
585 on anxiety related behaviour of problem dogs in the veterinary clinic. *Applied*
586 *Animal Behaviour Science* 98, 114–126.
587

588 Moffat, K., 2008. Addressing Canine and Feline Aggression in the Veterinary Clinic.
589 *Veterinary Clinics of North America: Small Animal Practice* 38, 983–1003.
590

591 Nagasawa, M., Mogi, K., Kikusui, T., 2009. Attachment between humans and dogs:
592 Attachment between humans and dogs. *Japanese Psychological Research*.
593 September 2009. Vol. 51, no. 3, p. 209–221.
594

595 Nagasawa, M., Ogawa, M., Mogi, K., Kikusui, T., 2017. Intranasal Oxytocin Treatment
596 Increases Eye-Gaze Behavior toward the Owner in Ancient Japanese Dog Breeds.
597 *Frontiers in Psychology* [online], 8.
598

599 Palmer, R. and Custance, D., 2008. A counterbalanced version of Ainsworth’s Strange
600 Situation Procedure reveals secure-base effects in dog–human relationships. *Applied*
601 *Animal Behaviour Science* 109, 306–319.
602

603 Prato-Previde, E., Custance, D. M., Spiezo, C. and Sabatini, F., 2003. Is the dog-human
604 relationship an attachment bond? An observational study using Ainsworth’s strange
605 situation. *Behaviour* 140, 225–254.
606

607 Rehn, T., Handlin, L., Uvnäs-Moberg, K., Keeling, L. J., 2014a. Dogs’ endocrine and
608 behavioural responses at reunion are affected by how the human initiates contact.
609 *Physiology & Behavior* 124, 45–53.
610

611 Rehn, T., Lindholm, U., Keeling, L., Forkman, B., 2014b. I like my dog, does my dog like
612 me? *Applied Animal Behaviour Science* 150, 65–73.
613

614 Savalli, C., Ades, C., Gaunet, F., 2014. Are Dogs Able to Communicate with Their Owners
615 about a Desirable Food in a Referential and Intentional Way? *PLoS ONE* 9, e108003.
616

617 Savalli, C., Resende, B., Gaunet, F., 2016. Eye Contact Is Crucial for Referential
618 Communication in Pet Dogs. *PLOS ONE* 11, e0162161.
619

620 Standford, T.L., 1981. Behavior of dogs entering a veterinary clinic. *Applied Animal Ethology*
621 7, 271–279.
622

623 Stellato, A. C., Dewey, C. E., Widowski, T. M., Niel, L., 2020. Evaluation of associations
624 between owner presence and indicators of fear in dogs during routine veterinary
625 examinations. *Journal of the American Veterinary Medical Association* 257, 1031-
626 1040.
627

- 628 Sundman, A-S., Van Poucke, E., Svensson Holm, A-C., Faresjö, Å., Theodorsson, E., Jensen,
629 P. and Roth, L. S. V., 2019. Long-term stress levels are synchronized in dogs and
630 their owners. *Scientific Reports* [online], 9.
631
- 632 Tami, G., Gallagher, A., 2009. Description of the behaviour of domestic dog (*Canis familiaris*)
633 by experienced and inexperienced people. *Applied Animal Behaviour Science* 120,
634 159–169.
635
- 636 Topál, J., Miklósi, Á., Csányi, V., Dóka, A., 1998. Attachment behavior in dogs (*Canis*
637 *familiaris*): a new application of Ainsworth's (1969) Strange Situation Test. *Journal*
638 *of comparative psychology* 112, 219.
639
- 640 Volk, J. O., Felsted, K. E., Thomas, J. G. and Siren, C. W., 2011. Executive summary of the
641 Bayer veterinary care usage study. *Journal of the American Veterinary Medical*
642 *Association* 238, 1275–1282.
643
- 644 Walker, R., Fisher, J., Neville, P., 1997. The treatment of phobias in the dog. *Applied Animal*
645 *Behaviour Science* 52, 275–289.
646
- 647 Waters, S. F., West, T. V., & Mendes, W. B., 2014. Stress contagion: Physiological covariation
648 between mothers and infants. *Psychological Science* 25, 934–942.
649
- 650 Yong, M. H. and Ruffman, T., 2014. Emotional contagion: Dogs and humans show a similar
651 physiological response to human infant crying. *Behavioural Processes* 108, 155–165.
652
- 653 Yong, M. H. and Ruffman, T., 2015. Is that fear? Domestic dogs' use of social referencing
654 signals from an unfamiliar person. *Behavioural Processes* 110, 74–81.
655
- 656 Ziv, G., 2017. The effects of using aversive training methods in dogs—A review. *Journal of*
657 *Veterinary Behavior: Clinical Applications and Research* 19, 50–60.

658 **Table 1**

659 Participant demographics and dyad characteristics.

660

Characteristics of dogs				Characteristics of owners
Dog	Age (years)	Sex	Breed	Age (years)
1	3	FN	Mixed shepherd	25-40
2	1	MN	Mixed retriever	25-40
3	4	FN	Cavalier King Charles	41-60
4	2.5	FN	Beauceron	25-40
5	3	FN	Schapendoes	< 25
6	5	FE	Mixed terrier	25-40
7	5	FN	Mixed terrier	> 60 ^a
8	5	ME	Mixed terrier	> 60 ^a
9	7.5	MN	Labrador	41-60
10	2.5	ME	Boxer	25-40
11	7	FN	Boxer	41-60
12	5	MN	Mixed terrier	25-40 ^a
13	6	MN	Mini Australian shepherd	25-40 ^a
14	2.5	MN	Whippet	25-40
15	2	ME	Boxer	41-60
16	2	MN	French Bulldog	41-60
17	1.5	ME	German shepherd	41-60
18	7	FN	Spitz	25-40
19	2	FE	Boxer	41-60
20	10	FN	Papillon	> 60 ^a
21	4	MN	Whippet	> 60 ^a
22	5	FN	Mixed terrier	41-60
23	3.5	FN	Cotton Tulear	25-40
24	3.5	MN	White Swiss shepherd	25-40
25	9	FN	Australian shepherd	41-60 ^a
26	5	FN	Australian shepherd	41-60 ^a
27	3	FN	Australian shepherd	41-60 ^a
28	4	FE	Groenendael	25-40
29	5	ME	Malinois	41-60

661 F, Female; M, Male, N, Neutered; E, Entire.

662 ^aOwners participating with more than one dog.

663

664 **Table 2**

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

666

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 owner	The dog gazed with its head oriented towards its owner
Avoidance (exclusive behaviours)	
Avoidance	The dog stepped backwards away from the veterinarian or the assistant following one of their actions
Situation (exclusive behaviours)	
Situation / owner	Half of the dog's body (head and chest) was situated less than 50 cm from its owner
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 with owner	The dog intentionally touched its owner

667 ^aStress-related behaviour

668

669 **Table 3**

670 Behavioural indices calculated using several behaviours from Tables 2 and 8.

671

Index (Unit)	Definition	Formula
Total Stress (%)	Sum of percentages of time spent yawning, panting, scratching, adopting low posture, shaking, sniffing, whining, barking and licking	Total Stress (%) = Yawning (%) + Panting (%) + Scratching (%) + Low postures (%) + Shaking (%) + Sniffing (%) + Whining (%) + Barking (%) + Licking (%)
Positive owner behaviours (%)	Sum of percentages of time spent gazing at dog, having contact with dog, and talking positively	Positive owner behaviours (%) = Gaze at Dog (%) + Contact with Dog (%) + Positive verbal interactions (%)
Physical contact (%)	Time dog and owner spent in contact: contact with owner and/or contact with dog	Physical contact (%) = Contact with Owner (%) + Contact with Dog (%)
Eye contact (%)	Time dog and owner spent in eye contact: gaze at owner and gaze at dog	Eyecontact (%) = [Gaze at Owner \cap Gaze at Dog] (seconds) / Phase duration (seconds)
Behaviours towards owner (%)	Sum of percentages of time spent gazing at, having contact with, and seeking proximity to the owner	Behaviours Towards Owner (%) = Gaze at Owner (%) + Contact with Owner (%) + Situation / Owner (%)

672 %, percentage of time (behaviour duration/phase duration); Yawning = the dog yawned;
673 Panting = the dog panted; Scratching= the dog scratched itself; Low posture = the dog's tail
674 was lowered, its ears faced backwards, or its legs were bent, at least two of these postures
675 were exhibited; Shaking = the dog shook; Sniffing = the dog sniffed the ground or straight
676 ahead; Whining = the dog whined; Barking = the dog barked; Licking = the dog licked its
677 mouth; Gaze at dog = the owner gazed with their head oriented towards their dog; Contact
678 with dog = the owner intentionally touched their dog; Positive verbal interaction = The owner
679 talked to their dog with an even or happy voice, encouraged their dog or made a soft sound;
680 Contact with owner = the dog intentionally touched its owner; Gaze at owner = the dog gazed
681 with its head oriented towards its owner; Situation / owner = half of the dog's body (head and
682 chest) was situated less than 50 cm from its owner.

683 **Table 4**

684 Rated emotional states of dogs during examination and greeting phases, their definitions and
685 scores.

686

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

687

688 **Table 5**

689 Rated owner and dog behavioural scores and their definitions and scores.

690

Behaviour	Definition and Score
Owner stress	1 = Calm and relaxed 5 = Agitated or anxious
Owner support	1 = Indifferent 5 = Many attempts to comfort the dog
Reunion / Dog	Greeting intensity by dog towards owner 1 = Indifferent 5 = Very happy, jumps on the owner, requests contacts
Reunion / Owner	Greeting intensity by owner towards dog 1 = Indifferent 5 = Talks to the dog, pets the dog a lot

691

692 **Table 6**

693 Rated levels of dog restraint performed by the assistant during the veterinary examination,
694 their definitions, and scores.

695

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 to keep the dog 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

696

697 **Table 7**

698 Rated manipulations performed by the veterinarian during the examination and the meaning
 699 of their success and difficulty score.

700

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 nodes 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

701 ^a Each dog received a score of 0 or 1 and these scores were used to calculate the percentage
 702 of success of all 29 dogs.

703 **Table 8**

704 Recorded behaviours of owners during the examination and greeting phases and their
705 definitions.

706

Observed behaviour	Description
Gaze (exclusive behaviours)	
Gaze at dog	The owner gazed with their head oriented towards their dog
Contact (exclusive behaviours)	
Contact with dog	The owner intentionally touched their dog
Verbal interaction (exclusive behaviours)	
Positive verbal interaction	The owner talked to their dog with an even or happy voice, encouraged their dog or made a soft sound
Neutral or negative verbal interaction	The owner spoke harshly to their dog, scolded it, gave it commands, or made a neutral sound

707

708 **Table 9**

709 Behaviours (% of total time) and Scores (units) of dogs and owners during the veterinary
 710 consultation. Results are expressed as mean \pm standard error.

Behaviours/Scores	Examination phase	Greeting phase
Dog behaviours (units)		
Gaze at owner (%)	35.91 \pm 3.49	36.0 \pm 3.18
Contact with owner (%)	-	18.0 \pm 4.62
Situation / owner (%)	-	68.10 \pm 4.51
Dog scores		
Emotional state ^c	2.62 \pm 0.08	1.57 \pm 0.07
Reunion / dog	-	2.98 \pm 0.23
Restraint level ^c	1.79 \pm 0.10	-
Success ^b	0.987 \pm 0.01	-
Difficulty ^b	1.43 \pm 0.07	-
Owner behaviours (units)		
Gaze at dog (%)	90.27 \pm 1.62	73.93 \pm 4.13
Contact with dog (%)	-	30.0 \pm 4.57
Positive talk (%)	4.54 \pm 1.11	17.76 \pm 3.29
Neutral or negative talk (%)	1.24 \pm 0.34	2.90 \pm 1.07
Owner scores		
Owner stress ^a	1.36 \pm 0.06	1.36 \pm 0.06
Owner support	2.68 \pm 0.20	-
Reunion / owner	-	3.11 \pm 0.19

711 %, percentage of time (behaviour duration/phase duration).

712 ^aA single score was attributed to owner stress for the entire consultation.

713 ^bManipulation success and difficulty correspond to mean scores for the all the medical acts.

714 ^cScores ranging from 1 to 3. The other scores ranged from 1 to 5.

715 Gaze at owner = the dog gazed with its head oriented towards its owner; Contact with owner
 716 = the dog intentionally touched its owner; Situation / owner = half of the dog's body (head
 717 and chest) was situated less than 50 cm from its owner; Emotional State, Rated emotional
 718 states of dogs (1 = Relaxed: No or low frequency of movement, with no visual evidence of
 719 tension in the body, 2 = Aroused: Tense, with high frequency of movement, but no visual
 720 evidence of anxious behaviours, 3 = Tense, with licking, yawning, crying, agitation or
 721 observable fearful posture; also see Table 4); Reunion / Dog, Rated greeting intensity by dog
 722 towards owner (1 = indifferent, 5 = very happy, jumps on the owner, requests contact; also see
 723 Table 5); Restraint, Rated levels of dog restraint (1 = low: the assistant did not need to use
 724 force to keep the dog in the right position, the dog was voluntarily almost immobile, 2 =
 725 medium: the assistant needed to increase her restraint to keep the dog in the same position, the
 726 dog was agitated/moved frequently, 3 = high: the assistant had to hold the dog firmly to keep
 727 it on the examination table or help the veterinarian perform the clinical examination, the dog
 728 tried to escape; also see Table 6); Success, (0 = failure, 1 = success); Difficulty, Rated
 729 difficulty of the manipulation (1 = easy, 5 = hard); Gaze at dog = the owner gazed with their
 730 head oriented towards their dog; Contact with dog = the owner intentionally touched their
 731 dog; Positive verbal interaction = The owner talked to their dog with an even or happy voice,

732 encouraged their dog, or made a soft sound; Neutral or negative verbal interaction = The
733 owner spoke harshly to their dog, scolded it, gave it commands, or made a neutral sound;
734 Owner stress, rated stress of the owner (1 = calm and relaxed, 5 = agitated or anxious; also see
735 Table 5); Owner support, rated support of the owner towards dog (1 = indifferent, 5 = many
736 attempts to comfort the dog; also see Table 5); Reunion / owner, Rated greeting intensity by
737 owner towards dog (1 = indifferent, 5 = talks to or pets the dog a lot; also see Table 5).

738 **Table 10**

739 Pearson's correlations between owner and dog behaviours observed during the veterinary
 740 examination and greeting phases.

741

Correlations		Examination phase			Greeting phase		
		<i>P</i>	<i>r</i>	<i>1-β</i>	<i>P</i>	<i>r</i>	<i>1-β</i>
Positive owner behaviours /	Behaviours towards owner	0.909			0.004	0.52	0.84
	Total stress	0.834			0.388		
	Emotional state	0.404			0.775		
	Avoidance	0.336					
	Success	0.500					
	Difficulty	0.592					
	Restraint	0.596					
Neutral or negative verbal interaction /	Total stress	0.049	0.37	0.51	0.136		
	Emotional state	0.044	0.38	0.53	0.545		
	Avoidance	0.140					
	Success	0.080					
	Difficulty	0.060					
	Restraint	0.324					
Owner support /	Total stress	0.767					
	Emotional state	0.466					
Owner Stress /	Total stress	0.808			0.976		
	Emotional state	0.387			0.938		
Eye contact /	Total stress	0.031	0.40	0.58	0.394		
	Emotional state	0.011	0.47	0.74	0.652		
Physical contact /	Total stress				0.238		
	Emotional state				0.706		
Reunion / Owner /	Reunion / Dog				0.001	0.58	0.92

742 Positive owner behaviours = Sum of percentages of time spent gazing at dog, having contact
 743 with dog, and talking positively; Behaviours towards owner = Sum of percentages of time
 744 spent gazing at, having contact with, and seeking proximity to the owner; Total Stress = Sum
 745 of percentages of time spent yawning, panting, scratching, adopting low posture, shaking,
 746 sniffing, licking, and whining; Emotional State, Rated emotional states of dogs (1 = Relaxed:
 747 No or low frequency of movement, with no visual evidence of tension in the body, 2 =
 748 Aroused: Tense, with high frequency of movement, but no visual evidence of anxious
 749 behaviours, 3 = Tense, with licking, yawning, crying, agitation or observable fearful posture;
 750 also see Table 4); Avoidance = The dog stepped backwards away from the veterinarian or the
 751 assistant following one of their actions; Success, (0 = failure, 1 = success); Difficulty, Rated
 752 difficulty of the manipulation (1 = easy, 5 = hard); Restraint, Rated levels of dog restraint (1 =

753 low: the assistant did not need to use force to keep the dog in the right position, the dog was
754 voluntarily almost immobile, 2 = medium: the assistant needed to increase her restraint to
755 keep the dog in the same position, the dog was agitated/moved frequently, 3 = high: the
756 assistant had to hold the dog firmly to keep it on the examination table or help the veterinarian
757 perform the clinical examination, the dog tried to escape; also see Table 6); Neutral or
758 negative verbal interaction = the owner spoke harshly to their dog, scolded it, gave it
759 commands, or made a neutral sound; Owner support, rated support of the owner towards dog
760 (1 = indifferent, 5 = many attempts to comfort the dog; also see Table 5); Owner stress, rated
761 stress of the owner (1 = calm and relaxed, 5 = agitated or anxious; also see Table 5); Eye
762 contact, time dog and owner spent in eye contact, gaze at owner and gaze at dog; Physical
763 contact, time dog and owner spent in contact, contact with owner and/or contact with dog;
764 Reunion / owner, Rated greeting intensity by owner towards dog (1 = indifferent, 5 = talks to
765 or pets the dog a lot; also see Table 5)); Reunion / Dog, Rated greeting intensity by dog
766 towards owner (1 = indifferent, 5 = very happy, jumps on the owner, requests contact; also see
767 Table 5).

768 **Figure legends**

769 Fig.1. Correlation between the duration of the owners' positive behaviours (%) and the
770 duration of the dog behaviours towards their owners (%) during the greeting phase.

771

772 Fig.2. Correlation between the duration (%) of the owners' neutral or negative verbal
773 interactions and the emotional state of their dogs during the examination phase.

774

775 Fig.3. Correlation between the duration (%) of eye contact and the duration (%) of the dogs'
776 total stress during the examination phase.

777