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1 Dominance in domestic dogs - a response to Schilder et al. (2014)

2

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7

8 Abstract

9 We here respond to the claim by Schilder and colleagues (Schilder, M. B. H., Vinke, C. M.,
10 van der Borg, J. A. M., 2014. Dominance in domestic dogs revisited: Useful habit and useful
11 construct? *J. Vet. Behav.: Clin. App. Res.* 9, 184-191) that dominance is a useful construct in
12 the interpretation of companion dog behavior. We first make the distinction between the
13 well-established use of the dominance framework in the ethology of wild species, and its
14 more contentious use in the domestic dog as a character trait and as a descriptor of
15 motivation. By evaluating recent studies of canine “personality” (individual differences in
16 behavior that are consistent across time and context), we conclude that there is no evidence
17 that dominance is a character trait of individual dogs, but rather that it is a property of
18 relationships, that can arise due to asymmetries in any one of at least three distinct
19 personality traits. We question whether concepts derived from wolf behavior have much
20 utility in interpreting the behavior of domestic dogs, since recent studies of groups of free-
21 ranging dogs confirm that the dog has lost three traits key to the social organization of the
22 grey wolf, namely coordinated group hunting, reproductive suppression, and provisioning of
23 cubs by non-reproducing relatives. We further question whether studies of free-ranging
24 dogs, which routinely compete for physical resources, provide an appropriate framework for
25 interpreting the behavior of companion dogs, which generally do not. We then reinterpret
26 Schenkel’s “active submission” posture as primarily affiliative and an indicator of the
27 dependence of younger, inexperienced dogs on the older members of their social group. By
28 reviewing the key literature on the cognitive abilities of domestic dogs and other social
29 Carnivora, we demonstrate that the primate-based “Utrecht School” model of dominance
30 makes assumptions that are invalid for domestic dogs, because the overwhelming balance of
31 evidence indicates that relationships among social Carnivora are based on non-cognitive
32 mechanisms. We conclude by examining the implications of Schilder and colleagues’ model
33 for the management of relationships between dogs and their owners.

34 Keywords: dominance; domestic dog; dog-human relationship; comparative cognition;
35 animal personality
36

37 In this paper we discuss the arguments made by Schilder et al. (2014) disputing the position
38 we set out in our paper “Dominance in domestic dogs - useful construct or bad habit?”
39 (Bradshaw et al., 2009): we also modify some of the conclusions we made there in the light
40 of studies published in the intervening period. We then extend our conclusions to address
41 the behavior and management of companion dogs more specifically.

42 In our 2009 paper, we did not intend to criticize the use by ethologists of constructs such as
43 “dominance” that conveniently summarize the flow of competitive interactions within groups
44 of animals, although both Schilder et al. (2014) and Bonnani and Cafazzo (2014) appear to
45 have assumed that we did. Without the statistical rigor that accompanies such analyses, it is
46 difficult to make reliable comparisons between different studies, or between species, and
47 accordingly they are a valuable tool for the ethologist interested in the adaptive nature of
48 competition. Primarily, as stated in our Abstract (Bradshaw et al., 2009), we set out to
49 challenge two widespread conceptions that underlie certain approaches to the management
50 of the behavior of companion dogs: first, that “dominance” is an identifiable character trait,
51 i.e. a property of individual dogs, and not (only) of relationships; and second that much of
52 companion dog behavior can be explained in terms of a motivation to achieve “status”, i.e.
53 the right of access to all resources irrespective of their current or future value to the dog
54 concerned. Bonnani and Cafazzo (2014) do not appear to address either of these issues, but
55 Schilder et al. (2014) restate and attempt to justify both.

56 We regard it as essential to retain the distinction between the use of dominance as a
57 conceptual framework by which ethologists can summarize their observations of competitive
58 interactions within a social group, and its use in understanding and predicting the behavior
59 of individual dogs, perhaps most crucially when diagnosing behavioral disorders and
60 deciding upon methods for behavior modification. Put simply, although it is easy to detect
61 an asymmetry in exchange of behavior between two dogs, we here propose that there is scant
62 scientific evidence supporting the idea that the dogs are aware of that asymmetry (their
63 “status”) and even less that they are motivated to increase that “status” through the exchange
64 of behavior. At the current state of our understanding of canine cognition (Bräuer, 2014) it
65 is more parsimonious to assume that each dog simply reacts to the behavior of the other,
66 based upon its previous experience of that dog’s behavior, of similar behavior performed by
67 other dogs, and the previous success (or otherwise) of its adoption of various behavioral
68 strategies in similar previous situations. We suggest that this approach best explains the
69 considerable variation in social relationships observed between domestic dogs, where only a

70 minority of dyads have an apparently fixed, unidirectional agonistic relationship, some have
71 an inconsistent or context related relationship, and most interact repeatedly but rarely
72 agonistically (Bradshaw et al., 2009; Trisko, 2011).

73 In their introduction, Schilder et al. (2014) highlight three recent studies as apparently
74 confirming the concept of dominance as being applicable to domestic dogs. One (van der
75 Borg et al., 2012; previously reported as Netto et al., 1993) is a brief conference abstract,
76 which lacks essential details, for example the ethogram used, and the inter-relatedness of the
77 group of dogs studied and its stability, so it is difficult for us to comment further. Trisko
78 (2011) is a study of 24 neutered dogs interacting spontaneously at a “daycare” facility. From
79 these interactions she was able to construct weak but inter-correlated hierarchies, based
80 upon aggressive, dominant and submissive behavior patterns respectively, but such behavior
81 formed only a small part of the interactions between the dogs. The third study, by Cafazzo et
82 al. (2010), is the first and to date the only study that has demonstrated that the formal
83 exercise of constructing dominance hierarchies can have utility in understanding group
84 dynamics among domestic dogs, including “leadership” (*sensu* Bonanni et al., 2010) and
85 reproductive success (Cafazzo et al., 2014).

86 Incorporating information from these and other studies published since 2009, we will here
87 address five issues that appear to have led to misinterpretation of companion dog behavior.

88

89 1. Is dominance a personality trait in dogs?

90 In our previous paper (Bradshaw et al., 2009) we argued that the term “dominance” should
91 be reserved for describing pairwise competitive relationships, and the vast majority of
92 ethologists now use it in this sense only (Petherick, 2010). Even if “dominant” were an
93 identifiable personality trait (a stable mental state that is predictive of behavior, see Miklósi
94 et al., 2014), it would be confusing if the same word were to be used to describe both an
95 absolute and a relative characteristic of the same animal: for example, a temperamentally
96 “dominant” dog might be “dominated” by a slightly less “dominant” but much larger dog.

97 That “dominance”, if it is to be used at all, should be reserved for relationships is confirmed
98 by several recent quantitative studies of canine personality that have failed to identify
99 “dominant” as a consistent dimension. As indicated by Schilder et al. (2014), some older
100 studies did identify a “dominance/submission” dimension. Gosling and John (1999) cite
101 several applying to primates, but only one (out of 4) refers to dogs, and in it “dominance” is
102 combined with “territoriality” to produce a “protective” dimension (Coren, 1998). In their
103 more extensive survey, Jones and Gosling (2005) identified 19 out of 47 studies of dogs that

104 included a dominance/submission dimension, but their classifications were made not
105 statistically but by a panel of judges who may have been using different conceptions of
106 “dominance”, and also, by the authors’ admission, have been biased by their own
107 preconceptions of dog behavior.

108 None of the most extensively validated personality inventories for dogs based on owner
109 descriptions has identified a “dominance” trait (C-BARQ, Hsu & Serpell 2003; revised-
110 MCPQ, Ley et al. 2009; DPQ, Mirkó et al. 2012). For example, “Dominant” does appear as
111 an item in the revised-MCPQ, but correlates with four other descriptors (“Nosey”,
112 “Opportunistic”, “Proud” and “Thorough”) to make up the subscale “Motivation” (Ley et al.
113 2009). This subscale is moderately positively correlated with Extraversion, weakly
114 negatively correlated with Neuroticism (which combines “Sensitive” with “Cautious”) and
115 uncorrelated with Amicability (which includes “Unaggressive”, and is therefore the inverse of
116 the various aggressive traits identified in many other studies): thus no link emerges between
117 “dominance” and aggression. Using behavioral testing of dogs, Svartberg et al. (2005)
118 identified five personality traits: Playfulness, Chase-proneness, Curiosity/Fearlessness,
119 Sociability and Aggressiveness - but not “dominance”. Akos et al. (2014), cited by Schilder et
120 al. (2014) do refer to a “unique personality” for “leader/dominant dogs”, but had studied
121 only 6 dogs, and moreover employed an unvalidated “dominance” index that is no longer in
122 use (Miklósi, pers. comm.).

123 We therefore conclude that even if “dominance/submission” is useful to describe pairwise
124 relationships between dogs, it is both confusing (semantically) and inaccurate (biologically)
125 to also use “dominant” to describe a hypothetical personality trait. A dog might well appear
126 to be “dominant” in a relationship when it scored higher than the other dog on “Motivation”
127 on the revised-MCPQ (for example), but it might equally well appear to be “dominant” if it
128 scored lower on either “Amicability” or “Neuroticism”. Logically, an observed asymmetry in
129 a relationship could arise from differences in one or more of several (so-called) personality
130 traits, including but not restricted to that most closely identified with the word “dominant”
131 by owners. Furthermore, and as also noted by Schilder et al. (2014), the personalities of two
132 dogs do not always predict the emerging relationship between them: in our conception, such
133 discrepancies can arise due to other asymmetries between the two animals, such as their
134 different perceptions of the context of the interaction.

135

136 2. Are dominance hierarchies, when they can be detected, functionally comparable
137 between wolves and free-ranging dogs?

138 Since our review (Bradshaw et al., 2009) a series of studies has been published of a single
139 large pack of free-ranging dogs in Rome (Bonanni et al., 2010; Cafazzo et al., 2010, 2014)
140 which demonstrate statistical links between dominance relationships (in the ethological
141 sense), leadership and reproductive success. Bonanni and Cafazzo (2014) also report
142 putative hierarchical structures in several other smaller dog packs, although the functional
143 significance of these appears not to have been investigated in detail. The elaborate structure
144 measured in the large pack may be unusual, since patchy and unpredictable distribution of
145 resources usually forces free-ranging dogs to forage singly or in male-female pairs, and pack
146 structure is usually fluid (Boitani et al., 2007; Majumder et al., 2014). Nevertheless, the
147 Rome studies do indicate that apparently functional hierarchies can sometimes be observed
148 in dog packs: it remains to be seen whether such correlations emerge from other free-
149 ranging groups, and in particular whether “dominance status” is actually an adaptive trait in
150 domestic dogs (see Bonanni and Cafazzo 2014 for discussion).

151 However, these apparent hierarchical structures need to be interpreted cautiously, not
152 simply hailed as evidence that all dog behavior is homologous with wolf behavior. It is
153 reasonable to assume that the exchanges of behavior that structure today’s wolf packs are
154 adaptive, or at least were adaptive over the millions of years of the evolution of canid
155 sociality. It is also self-evident that many dogs perform many of the same behavior patterns
156 that wolves employ for communication within their packs. However, this morphological
157 similarity may be superficial and misleading, if the social context within which these signals
158 are performed has been transformed by domestication, as appears to be the case from a
159 comparison of groups of feral dogs with family-based wolf packs. These are quite different
160 functionally, even though both may defend communal territories. First, such dogs are
161 usually scavengers, whereas wolves can exploit large prey by hunting in groups. Second, wolf
162 packs generally contain only one breeding pair assisted by their adult offspring from
163 previous years which temporarily forgo reproduction themselves, while the mating system
164 observed in feral dogs is promiscuous, such that most sexually mature members in feral dog
165 groups attempt to breed each season. Third, wolf cubs are provisioned by both parents and
166 by adult “helpers”, while the puppies of free-ranging dogs are generally cared for only by
167 their mothers, who may actively keep them away from other members of her group (see
168 Cafazzo et al., 2014 pp. 10-11 for references).

169 Therefore we cannot be confident that any behavior pattern performed by one free-ranging
170 dog towards another dog retains the function that it performs in wolf sociality. It is likely
171 that as the social structures of proto-dogs altered to include humans as well as conspecifics,
172 and also to take advantage of man-made environments, so the signaling requirements would
173 have changed. Rather than develop new communicative behavior patterns, it would have

174 been evolutionarily parsimonious to adapt the meaning of existing canid signals to suit the
175 new context. Thus apparently communicative behavior performed by domestic dogs may
176 have evolved a different function during domestication, possibly to facilitate interspecific
177 communication, or may even be a relic of wolf behavior that is no longer adaptive. Simply
178 because a hierarchical structure can be measured in some dog packs does not mean that all
179 dog behavior can be interpreted as if it were being performed by a wolf (and at that, in the
180 traditional “wolf-pack” model, a captive wolf behaving in an unnatural way; see Mech,
181 2008).

182

183 3. Companion dogs do not have to compete, as feral dogs do

184 Free-ranging or feral dogs have to compete to stay alive and to leave offspring; companion
185 dogs generally do not. The arguments put forward by Schilder et al. (2014) in support of the
186 idea that all dogs strive for “status” appear to rest not only on the assumption that they are
187 cognitively capable of doing so (see 5.), but also that because free-ranging dogs (apparently)
188 strive for “status” using exchanges of aggression and formal dominance, so must pet dogs.
189 Studies of interactions between pet dogs that could address this question are few, but two
190 cited by Schilder et al. (2014) may be informative.

191 First, companion dogs often choose not to engage in any kind of competitive interaction even
192 when given every opportunity to do so. Trisko (2011) reported that only 7% of the dyadic
193 encounters that she recorded contained competitive elements, and even this may an over-
194 estimate as she combined active submission (A-S, see below) with other submissive patterns,
195 and not with affiliative patterns (which were: Nose Nudge, Muzzle Lick, Nuzzle/Rub On,
196 Nibble, Genital Lick and Coat Lick). Affiliation with “submission” (i.e. probably primarily
197 affiliation) accounted for 22%, two-way submission/affiliation 21%, and 50% no affiliation or
198 submission. Moreover, mounting, a putative signal of “formal dominance” (Schilder et al.,
199 2014), was not associated with aggression or any other kind of agonistic exchange. The
200 overall conclusion of the study was that “Dogs use various combinations of agonism,
201 affiliation and play to negotiate social relationships with other dogs” (Trisko, 2011, p. 79): in
202 other words, “dominance” is certainly not the only, and probably not the main organizing
203 factor behind relationships between pet dogs. Likewise, Bauer and Smuts (2007) were only
204 able to assess the dominance status of 19 dyads out of 55, and 10 of these involved a single
205 individual that was evidently highly competitive both within and outside the context of play.
206 Arguably, if all pet dogs were primarily motivated by “status”, this should emerge in
207 signaling and/or actual aggression far more often than it evidently does.

208 This variation in social structures across studies of feral and companion dogs is consistent
209 with the concept that social groupings develop not through a single organizing principle (i.e.
210 “dominance”) but are an accumulation of learnt dyadic relationships between individual
211 pairs of dogs, and are based upon the net exchange of all types of behavior, including play
212 and affiliation. Such relationships arise through a combination of individual personality
213 characteristics, learnt experience specific to each individual, and cumulative learning from
214 prior experience of the consequences of patterns of signaling. Hence, in groups where one
215 individual has a particularly high ‘Motivation’ / low ‘Neuroticism’ / low ‘Amicability’
216 characteristic, and has cumulative prior experience of successfully achieving valued
217 resources from others in the group, this dog will appear to be ‘dominant’ in interactions with
218 all others. In groups where no individuals have such extreme personality characteristics, nor
219 have learnt ‘expectation’ of success in interactions with others, outcomes of interactions are
220 likely to be more variable, with no consistent overall structure.

221

222 4. Submissive-affiliative behavior is more correctly affiliative-submissive and is rarely a
223 response to aggression

224 Several authors, including Bonnani and Cafazzo (2014) Schilder et al. (2014), and Smuts
225 (2014) have emphasized that “dominance” is rarely a unitary construct, but can be broadly
226 divided into two types of asymmetric relationships. One type is based upon aggression
227 (threats, chasing, biting) to which the target animal responds either defensively, or
228 “submissively”, by retreating or adopting postures that indicate intention not to escalate the
229 encounter, such as (in the case of dogs) looking away, and lowering the head and/or body.
230 This broadly corresponds to the original “peck-order” concept of Schjelderup-Ebbe (see
231 Drews, 1993), and can arise whenever resources are disputed over, for example the
232 aggression between male dogs over receptive females noted by Pal et al. (1999) and Cafazzo
233 et al. (2010). The other, “formal dominance” (*sensu* van Hooff and Wensing, 1987) is based
234 upon exchange of ritualized displays with no overt aggressive component (de Waal, 1989),
235 such as (in free-ranging dogs: Cafazzo et al., 2010) an upright or stiff posture, placing the
236 paw or muzzle on the other dog’s back, tail held upright and wagging (all indicating
237 “dominance”) and “submissive-affiliative” behavior, comprising a slightly lowered posture
238 with ears flattened, tail wagging below the horizontal, and, in its most complete form, licking
239 the muzzle of the recipient.

240 “Formal dominance” is thought to evolve as a less costly version of the “peck-order”, because
241 it further reduces the risk of injury to both parties (Drews, 1993). In the dog pack studied by
242 Cafazzo et al. (2010), “submissive-affiliative” behavior correlated significantly but rather

243 weakly with “submissive” behavior, suggesting that they may play different roles, at least at
244 the dyadic level, in canine society. “Submissive-affiliative” behavior, although relatively
245 uncommon, was entirely unidirectional, i.e. there were no reversals in any of the pairs in
246 which it was recorded, and often “took place as an animal returned to the core area, or
247 generally, when a dog joined the group again after a separation” (Cafazzo et al., 2010).

248 As such, “submissive-affiliative” or, as we suggest below “affiliative-submissive”, behavior
249 (A-S) appears to be homologous with “active submission” as described by Schenkel (1967) for
250 the wolf. In naturally-composed wolf packs, A-S is performed spontaneously by the younger
251 members of the pack, especially towards the breeding pair, who are usually their parents,
252 and only exceptionally as a response to aggression or threat (Packard, 2003). It additionally
253 forms part of the “greeting ceremony” when the pack re-assembles, when it may be
254 performed by the parents to their offspring as well as vice-versa. It is also performed by
255 companion dogs under similar circumstances (Bradshaw and Nott, 1995). Morphologically,
256 it is self-evidently derived from the behavior whereby weanling wolf cubs stimulate
257 regurgitation of food by their parents, and is therefore an obvious candidate for evolution of
258 a ritualized display that acknowledges parenthood.

259 That this highly distinctive behavior pattern was ever labeled “submissive” could be regarded
260 as an artifact of the circumstances under which it was first described, i.e. artificial “packs” of
261 wolves with no kinship ties. Had David Mech’s studies of free-ranging wolves (e.g. Mech,
262 1999) been conducted before those conducted in zoos, rather than half a century later, A-S
263 might plausibly have been labeled affiliative from the outset, and its distortion into an
264 aggression-deflecting signal in artificial confined packs would then have been recognized for
265 what it is.

266 This interpretation also answers the following objection made by Schilder et al. (2014, p.
267 187) ‘Explaining submissive actions as conflict defusing actions, instead of submissive ones,
268 leaves the one-sidedness of the performance of submissive behaviors unexplained.’ We do
269 not conceive of A-S as primarily conflict-defusing, but as affiliation-building. Although the
270 benefits that young adults accrue by staying within their natal packs are not easily
271 quantifiable, and probably vary from one environment to another, they are likely to be
272 substantial, otherwise it would be adaptive for them to leave (see Jennions and Macdonald,
273 1994, and Smith et al., 2012, for reviews). To their parents, adult offspring represent
274 potential competition, both for immediate resources such as food, and as rival breeders. Due
275 to the asymmetries of relatedness inherent in mammalian families (cf. maternal-infant
276 conflict; Barrett and Dunbar, 1994), it pays young non-breeding adults to communicate their
277 intention to stay in the pack and not to breed (hence the ritualization of an offspring-to-

278 parent signal: see Majolo, 2010 for our definition of “ritualization”), until such time as their
279 same-sex parent comes to evaluate them as a net threat to his or her own reproductive
280 success (see Mech and Cluff, 2010, for an example). Given the very different mating system
281 of feral dogs compared to wolves, the accrued advantages of pack living may differ
282 considerably: nevertheless, A-S has evidently been retained during domestication, possibly
283 because it has been effective in forging amicable relationships between dogs and humans.
284 The distribution of A-S in the data of Cafazzo et al. (2010) can plausibly be explained as the
285 consequence of the following rule-of-thumb: “in order to be allowed to stay in the group,
286 perform affiliative behavior towards all the members of the group older than you are”. The
287 one-sidedness of A-S is therefore explainable by a combination of history and relatedness.
288 All members of the group benefit from keeping the group together, but less experienced
289 animals have more to gain than older, more experienced, animals.

290

291 5. Dominance can be explained without implying that it is a motivation.

292 The ethological definition of dominance, a consistent asymmetry in competitive encounters
293 between pairs of animals, says nothing about the motivations or thought processes of the
294 animals concerned. In computer models, not only individual dominance relationships but
295 also hierarchies of varying linearity can emerge from quite simple, even stochastic,
296 properties of the agents modeled (Chase et al., 2002). It has proved possible to build robots
297 that establish convincing and stable dominance hierarchies, based on straightforward
298 stimulus-and-response rules, and no "awareness" whatsoever (Vaughan et al., 2000; Funato
299 et al., 2011).

300 Altmann (1981) proposed that cognitive experiences of dominance relationships were only
301 plausible in higher primates and humans, and subsequent studies of the cognitive abilities of
302 Carnivora other than wolves and domestic dogs have tended to confirm this distinction.
303 Smith et al. (2012) state ‘Whereas both cognitive and non-cognitive (emotional and
304 temperamental) factors promote cooperation and tolerance in living chimpanzees and
305 humans all available evidence to date suggests that cooperation among extant carnivores
306 is facilitated by noncognitive mechanisms’. Even apparently complex social phenomena,
307 such as the “maternal rank inheritance” observed in spotted hyena clans, can be explained by
308 associative learning (Engh et al., 2000). In domestic dogs, most investigations of social
309 cognition have used humans as social partners rather than dogs, for ease of experimentation,
310 but since dogs have evolved to cooperate with humans, it is likely that their cognitive abilities
311 are no more sophisticated when dealing with members of their own species. To date, no
312 conclusive evidence has emerged that dogs understand that humans have minds, or

313 comprehend the relationships that they have with humans (Bräuer, 2014): ‘the evidence
314 suggests that dogs do not need to be readers of our minds; instead, they are exquisite readers
315 of our behavior’ (Udell and Wynne, 2011). Thus non-primate mammals, including domestic
316 dogs, are unlikely to have any concept of the “hierarchy” that human observers can deduce
317 that they are part of, other than the individual pairwise relationships that they have with
318 other individuals. Their behavior can be entirely explained in terms of recognition of group
319 members as individuals and recall of previous encounters with those individuals, without
320 recourse to more complex cognitive mechanisms. The comparisons that Schilder et al.
321 (2014) make with primate social structures therefore need to be taken with considerable
322 caution: the underlying cognitive processes are qualitatively different.

323 Dogs self-evidently react to the behavior of other dogs, and it is easy to jump to the
324 conclusion that they conceive of other dogs (and indeed humans) as cognizant beings. Since
325 dogs appear not to have sufficient ‘theory-of-mind’ to do this (Bräuer, 2014), it is therefore
326 more parsimonious to assume that dogs’ relationships with other dogs (and with people) are
327 built up progressively using associative learning, through the outcomes of successive
328 encounters. Escalation to the point of aggression may arise from any one of a large number
329 of factors, including the personality of the dog, the context, the perceived value of the
330 resource being disputed, the previous experiences of the dog with the other dog or, failing
331 that, generalization from encounters with similar dogs, and the effectiveness (or otherwise)
332 of signaling during previous similar encounters.

333 The consequences of presuming that dogs have a concept of “status” are not trivial for their
334 welfare: different notions of dogs’ concepts of their own social interactions lead to very
335 different methods for treating problems arising from intra-specific and inter-specific
336 aggression, with those supporting physical (positive) punishment often justifying it as
337 “dominance reduction”, based on the concept that dogs have a concept of hierarchy and will
338 only obey an “alpha leader” (Greenebaum, 2010). The use of aversive techniques can have a
339 negative impact on welfare (Schalke et al., 2007; Schilder and van der Borg, 2004) and can
340 also be dangerous to the person delivering the punishment, through elicitation of further
341 aggression (Schilder et al., 2014).

342

343 6. Implications for dog-human interactions

344 Schilder et al. (2014) conclude with a discussion of the implications for dog-human
345 relationships of their assertions about intraspecific dominance between dogs. A fast-growing
346 body of research does indeed support the idea that dogs are uniquely sensitive to human

347 body-language (Topál et al., 2014), but Schilder et al. further claim that ‘dogs are likely to
348 interpret human postural information in terms of a dominance/submission relationship’ (p.
349 189). However, they present no evidence to support this assertion, and the arguments made
350 do not align with our (RAC and EJB) clinical experience, or those of authorities such as
351 Luescher and Reisner (2008).

352 Schilder et al. (2014) claim that ‘(dominance/submission) explains why dogs that have an
353 unclear rank relationship with their human partner are more likely to attack when the
354 human partner shows a relatively “low posture”’ (p. 190). If “low posture” is a sign of formal
355 submission in dogs, as stated by van der Borg et al. (2012), then far from provoking the dog,
356 its performance by the owner should *reduce* the probability that the dog attacks, because the
357 signal should reinforce the dog’s “desired” relationship.

358 They also claim that ‘submissive status ... chiefly necessitates an adequate socialization of the
359 dog’. The converse of this statement would be that dominant status arises out of inadequate
360 socialization. However, the processes involved in the so-called “socialization period include
361 an inhibition of fear-based reactions towards unfamiliar social partners, and thus inadequate
362 socialization increases the risk of fear-based behavioral disorders (Appleby et al., 2002),
363 including aggression. Thus while thorough socialization is the essential basis for a
364 harmonious dog-owner relationship, the rationale for connecting this with “dominance” is
365 unclear.

366 Similarly, the assertion that preventing dominance requires a consistent response is also
367 difficult to interpret. Consistency of interaction is widely thought to be an important aspect
368 of human-dog interaction, enabling dogs to reliably predict how their owners will behave in
369 different circumstances. Whilst inconsistency in owners appears to be associated with
370 increased performance of anxiety and fear related behavior (Casey et al., 2007), it is not clear
371 how inconsistency may influence “dominance” relationships.

372 Schilder et al. (2014) also deduce that ‘attacks (that) occur in non-competitive contexts’ must
373 be motivated by the dog’s desire to enhance its “status”. In reality, it would be impossible to
374 determine whether the context of an attack was “non-competitive” from the dog’s
375 perspective, since this would have to rely on the report of the human victim, who is unlikely
376 to be fully aware of the dog’s motivation at the time. Indeed, the very fact that the attack has
377 happened at all makes it unlikely that the victim has an adequate appreciation of dog
378 behavior (Luescher and Reisner, 2008). In clinical cases, many owners report that
379 aggression occurs ‘out of the blue’ or for ‘no apparent reason’, but examination of historical
380 evidence generally indicates a trigger for the aggression based on fear of a particular
381 stimulus learnt during previous negative experiences, or anxiety due to exposure to a novel

382 situation. Furthermore, owner reports of dog attacks often include descriptions of
383 ambivalent body-language performed by the dog after the attack, including indicators of
384 both fear and appeasement inconsistent with the “status-enhancing” hypothesis (Luescher
385 and Reisner 2008). Moreover, the “body-language” of dogs is not interpreted consistently,
386 and even those with considerable experience of dog behavior can misread their behavior
387 (Westgarth and Watkins, 2015) .

388 Furthermore Schilder et al. (2014) state that ‘teaching a dog to accept humans as dominants’
389 cannot be achieved by reward-based training, but through socialization and ‘clear and
390 consistent behavior by the owner’ (the last of which we agree with - see Casey et al., 2007).
391 No indication is given by Schilder et al. (2014) as to whether any specific type of training
392 might be effective in reducing “dominant” tendencies, but the everyday reality is that
393 techniques based on physical punishment are widely employed to this supposed end
394 (Greenebaum, 2010). They do criticize the use of techniques such as “alpha-rolls”, but only
395 on the grounds that they are dangerous to the human participant. Luescher and Reisner
396 (2008), by contrast, offer very specific advice on the use of clinically-validated reward-based
397 training in the treatment of conflict-related aggression.

398 We are unclear as to how the arguments made by Schilder et al (2014) regarding ‘dominance’
399 as a personality trait relate to their recommendations for avoiding ‘dominance’ in human -
400 dog interactions. Their suggestion for ‘clear and consistent behavior by the owner’ involving
401 reward based training is similar to the advice given widely by those involved in clinical
402 behavior and training, without reference to dominance. It is not clear whether these authors
403 would suggest additional interventions for those dogs described as having a ‘dominant’
404 characteristic where owners have control problems, or what these may be, although the need
405 for such interventions is implied.

406 However, we agree completely with Schilder et al (2014) that the use of coercive methods
407 such as ‘alpha rolls’, widely used to assert ‘dominance’ over dogs (Greenebaum, 2010) are
408 entirely counter-productive. In addition to their concerns regarding owner safety, we would
409 emphasize the negative impact of using such techniques on the welfare of dogs (Rooney and
410 Bradshaw, 2014), and the association of such methods with a range of undesired behaviors
411 (Blackwell et al., 2008).

412

413 Conclusions

414 Although the conclusions arrived at by Schilder et al. (2014) are very different from those of
415 our earlier paper (Bradshaw et al., 2009), we do appear to be in agreement that the term

416 'dominance' is a valuable tool for ethologists, as the best method for summarizing agonistic
417 relationships between (largely free-living) animals. However, because companion dogs
418 occasionally appear to form unidirectional hierarchical relationships, but often do not, we
419 here argue that the concept of 'dominance' is overly simplistic for this species, since it
420 ignores much of the complexity of their social interactions. Instead, we believe that the
421 principles of associative learning provide not only a more parsimonious but also a more
422 complete explanation for relationships between companion dogs, influenced by each dog's
423 specific experience of the other across time and context, and also their cumulative experience
424 of previous encounters with other similar individuals. We agree with Schilder et al. (2014)
425 that personality is an important contributor to dyadic relationships, but we consider that the
426 personality characteristics of the two dogs, such as 'Motivation' (Ley et al. 2009), are no
427 more than a starting point for the formation of their relationship, subsequently interacting
428 with other factors, such as prior learning and physiological influences (e.g. fluctuation in
429 reproductive hormones) in determining how two individuals behave towards one another.
430 Furthermore, while there is still no absolute consensus as to how the personalities of dogs
431 should best be characterized, recent studies have failed to identify "dominance" as a
432 meaningful dimension. Moreover, the current consensus among ethologists (Petherick,
433 2010) is to restrict the term "dominance" to the description of relationships. Therefore, we
434 regard it as both misleading and inaccurate to use the word "dominant" to describe the
435 personalities of individual dogs.

436 Similarly, whilst it is clear that dogs have retained many of the individual patterns of
437 intraspecific communicative behavior from the wolf, we urge caution in extrapolating the
438 function of these behaviors from free-ranging dogs, or indeed wolves, to the behavior of
439 companion dogs, for two reasons. Not only has the significance of the various displays
440 almost certainly been altered during the process of domestication, but also the lifetime
441 experiences of companion dogs are very different from those of their free-ranging
442 counterparts. We particularly urge against the extrapolation of conclusions drawn from the
443 intraspecific behavior of free-ranging dogs to the interpretation of interspecific behavior
444 directed by companion dogs towards humans. Put simply, we do not believe that the fact
445 that human observers can measure consistent relationships between some pairs of dogs, and
446 can define these as dominance relationships, should be interpreted as providing evidence for
447 the hypothesis that 'dominance' is an inherent ('personality') characteristic of dogs, nor that
448 their behaviors are driven by the motivation to enhance their relative 'status'. Indeed, we
449 argue that at our current state of knowledge of cognitive processes in the Carnivora, it is
450 misleading to presume that domestic dogs have the mental capacity to conceptualize
451 "status".

452 We also consider it dangerous to use such extrapolations to support techniques used to alter
453 the behavior of companion dogs, whether that be basic training or the resolution of
454 behavioral disorders. The “dominance” concept has long been used to justify the application
455 of pain and fear in dog training, but it is becoming increasingly apparent that not only are
456 such methods potentially dangerous for the person using them, they are counterproductive
457 in terms of behavioral outcomes, owner-pet bonds, and canine welfare (Rooney and
458 Bradshaw, 2014; Schalke et al., 2007; Schilder and van der Borg, 2004).

459

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464

465 Conflicts of interest

466 John Bradshaw is an independent academic and has no conflicts of interest relevant to this
467 paper over the past 3 years. Rachel Casey and Emily Blackwell are employees of the
468 University of Bristol and have no conflicts of interest to declare.

469

470 Ethical statement

471 This commentary does not report any original experimental research.

472

473 Authorship statement

474 All authors contributed equally to conceiving and writing the manuscript. No original
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476

477 References

- 478 Ákos, Z., Beck, R., Nagy, M., Vicsek, T., Kubinyi, E., 2014. Leadership and path
479 characteristics during walks are linked to dominance order and individual traits in dogs.
480 PLoS One 10, e1003446. doi:10.1371/journal.pcbi.1003446
- 481 Altmann, S. A., 1981. Dominance relationships: the Cheshire cat's grin?. Behav. Brain Sci. 4,
482 430-431.
- 483 Appleby, D. L., Bradshaw, J. W. S., Casey, R. A., 2002. Relationship between aggressive and
484 avoidance behaviour by dogs and their experience in the first six months of life. Vet. Rec.
485 150, 434-438.
- 486 Barrett, L., Dunbar, R. I. M., 1994. Not now dear, I'm busy. New Sci. 142, 30-34.
- 487 Bauer, E.B., Smuts, B.B., 2007. Cooperation and competition during dyadic play in domestic
488 dogs *Canis familiaris*. Anim. Behav. 73, 489-499.
- 489 Blackwell, E. J., Twells, C., Seawright, A., Casey, R. A., 2008. The relationship between
490 training methods and the occurrence of behavior problems, as reported by owners, in a
491 population of domestic dogs. J. Vet. Behav: Clin. Appl. Res. 3, 207-217. DOI:
492 10.1016/j.jveb.2007.10.008
- 493 Boitani, L., Ciucci, P., Ortolani, A., 2007. Behaviour and social ecology of free-ranging dogs.
494 In: Jensen, P., (Ed.), The Behavioural Biology of Dogs. CAB International, Wallingford UK,
495 pp. 147-165.
- 496 Bonanni, R., Cafazzo, S., Valsecchi, P., Natoli, E., 2010. Effect of affiliative and agonistic
497 relationships on leadership behaviour in free-ranging dogs. Anim. Behav. 79, 981-991.
- 498 Bonanni, R., Cafazzo, S., 2014. The social organisation of a population of free-ranging dogs
499 in a suburban area of Rome: a reassessment of the effects of domestication on dogs'
500 behaviour. In: Kaminski, J., Marshall-Pescini, S., (Ed.), The Social Dog: Behaviour and
501 Cognition. Academic Press, London, pp. 65-104.
- 502 Bradshaw, J. W. S., Nott, H. M. R., 1995. Social and communication behaviour of companion
503 dogs. In: Serpell, J. A., (Ed.), The Domestic Dog: Its Evolution, Behaviour and Interactions
504 with People. Cambridge University Press, Cambridge, pp. 115-130.
- 505 Bradshaw, J. W. S., Blackwell, E. J., Casey, R. A., 2009. Dominance in domestic dogs - useful
506 construct or bad habit? J. Vet. Behav: Clin. Appl. Res. 4, 135-144.
- 507 Bräuer, J., 2014. What dogs understand about humans. In: Kaminski, J., Marshall-Pescini,
508 S., (Ed.), The Social Dog: Behaviour and Cognition. Academic Press, London, pp. 295-317.
- 509 Cafazzo, S., Valsecchi, P., Bonanni, R., Natoli, E., 2010. Dominance in relation to age, sex,
510 and competitive contexts in a group of free-ranging domestic dogs. Behav. Ecol. 21, 443-455.
- 511 Cafazzo, S., Bonanni, R., Valsecchi, P., Natoli, E., 2014. Social variables affecting mate
512 preferences, copulation and reproductive outcome in a pack of free-ranging dogs. PLoS ONE
513 9(6), e98594. doi:10.1371/journal.pone.0098594

- 514 Casey, R. A., Twells, C., Blackwell, E. J., 2007. An investigation of the relationship between
515 measures of consistency in owners and the occurrence of 'behavior problems' in the domestic
516 dog. *J. Vet. Behav: Clin. Appl. Res.* 2, 83-84.
- 517 Chase, I.D., Tovey, C., Spangler-Martin, D., Manfredonia, M., 2002. Individual differences
518 versus social dynamics in the formation of animal dominance hierarchies. *Proc. Nat. Acad.*
519 *Sci.* 99, 5744-5749.
- 520 Coren, S., 1998. *Why We Love the Dogs We Do*. Free Press, New York.
- 521 de Waal, F.B.M., 1989. Dominance style and primate social organisation. In: Staden, V.,
522 Foley, R.A. (Eds.), *Comparative Socioecology: The Behavioural Ecology of Humans and*
523 *Other Animals*. Blackwell Press, Oxford, UK, pp. 243-263.
- 524 Drews, C., 1993. The concept and definition of dominance in animal behaviour. *Behav.* 125,
525 283-313.
- 526 Engh, A. L., Esch, K., Smale, L., Holekamp, K. E., 2000. Mechanisms of maternal rank
527 'inheritance' in the spotted hyaena, *Crocuta crocuta*. *Anim. Beh.* 60, 323-332.
528 doi:10.1006/anbe.2000.1502
- 529 Funato, T., Nara, M., Kurabayashi, D., Ashikaga, M., Aonuma, H., 2011. A model for group-
530 size-dependent behaviour decisions in insects using an oscillator network. *J. Exp. Biol.* 214,
531 2426-2434.
- 532 Gosling, S.D., John, O.P., 1999. Personality dimensions in non-human animals: a cross-
533 species review. *Curr. Dir. Psychol. Sci.* 8, 69-75.
- 534 Greenebaum, J. B., 2010. Training dogs and training humans: symbolic interaction and dog
535 training. *Anthrozoös* 23, 129-141. DOI: 10.2752/175303710X12682332909936
- 536 Hsu, Y., Serpell, J. A., 2003. Development and validation of a questionnaire measuring
537 behavior and temperament traits in pet dogs. *J. Am. Vet. Med. Assoc.* 223, 1293-1300.
- 538 Jennions, M. D., Macdonald, D. W., 1994. Cooperative breeding in mammals. *Tr. Ecol. Evol.*
539 9, 89-93.
- 540 Jones, A.C., Gosling, S.D., 2005. Temperament and personality in dogs (*Canis familiaris*): a
541 review and evaluation of past research. *Appl. Anim. Behav. Sci.* 95, 1-53.
- 542 Ley, J. M., Bennett, P. C., Coleman, G. J., 2009. A refinement and validation of the Monash
543 Canine Personality Questionnaire (MCPQ). *Appl. Anim. Behav. Sci.* 116, 220-227.
544 doi:10.1016/j.applanim.2008.09.009
- 545 Luescher, A. U., Reisner, I. R., 2008. Canine aggression toward familiar people: A new look
546 at an old problem. *Vet. Clin. Small Anim.* 38, 1107-1130.
- 547 Majolo, B., 2010. Ritualization. In: Mills, D.S. (Ed.), *The Encyclopedia of Applied Animal*
548 *Behaviour & Welfare*. CAB International, Wallingford, UK, p. 529.
- 549 Majumder, S. S., Bhadra, A., Ghosh, A., Mitra, S., Bhattacharjee, D., Chatterjee, J., Bhadra,
550 A., 2014. To be or not to be social: foraging associations of free-ranging dogs in an urban
551 ecosystem. *Acta Ethol.* 17, 1-8. DOI 10.1007/s10211-013-0158-0

- 552 Mech, L. D., 1999. Alpha status, dominance and division of labor in wolf packs. *Can. J. Zool.*
553 77, 1196-1203.
- 554 Mech, L. D., 2008. Whatever happened to the term “alpha wolf”? *Int. Wolf*, Winter 2008, 4-
555 9.
- 556 Mech, L. D., Cluff, H. D., 2010. Prolonged intensive dominance behavior between gray
557 wolves, *Canis lupus*. *Can. Field-Nat.* 124, 215–218.
- 558 Miklósi, Á., Turcsán, B., Kubinyi, E., 2014. The personality of dogs. In: Kaminski, J.,
559 Marshall-Pescini, S., (Ed.), *The Social Dog: Behaviour and Cognition*. Academic Press,
560 London, pp. 191-222.
- 561 Mirkó, E., Kubinyi, E., Gácsi, M., Miklósi, Á., 2012. Preliminary analysis of an adjective-
562 based dog personality questionnaire developed to measure some aspects of personality in the
563 domestic dog (*Canis familiaris*). *Appl. Anim. Behav. Sci.* 138, 88– 98.
564 doi:10.1016/j.applanim.2012.02.016
- 565 Netto, W. J., van der Borg, J. A., Slegers, J. F., 1993. The establishment of dominance
566 relationships in a dog pack and its relevance for the man-dog relationship. *Tijdsch.*
567 *Diergeneeskunde* 117, 51S-52S.
- 568 Packard, J.M., 2003. Wolf behavior: reproductive, social, and intelligent. In: Mech, L.D.,
569 Boitani, L. (Eds.), *Wolves: Behavior, Ecology and Conservation*. University of Chicago Press,
570 Chicago, IL, pp. 35-65.
- 571 Pal, S.K., Ghosh, B., Roy, S., 1999. Inter- and intra-sexual behaviour of free-ranging dogs
572 (*Canis familiaris*). *Appl. Anim. Behav. Sci.* 62, 267-278.
- 573 Petherick, C.A., 2010. Dominance. In: Mills, D.S. (Ed.), *The Encyclopedia of Applied Animal*
574 *Behaviour & Welfare*. CAB International, Wallingford, UK, pp. 185-186.
- 575 Rooney, N. J., Bradshaw, J. W. S., 2014. Canine welfare science: an antidote to sentiment
576 and myth. In: Horowitz, A. (Ed.), *Domestic Dog Cognition and Behavior*. Springer-Verlag,
577 Berlin, pp. 241-274. DOI: 10.1007/978-3-642-53994-7_11
- 578 Schalke, E., Stichnoth, J., Ott, S., Jones-Baade, R., 2007. Clinical signs caused by the use of
579 electric training collars on dogs in everyday life situations. *Appl. Anim. Behav. Sci.* 105, 369–
580 380.
- 581 Schenkel, R., 1967. Submission, its features and function in the wolf and the dog. *Am. Zool.*
582 7, 319-329.
- 583 Schilder, M. B. H., van der Borg, J. A. M., 2004. Training dogs with help of the shock collar:
584 Short and long term behavioural effects. *Appl. Anim. Behav. Sci.* 85, 319–334.
- 585 Schilder, M. B. H., Vinke, C. M., van der Borg, J. A. M., 2014. Dominance in domestic dogs
586 revisited: Useful habit and useful construct? *J. Vet. Behav.: Clin. App. Res.* 9, 184-191.
587 doi.org/10.1016/j.jveb.2014.04.005

- 588 Smith, J. E., Swanson, E. M., Reed, D., Holekamp, K. E., 2012. Evolution of cooperation
589 among mammalian carnivores and its relevance to hominin evolution. *Curr. Anthropol.* 53,
590 No. S6, S436-S452. DOI: 10.1086/667653
- 591 Smuts, B., 2014, Social behaviour among companion dogs with an emphasis on play. In:
592 Kaminski, J., Marshall-Pescini, S., (Ed.), *The Social Dog: Behaviour and Cognition.*
593 Academic Press, London, pp. 105-130.
- 594 Svartberg, K., Tapper, I., Temrin, H., Radesater, T., Thorman, S., 2005. Consistency of
595 personality traits in dogs. *Anim. Behav.* 69, 283–291. doi:10.1016/j.anbehav.2004.04.011
- 596 Topál, J., Kis, A., Oláh, K., 2014. Dogs' sensitivity to human ostensive cues: a unique
597 adaptation? In: Kaminski, J., Marshall-Pescini, S., (Ed.), *The Social Dog: Behaviour and*
598 *Cognition.* Academic Press, London, pp. 319-346.
- 599 Trisko, R.K., 2011. Dominance, Egalitarianism and Friendship at a Dog Day Care Facility.
600 PhD Thesis. University of Michigan. <http://deepblue.lib.umich.edu/handle/2027.42/84470>
- 601 Udell, M. A. R., Wynne, C. D. L., 2011. Reevaluating canine perspective-taking behavior.
602 *Learn. Behav.* 39, 318–323. DOI 10.3758/s13420-011-0043-5
- 603 van der Borg, J.A.M., Schilder, M.B.H., Vinke, C., 2012. Dominance and its behavioural
604 measures in group housed domestic dogs. *Proceedings of the 3rd Canine Science Forum,*
605 *Barcelona, p. 52.*
- 606 van Hooff, J.A.R.A.M., Wensing, J.A.B., 1987. Dominance and its behavioral measures in a
607 captive wolf pack. In: Frank, H. (Ed.), *Man and Wolf.* Dr W. Junk Publishers, Dordrecht, The
608 Netherlands, pp. 219-252.
- 609 Vaughan, R.T., Stoy, K., Sukhatme, G. S., Mataric, M. J., 2000. Go ahead, make my day:
610 Robot conflict resolution by aggressive competition. In: Meyer, J. A., Berthoz, A., Floreano,
611 D., Roitblat, H. L., Wilson, S. W. (Ed.), *From Animals to Animats 6.* MIT Press, Cambridge
612 MA, pp. 491-500.
- 613 Westgarth, C., Watkins, F., 2015. A qualitative investigation of the perceptions of female dog
614 bite victims and implications for the prevention of dog bites. *J. Vet. Behav.: Clin. App. Res.,*
615 in press. DOI 10.1016/j.jveb.2015.07.035