



## **UWL REPOSITORY**

**repository.uwl.ac.uk**

Impulsivity and behaviour problems in dogs: a reinforcement sensitivity theory perspective

Piotti, Patrizia, Satchell, Liam ORCID logoORCID: <https://orcid.org/0000-0002-8805-4884> and Lockhart, Tom (2018) Impulsivity and behaviour problems in dogs: a reinforcement sensitivity theory perspective. *Behavioural Processes*, 151. pp. 104-110.

<http://dx.doi.org/10.1016/j.beproc.2018.03.012>

**This is the Accepted Version of the final output.**

**UWL repository link:** <https://repository.uwl.ac.uk/id/eprint/4712/>

**Alternative formats:** If you require this document in an alternative format, please contact: [open.research@uwl.ac.uk](mailto:open.research@uwl.ac.uk)

**Copyright:** Creative Commons: Attribution-Noncommercial-No Derivative Works 4.0

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

**Take down policy:** If you believe that this document breaches copyright, please contact us at [open.research@uwl.ac.uk](mailto:open.research@uwl.ac.uk) providing details, and we will remove access to the work immediately and investigate your claim.

**Rights Retention Statement:**



18

## 19 **1. Introduction**

20 Trait impulsivity is stirring growing interest among comparative researchers. One species  
21 where the trait is being extensively investigated is the domestic dog (*Canis familiaris*) (e.g. Miller  
22 et al., 2010, 2012; Fadel et al., 2016; Riemer et al., 2014; Wright et al., 2011, 2012). Research  
23 shows theoretical and evidential convergence between human and dog impulsivity. For example,  
24 consistent neuro-behavioural individual differences in cognitive control are found in dogs (Cook  
25 et al., 2016) as well as humans (e.g. Kane and Engle, 2002). Likewise, both in dogs and humans,  
26 self-control relies on biological mechanisms related to blood glucose levels (Miller, et al., 2010).  
27 There are also indications of human-dog convergence regarding genotype-phenotype  
28 associations for trait impulsivity (humans: Munafó et al., 2008; dogs: Hejjas et al., 2009; Wan et  
29 al., 2013). Impulsivity in dogs is also related to behaviours similar to human psychological  
30 disorders. For example, genetic and behavioural homologies between dogs and humans have  
31 been observed in relation to the Attention Deficit and Hyperactive Disorder (ADHD) (e.g. Hejjas  
32 et al., 2009; Vas et al., 2007), as measured in dogs through a rating scale for the assessment of  
33 ADHD in children, reworded for describing dog behaviour (Vas et al., 2007) and a behaviour  
34 battery (Kubinyi et al., 2012). Another typical case is the relationship between high impulsivity and  
35 aggressive behaviour, which has also been observed both in humans (Apter, et al., 1990) and  
36 dogs (Amat et al., 2013; Wright et al., 2012).

37 The current study brings together a biologically based human measure of impulsivity and a well  
38 validated dog measure of impulsivity, to investigate the extent to which the measures show  
39 convergence.

40 Trait impulsivity may be measured in domestic dogs with questionnaire scales, such as  
41 the Dog Impulsivity Assessment Scale (DIAS; Wright et al., 2011). The DIAS provides an overall  
42 questionnaire score (OQS), which directly reflects the dog owner's opinion on how impulsive their  
43 dog is and resulted to be higher in dogs with behaviour problems (Wright et al., 2011) as well as

44 behavioural measures (Brady et al., 2018). However, the scale also provides three independent  
45 sub-factors, which can reflect distinct nuanced features of dog impulsivity. Factor 1, 'Behaviour  
46 Regulation' factor provides a more focused measure of impulsivity: high scores relates to having  
47 little control over a response to stimuli, little thinking before acting and being impatient, on the  
48 other side relates to showing extreme physiological signs when being excited. Factor 2,  
49 'Aggression and Response to Novelty' relates to lower tolerance thresholds to potentially aversive  
50 stimuli: individuals with high scores are less keen on new situations and more likely to respond  
51 aggressively to stimuli. Factor 3, 'Responsiveness' relates to general responsiveness and  
52 environmental awareness: high scores reflect high trainability, long interest in stimuli and quick  
53 reactions (Wright et al., 2011). The scale was found to relate to variation in the behaviour  
54 observed in two systematically manipulated experimental designs, i.e. a delayed reward choice  
55 test (Wright et al., 2012) and, for the OQS and Factor 1, a spatial discounting test (Brady et al.,  
56 2018); correlations were found also between the DIAS scores and variation in physiological  
57 factors - i.e. serotonin metabolites (5-HIAA) levels (Wright et al., 2012). This suggests that the  
58 DIAS is a reliable measure of trait impulsivity in domestic dogs. Further investigations have  
59 indicated that DIAS scores and cognitive measures in behaviour tests remain stable over time,  
60 suggesting that personality trait of impulsivity is consistent over time (Riemer et al., 2014; Fadel  
61 et al., 2016).

62 In a broader sense trait impulsivity, as measured by the DIAS, may also be regarded as  
63 part of a wider network of theories investigating dispositional approach and avoidance behaviour.  
64 In this paper, we investigated how one such theory, the Reinforcement Sensitivity Theory (RST)  
65 of personality, might be of interest to research areas on dogs' individual differences.

66 RST is a neuropsychological account of the neural and cognitive processes underlying the  
67 major dimensions of personality (Corr, 2008). The theory describes three neurologically defined  
68 systems which influence the organism's behaviours; the Behavioural Approach System (BAS,  
69 activated by signals of reward), the Behavioural Inhibition System (BIS, related to the monitoring

70 and resolution of conflict between compelling goals) and the Fight-Flight-Freeze System (FFFS,  
71 activated by aversive stimuli). The BAS has its neural basis in the dopaminergic reward circuitry  
72 (Pickering and Gray, 2001) and underlies any behaviour that involves approaching appetitive  
73 stimuli, whether it is to eat food or attack a prey. Because of this, the BAS is related to personality  
74 traits such as optimism, reward-orientation and impulsivity (Corr, 2004). The neural basis of the  
75 FFFS is the periaqueductal grey and medial hypothalamus (McNaughton and Corr, 2004). On a  
76 proximal level, the system is activated in response to aversive stimuli, encouraging active  
77 avoidance behaviours, and is responsible for personality traits such as proneness to fear (Corr &  
78 McNaughton, 2008). The BIS can be related to the septo-hippocampal system (Gray &  
79 McNaughton, 2000; Miller, 1991). The BIS is concerned with the monitoring and resolution of  
80 conflict between incompatible but equally compelling approach and avoidance goals. In humans,  
81 a strong presence of trait BIS is experienced as repetitive thoughts, rumination and anxiety  
82 (Andersen, Moore, Venables & Corr, 2008; Markarian, Pickett, Deveson & Kanona, 2013; Morgan  
83 et al., 2009). While low trait BIS is manifested as risk proneness and has been linked to Attention  
84 Deficit Hyperactivity Disorder (Gomez, Woodworth, Waugh & Corr, 2012).

85 RST is highly relevant to the non-human animal research as it was developed from  
86 experimental non-human animal behaviour research (Gray, 1987; Wilson, Barrett & Gray, 1989).  
87 In fact, several RST neurological studies have been performed on non-human animals, such as  
88 rodents (Ito & Lee, 2016; Young & McNaughton, 2008) and even AI programs have been coded  
89 using RST (Fua, Horswill, Ortony & Reville, 2009). RST is especially useful when observing  
90 behaviour in non-verbalising species, as tendencies of approaching or avoiding aspects of the  
91 environment are readily codeable, in that behaviour measures may be unambiguous, such as  
92 increasing and decreasing of distances from a specific stimulus (see Budaev, 1997; Mather &  
93 Anderson, 1993). Finally, the strong focus on overt behaviour in experimental settings, such as  
94 go/no-go tasks, (Moore, Mills, Marshman & Corr, 2012) aids objective scoring of behaviour by  
95 human observers.

96           There are also some examples where elements drawn from RST have been employed in  
97 the development of frameworks directed, for example, to domestic animal research of affective  
98 states (Mendl, Burman & Paul, 2010) or individual differences in sensitivity to punishment and  
99 reward (Sheppards & Mills, 2002). To our knowledge, however, the RST of personality has not  
100 been applied in its entirety to companion animals' research (i.e. without integration within further  
101 theories). It is therefore not yet clear to which degree RST may be relevant to companion animals  
102 and whether there is any overlapping with existing theories. For this reason, it was of interest to  
103 place domestic dogs' trait impulsivity in an RST theoretical network.

104           Dogs were chosen as a species of interest because they are adapted to life with humans  
105 and share human social environment (Hare & Tomasello, 2002; Miklósi et al., 2003), which makes  
106 them an ideal and convenient model of comparison in the study of personality (Gosling et al.,  
107 2003). Additionally, the investigation of frameworks that are able to predict individual traits  
108 potentially linked to increased risk of developing behaviour problems in dogs has implications for  
109 animal welfare. For example, there are indications that aggressive behaviour in dogs may relate  
110 to neurotransmitters linked to impulsivity (Amat et al., 2013; Wright et al., 2012), a low BIS or high  
111 BAS-related trait. Aggressive responses may also be fear-related in dogs (van der Borg, Graat  
112 and Beerda, 2017; Zapata, Serpell and Alvarez, 2017), i.e. relevant to the FFFS. For example,  
113 tendency to engage in active avoidant behaviours like barking or growling could be seen as  
114 defensive behaviours, reflected in the FFFS. Or it could be the case that high trait BIS leads to  
115 better inhibition of destructive behaviour that may occur when the animal is distressed.  
116 Consistently with the theoretical link between impulsivity and behaviour inhibition, it has been  
117 observed that depletion of self-control is linked to risk proneness in dogs (Miller et al., 2012).

118           The current study brings together the DIAS (Wright et al., 2011) and a psychometric  
119 measure of RST (adapted from a children-focused scale; Cooper et al., 2017). As stated above,  
120 the principal reason for including both DIAS and RST measures is due to the mutual importance  
121 of trait impulsivity. We therefore predicted a positive association between the DIAS 'Behaviour

122 Regulation' trait (which is correlated with the spatial discounting test of impulsivity, Brady et al.,  
123 2018) and the RST BAS (which includes impulsivity) traits. Further, given that RST BIS is arguably  
124 the inverse of impulsivity and we expected this factor to negatively relate to the DIAS impulsivity  
125 measures. We had an exploratory approach regarding the relationship between the other factors  
126 of the RST and DIAS measures. Further we investigated the relationships between behavioural  
127 problems and the personality measures. Given that the DIAS was designed with behavioural  
128 problems in mind, we predicted that the DIAS traits predict behavioural problems. It was expected  
129 that FFFS would positively correlate with avoidance behaviours (e.g. biting, barking, cowering,  
130 trying to escape). We had no other explicit hypotheses for the relationship between the RST  
131 measures and the behavioural problems.

132

## 133 **2. Material and Methods**

134

### 135 **2.1. Procedure & Questionnaires**

136 The current study was approved by the University of Portsmouth's Science Faculty Ethics  
137 Committee (2017 - 026). The described work been performed in accordance with the Code of  
138 Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving  
139 humans. Responses were provided anonymously by the participants. This work did not involve  
140 direct experimentation, observation or interaction with live animals and ethics was required for  
141 the data collection with animal owners.

142 After providing informed consent, participants completed the RST personality trait  
143 questionnaire. This measure was adapted from the 'Reinforcement Sensitivity Theory Personality  
144 Questionnaire - Child (RSTPQ-C, 21 items; Cooper et al., 2017): for the current study, the  
145 RSTPQ-C was reworded into a format that allowed owners to report on their dogs' behaviour,  
146 creating a Reinforcement Sensitivity Theory Personality Questionnaire-Dog (RSTPQ-D). Care  
147 was taken so that the RST system each question was referring to was not altered. In order to

148 imitate the RSTPQ-C, the RSTPQ-D was also answered on a four-point scale with the options;  
149 *Not at all* (scoring 1), *Slightly* (2), *Moderately* (3) and *Highly* (4). The mean response to each of  
150 the RSTPQ-D subscales was used for analysis. The RSTPQ-D has 3 subscales of 7 items each,  
151 reflecting trait BIS, FFFS and BAS.

152 After completion of the RSTPQ-D, participants completed the 18 item DIAS. DIAS  
153 response is measured on a 5 point scale from *Strongly Agree* (5) to *Strongly Disagree* (1), with a  
154 sixth *Don't know/not applicable* option. Consistent with the scoring for the DIAS (Wright et al.,  
155 2011), each sub-factor was calculated as a ratio of the potential total score of items that had a  
156 response (due to the *Don't know* option, participants could opt to not respond to some items). The  
157 DIAS (Wright et al. 2011) has 3 factors, Factor 1 'Behavioural Regulation' (10 items, a high score  
158 implies higher trait impulsivity), Factor 2 'Aggression and Response to Novelty' (5 items, a high  
159 score suggests a more aggressive/aversive aversion to novelty) and Factor 3 'Responsiveness'  
160 (5 items, a high score implies fast and engaged responses to new things).

161 Finally, participants were asked to answer to a checklist of 12 further questions related to  
162 behaviour problems and indicate how well they described their dog's behaviour. Questions were  
163 presented in a 5-point scale, from *Very much like my dog* (5), to *Not at all like my dog* (1).  
164 Questions referred to aggressive behaviours (barking, growling, biting, showing teeth, snapping),  
165 cowering/fearful behaviour (shaking, panting, moving away), destructive behaviour (digging,  
166 chewing) and house soiling. A copy of the questionnaire is provided as Supplemental Information  
167 1.

168

## 169 **2.2. Participants**

170 The inclusion criteria for dog owners to participate in the study were to be at least 18 years  
171 old and to have owned their dog for at least 6 months at the time they participated. Responses  
172 from owners of 730 adults dogs (age range: 1 - 16 years, median = 5 years, SD = 3.36, M : F =

173 1, neutered : intact = 6 : 1) were used for analysis. Dogs' demographic information is included in  
174 the Supplemental Information 2.

175

### 176 **3. Results**

#### 177 **3.1. Behaviour Checklist Factors.**

178 Data were analysed using IBM SPSS Statistics version 22 and R (R Core Team, 2015).

179 We examined the grouping of the behaviours listed in the checklist as it was expected that some  
180 behaviours may co-occur in some dogs. We first used an exploratory orthogonal (varimax)  
181 principal component analysis (henceforth 'EFA') with the loadings of the 12 behaviours. This  
182 suggested a four factor structure (Eigenvalue= 1.69, explaining 72% of variance) and grouped  
183 the behaviours in the checklist in the expected manner. A confirmatory factor analysis (henceforth  
184 'CFA') further evidenced this ( $\chi^2 (df= 48) = 153.90, p < 0.001, CFI= 0.97, RMSEA= 0.06$ ). The four  
185 factors generated related to Active Avoidance (i.e. increasing distance from a perceived threat),  
186 Passive Avoidance (i.e. withholding interaction with a perceived threat), Destructive and  
187 Inappropriate Elimination Behaviours. Active Avoidance Behaviours consisted of frequency of  
188 Snapping (EFA loading= 0.89; CFA loading= 0.86), Biting (0.91; 0.92), Growling (0.82; 0.83) and  
189 Barking (0.74; 0.78). Passive Avoidance Behaviours constituted of frequency of Avoiding others  
190 (0.83; 0.95), Shaking (0.83; 0.96) and Panting (0.78; 0.87). Destructive Behaviours included  
191 frequent Damaging of objects (0.81; 0.71), Digging (0.72; 0.59) and Other Destructive behaviours  
192 (0.84; 0.76). Inappropriate Elimination related to reported Defecation (0.90; 0.52) and Urination  
193 (0.90; 0.74) at inappropriate locations. For further analyses, we retain aggregate response of the  
194 items for each factor, with a higher score indicating stronger endorsement of that behaviour. It is  
195 important to note that Inappropriate Elimination Behaviours were rarely endorsed (see Table 1)  
196 as were Destructive Behaviours (to a lesser extent). There was more variation in the Active and  
197 Passive Avoidance Behaviours but, on average, owners were more likely to disagree that these  
198 behaviours describe their dogs than agree (see Table 1).

199

### 200 3.2. Personality Factors.

201 We computed average score totals for the DIAS and RSTPQ-D. The RSTPQ-D retained  
202 an acceptable fit for its factor structure (21 items into three domains of FFFS, BIS and BAS) when  
203 applied to the owner's ratings of dogs (CFA:  $\chi^2$  ( $df= 186$ ) = 1001.94,  $p < 0.001$ , CFI= 0.88,  
204 RMSEA= 0.08). The descriptive statistics for these personality factors can be found in Table 1.  
205 Given that both these data and those of the behaviours are considered non-normal by  
206 Kolmogorov-Smirnov testing (table 1), we investigate relationships between our variables using  
207 Spearman's rho correlations. In order to correct for multiple comparisons, the significance level  
208 has been corrected for the number of comparisons, therefore a significance level of  $\alpha = 0.002$   
209 was accepted ( $\alpha = 0.05 / 24$ ).

210 The RSTPQ-D's BAS measure positively correlated with the DIAS' Responsiveness  
211 ( $r_s(730)= 0.46$ , 95% CI [0.40, 0.53],  $p < 0.001$ ), this suggests that the RST's BAS has a similar  
212 function to the DIAS' Responsiveness trait. There were small negative correlations with the DIAS'  
213 Aggression/Response to Novelty ( $r_s(730)= -0.19$ , 95% CI [-0.26, -0.12],  $p < 0.001$ ) and  
214 Behavioural Regulation ( $r_s(730)= -0.12$ , 95% CI [-0.19, -0.05],  $p= 0.002$ ).

215 There was a notable negative correlation between the RSTPQ-D's BIS and the DIAS'  
216 Behavioural Regulation factor ( $r_s(730)= -0.30$ , 95% CI [-0.37, -0.22],  $p < 0.001$ ), reflecting that  
217 reported impulsivity is in opposition to reported inhibition. There were much weaker correlations  
218 with the DIAS' Aggression/Response to Novelty ( $r_s(730)= 0.15$ , 95% CI [0.08, 0.23],  $p < 0.001$ )  
219 and Responsiveness ( $r_s(730)= -0.08$ , 95% CI [-0.15, -0.01],  $p= 0.024$ ) factors.

220 The RSTPQ-D's FFFS factor was largely distinct to the DIAS factors. It did not notably  
221 correlate with Behavioural Regulation ( $r_s(730)= -0.02$ , 95% CI [-0.10, 0.06],  $p= 0.531$ ),  
222 Aggression/Response to Novelty ( $r_s(730)= 0.04$ , 95% CI [-0.03, 0.12],  $p= 0.243$ ) or  
223 Responsiveness ( $r_s(730)= -0.12$ , 95% CI [-0.20, -0.04],  $p= 0.002$ ). Overall, RST's FFFS and the  
224 DIAS' Aggression/Response to Novelty did not correlate with the behavioural factors. Both FFFS

225 and Aggression/Response to Novelty relate to avoidance-style behaviours and this result would  
226 suggest that they relate to different aspects of behavioural avoidance. Fig 1. provides a visual  
227 overview of the relationships between the trait factors.

228

### 229 **3.3. Personality and Behaviours.**

230 One aim of this study was to identify personality traits that related to common problem  
231 behaviours in dogs. The correlations between personality and behaviours are reported in Table  
232 2. Overall the DIAS better reflects problem behaviours than the RSTPQ-D. There are notable  
233 correlations between DIAS' Behavioural Regulation (impulsivity measure) and the more overt  
234 Active Avoidance and Destructive Behaviours. DIAS' Aggression/Response to Novelty positively  
235 correlated with both the Active and Passive Avoidance Behaviours, implying that a trait aversion  
236 to novel stimuli was more likely to lead to behavioural avoidance. DIAS' Responsiveness showed  
237 no noteworthy correlations with the behaviours.

238 The RSTPQ-D had smaller correlations with the Behaviours than the DIAS. However, the  
239 FFFS trait did positively correlate with Passive Avoidant traits and (weakly) negatively with Active  
240 Avoidance traits and the difference in the size of these two correlations is notably large (Fisher's  
241  $Z$  test= 7.76,  $p < 0.001$ ). This suggests that the FFFS trait may reflect an axis of Active to Passive  
242 Avoidant Behaviour and offer more discriminability in the *style* of avoidance behaviour than the  
243 DIAS traits. BIS and BAS largely did not correlate with the behaviours.

244

## 245 **4. Discussion**

246 The current study investigated the overlap between measures of domestic dog  
247 impulsivity (DIAS) and a broader cross-species theory of individual differences in  
248 approach/avoid behaviour, Reinforcement Sensitivity Theory (Gray and McNaughton, 2000).  
249 Our results show that, in dogs, RST trait inhibition (BIS) is the inverse to impulsivity, as  
250 measured by the DIAS Behavioural Regulation, as hypothesised. Another interesting result is

251 the positive relationship between BAS and Responsiveness, as predicted. The DIAS  
252 Responsiveness factor contains behaviours related to high trainability, interest in the  
253 environment and quick reactions (Wright et al., 2011). Such behaviours intuitively relate to trait  
254 BAS, which promotes reward seeking and goal-oriented behaviours (Corr, 2004). These  
255 findings suggest that the RST theoretical framework can be used to complement the DIAS tool.

256         None of the DIAS facets related with the RST trait FFFS. FFFS did demonstrate a small  
257 positive correlation with the Passive Avoidance behaviour problems and a negative relationship  
258 with the Active Avoidance. From this, we see that FFFS is largely distinct from the DIAS model  
259 but it may potentially have predictive value for fear-related behavioural problems in dogs, such  
260 as aggression (in line with previous findings on dog aggression: Amat et al., 2013; Wright et al.,  
261 2012). According to RST, FFFS is related to the Fight-Flight-Freeze response, which reflects  
262 defensive avoidance strategies based on the perceived intensity of a threat. Threat perception  
263 may be measured in terms of defensive distance, i.e. distance from a threat that causes various  
264 defensive behaviours (Blanchard and Blanchard, 1988). The smallest defensive distances result  
265 in explosive attack (fight response), while intermediate defensive distances lead to flight and  
266 freeze (Blanchard and Blanchard, 1988; McNaughton and Corr, 2004). Interestingly, an  
267 alternative measure of individual differences in dogs, the PANAS scale (Positive and Negative  
268 Activation Scale, Sheppard and Mills, 2002), is partially driven from an RST scale based on an  
269 earlier version of the framework (Carver and White, 1994) and measures dogs' sensitivity to  
270 reward and to punishment, which reflects the directional component of the most recent version  
271 of RST (Gray and McNaughton, 2000). Given the current results, investigating how the PANAS  
272 relates with the updated FFFS domain would provide further evidence of the applicability of RST  
273 to the investigation of dog behaviour.

274         The relationship between DIAS-Behaviour Regulation and Active Avoidance /  
275 Destructiveness (both characterised by high activity levels) also suggests that such behaviours  
276 might relate to mechanisms such as frustration and lack of self-control. Such a possibility is in

277 line with the human literature, where low BIS is associated with risk proneness and ADHD  
278 (Gomez, Woodworth, Waugh & Corr, 2012) and the canine literature, where high impulsivity, as  
279 measured with the DIAS, is associated with aggressive behaviour (Wright et al., 2012). While it  
280 is not possible to draw conclusions on similar patterns in dogs, given the established similarities  
281 between human and dog ADHD (Hejjas et al., 2009; Kubinyi et al., 2012; Vas et al., 2007), it  
282 may be also of interest to understand whether RST relates with the existing measures of canine  
283 ADHD.

284 Overall, the current results highlight how RST might be potentially of interest for the  
285 investigation of dogs' individual differences, especially in the investigation of approach and  
286 avoidance behaviour. We suggest that the questions relating to the FFFS factor of the RSTPQ-  
287 D could integrate the existing DIAS scale. We also suggest that future research should look  
288 further into how RST framework may be used to interpret results obtained from the DIAS. In  
289 order to further explore this possibility, future research on the relationship between RST and  
290 trait dog behaviour should be investigated through behavioural experiments, providing direct  
291 observation of behaviour under systematic manipulation. Various existing experimental  
292 paradigms have indicated individual differences in dogs based on approach and avoidance  
293 behaviours (e.g. cognitive bias test, Starling et al., 2014; response to threat, Vas et al., 2008).  
294 There is also evidence that difference in persistence affects dogs' strategies when trying to  
295 retrieve a food reward in the presence of a cognitive conflict, such as in the so-called *unsolvable*  
296 *task* (Marshall-Pescini et al., 2017). Finally, several experimental tasks have been developed to  
297 measure inhibitory control in dogs (which is supposedly related to impulsive behaviour as  
298 measured by the DIAS, Wright et al., 2011), suggesting a subdivision in persistency,  
299 compulsivity and decision speed (Brucks et al., 2017). This subdivision suggests it may be of  
300 interest to investigate how the result of these behaviour tests relate with the RST domains.  
301 Given the existing strong neurobiology basis of RST, it is also worthy to consider that  
302 behavioural findings should be followed up by electrophysiological measures, typical of the RST

303 literature - for example, in humans, behaviour tests based on go/no go and stop signal tasks are  
304 paired with EEG measurements (Brier et al., 2010; Moore et al., 2012; Shadli, Glue, McIntosh &  
305 McNaughton, 2015). Finally, RST work could also be extended to other non-human species  
306 where individual differences research focuses on approach-avoid behaviours (e.g. birds: Meier  
307 et al., 2017; sheep: Beausoleil et al., 2005; sharks: Byrnes and Brown, 2016; Finger et al., 2016;  
308 minks: Malmkvist et al., 2003)

309         The current study revolves on data coded by dog-owners rather than direct observations  
310 of dogs' behaviour, which may be considered a limitation of the presented work. Although care  
311 was taken to avoid questions on "internalised" processes, it should be understood that the  
312 responses reflect the owner's interpretation of their dog's behaviour. However, previous  
313 research indicates that dog owners are relatively reliable in describing their dogs' behaviour  
314 (Gosling et al., 2003). Additionally, the DIAS scale has been validated against experimental  
315 measures and for consistency over time (Wright et al., 2011; Riemer et al., 2014; Fadel et al.,  
316 2016). Moreover, the aim of the current study was to measure correlations between the two  
317 scales, RSTPQ-D and DIAS, rather than informing on the validity of an RST measure in itself.  
318 Validation should be in fact a consideration for future studies.

319         Another consideration regards the relatively small correlations observed between the  
320 RST and the DIAS factors. This may suggest that part of the observed variance might be  
321 attributable to external factors (Ferguson, 2009) not considered in this study, such as breed  
322 differences or training experience. These and other potential confounders should be evaluated  
323 in the future.

324         Finally, it is noteworthy that the current findings support the idea that investigating the  
325 potential applications to RST to non-human animals may provide benefits also to animal  
326 welfare. Versions of RST scales (e.g. Carver and White, 1994; Gray 1994; McNaughton & Corr,  
327 2008) have been beneficial to the development of frameworks, based on approach and  
328 avoidance, to be used in non-human animal research (e.g. Sheppard and Mills, 2002; Mendl et

329 al., 2010), providing evidence that RST may be relevant to companion animals in general and  
330 dogs specifically. For example, research based on measuring dogs' tendency to approach  
331 rewarding stimuli and avoid unpleasant ones, has led to the demonstration of a negative  
332 cognitive bias in dogs affected by separation related issues (Burman et al., 2009). Additionally,  
333 a scale (PANAS), which partially draws from an earlier version of RST, proved to be useful in  
334 measuring sensitivity to reward and punishment in dogs, which is particularly relevant to predict  
335 the success of dog training or veterinary behaviour medicine interventions (Sheppard and Mills,  
336 2002). Indeed, RST provides a theoretical framework grounded on neurobiological evidence to  
337 understand traits related to behaviour issues, such as impulsive behaviour or anxiety. The  
338 partial overlapping between the RSTPQ-D and the DIAS and the relationship of the FFFS facet  
339 with reported behaviour issues potentially related to fear and anxiety (avoidance behaviours)  
340 further advocates for the investigation of RST as a tool to understand companion animals'  
341 behaviour. Given the necessary validation, RST might, in the future, aid the selection of  
342 treatments in clinical cases through a better distinction between FFFS-fear behaviours and BIS-  
343 anxiety behaviours, in line with the definitions provided by Gray and McNaughton (2000),  
344 especially in those cases characterised by immobility as behavioural response, which might  
345 reflect freezing behaviour (activation of FFFS) or conflict (activation of BIS). Again, RST has  
346 proved to be beneficial in human psychology for the identification of markers for the risk to  
347 develop psychological disorders (e.g. anxiety, Shadli et al., 2015); similar research directions  
348 could be explored in veterinary behaviour medicine, especially in the presence of other known  
349 environmental risk factors, such as dogs adopted from pet shops or shelters (Cannas et al.,  
350 2017). Nevertheless, benefits may be extended also to other species, even beyond domestic  
351 animals. For example, inhibitory control in a stop-signal task has been linked to increased fit and  
352 survival in pheasants (Whiteside et al., 2016).

353

#### 354 **4.1. Conclusion**

355 In conclusion, the findings of this work suggest an overlap between RST and the  
356 constructs of trait impulsivity in dogs (as measured by the DIAS). However, this is a starting  
357 point, the aim of which is to suggest RST as a useful framework for the cross-specific  
358 investigation of individual differences. Future experimental and large scale personality studies  
359 will allow for the comprehensive framework of RST to contribute to the literature on dogs' and  
360 other non-human animals' welfare and behaviour.

361

### 362 **Acknowledgments**

363 This work was supported by the University of Portsmouth (U.K.).

364 We would like to thank all the participants of our online questionnaire.

365

### 366 **Compliance with Ethical Standards**

367 Conflict of Interest: Patrizia Piotti declares that she has no conflict of interest. Liam Satchell  
368 declares that he has no conflict of interest. Tom Lockhart declares that he has no conflict of  
369 interest.

370

### 371 **References**

372

- 373 1. Amat, M., Le Brech, S., Camps, T., Torrente, C., Mariotti, V. M., Ruiz, J. L., & Manteca, X.  
374 (2013). Differences in serotonin serum concentration between aggressive English cocker  
375 spaniels and aggressive dogs of other breeds. *Journal of Veterinary Behavior: Clinical*  
376 *Applications and Research*, 8(1), 19-25.
- 377 2. Andersen, S. B., Moore, R. A., Venables, L., & Corr, P. J. (2009) Electrophysiological  
378 correlates of anxious rumination. *International Journal of Psychophysiology*, 71(2), 156–  
379 169.

- 380 3. Apter A., van Praag H. M., Plutchik R., Sevy S., Korn M., Brown S-L. (1990)  
381 Interrelationships among anxiety, aggression, impulsivity, and mood: A serotonergically  
382 linked cluster? *Psychiatry Research*, 32(2), 191–199.
- 383 4. Beausoleil, N. J., Stafford, K. J., & Mellor, D. J. (2005) Sheep show more aversion to a dog  
384 than to a human in an arena test. *Applied animal behaviour science*, 91(3), 219-232.
- 385 5. Blanchard, D. C., & Blanchard, R. J. (1988) Ethoexperimental approaches to the biology of  
386 emotion. *Annual review of psychology*, 39(1), 43-68.
- 387 6. Brady, K., Hewison, L., Wright, H., Zulch, H., Cracknell, N., & Mills, D. (2018) A spatial  
388 discounting test to assess impulsivity in dogs. *Applied Animal Behaviour Science*.
- 389 7. Brier, M. R., Ferree, T. C., Maguire, M. J., Moore, P., Spence, J., Tillman, G. D., Hart Jr, J.  
390 and Kraut, M. A. (2010) Frontal theta and alpha power and coherence changes are  
391 modulated by semantic complexity in Go/NoGo tasks. *International Journal of*  
392 *Psychophysiology*, 78(3), pp.215-224.
- 393 8. Budaev, S. V. (1997) Alternative styles in the European wrasse, *Symphodus ocellatus*:  
394 boldness-related schooling tendency. *Environmental Biology of Fishes*, 49(1), 71-78.
- 395 9. Cannas, S., Talamonti, Z., Mazzola, S., Minero, M., Picciolini, A., & Palestrini, C. (2017).  
396 Factors associated with dog behavior problems referred to a behavior clinic. *Journal of*  
397 *Veterinary Behavior*.
- 398 10. Cook P. F., Spivak M, Berns G (2016) Neurobehavioral evidence for individual differences  
399 in canine cognitive control: an awake fMRI study. *Animal cognition*, 19(5), 867-878.
- 400 11. Cooper, A. J., Stirling, S., Dawe, S., Pugnaghi, G., & Corr, P. J. (2017) The reinforcement  
401 sensitivity theory of personality in children: A new questionnaire. *Personality and Individual*  
402 *Differences*, 115, 65–69.
- 403 12. Corr, P. J. & McNaughton, N. (2008) Reinforcement Sensitivity Theory and personality. In  
404 P. J. Corr (ed.), *The Reinforcement Sensitivity Theory of Personality* (pp. 155-187).  
405 Cambridge: Cambridge University Press.

- 406 13. Fadel, F.R., Driscoll, P., Pilot, M., Wright, H., Zulch, H. and Mills, D. (2016) Differences in  
407 trait impulsivity indicate diversification of dog breeds into working and show lines. *Scientific*  
408 *reports*, 6, p.22162.
- 409 14. Ferguson, C.J. (2009) An effect size primer: a guide for clinicians and  
410 researchers. *Professional Psychology: Research and Practice*, 40(5), p.532.
- 411 15. Fua, K., Horswill, I., Ortony, A., & Revelle, W. (2009) *Reinforcement Sensitivity Theory and*  
412 *Cognitive Architectures* (AAAI Technical Repots FS-09-01). Arlington: AAAI Press
- 413 16. Gray, J. A., McNaughton, N. (2000) The neuropsychology of anxiety: an enquiry into the  
414 functions of the septo-hippocampal system, 2nd ed., Oxford University Press.
- 415 17. Goldberg L. R. (1990) An alternative "description of personality": the big-five factor  
416 structure. *Journal of personality and social psychology*, 59(6), 1216.
- 417 18. Gomez, R., Woodworth, R., Waugh, M., & Corr, P. J. (2012) Attention-Deficit/Hyperactivity  
418 Disorder symptoms in an adult sample: Associations with Cloninger's temperament and  
419 character dimensions. *Personality and Individual Differences*, 52(3), 290–294.
- 420 19. Gosling S. D., Kwan V. S., John O. P. (2003) A dog's got personality: a cross-species  
421 comparative approach to personality judgments in dogs and humans. *Journal of*  
422 *personality and social psychology*, 85(6), 1161.
- 423 20. Hare, B., Brown, M., Williamson, C., & Tomasello, M. (2002) The domestication of social  
424 cognition in dogs. *Science*, 298(5598), 1634-1636.
- 425 21. Hejjas K., Kubinyi E., Ronai Z., Szekely A., Vas J., Miklósi Á., Sasvari-Szekely M.,  
426 Kereszturi E (2009) Molecular and behavioral analysis of the intron 2 repeat polymorphism  
427 in the canine dopamine D4 receptor gene. *Genes, Brain and Behavior*, 8(3), 330-336.
- 428 22. Ito, R., & Lee, A. C. H. (2016) The role of the hippocampus in approach-avoidance conflict  
429 decision-making: Evidence from rodent and human studies. *Behavioural Brain Research*,  
430 313, 345–357.

- 431 23. Leary T. (1957) *Interpersonal Diagnosis of Personality: A Functional Theory and*  
432 *Methodology for Personality Evaluation*. Ronald: New York.
- 433 24. Markarian, S. A., Pickett, S. M., Deveson, D. F., & Kanona, B. B. (2013) A model of  
434 BIS/BAS sensitivity, emotion regulation difficulties, and depression, anxiety, and stress  
435 symptoms in relation to sleep quality. *Psychiatry Research*, 210(1), 281–286.
- 436 25. Mather, J. A., & Anderson, R. C. (1993) Personalities of octopuses (*Octopus*  
437 *rubescens*). *Journal of Comparative Psychology*, 107(3), 336
- 438 26. Meier, C., Pant, S.R., van Horik, J.O., Laker, P.R., Langley, E.J., Whiteside, M.A.,  
439 Verbruggen, F. and Madden, J.R., (2017) A novel continuous inhibitory-control task:  
440 variation in individual performance by young pheasants (*Phasianus colchicus*). *Animal*  
441 *cognition*, 20(6), pp.1035-1047.
- 442 27. Miller, H. C., Pattison, K. F., DeWall, C. N., Rayburn-Reeves, R., & Zentall, T. R. (2010)  
443 Self-control without a “self”? Common self-control processes in humans and dogs.  
444 *Psychological science*, 21(4), 534-538.
- 445 28. Miller, H. C., DeWall, C. N., Pattison, K., Molet, M., & Zentall, T. R. (2012) Too dog tired to  
446 avoid danger: Self-control depletion in canines increases behavioral approach toward an  
447 aggressive threat. *Psychonomic bulletin & review*, 19(3), 535-540.
- 448 29. Malmkvist, J., Herskin, M. S., & Christensen, J. W. (2003) Behavioural responses of farm  
449 mink towards familiar and novel food. *Behavioural processes*, 61(3), 123-130.
- 450 30. Moore, R. A., Mills, M., Marshman, P., & Corr, P. J. (2012) Behavioural Inhibition System  
451 (BIS) sensitivity differentiates EEG theta responses during goal conflict in a continuous  
452 monitoring task. *International Journal of Psychophysiology*, 85(2), 135-144.
- 453 31. Morgan, B. E., van Honk, J., Hermans, E. J., Scholten, M. R., Stein, D. J., & Kahn, R. S.  
454 (2009) Gray's BIS/BAS dimensions in non-comorbid, non-medicated social anxiety  
455 disorder. *The World Journal of Biological Psychiatry*, 10(4-3), 925-928.

- 456 32. Munafò M. R., Yalcin B., Willis-Owen S. A., Flint J. (2008) Association of the dopamine D4  
457 receptor (DRD4) gene and approach-related personality traits: meta-analysis and new  
458 data. *Biological psychiatry*, 63(2), 197-206.
- 459 33. R Core Team (2015). R: A language and environment for statistical computing. R  
460 Foundation for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>.
- 461 34. Riemer S., Mills D. S., Wright H. (2014) Impulsive for life? The nature of long-term  
462 impulsivity in domestic dogs. *Animal cognition*, 17(3), 815-819.
- 463 35. Shadli, S. M., Glue, P., McIntosh, J., & McNaughton, N. (2015) An improved human  
464 anxiety process biomarker: Characterization of frequency band, personality and  
465 pharmacology. *Translational Psychiatry*, 5, e699.
- 466 36. Sheppard, G., & Mills, D. S. (2002) The development of a psychometric scale for the  
467 evaluation of the emotional predispositions of pet dogs. *International journal of comparative*  
468 *psychology*, 15(2).
- 469 37. van der Borg, J. A., Graat, E. A., & Beerda, B. (2017). Behavioural testing based breeding  
470 policy reduces the prevalence of fear and aggression related behaviour in  
471 Rottweilers. *Applied Animal Behaviour Science*, 195, 80-86.
- 472 38. Vas, J., Topál, J., Péch, E., & Miklósi, A. (2007) Measuring attention deficit and activity in  
473 dogs: a new application and validation of a human ADHD questionnaire. *Applied Animal*  
474 *Behaviour Science*, 103(1), 105-117.
- 475 39. Wan M., Hejjas K., Ronai Z., Elek Z., Sasvari-Szekely M., Champagne F. A., Miklósi Á.,  
476 Kubinyi E. (2013) DRD4 and TH gene polymorphisms are associated with activity,  
477 impulsivity and inattention in Siberian Husky dogs. *Animal genetics*, 44(6), 717-727.
- 478 40. Whiteside, M. A., Sage, R., & Madden, J. R. (2016) Multiple behavioural, morphological  
479 and cognitive developmental changes arise from a single alteration to early life spatial  
480 environment, resulting in fitness consequences for released pheasants. *Royal Society*  
481 *open science*, 3(3), 160008.

- 482 41. Wright, H. F., Mills, D. S., Pollux, P. M. (2011) Development and validation of a  
483 psychometric tool for assessing impulsivity in the domestic dog (*Canis familiaris*).  
484 *International Journal of Comparative Psychology*, 24(2).
- 485 42. Wright, H.F., Mills, D.S. and Pollux, P.M., 2012. Behavioural and physiological correlates of  
486 impulsivity in the domestic dog (*Canis familiaris*). *Physiology & behavior*, 105(3), pp.676-  
487 682.
- 488 43. Young, C. K., & McNaughton, N. (2008) Coupling of Theta Oscillations between Anterior  
489 and Posterior Midline Cortex and with the Hippocampus in Freely Behaving Rats. *Cerebral*  
490 *Cortex*, 19(1), 24–40.
- 491 44. Zapata, I., Serpell, J. A., & Alvarez, C. E. (2016). Genetic mapping of canine fear and  
492 aggression. *BMC genomics*, 17(1), 572.

493

494 **Tables:**

**Table 1. The descriptive statistics of the critical behavioural and personality variables in this study**

Variable	Mean	SD	Skewness	Kurtosis	Kolmogorov-Smirnov test
<b>Behaviours</b>					
Active Avoidance Behaviours	1.93	0.93	1.25	1.44	0.16**
Passive Avoidance Behaviours	2.20	1.05	0.67	-0.25	0.13**
Destructive Behaviours	1.74	0.82	1.20	1.12	0.19**
Inappropriate Elimination Behaviours	1.34	0.71	2.62	7.76	0.41**
<b>Traits</b>					
<b>Reinforcement Sensitivity Theory Personality Questionnaire - Dog</b>					
Behavioural Approach System	3.81	0.81	-0.58	-0.08	0.09**
Behavioural Inhibition System	2.92	1.07	-0.04	-0.89	0.07**
Fight/Flight/Freeze System	2.46	0.84	0.29	-0.23	0.05**
<b>Dog Impulsivity Assessment Scale</b>					
Behavioural Regulation	2.78	0.78	-0.13	0.10	0.05*
Aggression/Response to Novelty	2.07	0.78	0.51	-0.14	0.12**
Responsiveness	3.63	0.59	-0.21	-0.01	0.09**
Overall Questionnaire Score	2.88	0.51	0.19	-0.35	0.05*

Notes: \* $p=.001$ , \*\* $p<.001$

495

496

497

498

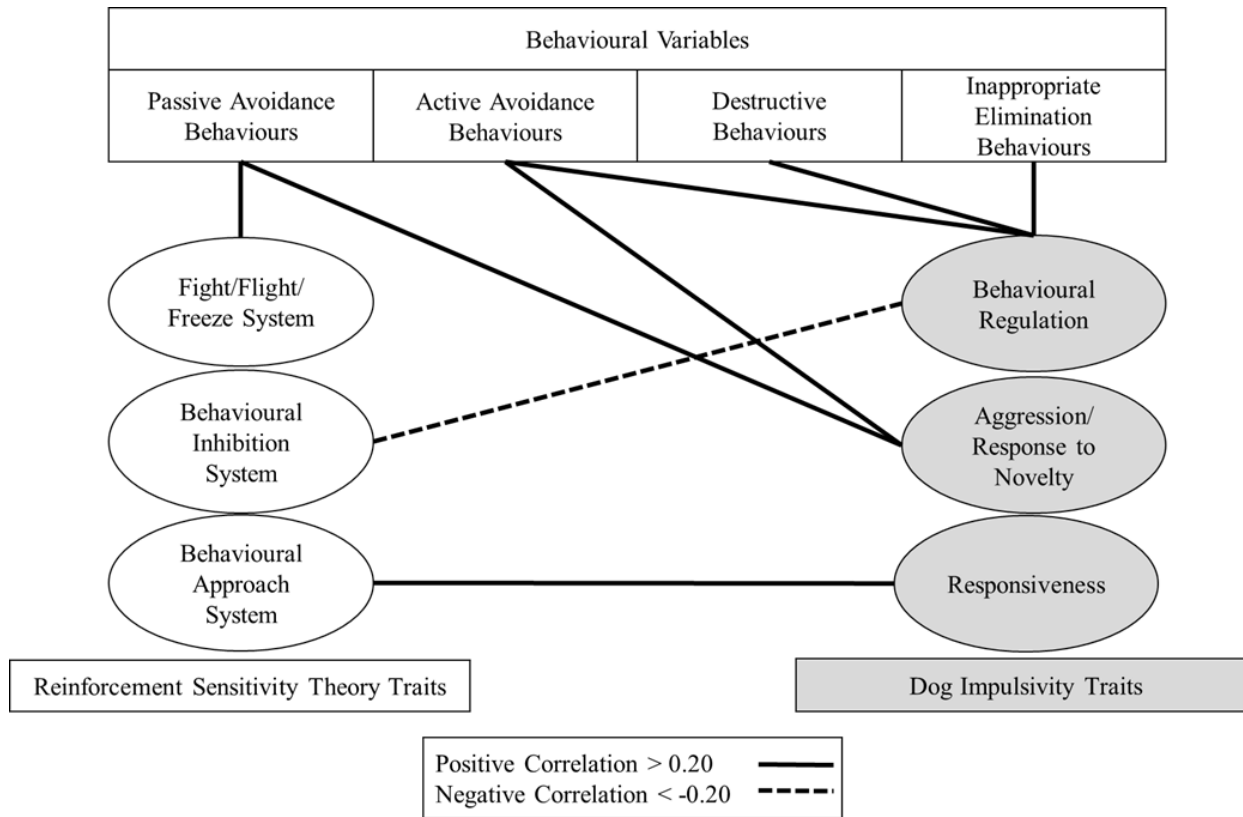
**Table 2. Spearman's correlations between the behaviour and personality trait variables (absolute *p* values in brackets) [95% CI in square brackets]**

Traits	Active Avoidance Behaviours	Passive Avoidance Behaviours	Destructive Behaviours	Inappropriate Elimination Behaviours
<b><i>Reinforcement Sensitivity Theory Personality Questionnaire - Dog</i></b>				
Behavioural Approach System	-0.08 (=0.032) [-0.15, -0.00]	-0.11 (=0.002) [-0.18, -0.04]	0.01 (=0.965) [-0.08, 0.08]	-0.04 (=0.281) [-0.12, 0.05]
Behavioural Inhibition System	-0.00 (=0.961) [-0.08, 0.08]	<b>0.16</b> <b>(&lt;0.001)</b> <b>[0.08, 0.23]</b>	<b>-0.15</b> <b>(&lt;0.001)</b> <b>[-0.24, -0.08]</b>	0.06 (=0.113) [-0.02, 0.13]
Fight/Flight/Freeze System	<b>-0.14</b> <b>(&lt;0.001)</b> <b>[-0.22, -0.06]</b>	<b>0.26</b> <b>(&lt;0.001)</b> <b>[0.19, 0.34]</b>	0.03 (=0.360) [-0.04, 0.11]	0.11 (=0.002) [0.02, 0.19]
<b><i>Dog Impulsivity Assessment Scale</i></b>				
Behavioural Regulation	<b>0.34</b> <b>(&lt;0.001)</b> <b>[0.27, 0.40]</b>	<b>0.17</b> <b>(&lt;0.001)</b> <b>[0.09, 0.24]</b>	<b>0.30</b> <b>(&lt;0.001)</b> <b>[0.23, 0.36]</b>	<b>0.22</b> <b>(&lt;0.001)</b> <b>[0.15, 0.29]</b>
Aggression/Response to Novelty	<b>0.53</b> <b>(&lt;0.001)</b> <b>[0.45, 0.57]</b>	<b>0.48</b> <b>(&lt;0.001)</b> <b>[0.38, 0.50]</b>	0.10 (=0.005) [0.02, 0.17]	<b>0.13</b> <b>(&lt;0.001)</b> <b>[0.04, 0.18]</b>
Responsiveness	-0.034 (=0.319) [-0.11, 0.04]	-0.11 (=0.003) [-0.18, 0.04]	0.03 (=0.415) [-0.04, 0.11]	-0.03 (=0.431) [-0.10, 0.05]
Overall Questionnaire Score	<b>0.40</b> <b>(&lt;0.001)</b> <b>[0.34, 0.46]</b>	<b>0.18</b> <b>(&lt;0.001)</b> <b>[0.12, 0.26]</b>	<b>0.29</b> <b>(&lt;0.001)</b> <b>[0.23, 0.36]</b>	<b>0.20</b> <b>(&lt;0.001)</b> <b>[0.13, 0.26]</b>

Notes:

Bold =  $p < 0.002$  (corrected alpha level of 0.05 over 24 comparisons)

500 **Figures:**



501

502 **Fig 1. Overview of the relationships between the behavioural and trait (from the Reinforcement Sensitivity Theory**  
503 **Personality Questionnaires and Dog Impulsivity Assessment Scale) factor variables in the study.** Spearman rho's  
504 correlations, with  $r$  above 0.20 are shown ( $p < 0.002$  – corrected alpha level of 0.05 over 24 comparisons;  $r$  cut-off was selected  
505 based on Ferguson, 2009).  
506

507 **Supplemental information 1**

508

**Reinforcement Sensitivity Theory of Personality Questionnaire - Dog**

		Strongly disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Strongly agree
1.	My dog would be frozen to the spot if there was a dangerous animal in the house with him/her.	1	2	3	4	5
2.	My dog would be frozen to the spot if he/she saw a large shadow when swimming.	1	2	3	4	5
3.	My dog would run away if he/she saw a dangerous animal.	1	2	3	4	5
4.	My dog would freeze if he/she thought a something was going to attack him/her.	1	2	3	4	5
5.	My dog would freeze if he/she heard scary noises at night.	1	2	3	4	5
6.	My dog would run away from an animal if it was making her/him feel scared.	1	2	3	4	5
7.	My dog would run upstairs if there was something scary downstairs.	1	2	3	4	5
8.	My dog is careful when doing something that might hurt him/her.	1	2	3	4	5
9.	My dog would be careful when playing.	1	2	3	4	5
10.	My dog would stop what he/she was doing if he/she thought there was physical danger or he/she might hurt him/herself.	1	2	3	4	5
11.	My dog would stop what he/she was doing if he/she thought it was too risky to keep going.	1	2	3	4	5
12.	My dog worries about getting hurt.	1	2	3	4	5
13.	My dog would stop and think before going down a steep slope or sharp drop (where they would not be able to stop easily).	1	2	3	4	5
14.	My dog appears to stop and think carefully before trying out for something.	1	2	3	4	5
15.	My dog spends a lot of time trying to get better at things he/she likes doing (such as fetch/agility).	1	2	3	4	5
16.	My dog works hard to do well at the things they like doing (like playing 'find it' or 'fetch').	1	2	3	4	5
17.	My dog likes to practice something he/she likes doing.	1	2	3	4	5
18.	My dog puts in lots of effort to achieve a goal (or get what he/she wants).	1	2	3	4	5
19.	My dog wants to keep on improving (getting better) at his/her favourite things.	1	2	3	4	5
20.	My dog is interested in exploring places.	1	2	3	4	5
21.	My dog likes to do new and exciting things.	1	2	3	4	5

512  
513  
514  
515  
516

**RSTPQ-D questionnaire and comparison with the original child version (Cooper et al., 2017)**

	<b>RSTPQ-D</b>	<b>RSTPQ-Child (Cooper et al., 2017)</b>
<b>FFFS:</b>		
1.	My dog would be frozen to the spot if there was a dangerous animal in the house with him/her.	I would be frozen to the spot if there was a snake or spider in the bathroom with me.
2.	My dog would be frozen to the spot if he/she saw a large shadow when swimming.	I would be frozen to the spot if I saw a large shadow when swimming in the ocean.
3.	My dog would run away if he/she saw a dangerous animal.	I would run away if I saw a spider or snake.
4.	My dog would freeze if he/she thought a something was going to attack him/her.	I would freeze if I thought a bird was going to attack me.
5.	I would say my dog would freeze if he/she heard scary noises at night.	I would freeze if I heard strange noises when in bed at night time.
6.	My dog would run away from an animal if it was making her/him feel scared.	I would run away from an animal if it was making me feel scared.
7.	My dog would run upstairs if there was something scary downstairs.	I would run back upstairs if there were no lights on downstairs.
<b>BIS:</b>		
8.	My dog is careful when doing something that might hurt him/her.	I am careful when doing something that might hurt me.
9.	My dog would be careful when playing.	I would be careful when playing a game or sport.
10.	My dog would stop what he/she was doing if he/she thought there was physical danger or he/she might hurt him/herself.	I would stop what I was doing if I thought there was physical danger or I might hurt myself.
11.	My dog would stop what he/she was doing if he/she thought it was too risky to keep going.	I would stop what I was doing if I thought it was too risky to keep going.
12.	My dog worries about getting hurt.	I worry about what would happen if I was hurt.
13.	My dog would stop and think before going down a steep slope or sharp drop (where they would not be able to stop easily).	I would stop and think before going down a hill on a skateboard, rollerblades, bike etc.
14.	My dog appears to stop and think carefully before trying out for something.	I would think carefully about trying out for something (e.g., sports team, school captain etc.) in case I didn't

		make it in.
<b>BAS:</b>		
15.	My dog spends a lot of time trying to get better at things he/she likes doing (such as fetch/agility).	I am training to be better at sport/things I like doing.
16.	My dog works hard to do well at the things they like doing (like playing 'find it' or 'fetch').	I work hard to do well at the things I like doing.
17.	My dog likes to practice something he/she likes doing.	I like to practise something I like doing so I can get better.
18.	My dog puts in lots of effort to achieve a goal (or get what he/she wants).	I put in lots of effort to achieve a goal (or get where I want).
19.	My dog wants to keep on improving (getting better) at his/her favourite things.	I want to keep on improving (getting better) at my favourite things.
20.	My dog is interested in exploring places.	I am interested in exploring places.
21.	My dog likes to do new and exciting things.	I like to do new and exciting things.

517

518

519 **Check-list of Behaviour Problems:**

520 1. My dog barks, charges or lunges at people, dogs, other animals or certain objects

521 2. My dog growls or snarl (shows his/her teeth) at people, dogs, other animals or certain  
522 objects

523 3. My dog tries to bite people, dogs, other animals or certain objects

524 4. My dog snaps or bites people, dogs, other animals or certain objects

525 5. My dog urinates where he/she shouldn't (e.g. in the house)

526 6. My dog defecates where he/she shouldn't (e.g. in the house)

527 7. My dog shakes in the presence of certain people, animals, objects or situations (e.g.  
528 crowded places or loud noises)

529 8. My dog pants in the presence of certain people, animals, objects or situations (e.g.  
530 crowded places or loud noises)

- 531 9. My dog tries to avoid people, other animals, objects or situations (e.g. crowded places  
532 or loud noises)
- 533 10. My dog damages or destroys objects (e.g. chews shoes or carpets)
- 534 11. My dog digs holes in the garden, etc.
- 535 12. My dog shows other destructive behaviours
- 536
- 537