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1 **Children's Beliefs about Animal Minds (Child-BAM): Associations with Positive and**
2 **Negative Child-Animal Interactions**

3
4 **Running title:** CHILDREN'S BELIEFS ABOUT ANIMAL MINDS

5
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13
14 **Abstract**

15 Children and animals can have a great impact on each other's lives, yet little is known
16 about the underpinnings of these relationships. Children's interactions with animals may be
17 influenced by their belief in animal minds, that animals are sentient and experience thoughts
18 and feelings. This study introduces a newly developed measure of children's beliefs about
19 animal minds (Child-BAM) and investigates associations between Child-BAM and factors
20 relating to positive and negative interactions with animals. Using a questionnaire-based
21 survey of over one thousand 6 to 13 year-olds in the UK, the results show that Child-BAM
22 was associated with higher attachment to pets ($p < 0.001$), compassion ($p < 0.001$), humane

23 ($p < 0.001$) and caring behaviour ($p < 0.001$) towards animals, emotional attachment to
24 animals ($p = 0.003$) and positive attitudes towards animals ($p < 0.001$). Child-BAM was also
25 associated with less acceptance of intentional animal cruelty ($p = 0.001$), unintentional animal
26 cruelty ($p = 0.007$), and animal neglect ($p = 0.01$). There was a significant difference in Child-
27 BAM between children with pets ($p = 0.014$), children who had a pet of their own ($p = 0.016$),
28 and age group ($p < 0.001$). This study enhances our understanding of the psychological
29 underpinnings of child-animal relationships and highlights the implications for animal
30 welfare education and for preventing childhood animal cruelty.

31

32 Key words: animal emotion, animal welfare, beliefs about animal mind, children, preventing
33 animal cruelty

34

35

Introduction

36 The relationship between humans and animals is multi-layered and complex; there are
37 many inter-related factors that shape these relationships. Although research interest is
38 expanding, child and animal relationships remain under-researched, which is surprising given
39 the significant impact animals can have on children's lives (Melson 2003) and vice versa
40 (Muldoon et al. 2009). It is important to conduct research into the 'complex web' of factors
41 that influence these relationships, both positively and negatively, to promote humane animal
42 treatment.

43 Human-animal interactions are affected by beliefs about animal mind (Davis and
44 Cheeke 1998). Beliefs about animal mind (BAM), that is, believing that non-human animals
45 have the ability to think, feel and experience emotions, is arguably the most important
46 cognitive domain (affective empathy being the most important emotional domain)

47 influencing the moral status of animals (Sorabji 1995), attitudes towards animals and
48 subsequent animal welfare (Ellingsen et al. 2010). There appears to be widespread belief in
49 the emotional lives of animals, especially among adult pet owners (Morris, Knight and Lesley
50 2012). Emotions in animals are often seen as ‘common sense’ (Katcher 1981). However, we
51 still have little understanding regarding the role of BAM in children-animal relationships.

52 Scientific research demonstrating the cognitive and emotional capabilities of a wide
53 range of animals continues to expand, such as language and cognition in non-human apes
54 (Rumbaugh 2014), morality in sperm whales (Peterson 2011) prosocial behaviour in rats
55 (Bartal, Decety and Mason 2011; Bartal et al. 2014) and cognitive complexities in fish
56 (Brown 2015). This increase in research, as well as increased public interest in animal
57 cognition over the past 20 years or so, may be affecting public attitudes towards animals. For
58 example, the recent case of whether human rights should be granted to chimpanzees (Foster
59 2015) and increased concern for farm animal welfare due to the rapid progression of research
60 on farm animal sentience (Boissy and Lee 2014). Attributing mental states to animals, or
61 believing animals are sentient, appears to be commonplace and cross-cultural but may depend
62 on species (Eddy, Gallup and Povinelli 1993), personal relevance, social identity and group
63 membership (Fraser et al. 2013; Morris, Knight and Lesley 2012). “Animal welfarists” for
64 example, may be more likely to believe in animal minds than laypersons or scientists (Knight
65 et al. 2009).

66 BAM is strongly related with concern for animals (Herzog and Galvin 1997), caring
67 behaviour (Kielland et al. 2008; Ellingsen et al. 2010), and can affect empathy and attitudes
68 towards animals (Hills 1995; Knight et al. 2004). Believing that animals are sentient
69 introduces moral dilemmas, such as whether animal experimentation is acceptable. BAM
70 positively correlates with concern for animal welfare among adults (Broida et al. 1993) and
71 may affect how children interact and treat particular animals (Burghardt 2009). Believing

72 animals are insentient may lead to negative behaviours towards animals (Knight et al. 2004),
73 thus compromising animal welfare.

74 BAM involves attributing animals with mental capacities (Eddy, Gallup and Povinelli
75 1993). Myers (1998) observed that even young children have a basic BAM. Research on the
76 theory of mind (ToM) shows that by the age of four, children have a range of concepts
77 relating to human minds including an understanding of desires, the origins of knowledge, that
78 people may have false beliefs, and later in development children begin to understand
79 personality differences and unobservable cognitive processes (Burke and Williams 2009; Lim
80 et al. 2010; Saracho 2014). Understanding of minds may depend on skill development and
81 interaction experiences (Dennett 1978), which may explain why pets are commonly
82 perceived to have higher cognitive capacities than other animals (Maust-Mohl, Fraser and
83 Morrison 2012). Children may over-estimate animal minds in those they perceive as similar,
84 familiar or phylogenetically closer to humans (Lockard 1971; Knight et al. 2004) and
85 anthropomorphism (attributing human characteristics to non-human animals) may affect how
86 children rate animals on sentience (Collins 2012). These judgements may be based on
87 inappropriate criteria such as positive or negative emotional feelings towards particular
88 species. A lack of understanding of animal's experiences can lead to inappropriate attitudes
89 and behaviour (Staub 1987).

90 Hills (1995) advocates focusing education on improving understandings of animal's
91 mental capabilities and thereby "capitalizing on the motivational power of feelings" (p.141).
92 Knight et al. (2004) also states that research should acknowledge the importance of BAM.
93 However, very few studies have investigated children's BAM and the influence this has on
94 their relationships with animals. Exploring how young children develop ideas about animal
95 minds will enable us to comprehend and explore how society's treatment of animals may be
96 influenced (Okamoto 2001).

98 This study explores associations between Child-BAM and factors relating to positive
99 and negative interactions with animals. We hypothesised that higher Child-BAM would be
100 related to higher attachment and compassion towards animals, positive attitudes towards
101 animals, reported humane behaviour and would be associated with less acceptance of animal
102 cruelty. It was also hypothesised that children with pets would have higher BAM.

103 A range of experiential and development influences may affect children's BAM.
104 These include pet ownership (Cain 1985; Driscoll 1992; Sanders 2003; Morris, Knight and
105 Lesley 2012; Wilkins, McCrae and McBride 2015). For example, pet owners are more likely
106 to report a wider range of emotions across species than those who do not have pets (Morris,
107 Knight and Lesley 2012; Wilkins, McCrae and McBride 2015). Demographic factors may
108 also affect children's BAM. Research has shown that females are more emotionally receptive
109 than males (Hoffmann et al. 2010; Whittle et al. 2011) and score higher on BAM than males
110 (Herzog and Galvin 1997; Nakajima, Arimitsu and Lattal 2002). Research has also found a
111 positive relationship between age and BAM (Knight et al. 2004), and that adults from urban
112 areas displayed more positive attitudes towards animals but less welfare knowledge about
113 farm animals (Kalof et al. 1999), with similar findings in children (Burich and Williams,
114 under review). Most of the previous research is with adults and so we aimed to identify
115 sociodemographic variables that may influence children's BAM including gender, age, pet
116 ownership, family affluence and area of residence.

117 We aimed to answer four primary research questions:

- 118 1) Is there a relationship between Child-BAM and children's attachment,
119 compassion, reported humane behaviour and attitudes towards animals?

- 120 2) Is there a relationship between Child-BAM and children's attitudes towards
121 animal cruelty?
122 3) Are there age, gender and demographic differences in Child-BAM?
123 4) Are there differences in Child-BAM between children with or without pets?
124

125 **Methods**

126 *Participants and Procedure*

127 Participants included 1,217 (51% boys, 49% girls) primary school children from 24
128 schools across Scotland UK. Children were aged between 6 and 13 years old (M=9.7, SD=1,
129 range 6.4-12.2) and grouped into two age groups for the purpose of analysis, 6-9 years
130 (52.8%) and 10-13 years (47.2%). The majority of children had pets (67%) and had a pet of
131 their own (54%). The types of pets included: dogs (35%), cats (22%), small mammals (18%),
132 fish/reptiles/amphibians (21%), birds (2%) and other (4%). A self-complete questionnaire,
133 comprising of a total of 35 questions (approximately 15 minutes to complete), was
134 administered to the children during class time by school teachers. Each child completed the
135 questionnaire individually at their classroom desks and could ask for help from a teacher if
136 they had difficulty reading or understanding any of the questions. The questionnaire used
137 appropriate terminology for the age group and a pilot study with three schools (n=128)
138 confirmed its suitability.

139 Questionnaires were either mailed or hand delivered to schools, following completion
140 the sealed questionnaires were either collected in person or sent by mail and then stored
141 securely within the University. All information was treated confidentially and kept secure at
142 all times; child and school data were anonymised during data preparation by adopting identity
143 numbers.

144 The ethical guidelines of the British Psychological Society, specifically relating to
145 research with children, was adopted for this research and ethical consent was granted from
146 the University of Edinburgh's Clinical and Health Psychology ethics committee. Permission
147 was sought from each local authority before schools were contacted. School participation was
148 at the head teacher's discretion and parental consent and child assent were obtained.

149 *Measures*

150 *Child-BAM*: As there is no consistent measure of BAM for adults, and no existing measure
151 for children, the Child-BAM (Children's Beliefs about Animal Minds) was developed from a
152 measure of adult's perceptions of animal mentality (see Rasmussen, Rajecki and Craft 1993;
153 Hills 1995). Each scale (e.g. "do you think the following animals are?") related to a
154 specific sentience item (clever/pain/happiness/sadness/fear). The emotions selected were
155 those children would have familiarity and understanding of in relation to humans and have
156 relevance to a wide range of species. These questions were asked in relation to eight animals
157 (dog/cow/human/robin/frog/badger/chimpanzee/goldfish). These animals represent a range of
158 domestic, farm and wild animals, on a scale of phylogenetic similarity to humans. These
159 specific animals were also chosen based on familiarity among UK children. Animals that may
160 have negative connotations for children (Borgi and Cirulli 2015) such as snakes were not
161 included as this may affect BAM scores. Each item was scored on a 5-point Likert scale
162 ("strongly agree"- "strongly disagree"). Overall Child-BAM scores were calculated for each
163 participant using the total score from each item (minimum score 40, maximum score 200), α
164 = 0.92.

165 *Attachment to Pets (SAPS)*: The Short Attachment to Pets Scale for Children and Young
166 People, developed and validated by Marsa-Sambola et al. (2015), was used to measure
167 attachment to pets. One 9-item scale asked children to "please tell us how you feel about your

168 favourite pet animal” with nine statements e.g. “I love pets” and “I consider my pet to be a
169 friend (or would if I had one)”. Each item was scored on a 5-point Likert scale (“strongly
170 agree”-“strongly disagree”). Total scores were calculated (minimum score 9, maximum score
171 45). $\alpha = 0.85$.

172 *Children’s Compassion towards Animals (CCA)*: A new measure of compassion to animals
173 for children was developed comprising one 5-item scale asking “what do you think about
174 animals?” with five statements e.g. “when I see an animal that is hurt or upset I feel upset”
175 and “when I see an animal that is hurt or upset I want to help it”. There are currently no
176 measures of compassion to animals for children. To develop this new scale we drew on
177 human self-compassion measures literature (e.g. Neff 2003). Adaptations included rewording
178 to focus on compassion to animals and reducing the number of items to achieve child-
179 appropriateness. The measure is scored on a 5-point Likert scale (“strongly agree”-“strongly
180 disagree”). Total scores were calculated (minimum score 5, maximum score 25). $\alpha = 0.7$.

181 *Children’s Reported Humane Behaviour towards Animals (CRHBA)*: The humane behaviour
182 measure was adapted from a combination of the Children’s Treatment of Animals
183 Questionnaire (Thompson and Gullone 2003) and the Lexington Attachment to Pets Scale
184 (Johnson, Garrity and Stallones 1992). One 12-item scale asked children “how often do you
185 do the following things with or for your pet animal(s) (or would if you had one)?” for each of
186 12 statements e.g. “play with”, “cuddle” and “talk to”. Each statement is scored on a scale of
187 1-4 (“often”, “sometimes”, “never” and “I cannot do this with my animal”). Total scores were
188 calculated (minimum score 12, maximum score 48). $\alpha = 0.84$.

189 Initial analysis using principal components analysis (PCA) extracted three
190 components from the humane behaviour variables explaining 58.7% of the overall variance
191 (Table 1). Component one, explaining 31.11% of the variance, was labelled “caring

192 behaviour towards animals”. Component two, explaining 18.35% of the variance, was
193 labelled “emotional attachment to animals”. Component three, explaining 9.23% of the
194 variance, was labelled “aggression towards pets”. These three subscales were used in
195 subsequent statistical analysis.

196 [insert Table 1 here]

197

198 *Attitudes towards Animals*: This measure was adapted from the Pet Attitude Scale (see
199 Munsell et al. 2004; Daly and Morton 2006). This is a 28-item scale, nine items relating to
200 pet animals (e.g. “all pet animals should be cared for by humans”), eight relating to wild
201 animals (e.g. “wild animals should live free in the wild”) and 11 relating to farm animals (e.g.
202 “I don’t care about farm animals”), each scored on a 5-point Likert scale (“strongly agree”-
203 “strongly disagree”). An overall total score for attitudes towards animals was calculated
204 (minimum 28, maximum 140), as well as subtotals for each type of animal (pet/wild/farm). α
205 = 0.72.

206 *Children’s Attitudes towards Animal Cruelty (CAAC)*: This measure, adapted from Connor,
207 Williams and Lawrence (2014), is an 11-item scale where children are asked “how acceptable
208 do you think it is to..?” with 11 behaviours e.g. “kill an animal” (See Hawkins and Williams,
209 in preparation). These include deliberate cruelty (e.g. “hurt an animal on purpose”),
210 accidental cruelty (e.g. “kick an animal by accident”), and animal neglect (e.g. “forget to feed
211 a pet”. Items were scored on a 5-point Likert scale (“not acceptable at all”-“very
212 acceptable”). A total score was calculated (minimum 11, maximum 55). $\alpha = 0.7$.

213 Initial analysis using PCA extracted three components from the 11 animal cruelty
214 variables explaining 59.07% of the overall variance (Table 2). Component one, explaining
215 24.91% of the variance, was labelled “intentional animal cruelty”. Component two,

216 explaining 17.57% of the variance, was labelled “unintentional animal cruelty”. Component
217 three, explaining 16.59% of the variance, was labelled “animal neglect”. The subscales were
218 used in subsequent statistical analysis.

219

220 [insert Table 2 here]

221

222 *Family Affluence and Pet Ownership:* The validated Family Affluence Scale (II; Currie et al.
223 2008) was included to measure family wealth. This scale comprises of four questions: 1) does
224 your family own a car, van or truck? 2) Do you have your own bedroom for yourself? 3)
225 During the past 12 months, how many times did you travel away on holiday with your
226 family? 4) How many computers does your family own? A composite FAS II score was
227 calculated ($\alpha=0.33$). The pet ownership questions were adapted from the Childhood Pet
228 Ownership Questionnaire (Paul and Serpell 1993). These questions related to current
229 ownership of pets, types of pets, the number of pets in the household and whether there was a
230 pet that the child considered to be their own.

231 The full versions of the scales are available from the first author upon request.

232

233

Results

234 Data that did not conform to parametric assumptions were transformed using
235 logarithms (base 10 log). Paired-sample T-tests examined statistical differences in Child-
236 BAM scores between animals. Table 3 displays the order in which children rated animals as
237 sentient. Children rated dogs as the most sentient above all other animals except humans,
238 whereas goldfish and frogs were rated as the least sentient. All paired differences for ratings

239 of intelligence, pain, happiness and sadness were significant ($p < 0.05$). All paired differences
240 for ratings of fear were significant, except for goldfish and frogs ($p = 0.063$), and badgers and
241 cows ($p = 0.93$).

242

243 [insert Table 3 here]

244

245 *1) Is there a relationship between Child-BAM and children's attachment, compassion,*
246 *reported humane behaviour and attitudes towards animals?*

247

248 Linear regression analysis (see Table 4) found that higher Child-BAM significantly
249 but weakly predicted higher: attachment to pets, compassion, reported humane behaviour,
250 caring behaviour, emotional attachment, and attitudes towards wild animals. Child-BAM was
251 significantly but weakly predicted by positive attitudes towards animals and pets.

252 *1) Is there a relationship between Child-BAM and children's attitudes towards animal*
253 *cruelty?*

254

255 Linear regression analysis (see Table 4) found that Child-BAM significantly but
256 weakly predicted CAAC, intentional animal cruelty, unintentional animal cruelty and animal
257 neglect. Lower Child-BAM was associated with higher acceptance of animal cruelty,
258 including intentional, unintentional animal cruelty and animal neglect.

259 *2) Are there age, gender and demographic differences in Child-BAM?*

260 Independent T-Test analysis showed that older children (10-13 years) scored
261 significantly higher on Child-BAM than younger children (6-9 years) ($t(1084) = 4.39$, $p <$
262 0.001 , $d = 0.3$). There was no significant difference in Child-BAM between boys and girls
263 ($t(1124) = 0.93$, $p = 0.36$, $d = 0.06$).

264 One-way ANOVA found an initial significant difference between area of residence
265 ($F(4,1119)=3.2, p=0.013, n^2=0.01$) but no significant difference was found following
266 Bonferroni post-hoc analysis. Linear regression analysis (Table 4) found no significant
267 relationship between Child-BAM and family affluence.

268 3) *Are there differences in Child-BAM between children with or without pets?*

269

270 Independent T-Test analysis revealed that children who had a pet of their own scored
271 higher on Child-BAM than children without a pet of their own ($t(1111)=-2.41, p=0.016,$
272 $d=0.1$). One-way ANOVA found that Child-BAM significantly differed depending on the
273 number of pets currently living in the child's home ($F(3,1120)=3.59, p=0.013, n^2=0.01$).
274 Bonferroni post-hoc showed that children with two or more pets scored higher on Child-
275 BAM compared to children with no pets ($p=0.007$). No significant difference was found for
276 children with one or two pets ($p>0.05, ns$), or between children who had or did not have
277 particular types of pets (all $p>0.05, ns$).

278 Independent T-Tests analysis showed that children who had pet dogs rated dogs
279 higher on sentience compared to children who did not have pet dogs ($t(907)=2.88, p=0.004,$
280 $d=0.2$). However, children with pet birds did not rate robins higher on sentience compared to
281 children without pet birds ($t(1183)=0.87, p=0.38, d=0.05$), similarly with pet fish
282 ($t(1174)=0.1, p=0.92, d=0.01$).

283 One-way ANOVA revealed that children scored higher on Child-BAM if they:
284 believed their pet was their friend, their pet made them feel happy, they liked animals, they
285 talked to their pets a lot, they spent time everyday playing with their pets and if they felt that
286 there are times they would be lonely without their pet (see Table 5). Children scored higher
287 on Child-BAM if they did the following things often with their pet/s (or would if they had
288 one): played with, took for a walk, patted/stroked, cuddled, cried with, groomed, told secrets

289 to and spent time with (see Table 6). Spending more time with pets as well as having a close
290 relationship to pets therefore increases Child-BAM.

291

292 [insert Tables 4, 5 and 6 here]

293

294

Discussion

295 We set out to study associations between Child-BAM and factors relating to positive
296 and negative interactions with animals. The results from the study confirmed the hypothesis
297 that Child-BAM is positively related to attachment to pets and compassion to animals,
298 humane behaviour towards animals, as well as attitudes towards animals. The findings also
299 confirmed that Child-BAM was negatively associated with acceptance of intentional and
300 unintentional animal cruelty and animal neglect. Children with pets and those with close
301 relationships with their pets, scored higher on Child-BAM. All effect sizes were small
302 (Cohen 1988; Miles and Shevlin, 2001). No gender or demographic differences were found.
303 However, there was a significant developmental trend where older children scored higher on
304 Child-BAM.

305 It was promising that Child-BAM positively related to attachment, given that
306 attachment to pets has been related to positive attitudes towards animals, more pro-social
307 behaviour and the development of empathy among children (Poresky and Hendrix 1990;
308 Knight et al. 2004; Kruger McCune and Merrill 2012). The results of our study are consistent
309 with previous findings (for example, Hills 1995) that BAM may be linked to positive human-
310 animal relationships, which has positive implications for animal welfare and animal-related
311 education.

312 Cognitive judgements of similarity or familiarity can determine perceptions of
313 animals and empathic response (Hornstein 1976; Hoffman 1984; Fenton and Hills 1988),
314 particularly in regards to mental capabilities (Plous 1993). This may be linked with children's
315 education, 'naïve biology' or use of 'personification' (Carey 1985; Hatano and Inagaki 2002).
316 Children use humans as their most familiar exemplar of biological entities to compare to
317 other animals; in other words, children may project human properties onto animals when
318 attempting to understand their minds and behaviour and so are more likely to rate animals
319 phylogenetically closer to humans higher on sentience (Eddy, Gallup and Povinelli 1993;
320 Wilkins, McCrae and McBride 2015; Borgi and Cirulli 2015). However, this was not the case
321 in the present study, instead children's emotional connections to species seems to have been
322 most salient in their BAM scores. Although birds, frogs, badgers and cows were always rated
323 lower on sentience, children rated dogs higher than chimpanzees for all sentience items. This
324 finding is consistent with previous research that dogs are rated highly on sentience (Morris,
325 Knight and Lesley 2012) and are perceived as possessing similar mental processes as humans
326 (Rasmussen, Rajecki and Craft 1993). One possible explanation of our finding is that children
327 within this age group may have less familiarity, or may lack the necessary cognitive maturity
328 to understand complex emotions in a diverse range of animals, including chimpanzees. In a
329 different study, older children were more likely to rate animals as sentient compared to
330 younger children, especially for chimpanzees, dogs, and dolphins; younger children were
331 more likely to rate animals such as rabbits, rats, pigs and goldfish as more sentient (Okamoto
332 2001). Similarly, young adults rate primates as more intelligent than dogs and cats (Furnham
333 and Heyes 1993). Knowledge about animal sentience may be taught to children over time,
334 either through informal learning (e.g. experience and social learning) or through instruction
335 (e.g. school input on animals and nature). Child-BAM may also be linked to cognitive
336 developmental processes (e.g. Theory of Mind) and so the cognitive ability to understand a

337 variety of emotions in a variety of animal species may develop with age. Our study seems to
338 be consistent with previous findings that BAM increases with age (Knight et al. 2004) and
339 that mental attribution in general becomes more complex with age (Baron-Cohen 2003). If
340 Child-BAM is linked to knowledge, then education may be the key to increasing BAM,
341 which may result in more positive child-animal interactions.

342 In the current study, pet ownership was common, 67% of the children reported having
343 a pet and 54% reported having a pet of their own. As expected, children scored higher on
344 Child-BAM if they had pets, particularly if they had a pet of their own or had two or more
345 pets, rather than the type of pet. The ‘contact hypothesis’, which states that direct contact can
346 lead to shared positive experiences and attachment (Allport 1954), may explain why pet
347 owners scored higher on Child-BAM. Children with pet dogs rated dogs higher on sentience
348 compared to children who did not have pet dogs, which is consistent with previous research
349 that more emotions are reported in species that are kept as pets (Morris, Knight and Lesley
350 2012; Walker et al. 2014), although this was not found for birds or fish. Emotional bonding
351 and a sense of oneness (Staub 1987) may have a positive effect on child-animal relationships
352 and Child-BAM, which may explain the results for pet ownership.

353 Many children have close emotional relationships with their pets (Melson 2003) and
354 the bond between people and their pets may “facilitate a connection to animals and
355 acceptance of cognitive abilities through their interactions and emotional attachment”
356 (Maust-Mohl, Fraser and Morrison 2012, p.114). The present findings indicate that Child-
357 BAM may be related to caring behaviour towards animals and feelings of emotional
358 attachment towards animals. Child-BAM may be related to social engagement with animals
359 (Carporeael and Heyes 1997), affection and a close relationship with animals (Kiesler, Lee and
360 Kramer 2007), rather than pet ownership alone (Morris, Knight and Lesley 2012). Paul and
361 Serpell (1993) suggested that experience of animals should be measured in terms of quality of

362 relationships, viewing an animal as a friend rather than contact alone. Walker et al. (2014)
363 recommended that future research distinguish “owner” from “care-giver”. The current study
364 provides new evidence on the quality of child-pet relationships; spending quality time with
365 and having close connections to pets, rather than contact alone, is associated with higher
366 Child-BAM. It should be noted that we cannot make conclusions regarding the direction of
367 the relationship between pet ownership, pet care and Child-BAM. Future research could
368 explore this further to determine whether children with pets learn about animal minds through
369 experience, or whether children with high BAM have more motivation for the acquisition of a
370 pet.

371 A key finding to highlight from the current study is that children were less accepting
372 of animal cruelty if they scored higher on Child-BAM; this included intentional cruelty,
373 unintentional cruelty, and animal neglect. Although it is important to emphasise that these
374 associations were weak and that further research is required. These findings are important
375 given that they highlight that Child-BAM may be negatively related to all types of animal
376 cruelty. The median onset age of childhood animal cruelty is 6 and half years (Frick et al.
377 1993) and so early prevention may be beneficial (Ascione 1993; Gullone 2014). It is
378 important to note that BAM may be one of many inter-related factors that could affect
379 whether a child is cruel to an animal (for a systematic review see Hawkins, Hawkins and
380 Williams, in press). Children who are cruel to animals may believe animals are sentient, but
381 their behaviour has been distorted for other reasons such as learning cruelty through social
382 learning or adverse childhood experiences (Ascione 1993; Baldry 2005; Duncan, Thomas and
383 Miller 2005; Gullone and Robertson 2008). However, no research to date has examined how
384 Child-BAM may or may not link to animal cruelty behaviour. This will be an important new
385 avenue of research for childhood animal cruelty prevention.

386 Despite these limitations, it seems hopeful that teaching children about animal
387 emotions and cognition may lead to positive impacts on animal welfare, and indeed some
388 research has demonstrated this. An animal-focused course where students were made aware
389 of animal minds, led to an increase in pro-animal attitudes and concern for animals and their
390 natural habitats (Helton and Helton 2005). Furthermore, an increase was found in children's
391 BAM following participation in an animal welfare education programme alongside a
392 decrease in acceptance of animal cruelty (Hawkins, Williams & Scottish SPCA, under
393 review). Interventions that promote positive child-animal relationships and aim to prevent
394 animal cruelty could benefit from incorporating teaching material about animal minds into
395 their programmes.

396 There seems to be a disconnection between scientific research and the general
397 public's understanding of animal minds. Maust-Mohl, Fraser and Morrison (2012) for
398 example, found that non-scientists seem to lack understanding of animal cognitive abilities
399 but are open to new ideas and express excitement about seeking further information. Children
400 also express a great interest in animals (Melson and Melson 2009; Muldoon, Williams and
401 Lawrence 2015) and hold beliefs about animal minds. Fraser et al. (2013) argue that animal
402 cognition researchers, social scientists, animal welfare organisations, and educators, should
403 collaborate to enhance public understanding of animal minds. Child-friendly education
404 materials could be developed and distributed throughout schools, zoos, or wildlife and/or
405 animal parks and scientifically evaluated to enhance their effectiveness.

406 No difference in Child-BAM was found for gender, family affluence or area of
407 residence in the current study, although other researchers have found that higher levels of
408 education (Mariti et al. 2011), and adults from urban backgrounds display more positive
409 attitudes towards animals (Bjerke, Ødegårdstuen and Kaltenborn 1998; Kalof et al. 1999;
410 Vanhonacker et al. 2010). There may also be cultural differences in BAM (e.g. Nakajimi,

411 Arimitsu and Lattal 2002) and so this study cannot be generalised to other cultures; the Child-
412 BAM measure may need to be tailored to the country in which it is administered. There seem
413 to be conflicting findings for gender differences in BAM but little research has provided
414 evidence for gender differences in BAM (e.g. Rasmussen, Rajecki and Craft 1993; Knight et
415 al. 2004; Morris, Knight and Lesley 2012; Maust-Mohl, Fraser and Morrison 2012).
416 Although, research has shown that males are less likely to attribute complex emotions to
417 animals such as depression, grief and love, than females (Walker et al. 2014) and there may
418 be gender differences in emotional and cognitive orientations towards animals (Kellert and
419 Berry 1987).

420

421 *Limitations and Future Directions*

422 This study involved a large sample because of the school-based questionnaire
423 approach, however, self-report data have limitations such as social desirability, potential peer
424 influence and demand characteristics. A benefit of taking a large-scale questionnaire study
425 approach is that it facilitated the creation of Child-BAM, for use in other studies. Future
426 research utilising experimental and/or observational methods would enhance our
427 understanding of the role of BAM on behaviour. Although the family affluence measure
428 demonstrated a low reliability within our sample, there are currently no alternative child self-
429 report measures of family wealth.

430 The humane behaviour measure, as a whole, assessed reported behaviour rather than
431 actual behaviour, which is a limitation. Furthermore, the sub-scale “aggression towards pets”
432 was weakened by consisting of only one item, which may explain why no significant
433 relationship was found. While there is a strong evidence base for the link between attitudes

434 and actual behaviour (see Armitage and Christian 2003 for a review) further research is
435 required.

436 The children's attitudes towards animal cruelty measure (CAAC) used in this study is
437 a novel measurement tool that offers an ethically sensitive way to explore children's
438 orientations to animal cruelty. Asking children about actual cruelty is often not acceptable to
439 schools or parents, and may be distressing for children and so this new measure was
440 developed to provide child data on this important behaviour. While it has produced
441 interesting findings, it should be noted that it did not focus on particular species and instead,
442 focused on attitudes towards animal cruelty in general. Children may hold particular attitudes
443 or feelings of morality towards certain species. For example, cruelty to dogs may be viewed
444 as unacceptable, whereas cruelty to insects (for example stepping on ants) may be viewed as
445 acceptable during curious childhood play (Ascione 2005). Further research investigating
446 children's attitudes about cruelty to particular species and parental attitudes would be
447 beneficial (Paul and Serpell 1993). It is worth noting that the item "kill an animal" may be
448 interpreted differently (e.g. for food or for fun) and some children wrote next to this item
449 "only for food". Future research could refine this item, for example altering it to "kill an
450 animal not for food". A strength of the scale is that it included unintentional harm, and
451 neglect in addition to intentional cruelty. This scale is analysed and presented in more detail
452 in a separate publication (Hawkins and Williams, in preparation).

453

454 *Conclusion*

455 This study reveals that children's beliefs about animal minds may underpin the factors
456 relating to their humane treatment of animals, highlighting the important role of Child-BAM
457 on children's attachment, compassion, humane behaviour, attitudes towards animals and

458 attitudes towards animal cruelty. Child-BAM is influenced by age, cognitive development
459 and experience of pets and will be open to educational intervention. We have created a useful
460 research and evaluation tool to measure Child-BAM that will aid future studies in this area.
461 The development and evaluation of education materials designed to increase children's
462 understanding of animal minds is required to promote positive and safe interactions between
463 children and animals and prevent childhood animal cruelty.

464

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469

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683 **Table 1.** Principal components analysis with varimax rotation showing variable loadings on
 684 each component extracted from analyses (N = 1217). High loadings are in bold.

Item from the Children's Reported Humane Behaviour towards Animals (CRHBA) Measure	Component		
	1	2	3
Pat/stroke	0.835	0.154	0.179
Cuddle	0.821	0.245	0.064
Play	0.777	0.240	0.084
Take for a walk	0.645	0.074	-0.371
Groom (comb hair)	0.642	0.336	-0.142
Spend time with	0.613	0.391	0.229
Allow to stay in room	0.509	0.192	0.032
Tell secrets to	0.189	0.779	-0.111
Give food or water to	0.093	0.645	0.040
Cry with when sad	0.366	0.609	-0.025
Talk to	0.341	0.599	0.236
Shout at	0.075	0.027	0.886

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697 **Table 2.** Principal components analysis with varimax rotation showing variable loadings on
 698 each component extracted from analyses (N = 1217). High loadings are in bold.

Item from the Children's Attitudes towards Animal Cruelty (CAAC) measure	Component		
	1	2	3
Hurt on purpose	0.810	-0.040	0.115
Kick on purpose	0.719	-0.047	0.142
Frighten on purpose	0.698	0.155	-0.064
Annoy on purpose	0.679	0.050	0.010
Tease	0.611	0.120	-0.003
Kill	0.429	0.130	0.221
Kick accidentally	-0.021	0.911	0.117
Hurt accidentally	0.009	0.888	0.173
Leave alone for a few days	0.210	0.457	0.040
Forget to give water	0.066	0.163	0.921
Forget to feed	0.109	0.129	0.919

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Table 3. Phylogenetic differences in ratings of sentence in ascending order

Animal In order of intelligence	Clever		Pain		Happiness		Sadness		Fear	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Human	1.15	0.6	1.08	0.4	1.05	0.3	1.07	0.4	1.09	0.4
Dog	1.3	0.7	1.15	0.7	1.08	0.4	1.14	0.5	1.13	0.6
Chimpanzee	1.72	1.1	1.42	0.8	1.43	0.8	1.55	0.9	1.47	0.9
Robin	2.1	1	1.53	0.9	1.71	1	1.83	1	1.51	0.8
Badger	2.18	1.1	1.56	0.9	1.8	1	1.84	1	1.59	1
Frog	2.67	1.2	1.6	1	1.89	1	1.9	1.1	1.59	0.9
Cow	2.96	1.2	1.75	1	1.93	1.2	2	1.2	1.73	1
Goldfish	2.97	1.4	1.81	1.1	1.99	1.1	2.04	1.4	1.78	1.1

Note: Scores are reversed, low scores= high sentence, high scores= low sentence

733 **Table 4.** Results from simple linear regression analysis investigating children's beliefs about
 734 animal minds (Child-BAM).

Variables	df	F	p	Predictors of Child-BAM			Variables that Child-BAM predicts		
				r	VE %	B	r	VE %	B
Family affluence	988	0.14	0.71	0.012	0	0.000	0.004	0	-0.06
Attachment to pets	1081	38.1	< 0.001	0.19	3.4	0.14	0.19	3.4	0.24
Reported humane behaviour	1069	31.41	< 0.001	0.17	2.9	0.16	0.17	2.9	0.18
Caring behaviour (sub-scale)	1068	15.65	< 0.001	0.12	1.4	0.01	0.12	1.4	1.1
Emotional attachment (sub-scale)	1068	8.72	0.003	0.09	0.8	0.01	0.09	0.8	0.77
Aggression towards pets (sub-scale)	1069	0.044	0.834	0.006	0	0.001	0.006	0	0.06
Attitudes towards animals	970	64.42	< 0.001	0.25	6.2	0.37	0.25	6.3	0.17
Attitudes towards pets	1062	26.43	< 0.001	0.16	2.4	0.21	0.16	2.4	0.12
Attitudes towards wild animals	1042	57.5	< 0.001	0.23	5.2	0.21	0.23	5.2	0.26
Attitudes towards farm animals	1010	27.6	< 0.001	0.16	2.7	0.004	0.16	2.6	5.8
Compassion to animals	1047	17.3	< 0.001	0.13	1.6	0.01	0.13	1.6	0.16
Attitudes towards animal cruelty	1081	20.24	< 0.001	0.14	1.8	0.13	0.14	1.8	0.14
Intentional animal cruelty (sub-scale)	1080	12.2	0.001	0.11	1.1	0.01	0.11	1.1	0.88
Unintentional animal cruelty (sub-scale)	1080	7.34	0.007	0.08	0.7	0.01	0.08	0.7	0.7
Animal neglect (sub-scale)	1080	6.7	0.01	0.08	0.6	0.01	0.08	0.6	0.68

735 *Notes: VE= variance explained*

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744 **Table 5.** One-way ANOVA results for differences in Child-BAM between items from the

745 attachment to pets (SAPS) measure.

Item from the attachment to pets measure	One-way ANOVA	Post-Hoc
I don't really like animals	$F(4,1108)=9, p=0.000, n^2=0.03$	SD, NS $p=0.001$ SD, SA $p=0.038$ SD, D $p<0.001$
I spend time every day playing with my pet (or would if I had one)	Welch's' $F(4,127)=6.3, p<0.001$	SA, NS $p<0.001$ A, NS $p=0.04$ SA, A $p=0.026$
I have sometimes talked to my pet and understood what it was trying to tell me (or would if I had one)	$F(4,1105)=1.69, p=0.151, n^2=0.01$	Ns
I love pets	Welch's' $F(4,58)=2.43, p=0.058$	Ns
I talk to my pet quite a lot (or would if I had one)	$F(4,1103)=6.92, p<0.001, n^2=0.02$	SA, NS $p<0.001$ A, NS $p=0.025$
My pet makes me feel happy (or would if I had one)	$F(4,1105)=5.4, p<0.001, n^2=0.02$	SA, NS $p=0.029$
I consider my pet to be a friend (or would if I had one)	$F(4,1104)=6.36, p<0.001, n^2=0.02$	SA, NS $p=0.024$ A, NS $p=0.019$
My pet knows when I am upset and tries to comfort me (or would if I had one)	$F(4,1106)=2.24, p=0.063, n^2=0.01$	Ns
There are times I'd be lonely without my pet (or would if I had one)	$F(1103)=3.4, p=0.009, n^2=0.01$	SA, NS $p=0.019$

746 *Notes: SA= strongly agree, A=agree, NS= not sure, SD=strongly disagree. Ns=not*747 *significant.*

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756 **Table 6.** One-way ANOVA results for differences in children’s beliefs about animal minds
 757 (Child-BAM) between items from the children’s reported humane behaviour towards animals
 758 measure (CRHBA).

Item from the children’s reported humane behaviour towards animals measure	One-way ANOVA	Post-Hoc
Play with	$F(3,1114)=8.5, p<0.001, n^2=0.02$	O, S $p<0.001$
Give food or water to	$F(3,1114)=1.2, p=0.304, n^2=0.003$	Ns
Take for a walk	$F(3,1106)=7.7, p<0.001, n^2=0.02$	O, S $p<0.001$ O, N $p=.005$
Pat/stroke	$F(3,1110)=6.53, p<0.001, n^2=0.02$	O, S $p=0.002$
Shout at	$F(3,1109)=1.1, p=0.369, n^2=0.003$	Ns
Cuddle	$F(3,1105)=5.93, p=0.001, n^2=0.02$	O, S $p=0.002$
Cry with when I am sad	$F(3,1100)=3.4, p=0.018, n^2=0.01$	O, C $p=0.018$
Talk to	$F(3,1110)=3.44, p=0.016, n^2=0.01$	Ns
Allow to stay in my room	$F(3,1112)=2.8, p=0.038, n^2=0.01$	Ns
Groom (comb hair)	$F(4,1107)=8.99, p<0.001, n^2=0.02$	O, S $p=0.001$ O, N $p<0.001$ O, C $p=0.002$
Tell my secrets to	$F(3,1106)=4.2, p=0.006, n^2=0.01$	O, N $p=0.019$
Spend time with	$F(3,1106)=6.94, p<0.001, n^2=0.02$	O, S $p<0.001$

759 *Note: O=often, S=sometimes, N=never, C= I cannot do this with my animal(s); Ns=not*

760 *significant*

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