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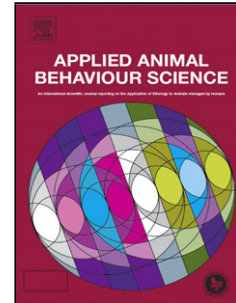
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1 The effects of audiobooks on the behaviour of dogs at a rehoming kennels.

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9
10 *Abstract*

11 Domestic dogs are often kept in kennelled environments. These may be stressful, and impact
12 negatively upon welfare, due to unpredictable variations in space, social interaction and
13 noise. Auditory stimulation such as music has been demonstrated to enhance animal welfare
14 in a range of species, however despite suggested benefits in humans the potential of
15 audiobooks as auditory enrichment for animals has not been investigated. The present study
16 aimed to investigate the effects of audiobooks upon the behaviour of 31 dogs housed in a
17 rescue shelter. The dogs were exposed to five auditory conditions (audiobook, classical
18 music, pop music, psychoacoustically designed dog music and no auditory control) for 2
19 hours with an intervening period of 2 days between conditions. The dogs' behaviour were
20 recorded every 5 minutes throughout the 2 hour auditory conditions using instantaneous scan-
21 sampling. The findings from the present study indicate that exposure to audiobooks
22 significantly influences the behaviour of kennelled dogs. Audiobooks resulted in dogs
23 spending more of their time resting than when exposed to any of the other auditory conditions
24 (Control: $Z = -4.807$, $P < 0.001$; Pop: $Z = -4.791$, $P < 0.001$; Classical: $Z = -4.732$, $P < 0.001$;
25 Psychoacoustically designed dog music: $Z = -3.911$, $P < 0.001$). Dogs also spent less time
26 displaying sitting or standing vigilant behaviour when the audiobook was played compared to
27 all other conditions (Control: $Z = -4.579$, $P < 0.001$; Pop: $Z = -4.504$, $P < 0.001$; Classical: Z
28 $= -3.450$, $P = 0.001$; Psychoacoustically designed dog music: $Z = -3.514$, $P < 0.001$). This
29 study suggests that exposure to audiobooks can enhance the welfare of kennelled dogs due to
30 their calming influence on dog behaviour. Use of audiobooks provides a simple yet practical
31 tool that can be readily used in many kennel environments to enhance dog welfare and
32 potentially increase the likelihood of successful rehoming of dogs.

33
34 *Keywords*

35 Audiobooks, Auditory stimulation, Animal Welfare, Dogs, Environmental enrichment.

36
37 *1. Introduction*

38 Audiobooks increase resting behaviour in kennelled dogs.

39 Audiobooks decrease sitting/standing behaviour in kennelled dogs.

40 Audiobooks have potential as auditory enrichment for kennelled dogs.

41
42
43 Domestic dogs are kept in kennel environments for a range of reasons with rescue, boarding,
44 quarantine and laboratory kennels being commonplace (Hubrecht, 1995; Taylor and Mills,
45 2007). Kennels are often stressful environments due to the associated spatial and social
46 restrictions (Beerda et al., 1999a; Hiby et al., 2006; Taylor and Mills, 2007). Limited social
47 interactions, restricted space, high noise levels and lack of control occurring within kennels
48 are all potential sources of stress for dogs (Hubrecht and Turner, 1998; Sales et al., 1997;
49 Taylor and Mills, 2007). Continued exposure to these factors can result in chronic stress and
50 compromised welfare (Beerda et al., 1999ab; Beerda et al., 2000). They can also lead to

51 behavioural problems (Serpell and Jagoe, 1995; Tuber et al., 1999; Wells and Hepper, 2000)
52 which can impact upon successful re-homing of shelter dogs (Mondelli et al., 2004;
53 Normando et al., 2006).

54

55 Auditory stimulation is a form of sensory enrichment that can include sounds of conspecifics,
56 natural habitat sounds and music (Wells, 2009). A number of studies have demonstrated the
57 potential for the use of music to enhance animal welfare. Listening to music can result in
58 physiological and psychological benefits in humans (McCraty et al., 1998; Särkämö and
59 Soto, 2012; Sousou, 1997; Wall and Duffy, 2010). Classical music has also been shown to be
60 beneficial in reducing abnormal behaviour in Asian elephants, *Elephas maximus* (Wells and
61 Irwin, 2008) and gorillas, *Gorilla gorilla* (Wells et al., 2006, But cf, Robbins and Margulis,
62 2014). Domestic cats have not been found to benefit from musical stimulation (Stephens and
63 Montrose, 2014) however have recently been shown to exhibit a preference for specially
64 designed species-appropriate music (Snowdon et al., 2015). Few studies currently exist into
65 the effects of auditory stimulation on kennelled dogs. Wells et al. (2002) investigated effects
66 of exposure to human conversation, classical, pop and heavy metal music on behaviours of
67 dogs in rescue kennels. They found that exposure to classical music resulted in dogs spending
68 more time resting and less time standing and barking when compared to the other auditory or
69 control conditions. Kogan et al. (2012) furthered this investigation, identifying behavioural
70 changes in kennelled dogs upon exposure to classical, heavy metal and psychoacoustically
71 designed dog music. They found dogs spent more time sleeping and less time vocalising
72 when exposed to classical music than the other auditory treatments. Recently Bowman et al.
73 (2015) found classical music to induce more resting behaviour and less time standing and
74 barking in kennelled dogs compared to a silent control condition. Excessive barking and
75 activity are indicators of stress in dogs (Beerda et al., 2000; Hetts et al., 1992; Stephen and
76 Ledger, 2010). Classical music is seemingly efficacious as environmental enrichment for
77 kennelled dogs, however other forms of potentially beneficial auditory stimulation have not
78 yet been investigated in a kennel environment.

79

80 An audiobook is a recording of a book read by the author, an actor, a celebrity or an amateur
81 (Colbjørnsen, 2015). Audiobooks are widely utilised as a form of human entertainment (APA
82 2014). Audiobooks have been suggested to provide company and comfort to listeners and
83 enable control over the emotional state of their physical environment (Pedersen and Have,
84 2012). The use of audiobooks has also been found to aid neurological rehabilitation in stroke
85 patients (Särkämö et al. 2010), and to have beneficial emotional effects in dyslexic children
86 (Milani et al., 2010). However, to date, the potential of audiobooks as auditory enrichment
87 for animals, including kennelled dogs, has not been investigated. The present study aimed to
88 investigate the effects of audiobooks upon the behaviour of kennelled dogs. In order to
89 determine how these effects compared to other forms of auditory stimulation we also
90 examined the effects of classical, pop and psychoacoustically designed dog music upon the
91 behaviour of the kennelled dogs.

92

93

94 2. Material and methods

95 2.1. Subjects

96 Thirty one dogs (twenty four males; seven females) aged between 9 months and 13 years and
97 2 months (mean age: 5 years and 4 months) were used in this study. All dogs were neutered
98 or spayed and in good general health including possessing good hearing. The dogs' had
99 varying origins such that eighteen were owner relinquished, five removed from their owners
100 due to welfare concerns and eight were strays. All of the dogs were housed at Burford Blue

101 Cross rehoming centre, Burford, Oxfordshire, UK. The centre is divided into four blocks each
102 of which has the capacity to house six dogs. Within each block each dog was singly housed in
103 individual kennels. The kennel blocks are not open to the public with only Blue Cross staff
104 and volunteers having access to the kennels. The potential confounding factors of visiting
105 hours and the impact of visitors upon the dogs' behaviour were thus negated. The length of
106 time that the dogs had been housed in the kennels varied from 7 days to 330 days (mean
107 length of time in kennels: 51.4 days). Dogs soon to be rehomed were excluded from data
108 collection ensuring that every dog studied was exposed to all auditory conditions. Kennels
109 were made of concrete with wire doors and were rectangular in shape, varying in size from
110 3m by 2m to 4m by 4m. All kennels contained a bed, toys, food and water bowls. Kennels
111 were cleaned daily at 8:30 h. Dogs were taken into individual outside runs twice daily for
112 approximately an hour in the morning whilst cleaning occurred and a second hour in the
113 afternoon. Dogs were walked at least once a day. Dogs were fed two or three times daily. The
114 feed times varied depending on the dogs' condition with underweight dogs being fed three
115 times a day. All dogs were fed at 9:30 h and 15:30 h, and underweight dogs were fed again at
116 12:00 h. Of the thirty-one dogs in the study only seven dogs were fed three times a day.
117 These dogs received the three feeds consistently throughout all conditions in the study.

118
119

120 2.2. Auditory treatments

121 The dogs experienced five different auditory treatments: audiobook, classical music, pop
122 music, psychoacoustically designed dog music and no auditory control. For the audiobook
123 condition 'The Lion, the Witch and the Wardrobe' (C.S.Lewis; performed by Michael York,
124 Harper Collins publisher) was used. In the classical condition, dogs were exposed to 'The
125 best of Beethoven' album (Naxos). In the pop condition, a randomly chosen mixture of tracks
126 from a pop album 'Now 88' (EMI Virgin Records) were used. In the dog specific music
127 condition, dogs experienced the psychoacoustically designed dog music album "Through a
128 dogs' ear" (Leeds and Wagner, 2008). All auditory treatments were played at 60 decibels, the
129 same volume as normal conversation (NIH, 2011), to ensure that it would not be harmful to
130 dogs or staff. In all auditory conditions dogs were also exposed to normal kennel sounds such
131 as barking and staff talking. The audiobook used was selected as it is popular amongst
132 humans and appropriate for all ages, therefore is suitable for a range of environments (Good
133 Reads, 2015). The other auditory conditions were used to enable comparison of the
134 audiobook treatment with auditory conditions used in previous enrichment studies (e.g.
135 Bowman et al., 2015; Kogan et al., 2012; Wells et al., 2002).

136
137

138 2.3. Procedure

139 The experimental design used was based on that previously utilised to investigate the effects
140 of auditory stimulation on kennelled dogs (Wells et al., 2002). A CD player (Lenco SD-24,
141 UK) was placed in the central empty kennel of each block, between 4m and 12m away from
142 each individual. Dogs experienced each auditory condition for two hours from 10:00 h to
143 12:00 h, with an intervening period of two days between treatments to avoid over stimulation.
144 The control condition was applied first followed by pop music, classical music, audiobook,
145 and psychoacoustically designed dog music. This order was randomly determined. The dogs'
146 behaviour was recorded every 5 minutes using an instantaneous scan-sampling technique
147 resulting in twenty-four behaviour points being recorded for every condition. The behaviour
148 of each dogs at each of these points was recorded using an ethogram (based on Hubrecht et
149 al., 1992; Stephen and Ledger, 2005; Wells et al., 2002; Table 1). Video cameras (Vivitar
150 DVR508, UK) set up to view the entirety of each dog kennel were used to record dog

151 behaviour and avoid observer effects (Martin and Bateson, 2007). The authors have read and
152 can confirm that this study complies with the ISAE policy relating to animal ethics.
153

154

155

155 2.4. Data Analysis

156 For each auditory treatment the total number of times each dog was recorded exhibiting each
157 behaviour was summed. A total frequency count for each dog for each behaviour was thus
158 generated. Where behaviours were exhibited at very low levels (mean occurrence <1) they
159 were omitted from analysis as statistical analyses are not robust at such low levels. Otherwise
160 Wilcoxon Signed-Rank Tests were conducted for each behaviour to evaluate differences
161 between audiobooks versus each of the other auditory treatments. The statistical significance
162 level was accepted at $P < 0.05$. All analyses were carried out in SPSS (version 22.0, SPSS
163 Inc. 2013).
164

165

166

166 3. Results

167 3.1. Walking

168 In a comparison of the efficacy of the audiobook and other auditory conditions, significant
169 differences between walking behaviour were found between the audiobook and the control
170 condition ($Z = -3.181$, $P = 0.001$), pop condition ($Z = -3.224$, $P = 0.001$) and
171 psychoacoustically designed dog music condition ($Z = -4.171$, $P < 0.001$). For all these
172 conditions, lower levels of walking behaviour occurred in the audiobook condition (Table 2).
173 No difference in walking behaviour was found between the audiobook and classical music
174 conditions ($Z = -1.198$, $P = 0.231$).
175

176

177

177 3.2. Sitting/Standing

178 The levels of sitting/standing behaviour differed between the audiobook and all other
179 auditory conditions (Control: $Z = -4.579$, $P < 0.001$; Pop: $Z = -4.504$, $P < 0.001$; Classical: Z
180 $= -3.450$, $P = 0.001$; Psychoacoustically designed dog music: $Z = -3.514$, $P < 0.001$). For all
181 these comparisons, lower levels of sitting/standing behaviour were displayed in the
182 audiobook condition (Table 2).
183

184

185

185 3.3. Inactive (resting/sleeping)

186 Significant differences between inactive behaviour were found between the audiobook and all
187 other auditory conditions (Control: $Z = -4.807$, $P < 0.001$; Pop: $Z = -4.791$, $P < 0.001$;
188 Classical: $Z = -4.732$, $P < 0.001$; Psychoacoustically designed dog music: $Z = -3.911$, $P <$
189 0.001). Higher levels of resting/sleeping behaviour were displayed in the audiobook
190 condition (Table 2).
191

192

193

193 3.4. Barking

194 Barking behaviour differed between the audiobook condition and the pop music condition (Z
195 $= -3.229$, $P = 0.001$), classical condition ($Z = -2.018$, $P = 0.044$), and psychoacoustically
196 designed dog music condition ($Z = -2.832$, $P = 0.005$). For all these comparisons, lower
197 levels of barking were exhibited in the audiobook condition (Table 2). No difference in
198 barking behaviour was found between the audiobook and control condition ($Z = -1.753$, $P =$
199 0.080).
200

200

201

202 *3.5. Other vocalisations (howling/growling/whining)*

203 The levels of other vocalisations displayed differed between the audiobook and control
204 condition ($Z = -3.639, P < 0.001$) and audiobook and pop condition ($Z = -3.519, P < 0.001$).
205 Lower levels of vocalisations occurred in the audiobook condition (Table 2). Levels of
206 vocalisations did not significantly differ between the audiobook and classical condition ($Z = -$
207 $1.157, P = 0.247$) or the audiobook and psychoacoustically designed dog music condition (Z
208 $= -0.922, P = 0.357$).

209

210

211 *3.6. Other Behaviours*

212 All other behaviours were performed at very low levels and were omitted from the statistical
213 analyses.

214

215

216 *4. Discussion*

217 The findings from the present study indicate that exposure to audiobooks significantly
218 influences the behaviour of kennelled dogs. Audiobooks resulted in dogs spending more of
219 their time resting or sleeping than any of the other auditory conditions. Dogs also spent less
220 time sitting or standing when exposed to audiobooks compared to all other conditions. Lower
221 levels of barking were also displayed when exposed to audiobooks compared to all other
222 conditions bar the control. Audiobooks also decreased walking behaviour in dogs compared
223 to all auditory treatments bar classical music where in both conditions similarly low levels of
224 walking behaviour were displayed. Lower levels of vocalisations such as howling, growling
225 and whining were displayed in the audiobook condition compared to the control and pop
226 conditions.

227

228

229 A number of these behaviours such as increased activity and vocalising act as indicators of
230 stress in dogs (Beerda et al., 2000; Hetts et al., 1992; Stephen and Ledger, 2000). Sitting and
231 standing behaviour, which tended to be performed by subjects at the front of kennels
232 alongside vigilance behaviours, has also been suggested to be indicative of anxiety or distress
233 (Beerda et al., 2000; Hiby et al., 2006; Taylor and Mills, 2007). Exposure to audiobooks
234 resulted in reduced vocalising and sitting or standing vigilant behaviour as well as increased
235 resting behaviour, all of which are indicative of lower levels of stress in dogs (Beerda et al.,
236 2000; Hetts et al., 1992; Hiby et al., 2006; Stephen and Ledger, 2000). The changes in
237 behaviour induced by audiobooks are therefore suggestive of enhanced welfare in dogs.

238

239

240 Whilst exposure to classical music was equally effective in terms of reducing behaviours
241 such as walking, a finding which is perhaps unsurprising considering the beneficial effects
242 that classical music has been shown to produce in kennelled dogs (e.g. Bowman et al., 2015;
243 Kogan et al., 2012; Wells et al., 2002), exposure to audiobooks was more effective than all
244 other auditory conditions, including classical music, in enhancing resting behaviours.
245 Activity is often used as an indicator of canine stress (e.g. Beerda et al., 2000; Hetts et al.,
246 1992; Stephen and Ledger, 2010), with enhanced resting behaviour being viewed as
247 indicative of relaxation and improved welfare in kennelled dogs (Kogan et al., 2012; Wells et
248 al., 2002). Excessive barking is another indicator of canine stress (e.g. Hetts et al., 1992;
249 Stephen and Ledger, 2010). Whilst lower levels of barking were also displayed under the
250 control condition, the audiobook treatment was the most effective of the auditory stimulation

251 conditions in reducing barking. This study therefore suggests that audiobooks may be a more
252 beneficial form of auditory enrichment for kennelled dogs than classical music. This result is
253 somewhat surprising considering the enriching effects of classical music that have been
254 documented in a range of species (e.g. Chickens, *Gallus gallus domesticus*: Gvoryahu et al.
255 1989; Carp, *Cyprinus carpio L*: Papoutsoglou et al., 2007; Gorillas: Wells et al., 2006; Dogs:
256 Wells et al. 2002; Asian Elephants: Wells and Irwin, 2008), however audiobooks have also
257 been demonstrated to benefit humans via providing company, comfort and other positive
258 emotional effects (Milani et al., 2010; Pedersen and Have, 2012). Dogs are highly social
259 animals whose welfare is enhanced by human interactions (Taylor and Mills, 2007; Tuber et
260 al, 1996; Wells, 2004). Audiobooks may approximate this human interaction for dogs and
261 thus provide the illusion of company and comfort in a kennel environment.
262

263

264 These beneficial effects of audiobooks are also interesting considered that a previous study
265 has found that human conversation had no effect on dog behaviour (Wells et al., 2002). This
266 difference could be due to the fact that whilst dogs may habituate to conversation due to this
267 being heard on a regular basis, audiobooks are likely to be a novel form of auditory
268 stimulation due to being rarely played within kennel environments. Another factor to
269 consider is the presentation of audiobooks as opposed to overheard conversation. Audiobooks
270 are characterised by clear and strong enunciation, a steady pace and tempo, and non-
271 monotonous or stilted delivery (NLS, 1995). The focused delivery of the audiobook
272 (Pedersen and Have, 2012) may also make the narration of more relevance to the dog. These
273 aspects may help ensure that the dog retains interest in the audiobooks, as opposed to regular
274 human conversation.
275

276

277 This study indicates that exposure to audiobooks can have beneficial effects on the welfare of
278 dogs in a kennel environment. Kennels are frequently stressful environments due to the
279 restricted space and social interactions and high noise levels (Hubrecht and Turner, 1998;
280 Sales et al., 1997; Taylor and Mills, 2007) so any amelioration of this stress is beneficial for
281 dog wellbeing. It is also important to consider indirect effects on dog welfare. By reducing
282 the stress of kennelled dogs this may not only reduce behaviours such as excessive barking or
283 activity (Serpell and Jagoe, 1995; Stephen and Ledger, 2010), but also potential behavioural
284 problems (Tuber et al., 1999; Wells and Hepper, 2000), both of which can impact upon
285 rehoming potential and successful rehoming of shelter dogs (Mondelli et al., 2004; Normando
286 et al., 2006; Wells and Hepper, 2000).
287

288

289 5. Conclusions

290 Overall, the findings from this study indicate that audiobooks have beneficial effects upon the
291 behaviour of kennelled dogs. The audiobook condition influenced the dogs' behaviour in a
292 manner suggestive of improved welfare, displaying positive effects upon dog behaviour even
293 compared to classical music, which has previously proven the most efficacious in kennel
294 environments. Due to their calming influence on dog behaviour, audiobooks are suggested to
295 display strong potential for use as auditory enrichment. Audiobooks provide a simple, cost-
296 effective and practical tool that can be readily used in many kennel environments to enhance
297 dog welfare and potentially increase the likelihood of successful rehoming of dogs.

298 Limitations to the current study include the sample size which was relatively small compared
299 to previous studies in the field (e.g. Bowman et al., 2015; Kogan et al., 2012; Wells et al.,
300 2002) and the limited duration of exposure to auditory stimulation. A further limitation is that

301 the researcher was not blind to the auditory conditions during behavioural analysis providing
302 a potential source of bias. Investigation of the effects of daily exposure to audiobooks over a
303 longer time frame would be useful to determine whether audiobooks are effective at reducing
304 stress experienced by kennelled dogs in the long term. In addition further research should
305 occur to determine what aspects of audiobooks are important in reducing canine stress.
306 Investigating dog behaviours in response to such factors as the narrator's gender, age, accent,
307 voice pitch and speed of narration would be of interest in determining which audiobooks to
308 play to best enhance the welfare of kennelled dogs.

309
310

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314
315

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Table 1 Description of dog behaviours sampled.

| Behaviour | Definition |
|-----------------------------|---|
| Walking | Dog engages in ambulatory gait around kennel. |
| Sitting/Standing | Dog sits on hind legs/Dog stands on four legs. |
| Inactive (resting/sleeping) | Dog reclines in ventral or lateral position, eyes open or closed. |
| Barking | Staccato vocalisation; varying in duration. |
| Other vocalisations | Includes howling, growling or whining. |
| Playing | Dog engages in solitary playing with toys; or displays play bow. |
| Panting | Dog pants for reasons other than physical exertion or a warm ambient temperature. |
| Drinking | Dog ingests water. |
| Eating | Dog ingests food. |
| Repetitive pacing | Dog repeatedly paces around kennel in a fixed route. |
| Wall bouncing | Dog repeatedly jumps up kennel wall from side to side. |
| Circling | Dog walks around in small circle repeatedly. |
| Self-mutilation | Dog chews or bites own body. |
| Chewing bedding | Dog chews its own bedding. |
| Digging | Dog digs into the corner of kennel or in bedding with forepaws. |

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 508
 509 Table 2 The mean (\pm S.D.) number of times each behaviour was displayed by the dogs in the
 510 five auditory conditions.

| Behaviour | Control | Classical | Pop | Dog music | Audiobook |
|-----------|---------|-----------|-----|-----------|-----------|
|-----------|---------|-----------|-----|-----------|-----------|

| | | | | | |
|------------------------|---------|---------|---------|------------------|---------|
| Walking | 2.97 | 1.97 | 2.84 | 3.10 | 1.74 |
| | (2.105) | (1.560) | (2.115) | (1.399) | (1.437) |
| Sitting/ Standing | 12.03 | 10.00 | 13.68 | 10.45 (4.523) | 8.19 |
| | (5.930) | (4.967) | (5.659) | | (4.963) |
| Inactive | 9.61 | 11.16 | 7.71 | 10.35 | 15.00 |
| | (7.753) | (6.293) | (6.394) | (5.625) | (8.095) |
| Barking | 5.06 | 4.84 | 5.90 | 5.23 | 3.90 |
| | (0.359) | (5.080) | (5.160) | (5.371) | (4.134) |
| Other vocalisations | 4.10 | 1.81 | 2.71 | 1.84 | 1.52 |
| | (5.455) | (4.199) | (4.762) | (4.591) | (3.345) |
| Playing | 0.29 | 0.19 | 0.13 | 0.19 | 0.23 |
| | (0.739) | (0.654) | (0.428) | (0.543) | (0.669) |
| Panting | 0.23 | 0.16 | 0.19 | 0.16 | 0.16 |
| | (0.956) | (0.735) | (0.792) | (0.735) | (0.735) |

| | | | | | |
|-------------------|---------|---------|---------|---------|---------|
| Drinking | 0.03 | 0.13 | 0.06 | 0.06 | 0.06 |
| | (0.180) | (0.428) | (0.250) | (0.250) | (0.250) |
| Eating | 0.03 | 0.03 | 0.00 | 0.06 | 0.13 |
| | (0.180) | (0.180) | (0.000) | (0.250) | (0.341) |
| Repetitive Pacing | 0.84 | 0.29 | 0.52 | 0.58 | 0.23 |
| | (1.675) | (1.039) | (1.092) | (1.311) | (0.956) |
| Wall Bouncing | 0.45 | 0.10 | 0.35 | 0.13 | 0.00 |
| | (1.060) | (0.396) | (0.755) | (0.428) | (0.000) |
| Circling | 0.39 | 0.00 | 0.13 | 0.03 | 0.00 |
| | (1.086) | (0.000) | (0.499) | (0.180) | (0.000) |
| Chewing Bedding | 0.26 | 0.26 | 0.10 | 0.13 | 0.13 |
| | (0.815) | (0.815) | (0.396) | (0.428) | (0.562) |
| Digging | 0.10 | 0.06 | 0.00 | 0.00 | 0.00 |
| | (0.539) | (0.359) | (0.000) | (0.000) | (0.000) |

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