

1 **Assessment of cats' behavior during a cat show**

2 Simona Cannas^{1*}, Sabrina Alessi¹, Federica Scarpazza¹, Clara Palestrini¹

3

4 ¹Dipartimento di Medicina Veterinaria e Scienze Animali, Università degli Studi di Milano, Via
5 Dell'Università 6, 26900, Lodi, Italy

6

7

8 ***Corresponding author**

9 Dipartimento di Medicina Veterinaria e Scienze Animali, Università degli Studi di Milano, Via
10 Dell'Università 6, 26900, Lodi, Italy

11 Tel : +39 02 50334549

12 E-mail address: simona.cannas@unimi.it

13

14

15

16 **Abstract**

17 Cats, as a highly territorial animal, suffers changes in their physical and social environment; the
18 change of environment and the loss of spatial and social anchors that occur during a cat show could
19 represent a source of stress. Most studies concerning cat welfare have focused on shelters and catteries
20 and to our knowledge, the literature, to date, offers no answers regarding the specific area of feline
21 exhibitions. The aim of this pilot study is to explore behaviors and postures adopted by the cats during
22 the exhibition day, to detect any signs of stress or discomfort. This may also clarify whether it may
23 be necessary to make changes to the environment in which the cats are being exhibited to improve
24 the welfare of animals.

25 Behaviors of 82 cats were collected through direct observation (the observer stood in front of the
26 cages once an hour, from 10 to 17, for a total of 8 times for each cat) during a feline exposition.

27 Analysis of behaviors exhibited by cats during the exposition day revealed that most of them were
28 sleeping (93.9%), resting (62.2%), and looking at their surroundings (92.7%). Some cats played
29 (32.9%), and few cats hid themselves with a low frequency (20.7%). Behaviors showed by cats in
30 our sample seem to indicate no discomfort supported also by the assumed postures, being, for the
31 most part, body not in tension with straight ears (78.8%) and in few cases presenting belly-up.

32 Focusing on the presence of visitors, our results indicate that most cats remain indifferent to their
33 presence, but during the high attendance of visitors at 3 and 4 pm we recorded the largest
34 percentage of cat hiding ($p \leq 0.05$). In conclusion, the cats show environment represents a situation
35 full of stressful stimuli for the cat, despite this, our results have identified few behaviors of
36 discomfort or stress manifested with low frequencies. This can be due to the habituation done on
37 cats and to the coping abilities of these animals in this context of acute stress. Further studies are
38 required to confirm and deepen our results.

39

40 **Keywords:** *cat show, behavior assessment, cat welfare, cats*

41 **Introduction**

42
43 The cat represents one of the most frequent pets in different countries (Serpell, 1996). There are
44 roughly 370 million pet cats in the world (Sivewright et al., n.d.) in particular, about 100 million cats
45 live in Europe (*FEDIAF Annual Report 2021*, n.d.) and 58 million in the USA (Burns, 2018).

46 Current archaeological discoveries indicate that the process of domestication of the wild cat probably
47 began about 10,000 years ago in a region of the Middle East known as the Fertile Crescent, probably
48 reaching full domestication status in Ancient Egypt around 4,000 to 3,300 years ago (Vigne et al.,
49 2004; Lipinski et al., 2008; Bradshaw, 2016a). The domestic cat is the product of a natural process
50 of domestication and only in the last 200 years have humans begun to actively select genetic traits to
51 create cat breeds with certain features. The concept of different cat breeds is relatively modern and
52 dates back about 150 years. Although the domestic cat has been in relationship with humans for at
53 least 4,000 years, the selective breeding of cats to produce distinct breeds is a recent activity that
54 began in the late 19th century. The first "Cat Show" took place in England at the St. Giles Fair in
55 Winchester in 1598, but the first feline show in which judging concerned the type, coat, conformation,
56 pattern, and color of the cats was held at the Crystal Palace in 1871.

57 Organizations like the Cat Fanciers' Association (CFA) in the U.S.A., the Governing Council of the
58 Cat Fancy (GCCF) in the U.K. and the International Cat Association (TICA) put on hundreds of
59 different kinds of cat shows each year. A typical feline show takes place inside an indoor exhibition
60 facility, where "rings," or areas used to house cat cages, are set up. The rings are arranged in
61 rectangles, where breeders stay inside so they can get the cats out of their cages, groom and prepare
62 them, while outside the rings visitors can circulate for visiting the expo and admire the cats. Each cat
63 is usually brought to be judged, by one of the judges present in expo, in a special area of the exhibition
64 facility: the cat is then placed on the judging table by the breeder/exhibitor and the judges manipulate
65 the cat to make their evaluations. After judgment, the cat returns to its cage. This procedure may
66 cause stress in cats because usually they don't appreciate being handled by strangers in an unfamiliar
67 environment. The exhibition day starts around 8-9 a.m. and ends around 6-7 p.m. According to the
68 rules reported by FIFe (Fédération Internationale Féline), cages used in exhibitions must be adequate
69 to ensure proper comfort for the exhibits (FIFe, n.d.). Minimum cage dimensions are 50x50x50 cm
70 per cat, and a single cat must be housed in a single cage; a maximum of three cats can be housed in a
71 double cage (except litters). In addition, placing one cage on top of another is prohibited, and a
72 minimum walkable space of 1.25 m must be available for visitors between cage rings.

73 The cat descends from a territorial ancestor and, as a result, its priority is the exclusive use of a certain
74 amount of space, ie, a territory of its own (Bradshaw, 2016b). For a cat, security appears to arise
75 mainly from confidence and familiarity in its environment and territory (Mills, 2016). When an

76 animal is faced with a change in its environment, it will perceive such change through various sensory
77 systems and will experience a particular feeling (often referred to as an emotional state or mood) that
78 can be manifested both behaviorally and psychologically (Mills, 2016). Thus, the most common
79 stressor for a pet cat stems from displacement from its territory, physical disruption of its territory,
80 intrusion of a potential threat, loss of real or perceived security of its territory, anything which reduces
81 the cat's subjective sense of control of its resources (Bradshaw, 2016b).

82 Most studies concerning cat welfare have focused on shelters and catteries (Guy et al., 2014; Machado
83 and Genaro, 2014; Vinke et al., 2014). Assessing the welfare of owned domestic cats has been rather
84 neglected and is not addressed to the same extent as it is assessed within a research laboratory or
85 shelter, although similar problems are likely to arise in all environments where cats are confined.

86 Novelty, confinement, and the inability to express species-typical behaviors can cause cats stress and
87 distress and stressful experiences could have an impact on the well-being of cats.

88 Environmental factors that could be perceived as stressful and that could affect well-being by cats
89 confined in homes or cages in shelters, veterinary hospitals, or research facilities could be classified
90 into four categories (Stella et al., 2014). These include macro and micro-environments, predictability
91 and control of the environment, and human-animal interactions. The macro-environment refers to the
92 cat's living space; it is defined as the room in which the cage is located. Factors related to the room
93 environment are temperature, type of lighting, odors, and the intensity and type of sounds (Morgan
94 and Tromborg, 2007). The micro-environment concerns the features of the cage; these factors include
95 material of the floor, usable floor space, the opportunity to hide and perch, objects for the expression
96 of the typical behaviors of the species, the way in which the food is presented (for example, wet and
97 dry food in the same bowl) and the characteristics of the elimination area, including type and size of
98 the litterbox as well as depth, type and texture of the litter (Stella and Croney, 2016). The type,
99 presentation, and availability of these features of the environment can be a source of either stress or
100 enrichment to cats (Morgan and Tromborg, 2007; Stella and Buffington, 2016).

101 The change of environment and the loss of spatial and social anchors that occur during a cat show
102 could be a source of stress for the cat. To our knowledge, the literature, to date, offers no answers
103 regarding the specific area of feline exhibitions. The aim of this pilot study is to explore behaviors
104 and postures adopted by the cats during the exhibition day, to detect any signs of stress or discomfort.
105 This may also clarify whether it may be necessary to make changes to the environment in which the
106 cats are being exhibited to improve the welfare of animals.

107

108 **Materials and Methods**



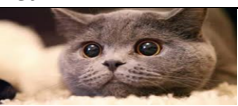



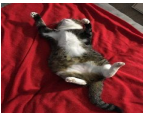
109 *Data collection*

110 The study was carried out on 82 cats. Data were collected at the feline exposition that took place in
 111 in Milan on 30th March 2019, after staff and organizer's authorization of the exposition.

112 The behaviors of the cats were collected through direct observation where the observer stood in front
 113 of the cages once an hour, from 10 to 17, for a total of 8 times for each cat. General information of
 114 the cat (such as breed, age, sex), postures and position in the cage, cat's behaviors and cat's reaction
 115 as visitors approached were collected using a data collection form (see table 1).

116

Number								
Breed								
Age								
Sex								
Hours	10	11	12	13	14	15	16	17
Position in the cage								
Litter box								
Cat bed								
Floor cage								
Behaviours								
Playing (cat manipulates an object with its paws in an apparently playful manner. The cat may pat, throw, pounce or wrestle with the object. Cat plays with its own body, usually the tail. Cat directs play at another cat or the observer)								
Sleeping								
Resting (the cat remains generally inactive with eyes closed but occasionally opens them to scan the area; ears flicking regularly)								
Hiding								
Oriented to environment (sitting, standing, or lying down-the head does not rest on the ground- with obvious orientation towards the physical or social environment, including sniffing, close visual inspection, distant visual inspection-vigilance or scanning)								
Grooming (cleaning the body surface by licking, nibbling, picking, rubbing, scratching,								

etc., directed toward the animal's body)								
Eating								
Urinating								
Defecating								
Diarrhea								
Vomiting								
Vocalization (any form of vocalization, including meowing, moaning, mewing, etc.)								
Behaviors when visitor approaches								
<i>Ignoring</i>								
<i>Seek interaction</i>								
<i>Withdrawal</i>								
<i>Hiding</i>								
<i>Observing</i>								
<i>Hissing</i>								
Postures								
<i>Crouched body posture with tail closed to body</i> 								
<i>Ears flattened</i> 								
<i>Mydriasis</i> 								
<i>Mouth opened with teeth on display</i> 								
<i>Mouth open, no teeth showing, panting</i> 								
<i>Straight ears, no body tension</i> 								
<i>Belly-up</i> 								

117

118 **Table 1.** Form used to collect general information of the cat, postures and position in the cage, cat's
119 behaviors and cat's reaction as visitors approached.

120

121 *Statistical Analysis*

122 Data were entered into Microsoft Excel (Microsoft Corporation, 2016, Washington, DC), before
123 being analyzed using IBM SPSS Statistic 27 (SPSS Inc., Chicago). Descriptive statistics (relative
124 proportions, minimum and maximum values, median, mean, and standard deviations) were calculated
125 to provide a general description of the sample. Data were tested for normality, and the Pearson's Chi
126 Square test with Bonferroni correction and Kruskal Wallis test were used to investigate possible
127 association between some variables and behaviors shown by cats. A Friedman test was used to
128 investigate potential effects of time on cats' behavior during the day. Differences were considered to
129 be statistically significant if $p \leq 0.05$.

130

131 **Results**

132 *Cat Signalament*

133 Maine Coon (n=14) were 17.1% of cats, 13.4% Sphynx (n=11), 12.2% Bengal (n=10), 9.8 %
134 Norwegian Forest Cat (n=8), 8.5% Scottish (n=7) 8.5% Thai (n=7) and 30.5% (n=25) were other
135 breeds (Devon Rex, Persian, Russian Blue, Siberian, Kurilian Bobtail, Highland Fold, British Short
136 Hair, Burmese, Exotic Short Hair, Ragdoll).

137 Most of the cats (47.6%, n=39) aged between 1 and 2 years, 37.8% (n=31) between 3 months and 1
138 year and 14.6% (n=12) between 3 and 11 years.

139 In our study population, 53.7% of cats were female (n=44) and 4 of them were sterilized; 46.3% were
140 male (n=38) and 6 of them were sterilized.

141 *Cat behaviors, postures, and position in the cage*

142 As shown in Figures 1 and 2, the most represented behaviors during the feline exposition were
143 sleeping and looking at the environment. In fact, most of the cats (93.9%, n=77) showed sleeping
144 behaviors with a mean frequency of 3.48 out of the eight intervals of observations.

145 Most cats (92.7%, n=76) looked at the environment with a mean frequency of 2.51 out of the eight
146 intervals of observations.

147 Resting behaviors was shown by 62.2% (n=51) of cats with a mean frequency of 1.09 out of the
148 eight intervals of observations.

149 Play and hiding behaviors were showed with lower frequency: 32.9% of cats played with a mean
150 frequency of 0.44 out of the 8 intervals and 20.7% hid with a mean frequency of 0.30 out of the
151 eight intervals.

152 Other behaviors observed were showed by a lower percentage of cats with a lower frequency:
153 41.5% of cats showed grooming with a mean frequency of 0.54 out of eight intervals of
154 observations, 13.4% ate with a mean frequency of 0.15 out of eight intervals of observations and
155 7.3% vocalized with a mean frequency of 0.15 out of eight intervals of observations. Just one cat
156 urinated and another one defecated.

157 As shown in Figure 3 and 4, regarding the **position of the cat in the cage**, most of them (93.9% n=
158 77) were on the floor with a mean frequency of this position of 4.30 out of the eight observation
159 intervals. While 69.5% (n=57) of cats were in the cat's bed with a mean frequency of this position
160 of 2.74 out of the eight observation intervals. Finally, only 8.5% of cats positioned themselves in
161 the litter tray with a 0.12 mean frequency of this position out of the eight observation intervals.

162 Regarding the **postures of cats**, in figures 5 and 6 it is shown that 78.8% of cats were oriented to the
163 environment with straight ears and relaxed body posture, with a 1.65 mean frequency out of eight
164 observation intervals. 63.4% of cats showed a crouched body posture with tail closed to body, with a
165 1.07 mean frequency out of eight observations. Ears flattened were shown by 26.8% of cats, with a
166 0.33 mean frequency out of eight observation intervals. A percentage of 20.7% showed belly up and
167 19.5 mydriasis with a mean frequency of 0.27 and 0.26 out of eight observation intervals respectively.
168 No cats showed panting, or mouth opened with teeth on display.

169 *Behaviors related to age and sex*

170 We found no statistically significant difference in the various behaviors according to age, whilst a
171 statistically significant correlation was found between the average frequency of hiding, vocalizing,
172 resting, and belly-lying with sex of cat ($p \leq 0.05$) (see Table 2).

173 A percentage of 26.7% of females tend in general to hide, with an average frequency of 0.42 out of
174 eight observation intervals, while just 13.8% of males showed this behavior, with an average
175 frequency of 0.16 out of eight observation intervals. In particular, we found that 37.8% of females
176 hid as the visitor approached, with an average frequency of occurrence of 0.56 out of eight
177 observation intervals; while in males, the percentage of cats that exhibited this behavior drops to
178 18.9%, with an average frequency of 0.22 out of eight observation intervals.

179 A percentage of 4.4% of females vocalized, with an average frequency of 0.04 out of eight
180 observation intervals, while 10.8% of males exhibited this behavior, with a frequency of 0.22 out of
181 eight observation intervals.

182 Resting was shown by 64.9% of males and 60% of females, with an average frequency respectively
183 of 1.19 and of 1 out of eight observation intervals ($p \leq 0.05$).

184 A percentage of 24.3% of males went belly-up, with an average frequency of 0.30 out of eight
185 observation intervals, while in females the percentage drops to 17.8% with a mean frequency of
186 0.24 of eight observation intervals ($p \leq 0.05$).

187

Behaviors	Females		Males	
	%	Average frequency	%	Average frequency
Hiding to visitors	37.8	0.56	18.9	0.22
Hiding	26.7	0.42	13.5	0.16
Vocalizations	4.4	0.04	10.8	0.22
Resting	60	1	64.9	1.19
Belly-up	17.8	0.24	24.3	0.30

188

189 **Table 2.** Behaviors that showed a statistically significant correlation in frequency of occurrence
190 with respect to sex ($p \leq 0.05$).

191

192 *Cat's reaction to visitors*

193 As shown in figure 7, most of cats (93.3%) ignored the visitors with a 4.52 mean frequency out of
194 eight observation intervals, 87.8% of cats observed the visitors, with a 2.2 mean frequency out of
195 eight observation intervals and 29.3% of cats hid with a 2.2 mean frequency out of eight observation
196 intervals. A percentage of 17.7% of cats looked for interaction with the visitors and 6.1% moved
197 away with a mean frequency of 0.18 and 0.06 out of eight observation intervals. One cat hissed one
198 time.

199 We also recorded the average visitor attendance during the exhibition day at the various observation
200 intervals and verified that the times with the lowest attendance were 10 am, 11 am, 12 pm, 2 pm,
201 the times with medium attendance were 1 pm and 5 pm, and the times with high attendance were 3
202 pm and 4 pm. Hiding is the behavior that statistically significant changes according to crowding of
203 people ($p \leq 0.05$): the largest percentage (54.5%) of cats that exhibited this behavior was observed at
204 the most crowded times (at 3 and 4 pm).

205 *Behaviors over time*

206 We assessed how behaviors changed over time and we found that the mean frequency of playing,
207 hiding and oriented to the environment with straight ears and body not in tension changed
208 significantly ($p \leq 0.05$).

209 In table 3 is shown the percentage of subjects showing playing, hiding and oriented to environment
210 in the eight observation intervals.

211

Behaviors	Observation intervals (hrs)							
	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00
<i>Playing</i>	12.2%	2.4%	7.3%	8.5%	7.3%	2.4%	2.4%	1.2%
<i>Hiding</i>	1.2%	0%	2.4%	4.9%	3.7%	9.8%	4.9%	0%
<i>Oriented to environment</i>	30.50%	15.9%	31.7%	20.7%	15.9%	17.1%	17.1%	18.3%

212 Table 3. Representation of the percentage of subjects engaging in playing, hiding and oriented to
213 environment in the eight observation intervals.

214

215 **Discussion**

216 Cats, as a highly territorial animal, suffers changes in their physical and social environment; for this
217 reason, our aim was to investigate the effect of an exhibition day on cats, where animals are removed
218 from their home, transported by car or other type of vehicle (by train or by plane as well), to the
219 exhibition facility. Here, after the veterinary examination, the cat is housed in a cage and remains
220 inside throughout the day, except when the breeder prepares it for judgment and brings it to the judge.
221 A novel environment that includes new people, new conspecifics, and new odors contributes to the
222 novelty of the situation. During the exhibition day, access to the facility is allowed to the public who
223 can visit the exhibition, resulting in a flurry of people with changes in acoustic, olfactory, and visual
224 stimuli. When exposed to an entirely novel situation, however, on average, cats will experience stress
225 to some degree (Levine, 1985)

226 Our sample of cats belonged to different breeds with a predominance of Maine Coon, Sphynx, and
227 Bengal, but this may be related to random factors linked to location or commitments of the various
228 breeders. The percentage of male and female was similar with a prevalence of intact individuals, due
229 to obvious needs of expository careers. The age of cats was mostly between 1 and 2 years, but a good
230 percentage of cats was between 3 months and 1 year; this could be explained because it takes years
231 to complete the exhibition career. Moreover, the presence of kittens is important to allow the cat to
232 get used to the exhibition environment.

233 The best way to keep a cat from becoming stressed during such an experience is precisely to
234 encourage the habituation process. Habituation is learning not to respond to a stimulus that triggers
235 an instinctive response (Mills, 2009). During development, animals can be exposed to many stimuli
236 in a non-traumatic way, which affects not only the specific responses to that stimulus, but also the
237 general response to what is new. The process of habituation is therefore essential to allow an animal
238 to develop normal reactions to new stimuli and can be used to modify reactions to anxiogenic or
239 stressful stimuli (Mills, 2009). Habituation is adaptive for animals, who learn which stimuli are

240 harmful and which are not, allowing them not to live constantly in a useless and expensive state of
241 fear (Shaw and Martin, 2014).

242 Analysis of the behaviors exhibited by cats during the exposition day revealed that most of them were
243 sleeping, resting, and looking at their surroundings and some cats played.

244 Few cats of our sample hid themselves with a low frequency. Hiding is a natural cat behavior (Houser
245 and Vitale, 2022). The ability to hide is a necessity for cats when exposed to a stressor (Mccune,
246 1994; Smith et al., 1994; Rochlitz, 2000) and could be a way to isolate itself and cope with the
247 situation.

248 All behaviors were shown by cats while they were on the cage floor or in their bed, indicating a
249 possible cat quietness. Just a few cats, and with a very low frequency, placed themselves in the litter
250 box. Vinke et al. (2014), in their study, found that cats in shelters which were not given boxes, were
251 found hiding in other locations, such as litter boxes. So, it is possible that, for our cats, the position
252 in the litterbox could be a method to create a partial isolation from conspecifics and people. Hiding
253 enrichment is beneficial for cats entering a novel or otherwise stressful environment (Smith et al.,
254 1994; Kry and Casey, 2007; Rochlitz, 2009), as this may be of critical importance to some, enabling
255 them to feel a sense of security that would otherwise not occur (Stella and Buffington, 2016).

256 Behaviors showed by cats in our sample seem to indicate no discomfort supported also by the
257 assumed postures, being, for the most part, body not in tension with straight ears and in few cases
258 presenting belly-up. However, many cats showed, with a low frequency, a crouched body posture
259 with tail closed to body; this is recognized as agonistic posture (Stella et al., 2014) or anxious/fearful
260 posture, but in this case the cat normally shows also tense musculature, head and neck pulled in close
261 to body and are accompanied by other postures like ears flattened down against the head, tail tucked
262 close or under the body and mydriasis. Crouched position could be a maintenance position when the
263 body is not in tension and head and neck are not pressed down on the body but are in a relaxed
264 position (Carney and Gourkow, 2016). One limitation of our study is the lack of data related to these
265 insights, which should be explored in further studies. However, it is likely to assume that cats may
266 experience even limited moments of acute stress due to changes present in the macroenvironment of
267 feline exhibition and eventually promote behaviors that help the cat cope with these moments, like
268 hiding. It is important to offer refuge areas to cats that should allow partial isolation from conspecifics
269 and people, as this may be of fundamental importance for some individuals, allowing them to
270 experience a sense of security that would not otherwise occur (Stella and Buffington, 2016).

271 Well-recognized signs of stress like panting, or mouth opened with teeth on display were not
272 exhibited by cats (Carney and Gourkow, 2016).

273 The presence of visitors is a further stressful element for cats: visitors bring with them changes in
274 acoustic (such as adults' and children's vocalizations, clamor, clutter, etc.), visual (people walking
275 back and forth in front of the cages, children running and jerking around) and olfactory stimulation.
276 It is known that social contact with either people or conspecifics influences the cats' welfare (Kessler
277 and Turner, 1999). If the cat is properly socialized, interaction with others can greatly improve its
278 welfare; while, if the cat is not socialized, contact results only in further stress production (Kry and
279 Casey, 2007). Focusing on the presence of visitors, our results indicate that most cats remain
280 indifferent to their presence, indicating a very likely habituation to this strong stimulus.

281 Our results do not indicate any difference in behaviors relating to age, but instead an effect of sex.
282 Female cats are more prone to hide and vocalize, while males more to rest and to get belly up.
283 According to Hart et al. (2014) males are more outgoing and affectionate than females, and this could
284 explain what we found.

285 Moreover, we tested how behaviors change over time to see if there was an effect of boredom or
286 possible stress buildup. Our results indicate an effect of the time of day, most likely related to the
287 presence of visitors whose numbers fluctuate throughout the day: during the high attendance of
288 visitors at 3 and 4 pm we recorded the largest percentage of cat hiding. This could confirm that the
289 most stressful element during a cat show is the crowding of people. Sound is a macroenvironmental
290 factor that can affect cat well-being. It is important considering sound frequency range and intensity.
291 Cats are reported to be able to hear up to 70 kHz, much higher than humans (Heffner and Heffner,
292 1985) and this makes the assessment of the welfare implications of high frequency noise difficult.
293 Sound intensity regularly exceeds 100 dB in shelters and laboratories during routine husbandry
294 (Coppola et al., 2006) and it is possible that this intensity could be exceeded during a cat show,
295 especially during the crowded time of the day. It's reported that in savannah and rain forest habitats
296 the sound intensity ranges from 20 to 40 dB (Morgan and Tromborg, 2007) and sound intensity of 73
297 dB has been found to activate the stress response system of rats (Baldwin et al., 2007). From this, we
298 can assume that the increased hiding at times of increased crowding may be related to acoustic
299 stressors. However, we cannot rule out olfactory and visual stressors; odor is another
300 macroenvironmental factor that impacts cat wellbeing in various housing environments. Cats are very
301 sensitive to odors, so aversive smells can be a source of stress for confined animals (Stella and
302 Croney, 2016). Potentially objectionable odors cats can encounter during an expo include the scent
303 of unfamiliar conspecifics and humans and cleaning chemicals (Morgan and Tromborg, 2007; Stella
304 and Buffington, 2016).

305 It might be helpful to draw up guidelines for the management of cats during the exhibition, to setting
306 up cages to improve their welfare. It is necessary to consider the usable floor space, the food

307 presentation, the elimination facilities, and outlets for the expression of species-typical behaviors in
308 terms of type, presentation, and availability of these features (Stella et al., 2014; Stella and
309 Buffington, 2016; Stella and Croney, 2016; Houser and Vitale, 2022). Recent studies have indicated
310 that the quality of the environment may be more relevant to the cat than the size of the cage during
311 both short and long periods of cage confinement (Stella et al., 2011, 2013, 2014). Although cage
312 space has been found to be important in un-owned shelter cats, in studies where pet cats are
313 temporarily kept in cages for 2 days, results indicate that increased cage space did not improve welfare
314 outcomes (Stella et al., 2014, 2017). In our case, where the cats were kept in cages for about 10-12
315 hours for two days, the most important aspect appeared to be the quality of the cage environment,
316 focusing on elements that could allow effective coping behaviors for acute stress (Stella et al., 2011,
317 2013, 2014). This includes adding areas where the cat can hide, structures or ledges to jump to,
318 scratching and resting posts, perching areas, hammocks and platforms, and toys (Rochlitz, 2009;
319 Dantas-Divers et al., 2011; Vinke et al., 2014). Environmental thermoregulation has a great influence
320 on cat well-being, representing one of the macroenvironmental elements to be considered: cats may
321 be unable to express temperature regulating behaviors because of a lack of resources available to
322 them (Stella and Croney, 2016). The thermoneutral zone for domestic cats is 30–38°C (NRC, 2006)
323 and it is likely that in a cat show facility the temperature is kept between 20-22 degrees \pm 2°C, so
324 thermal discomfort may be a problem faced by show cats. Safely heated beds, resting areas and boxes
325 will enable them to cope with the environment more easily (Stella and Croney, 2016).

326 As a pilot study, we have collected data that have allowed us to understand which can be the most
327 useful elements to work in this field; but surely collecting more data in different cats' shows and
328 comparing data with other physiological parameters, could be essential to be able to confirm our
329 results. Further study could include Cat Stress Score (CCS) to standardize the behavioral assessment
330 of stress in cats: we know that this scoring system, developed by Kessler and Turner (Kessler and
331 Turner, 1997), ranks the level of stress perceived in the cat based on observations of its posture and
332 behavior.

333 To summarize, we found that most of the cats during the exposition day were sleeping, resting, and
334 looking at their surroundings and some cats played. Few cats hid themselves, in particular during the
335 crowded time of the day. Most behaviors were shown by cats with body not in tension and straight
336 ears while they were on the cage floor or in their bed, and just few cats in the litter box. We found
337 just few and with low frequency uncomfortable and stress-related behaviors and postures, such as the
338 aforementioned hiding, crouched body with closed tail and ears flattened.

339 In conclusion, the cats show environment represents a situation full of stressful stimuli for the cat:
340 starting from moving away from home and territory, being restrained in a cage and due to different

341 aspects of the micro and macro-environment. Despite this, our results have identified few behaviors
342 of discomfort or stress manifested with low frequencies. This can be due to the habituation done on
343 cats and to the coping abilities of these animals in this context of acute stress. Stress is a normal aspect
344 of life and is experienced by all living animals (Dawkins, 1998); problems arise when the amount of
345 stress experienced by the animal exceeds a certain level and becomes distress and the coping
346 mechanisms of the individual are no longer adequate with serious implications for animal's welfare
347 (Moberg, 2000; Kry and Casey, 2007).

348

349 **Acknowledgements**

350 The authors would like to thank all the breeders and cats that participated as volunteers.

351

352 **Ethical Statement**

353 All subjects who voluntarily accessed the questionnaire were informed on the purpose of the survey
354 and that their responses would remain anonymous and be used for scientific research only. They also
355 gave their consent and an authorization to allow us to use the data according to the National Privacy
356 Law 675/96 and subsequent amendments.

357

358 **Authorship statement**

359 The idea for the paper was conceived by Simona Cannas and Clara Palestrini.

360 The experiments were designed by Simona Cannas and Clara Palestrini.

361 The experiments were performed by Simona Cannas e Sabrina Alessi.

362 The data were analyzed by Simona Cannas, Clara Palestrini and Federica Scarpazza.

363 The paper was written by Simona Cannas and Clara Palestrini.

364

365 **Conflict of interest statement**

366 The authors of this paper do not have a financial or personal relationship with other people or
367 organizations that could inappropriately influence or bias the content of the paper.

368

369

370 **References**

- 371 Baldwin, A.L., Schwartz, G.E., Hopp, D.H., 2007. Are investigators aware of environmental noise
372 in animal facilities and that this noise may affect experimental data? *J. Am. Assoc. Lab. Anim.*
373 *Sci.* 46, 45–51.
- 374 Bradshaw, J., 2016a. Sociality in cats: A comparative review. *Journal of Veterinary Behavior: Clinical Applications and Research* 11, 113–124. <https://doi.org/10.1016/j.jveb.2015.09.004>
- 375
376 Bradshaw, J., 2016b. What is a cat, and why can cats become stressed or distressed, in: Ellis, S., Sparkes, A. (Eds.), *ISFM Guide to Feline Stress and Health. Managing Negative Emotions to Improve Feline Health and Wellbeing*. International Cat Care, Tisbury, Wiltshire, pp. 19–29.
- 377
378
- 379 Burns, K., 2018. Pet ownership stable, veterinary care variable. *American Veterinary Medical Association News* (<https://www.avma.org/javma-news/2019-01-15/pet-ownership-stable-veterinary-care-variable>)
- 380
381
- 382 Carney, H., Gourkow, N., 2016. Impact of stress and distress on cat behavior and body language, in: Ellis, S., Sparkes, A. (Eds.), *ISFM Guide to Feline Stress and Health. Managing Negative Emotions to Improve Feline Health and Wellbeing*. International Cat Care, Tisbury, Wiltshire, pp. 31–39.
- 383
384
385
- 386 Coppola, C.L., Enns, R.M., Grandin, T., 2006. Noise in the Animal Shelter Environment: Building Design and the Effects of Daily Noise Exposure. *Journal of Applied Animal Welfare Science* 9, 1–7. https://doi.org/10.1207/s15327604jaws0901_1
- 387
388
- 389 Dantas-Divers, L.M.S., Crowell-Davis, S.L., Alford, K., Genaro, G., D’Almeida, J.M., Paixao, R.L., 2011. Agonistic behavior and environmental enrichment of cats communally housed in a shelter. *J. Am. Vet. Med. Assoc.* 239 (6). <https://doi.org/10.2460/javma.239.6.796>
- 390
391
- 392 Dawkins, M.S., 1998. Evolution and Animal Welfare. *Q Rev Biol* 73, 305–328. <https://doi.org/10.1086/420307>
- 393
- 394 FEDIAF Annual Report 2021, n.d. (https://www.portalveterinaria.com/upload/20220614163901FINAL_FEDIAF_AR_2021.pdf)
- 395
- 396 Fife, ©, n.d. Fédération Internationale Féline-FIFe FIFe Show Rules. (<https://www.sfdh.hr/wp-content/uploads/2017/04/FIFe-SHOW-RULES-2017.pdf>)
- 397
- 398 Guy, N.C., Hopson, M., Vanderstichel, R., 2014. Litterbox size preference in domestic cats (*Felis catus*). *Journal of Veterinary Behavior* 9, 78–82. <https://doi.org/10.1016/j.jveb.2013.11.001>
- 399
- 400 Hart, B.L., Hart, L.A., Lyons, L.A., 2014. Breed and gender behaviour differences: relation to the ancient history and origin of the domestic cat, in: Turner, D.C., Bateson, P. (Eds.), *The Domestic Cat: The Biology of Its Behaviour*. Cambridge University Press, Cambridge.
- 401
402

403 Heffner, R.S., Heffner, H.E., 1985. Hearing range of the domestic cat. *Hear. Res.* 19, 85–88.
404 [https://doi.org/10.1016/0378-5955\(85\)90100-5](https://doi.org/10.1016/0378-5955(85)90100-5)

405 Houser, B., Vitale, K.R., 2022. Increasing shelter cat welfare through enrichment: A review. *Appl*
406 *Anim Behav Sci.* 248. <https://doi.org/10.1016/j.applanim.2022.105585>

407 Kessler, M.R., Turner, D.C., 1999. Socialization and stress in cats (*Felis silvestris catus*) housed
408 singly and in groups in animal shelters. *Anim. Welf.* 8.

409 Kessler, M.R., Turner, D.C., 1997. Stress and adaptation of cats (*Felis silvestris catus*) housed
410 singly, in pairs and in groups in boarding catteries. *Anim. Welf.* 6, 243-254

411 Kry, K., Casey, R., 2007. The effect of hiding enrichment on stress levels and behaviour of
412 domestic cats (*Felis sylvestris catus*) in a shelter setting and the implications for adoption
413 potential. *Anim. Welf.* 16, 375–383.

414 Levine, S., 1985. A Definition of Stress?, in: Moberg, G.P. (Ed.), *Animal Stress*. Springer New
415 York, New York, NY, pp. 51–69. https://doi.org/10.1007/978-1-4614-7544-6_4

416 Lipinski, M.J., Froenicke, L., Baysac, K.C., Billings, N.C., Leutenegger, C.M., Levy, A.M.,
417 Longeri, M., Niini, T., Ozpinar, H., Slater, M.R., Pedersen, N.C., Lyons, L.A., 2008. The
418 ascent of cat breeds: Genetic evaluations of breeds and worldwide random-bred populations.
419 *Genomics* 91. <https://doi.org/10.1016/j.ygeno.2007.10.009>

420 Machado, J., Genaro, G., 2014. Influence of olfactory enrichment on the exploratory behaviour of
421 captive-housed domestic cats. *Aust. Vet. J* 92, 492–498. <https://doi.org/10.1111/avj.12253>

422 Mccune, S., 1994. Caged cats: avoiding problems and providing solutions *Newsletter of the*
423 *Companion Animal Study Group* 7, 1-9

424 Mills, D., 2016. What are stress and distress, and what emotions are involved?, in: *ISFM Guide to*
425 *Feline Stress and Health. Managing Negative Emotions to Improve Feline Health and*
426 *Wellbeing*. International Cat Care, Tisbury, Wiltshire

427 Mills, D.S., 2009. Training and learning protocols, in: *BSAVA Manual of Canine and Feline*
428 *Behavioural Medicine*. British Small Animal Veterinary Association, pp. 49–64.
429 <https://doi.org/10.22233/9781905319879.5>

430 Moberg, G.P., 2000. Biological response to stress: implications for animal welfare., in: *The Biology*
431 *of Animal Stress: Basic Principles and Implications for Animal Welfare*. CABI Publishing,
432 UK, pp. 1–21. <https://doi.org/10.1079/9780851993591.0001>

433 Morgan, K.N., Tromborg, C.T., 2007. Sources of stress in captivity. *Appl Anim Behav Sci* 102,
434 262–302. <https://doi.org/10.1016/j.applanim.2006.05.032>

435 Rochlitz, I., 2009. Basic requirements for good behavioural health and welfare in cats, in: Horwitz,
436 D., Mills, D. (Eds.), BSAVA Manual of Canine and Feline Behavioural Medicine. British
437 Small Animal Veterinary Association, Gloucester, pp. 35–48.

438 Rochlitz, I., 2000. Feline welfare issues, in: Turner, D.C., Bateson, P. (Eds.), The Domestic Cat:
439 The Biology of Its Behaviour. Cambridge University Press, Cambridge, UK, pp. 207–226.

440 Serpell, J.A., 1996. Evidence for an association between pet behavior and owner attachment levels.
441 Appl. Anim. Behav. Sci 47, 49–60. [https://doi.org/10.1016/0168-1591\(95\)01010-6](https://doi.org/10.1016/0168-1591(95)01010-6)

442 Shaw, J.K., Martin D., 2014. Canine and Feline Behavior for Veterinary Technicians and Nurses.
443 John Wiley & Sons, Ltd, Chichester, UK. <https://doi.org/10.1002/9781119421412>

444 Sivewright, J., Americas, P., Krueger, N.L., n.d. Winning in PetCare
445 ([https://www.nestle.com/sites/default/files/asset-](https://www.nestle.com/sites/default/files/asset-library/documents/library/presentations/investors_events/investor-seminar-2019/petcare.pdf)
446 [library/documents/library/presentations/investors_events/investor-seminar-2019/petcare.pdf](https://www.nestle.com/sites/default/files/asset-library/documents/library/presentations/investors_events/investor-seminar-2019/petcare.pdf))

447 Smith, D.F., Durman, K.J., Bradshaw, J.W., 1994. Behavioural aspects of the welfare of rescued
448 cats. The Journal of the Feline Advisory Bureau 31, 25–28.

449 Stella, J., Croney, C., Buffington, T., 2014. Environmental factors that affect the behavior and
450 welfare of domestic cats (*Felis silvestris catus*) housed in cages. Appl. Anim. Behav. Sci. 160,
451 94–105. <https://doi.org/10.1016/j.applanim.2014.08.006>

452 Stella, J., Croney, C., Buffington, T., 2013. Effects of stressors on the behavior and physiology of
453 domestic cats. Appl. Anim. Behav. Sci. 143, 157–163.
454 <https://doi.org/10.1016/J.APPLANIM.2012.10.014>

455 Stella, J.L., Buffington, T., 2016. Environmental strategies to promote health and wellness, in:
456 Little, S. (Ed.), August’s Consultations in Feline Internal Medicine. Elsevier, pp. 718–736.

457 Stella, J.L., Croney, C.C., 2016. Environmental Aspects of Domestic Cat Care and Management:
458 Implications for Cat Welfare. Scientific World Journal 2016.
459 <https://doi.org/10.1155/2016/6296315>

460 Stella, J.L., Croney, C.C., Buffington, C.T., 2017. Behavior and Welfare of Domestic Cats Housed
461 in Cages Larger than U.S. Norm. J. Appl. Anim. Welf. Sci. 20, 296–312.
462 <https://doi.org/10.1080/10888705.2017.1317252>

463 Stella, J.L., Lord, L.K., Buffington, C.A.T., 2011. Sickness behaviors in response to unusual
464 external events in healthy cats and cats with feline interstitial cystitis. J. Am. Vet. Med. Assoc.
465 238. <https://doi.org/10.2460/javma.238.1.67>

466 Vigne, J.D., Guilaine, J., Debue, K., Haye, L., Gérard, P., 2004. Early Taming of the Cat in Cyprus.
467 Science 304 (5668), 259. <https://doi.org/10.1126/science.1095335>

468 Vinke, C.M., Godijn, L.M., van der Leij, W.J.R., 2014. Will a hiding box provide stress reduction
469 for shelter cats? *Appl. Anim. Behav. Sci.* 160. <https://doi.org/10.1016/j.applanim.2014.09.002>
470
471

472 **Figures caption**

473 Figure 1 and 2. Cats' behaviors and mean frequency of occurrence.

474 Figure 3 and 4. Position of the cat in the cage and mean frequency of occurrence.

475 Figure 5 and 6. Postures showed by cats and mean frequency of occurrence.

476 Figure 7. Cats' behaviors in relation to visitors.

477 Figure 8. Mean frequency of playing, hiding and oriented to environment with straight ears and
478 body not in tension over time ($p \leq 0.05$).

479

480

481

482

483