Behavioral modification in sheltered dogs

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Abstract: The aim of this study was to assess whether one month's stay in a shelter causes any behavioral change in the guest dogs. Fifteen cross-breed dogs were video-recorded for twenty minutes in their boxes once a week for five times, starting from the third day after admittance to the shelter. A significant reduction was observed in the frequency of dozing (r=0.95; p=0.01), waving high tail (r=0.95; p=0.01), and waving tail (r=0.92; p=0.02); duration was reduced for lying down (r=0.93; p=0.021), dozing (r=0.98; p=0.003), and waving high tail (r=0.93; p=0.019). Moreover a significant increase was observed in the duration of activity behavioral patterns, such as scratching door (r=0.93; p=0.023) and digging (r=0.86; p=0.060). In addition, an increase was observed in the frequency of standing upright (r=0.92; p=0.026), scratching door (r=0.99; p=0.001), digging (r=0.91; p=0.034), whining (r=0.92; p=0.024), and scratching (r=0.93; p=0.024).

On the third and fourth week of their stay, some behaviors that are typical of a state of restlessness appeared, while others that are typical of a state of inactivity disappeared.

The dogs underwent a behavioral test involving the introduction of different stimuli (unexpected noise, food and toy) in an unknown place, which showed they had got used to such external stimuli as noise (p=0.004).

Data suggest that staying in a shelter can induce behavioral changes that should be carefully monitored to prevent behavioral problems which might develop after adoption.

Key Words: animal welfare, behavior, dog, shelter, stress.

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Introduction

The arrival to the shelter may be considered a particularly stressful event for the dog, since the dog often comes there after a traumatic event such as abandonment and/or separation from its former family, maybe after having wandered about without food in an unknown environment, surrounded by unusual stimuli, before being captured. Therefore, the dog is brought into in an environment which, although meeting the rules set forth by all the national and local legislations, can be a source of stress, because of its new environmental conditions and because it deeply changes the dog's relationships with human beings (Coppola et al. 2006).

Stress can mainly modify dog behavior (Mariti et al., 2012), so it can be considered a reliable indicator (Beerda et al., 1998). Besides the above-mentioned factors, general environmental conditions, characteristics of the shelter and type of management are other possible sources of stress (Wells et al., 2002). As dogs are extremely social animals, housing them alone is generally considered to be negative for canine welfare (Hughes et al., 1989; Hetts et al., 1992; Hubrecht et al., 1992; Hubrecht, 1995; Mertens & Unshelm, 1996; Weels & Hepper, 1998). Factors including separation from the owner, handling by unfamiliar shelter staff, novel surroundings and changes in husbandry routine are likely to contribute to the behavioral and physiological indicators of stress that are observed in the short term in dogs experimentally housed in isolation or in shelters (Beerda et al.,

Dog Behavior, 3-2016, pp. 1-12
doi 10.4454/db.v2i3.38

Received, 11/05/2016
Accepted, 12/04/2016

1997; Hennessy et al., 1998, 2001). Behavioral correlates of stress have also been observed in dogs sheltered for longer periods (Hubrecht 1992; Beerda et al., 1999a, 2000). For example, dogs were observed to display behaviors associated with frustration and depression eight weeks following admittance to a shelter (Stephen & Ledger, 2005).

About two third of dogs coming from a shelter display one or more behavior problems during the first month post-adoption (Wells & Hepper, 2000), and behavior problems represent one of the most common reasons for relinquishing dogs to shelters (Tuber et al., 1999). Therefore it is relevant to assess if and how dog behavior changes during the permanence in a shelter and if these changes are correlated with future behavior problems that dogs often display during the first period after adoption.

The aim of this study was to observe the presence and extent of any change in the sheltered dogs' behaviors based on an ethogram of such species borrowed from literature (De Palma et al., 2005; Beerda et al., 1999a; Gosling & Bonnenburg, 1998) for a better understanding of how to properly manage animals in a way that will protect their welfare and improve their future chances to be adopted early after admittance to the shelter.

Materials and methods

The study was conducted at the public shelter of Lucca (Italy). This is equipped with individual boxes, consisting of an outdoor area (95 cm. wide, 140 cm. long, 170 cm. high) and an indoor area of the same size. The boxes, with a concrete floor, are cleaned every morning. Each dog can see the box in front of its own, and is fed, about at 4 p.m., with dry food and walked once a day.

Subjects

A sample of fifteen crossbreed dogs (seven females and eight males) of an estimated age of two to eight years were analyzed. The use of mongrels prevented any valid analysis of breed differences (Wells et al., 2002). None of the dogs had docked tails. Organic and behavioral pathologies were ruled out for all dogs before admittance to the study protocol.

It was not possible to clearly document the source of many dogs, so no attempt was made to distinguish subjects on the basis of their provenance.

Procedures

Starting on the third day after the dogs' admittance to the shelter, each subject was video-recorded for twenty minutes once a week for five times (T0, T1, T2, T3, T4) between 9.00h and 12.00h a.m. The video camera was placed in front of the outdoor area of the kennel, the only one left available during the video-recording. Shelter staff could not interact with the dogs or work near the box being filmed. This setting was selected so as to assess the dogs' spontaneous behavior in a standardised situation, which did not differ from a regular day. The videos were analyzed to measure the frequency and duration of 37 behaviors (De Palma et al., 2005) as described in Table 1. In addition, dogs underwent a behavioral test on the fifteenth and thirtieth day after admittance to the shelter. The dogs were not tested earlier, in order not to make them suffer the influence of the stress of the first few days. On both occasions, the test was conducted inside an unknown, closed room.

The test included three subtests, preceded by five minutes to let the dog get used to the environment. Each subtest, at five minutes' intervals from the next, consisted of introducing a specific stimulus. The subject was video-recorded by a hidden person for the subsequent assessment of the dog's behavioral responses according to a scale that kept into account five increasing levels of reactivity.

Table 1. Behaviors analysed in the dog's box (De Palma et al., 2005).

Behavior	**Description**
Biting bars	Biting the box's bars
Ears up	Raising the ears turning them forward, showing attention to something
Ears backwards	Putting the ears backwards
Tail still	The tail is still and rigid at a medium height
Tail beetwen the legs	The tail is kept between the hind legs, covering genital organs
Waving tail	The tail is waved intensely
Waving high tail	The tail is waved while kept high
Indifferent towards the barking of other dogs	The dog is indifferent when the other dogs are barking
Getting frightened by noises	Being frightened by noises
Prompt	Ready to spring towards a stimulus with the ears raised, watchful eyes, the tail still and the whole body vibrating
Looking outside	Looking outside the box
Looking at the environment	Looking around the environment
Raising forelegs on wall	Raising both forelegs onto the wall or onto the bars, looking carefully outside
Sniffing air	Raising the head, moving the nostrils and breathing the air, to perceive odours
Sniffing environment	Putting the muzzle on the ground, on the wall, or on the objects in the box, the dog sniffs the environment
Scratching	Raising one hind leg and scratching itself vigorously
Yawing	Opening the mouth and inhaling and exhaling air
Circling	Running around circling itself. When this behavior is recorded in the box it might take the place of running
Licking lips	Passing the tongue on the lips
Licking objects persistently	The dog lick an object persistently
Jumpinng	Jumping with all four legs, falling down on the same place
Self-grooming	Cleaning itself with the tongue and the teeth
Barking	Vocalisation characteristic of dogs
Whining	A mournful vocalisation
Grumbling	A low and deep vocalisation that seems to come from the chest. The dog generally has the mouth closed
Howling	Vocalisation characteristic of wolves, this consist in a long, high and mournful sound; quite rare in dogs
Urinating	Emitting urine in a crouching position
Urinating with a raised leg	Emitting the urine with one hind leg raised, so that urine goes beside the
Urinate jumping	Emitting the urine while jumping
Scratching with hind legs	Scratching the round with the hind legs after having urinated or defecated
Lying down	Lying down on the ground
Crouching	Lying with the ventral region in contact with the ground
Sitting	Sitting down with the rump leaning on the ground
Upright	Standing up on four legs
Dozing	Curling up, the dog is half asleep
Scratching door	Scratching the door with a fore leg
Digging	Digging on the round with the fore legs, to make a hole

First subtest (NOISE): an alarm clock rang suddenly for 10 seconds. The dog's behavioral responses were assessed according to the following scale:

1. No attention.
2. Slight attention, the dog moves its head.
3. Attention to the source of the noise, the dog turns with pricked-up ears.
4. Immediate attention, the dog turns to the source of the noise.
5. The dog quickly moves towards the source of the noise.

Second subtest (FOOD): some dry food, the same usually fed in the shelter, was thrown into the room, and the dog's behavioral response was assessed according to the following scale:

1. Does not explore.
2. Sniffs the food but keeps off it.
3. Sniffs the food and goes near it several times.
4. Sniffs the food, goes near it several times, and eats it.
5. Sniffs the food and eats it straightaway.

Third subtest (PLAY): a toy (ringing plastic toy) unknown to the animal was thrown into the room and left at the dog's disposal. The animal's responses were assessed according to the following scale:

1. No exploration.
2. Slight attention to the toy, no interaction.
3. The dog goes near the toy and sniffs it.
4. Interaction with the toy, without any special interest.
5. Active play.

Statistical Analysis

The statistical analysis of data resulting from the observation of the dog's behaviors in its box in terms of duration and frequency was based on the linear regression test.

The similarity data analysis based on *non-metric Multi-dimensional-scaling* (MDS) (Kruskal, 1964; Kruskal & Wish, 1978; Clarke & Warwick, 2001) helped identify the dog's most common behaviors and their distribution and variation over time. In addition, DISTLM, a non-parametric multivariate analysis, was carried out (Anderson 2001, 2004; McArdle & Anderson, 2001), according to a mono-factorial ANOVA design with repeated measurements to test the effect of time (Fixed Factor with five levels, one per observation) on the whole of the behaviors. Because of the low number of possible permutations, due to the level of replication and the experimental design, a Monte Carlo simulation was used to obtain a significance value (Anderson & Robinson, 2003). The analysis was carried out on the square root of the data, in order to offset the weight of those behaviors that tended to last longer than those which are potentially as characteristic but tend to last less. SIMPER analysis was used to identify behaviors that appeared more frequently in each observational session.

The results of the behavioral test were analysed by comparing the mean value of the score given to the dogs in each test in both observations. In particular, because of the low number of subjects in the sample and the presence of many cases in which the score remained the same in both observations, the Friedman Test was used (Friedman, 1937).

Results

The mean (± standard deviation) duration and frequency in the expression of the sheltered dogs' monitored behaviors are listed in Table 2 and 3.

Table 2. Mean values (±S.D.) of the duration of dogs' behaviors while in the box.

Behaviors	**T 0**	**T 1**	**T 2**	**T 3**	**T 4**
Biting bars	0.27±1.03	3.40±10.14	3.67±10.52	5.20±9.04	3.80±11.77
Ears up	49.47±51.92	40.27±94.23	18.33±36.77	21.47±29.17	56.33±86.58
Ears backwards	20.60±58.69	1.00±3.87	34.27±91.25	8.87±19.65	40.67±99.90
Tail still	298.13±462.90	210.53±429.64	340.87±537.21	192.20±420.68	200.40±420.68
Tail beetwen the legs	0.00	94.73±311.02	110±306.44	100.73±308.11	105±305.37
Waving tail	22.33±38.80	17.00±23.50	28.60±55	5.87±11.54	4.60±14.01
Waving high tail	25.27±87.10	25.47±70.02	7.47±22.28	5.27±19.06	0.93±3.61
Indifferent towards barking of other dogs	1167.60±49.06	1183.20±27.82	1172.87±33.02	1174.07±35.25	1124.4±114.28
Getting frightened by noises	10.53±40.80	1.53±5.94	1.80±6.97	1.53±5.94	18±34.62
Prompt	21.87±35.16	15.27±27.31	25.20±33.52	23.73±32.96	57.60±112.26
Looking	287.80±218.64	550.60±292.31	498.27±281.90	457.93±337.64	434.20±321.91
Looking at the environment	302.33±234	261.67±210.10	240.80±239.79	328.33±295.73	38.13±67.41
Raising forelegs on wall *o*	53.20±139.47	34.87±30.55	24.93±30.11	39.27±53.58	47.40±45.66
Sniffing air	23.20±21.09	16.47±22.22	8.07±7.71	8.93±8.40	18.60±15.95
Sniffing environment	82.27±128.25	66.53±51.10	50.80±46.98	67.73±63.37	67.53±65.75
Scratching	2.07±4.61	6.00±21.38	4.27±6.49	3.93±7.72	5.40±8.81
Circling	78.07±263.75	24.73±31.98	28.60±23.24	36.73±29.21	33.93±26.35
Licking objects persistently	0.60±2.32	0.00	0.00	0.93±3.61	1.20±4.65
Jumping	2.13±4.76	1.33±2.89	2.60±6.39	4.53±4.90	3.20±5.17
Self-grooming	25.87±35.29	12.53±18.05	18.33±31.79	18.93±36	2.07±4.56
Barking	16.73±20.74	27.07±56.32	40.20±69.38	113.47±279.16	47.67±72.75
Whining	117.07±247.94	106.33±189.46	112.80±154.02	78.47±87.57	146.07±296.36
Grumbling	50.07±128.30	18.27±52.85	9.67±19.31	26.00±82.80	6.13±11.57
Howling	15.13±46.21	9.00±16.20	10.00±24.97	14.20±26.71	13.07±27.49
Urinating	1.40±3.70	0.67±2.58	0.00	1.27±3.47	2.47±5.11
Urinating with a raised leg	1.20±3.69	2.20±8.52	0.20±0.77	0.00	0.00
Urinate jumping	0.00	0.00	0.00	0.00	0.00
Scratching with hind legs	0.00	0.00	0.20±0.77	0.93±3.61	2.33±4.64
Lying down	259.9±372.46	164.67±278.29	108.07±220.50	111.47±238.53	63.60±170.23
Crouching	146.07±215.38	137.60±206.16	117.73±224.94	95.33±158.04	103.40±258.98
Sitting	220.13±153.24	303.40±355.88	333.33±303.77	347.87±361.57	350.73±258.18
Upright	573.87±348.69	594.33±352.97	694.20±492.16	645.33±354.08	682.27±332.66
Dozing	186.20±206.97	143.67±247.46	117.53±176.76	83.67±169.11	10.67±32.50
Scratching door	3.33±5.15	7.00±14.47	8.33±10.32	21.13±30.68	37.73±47
Digging	0.47±1.81	0.00	2.67±8.37	1.80±3.17	4.80±5.73

Table 3. Mean values (±S.D.) of the frequency of dogs' behaviors while in the box.

Behaviors	**T 0**	**T 1**	**T 2**	**T 3**	**T 4**
Biting bars	0.07±0.26	0.53±1.46	0.60±1.55	1.13±2.03	1±3.07
Ears up	1.60±1.50	0.93±1.28	0.93±1.83	1.60±1.96	1.87±2.39
Ears backwards	0.20±0.41	0.07±0.26	1.20±1.82	0.93±1.83	1.40±1.80
Tail still	0.67±0.72	0.53±0.64	0.53±0.83	0.60±1.55	0.80±1.66
Tail beetwen the legs	0.00	0.40±1.30	0.87±1.51	0.40±0.63	1.27±1.67
Waving tail	1.13±1.85	0.93±0.96	1.00±1.51	0.33±0.62	0.20±0.56
Waving high tail	0.73±1.71	0.80±1.93	0.47±1.30	0.27±0.80	0.07±0.26
Getting frightened by noises	0.07±0.26	0.07±0.26	0.13±0.52	0.20±0.77	0.80±1.70
Prompt	0.87±1.36	0.73±1.10	0.93±1.28	1.00±1.31	0.93±1.22
Looking outside	7.13±4.53	8.80±3.34	8.73±3.49	7.87±3.09	6.87±4.36
Looking at the environment	7.07±4.33	6.80±3.51	6.07±3.69	6.67±2.82	5.33±3.22
Raising forelegs on wall	4.13±4.63	4.93±2.96	3.80±3.21	5.33±6.97	7.13±6.09
Sniffing air	2.47±1.77	2.27±2.60	1.40±1.35	1.47±1.30	2.53±1.55
Sniffing environment	4.53±3.00	4.67±3.02	4.80±2.11	4.67±2.77	4.67±3.15
Scratching	0.40±0.83	0.33±1.05	0.80±1.21	0.87±1.64	1.00±1.56
Yawning	1.13±1.25	0.53±0.92	1.20±1.32	1.00±1.56	3.47±3.18
Circling	1.87±1.77	4.73±3.22	6±3.89	7.40±4.12	8.07±5.32
Licking lips	1.40±1.80	3.07±6.99	1.07±1.16	0.73±1.28	1.67±1.84
Licking objects persistently	0.13±0.52	0.00	0.00	0.13±0.52	0.27±1.03
Jumping	0.80±1.78	0.53±1.06	0.80±1.82	1.47±1.46	1.20±2.01
Self-grooming	2.07±2.22	3.27±5.19	1.27±1.79	1.07±1.87	0.53±1.25
Barking	2.60±3.02	3.27±5.19	3.87±6.12	4.60±6.68	4.20±4.33
Whining	3.00±3.16	4.13±4.61	5.20±4.63	4.93±4.67	3.60±3.42
Grumbling	1.80±3.28	1.20±2.31	0.93±1.91	1.33±3.13	1.00±1.93
Howling	1.60±4.27	1.13±1.68	1.47±3.23	1.53±2.50	1.93±3.92
Urinating	0.20±0.56	0.13±0.52	0.00	0.13±0.35	0.27±0.59
Urinating with a raised leg	0.33±0.90	0.07±0.26	0.07±0.26	0.00	0.00
Urinate jumping	0.00	0.00	0.00	0.00	0.00
Scratching with hind legs	0.00	0.00	0.07±0.26	0.20±0.77	0.47±0.83
Lying down	1.40±1.84	1.13±2.03	0.73±1.49	1.00±2.33	0.87±1.51
Lying down	1.40±1.84	1.13±2.03	0.73±1.49	1.00±2.33	0.87±1.51
Crouching	0.67±0.90	1.20±1.61	1.07±1.71	0.87±1.36	1.27±2.52
Sitting	3.53±2.53	3.87±3.85	4.73±3.75	5.87±4.27	7.87±4.47
Upright	4.67±2.72	6.27±3.90	5.93±3.69	6.93±3.49	7.33±4.15
Dozing	1.13±1.41	1.00±1.65	0.93±1.58	0.40±0.63	0.13±0.35
Scratching door	0.80±1.08	1.80±3.43	2.33±4.32	3.20±4.81	4.53±4.49
Digging	0.13±0.52	0.00	0.27±0.70	0.53±0.92	1.00±1.36

As to the duration of such behaviors, the data analysis showed a statistically significant increase of some behaviors, such as scratching door (r=0.93; p=0.023) and digging (r=0.86; p=0.060). At the same time, a decrease was observed in the duration of lying down (r=0.93; p=0.021), dozing (r=0.98; p=0.003) and waving high tail (r=0.93; p=0.019). Some of the behaviors that might suggest

a state of activity increased in frequency. This happened especially for standing upright (r=0.92; p=0.026), scratching door (r=0.99; p=0.001), digging (r=0.91; p=0.034), whining (r=0.92; p=0.024), and scratching (r=0.93; p=0.024). In addition, a significant reduction was observed in the frequency of dozing (r=0.95; p=0.01), waving tail (r=0.92; p=0.02) and waving high tail (r=0.95; p=0.01).

No statistically significant difference was observed in the other monitored behaviors.

The similarity analysis of the MDS data showed that samples from the five observational sessions presented no clear segregation but rather a behavioral gradient. Using the Monte Carlo simulation, the data analysis showed a significant effect of the time factor in the variation of the overall behavior (p=0.004).

The SIMPER analysis helped instead to single out the characteristic behaviors of each observation by determining, in each observational session, which ones were most frequent and characteristic of the different phases of the dog's stay in the shelter. Table 4 lists the average percentage of time spent by the dogs in displaying the most frequent behaviors during the observational sessions.

Table 4. Average percentage of time spent by dogs in displaying the most frequent behaviors.

Behaviors	**T 0 %**	**T 1 %**	**T 2 %**	**T 3 %**	**T 4%**
Indifferent towards the barking of other dogs	48.60	48.88	46.93	48.30	45.53
Upright	15.66	15.56	16.82	17.69	20.42
Looking outside	7.36	15.76	13.18	10.90	10.25
Looking environment	7.30	6.08	4.48	6.98	4.22
Sitting	5.58	5.58	6.86	6.67	8.91
Dozing	2.91	1.14	1.31	-	-
Lying down	2.87	1.37	-	-	-
Tail still	2.44	1.05	2.74	-	0.87
Crouching	1.52	1.42	0.80	0.83	-
Sniffing environment	1.15	1.53	1.05	1.51	1.38
Whining	-	-	1.31	1.30	1.42
Circling	-	-	-	0.84	0.82
Raising forelegs on wall	-	-	-	-	0.99
Scratching door	-	-	-	-	0.63

The analysis shows that the five observations are basically characterised by the same behaviors. However, observations following the first one showed the appearance of behaviors which suggest increasing levels of activity: this is the case of circling (which appeared at the fourth observation), scratching door and raising forelegs on wall (which appeared at the 5th observation).

In addition, among the characteristic behaviors, some indicators associated with inactivity, such as dozing, crouching and lying down, disappeared between T2 and T4.

Table 5 lists the ratios of similarity to the standard deviation (S.D.) of each behavior in the different observations: the indicator matches the absolute contribution with the similarity and variability of a given behavior shown by the dogs, where higher values are taken by those behaviors, which are more consistently expressed within the group.

Some individual variability can be observed in the expression of activity behaviors, which increase as the dog remains in the shelter, and inactivity behaviors, which remarkably decrease over time.

Table 5. Ratios of the similarity of individual behaviors over the weeks to the standard deviation.

Behaviors	**T 0 Sim/SD**	**T 1 Sim/SD**	**T 2 Sim/SD**	**T 3 Sim/SD**	**T 4 Sim/SD**
Indifferent towards the barking of other dogs	8.24	9.02	9.16	9.33	5.89
Upright	1.47	1.67	1.91	1.70	2.11
Looking outside	1.56	1.73	1.55	1.53	1.54
Looking environment	1.02	0.97	0.85	1.06	0.86
Sitting	1.13	0.56	0.94	0.74	1.02
Dozing	0.59	0.31	-	-	-
Lying down	0.44	0.31	-	-	-
Tail still	0.35	0.21	0.30	-	0.20
Crouching	0.36	0.41	0.23	0.28	-
Sniffing environment	0.91	1.35	1.18	1.20	0.89
Whining	-	-	0.57	0.67	0.68
Circling	-	-	-	1.08	1.10
Raising forelegs on wall	-	-	-	-	0.95
Scratching door	-	-	-	-	0.81

Table 6 lists the mean scores (± S.D.) given to the dogs during the behavioral tests and the statistically-significant differences found by using the Friedman's test.

Table 6. Mean scores (± S.D.) obtained by the dogs at the behavioral test and statistical differences at the Friedman's test.

Test	**15 th day**	**30th day**	**p**
Noise	3.27±1.16	1.80±0.94	χ^2= 8.33 p= 0.004
Food	2.80±1.37	3.60±1.72	χ^2= 1.6 p = 0.21
Play	3.00±0.65	2.60±1.30	χ^2= 3.6 p= 0.06

The dogs showed a highly significant decrease in reactivity to the noise. The same trend was noticed for the play subtest.

Discussion

The behavior of every living being has developed in connection with the environment in which the species has evolved, so as to adapt to it in a way that protected its individual wellbeing (Moberg, 2000). Some animal species, such as the dog, show a high ability to adapt their behavior in response to the environment conditions. These are the resources the dog implements when housed in a shelter, where it often experiences a number of potentially stressful conditions. As a matter of fact, even in a well-run and caring shelter, dogs are exposed to a high level of novelty and noise (Wells et al., 2002); they are separated from any previous attachment and their environment becomes unpredictable and uncontrollable (Hennessy et al., 2001). These and other factors can remarkably affect the dog's welfare and make the dog change its behavior in the attempt to adapt to the new circumstances.

Studies conducted on the dog have showed the onset of new behaviors in dogs that were experimentally kept in a poorly-stimulating environment and segregated from their conspecifics for 6 weeks (Beerda et al., 1999a). The transition to these housing conditions resulted in a significant increase in the dog's interaction with the environment, often in the form of repetitive, mechanical behaviors and oral behaviors (Beerda et al., 1999a and b). Similar results have also been shown by this study, which found that the dog's behaviors progressively changed in the first month in which it stayed at the kennel. A decrease was actually found in the duration and/or frequency of inhibited and passive behaviors (such as dozing and lying down) which the dogs usually have when faced with a new situation, while an increase was observed in the active behaviors (upright, scratching door and digging).

Other behaviors that were modified by the dog's confined conditions, in the study of Beerda et al. (1999a), were an increase in the frequency of auto-grooming, circling, eating faeces and paw lifting. These behaviors went hand in hand with an increase in the levels of cortisol in the saliva (Beerda et al., 1999b). Other Authors too report that self-grooming (Hetts et al., 1992) and scratching (Hiby et al., 2006), as well as barrier manipulation (Hetts et al., 1992), increase in individually-stabled dogs confined to narrow spaces. We can assume, therefore, that even in this study social isolation might be the cause or one of the causes of the rise in the frequency of behaviors that are potential stress indicators, such as whining and scratching.

The animal's growing state of activity and greater interaction with the environment, even if they are the dog's response to unfavourable environment conditions, should be carefully monitored, since they might be early indicators of the development of behavioral problems. Previous studies demonstrated that behavior observed in animal shelters can be related to behavior problems after adoption (van der Borg et al., 1991), above all when dogs are young, with distorted responses to behavioral tests (Hennessy et al., 2001). Other studies suggest that dogs acquired from a rescue shelter are more likely to exhibit problem behaviors than other sources of acquisition; e.g. they are particularly prone to separation-related problems (McCrave, 1991), as well as to hyperactivity (37.4%) and destructive tendencies (24.5%) (Wells & Hepper, 2000). These behavioral changes might actually be caused by some of the behaviors that have been observed during the dog's comparatively short stay in a shelter, as it happened in this study. We could assume that, as suggested by other Authors (Hetts et al., 1992; Hubrect et al., 1992), caging dogs alone is a cause of animal boredom, understimulation and development of behavior problems.

Another important consideration is that the observed behavioral changes are not macroscopic. The SIMPER analysis actually demonstrated that over 80% of the observation time was taken up with mostly unchanged behaviors during the observational sessions. Only a careful observation could detect any statistically significant changes in the duration of such behaviors as scratching door, digging, lying down, dozing and waving high tail, which could therefore be regarded as indicators of early behavioral changes in the animal.

Regarding the test, behavioral changes were observed in the dog at the 'sudden sound' subtest, in which the animal showed less reactivity in the second test than in the first one. This might be accounted for by the animal's getting used to such stimuli during the time spent in an environment full of intense sound stimuli, such as the kennel is (Sales et al., 1997). For the 'play' subtest too, the response was one of greater apathy (verging on statistical significance) during the second measurement; this might be construed as the dog's losing interest in stimuli which are usually motivating for the dog, such a play, because of the social isolation in which the dog lives when in the shelter.

The presence of gender differences was not analysed because of the small number of available subjects. However the considerations made by Beerda et al., (1999a), according to whom gender did not affect the chronic stress behavioral responses to social and spatial restriction, probably apply.

This study provided a better understanding of the alterations that can be observed in some of the dog's behaviors when in the shelter, which should be assessed through accurate monitoring. In the

shelter, after a first stage in which the animals are inhibited by the unpredictability of the environment events, social and otherwise, the dogs become active again. The lack of guidance and social organisation leads them to implement adaptation strategies that are independent on their interaction with a partner, human or canine. The lack of feedback, guidance and control, which occurs when the dog responds to external stimuli, might contribute to the onset of behaviors that are hardly compatible with life in a human household. In addition, it can be assumed that, in dogs that stay in the shelter for a long time, some of the observed behavioral changes might become chronic and might be indicators of the animal's poor state of welfare. A further investigation is however required to see if there may be any correlation between the observed behavioral changes and other parameters that are universally recognised as stress indicators, so that such behavioral changes might be used as potential indicators of the state of welfare of shelter dogs.

In conclusion, special measures should be taken in shelters, including paying special attention to the changes of dog's behavior. To do this, shelter staff should be appropriately trained to detect the hardly-detectable early signs that have been observed in this study. In addition, measures should be taken to reduce the dogs' likelihood to develop behavioral problems that might become difficult to manage and cause the dog to go back to the shelter after adoption. For instance, by maintaining and promoting the dogs' correct intra- and inter-specific socialisation, as well as training them, to increase adoptability for shelter dogs (Luescher et al., 2007).

Finally, measures should be taken regarding the shelter environment and housing conditions. It is well known that stress may be reduced in the shelter by adding environmental enrichment (i.e toys, beds, companionship, food, and complexity to the enclosure), allowing for social interaction (human and conspecific) and providing adequate exercise (Normando et al., 2004; Wells, 2004; Coppola et al., 2006). For example, enriching their environment with objects that can be chewed, moved around with paws and carried around (Hetts et al., 1992) might reduce their bar-chewing or ground-digging behaviors.

The results suggest that, for the animal's welfare to be protected, more attention should be paid to the caged environment of the sheltered dogs in an attempt to reduce the likelihood of dogs developing behavior problems whilst in captivity. It is obvious, however, that the most effective way to improve the long-term welfare of a sheltered dog is to ensure that the animal is adopted (Wells & Hepper, 2000) and that it can live its relation with man to the fullest, as is in its nature.

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Modificazioni del comportamento in cani ospitati in canile

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Sintesi

Lo scopo del presente studio è stato quello di valutare se la permanenza in canile sanitario può causare cambiamenti comportamentali nei cani osservati. Sono stati video-registrati quindici cani meticci per venti minuti ciascuno, nel proprio box, una volta alla settimana per cinque volte iniziando dal terzo giorno dall'arrivo in canile.

E'stata osservata un riduzione nella frequenza di comportamenti quali il sonnecchiare (r=0,95; p=0,01), lo scodinzolare a coda alta (r=0,95; p=0,01), lo scodinzolare (r=0,92; p=0,02); inoltre è stata osservata una riduzione della durata dello stare sdraiato (r=0,93; p=0,021), del sonnecchiare (r=0,98; p=0,003) e dello scodinzolare a coda alta (r=0,93; p=0,019). Oltre a ciò è stato osservato un aumento nella durata di alcuni comportamenti quali il grattare la porta (r=0,93; p=0,023) e lo scavare per terra (r=0,86; p=0,060). Infine è stata osservato un aumento significativo della frequenza dello stare alzato (r=0,92; p=0,026), del grattare la porta (r=0,99; p=0,001), dello scavare per terra (r=0,91; p=0,034), dell'uggiolare (r=0,92; p=0,024) e del grattarsi (r=0,93; p=0,024).

A partire dalla terza e quarta settimana sono apparsi alcuni comportamenti tipici di uno stato di irrequietezza, mentre sono scomparsi altri comportamenti di inattività.

I cani, durante il periodo di osservazione, sono stati sottoposti ad un test comportamentale che consisteva nell'introduzione di differenti stimoli (rumore improvviso, cibo e gioco) in un luogo sconosciuto; il test ha dimostrato come i soggetti si abituassero a stimoli esterni come ad esempio il rumore improvviso (p=0,004).

I dati ottenuti suggeriscono che la permanenza in canile può indurre cambiamenti del comportamento che andrebbero attentamente monitorati per prevenire eventuali problemi che potrebbero svilupparsi dopo l'adozione.