

SOCIALIZATION AND STRESS IN CATS (*FELIS SILVESTRIS CATUS*) HOUSED SINGLY AND IN GROUPS IN ANIMAL SHELTERS

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Abstract

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Single- and group-housing conditions for cats in animal shelters represent spatially and socially very different housing types. This study investigated whether the socialization of the cat towards conspecifics and people influences adaptation to these two housing types. Socialization towards conspecifics and people was determined in 169 rescued cats by means of two behavioural tests and a socialization questionnaire. Stress levels of the cats in the single- and group-housing condition were recorded by the non-invasive Cat-Stress-Score. Cats which were non-socialized towards conspecifics (n-SC) were more stressed than cats socialized towards conspecifics (SC) in the group enclosure. During the first hour and on days 6 and 7 in the observation cage, the n-SC were significantly less stressed under the single- than under the group-housing condition. The other members of the group had a higher stress level when a n-SC entered the group than if the new cat was a SC. Among the SC, there was no detectable difference in stress levels between the single- and group-housing condition. Cats which were non-socialized towards people (n-SP) were more stressed than cats socialized towards people (SP) during the whole stay under both single- and group-housing conditions.

It was concluded that n-SC should be held under single-housing conditions in animal shelters. For SC both the single- and group-housing condition are equally recommended for stays of a few weeks. For n-SP, stays in animal shelters should be avoided because of their high stress levels.

Keywords: *animal husbandry, animal shelter, animal welfare, cat, socialization, stress*

Introduction

Animal shelters assume an important public function as a rescue station for homeless animals and for the temporary housing of boarding cats. It is therefore essential that they provide appropriate housing conditions and promote a quick adjustment to new surroundings even during a temporary stay.

A cat's adjustment to the animal shelter generally takes between 2 and 5 weeks with a pronounced decrease in stress during the first few days (Smith *et al* 1994; Rochlitz *et al* 1995; Kessler & Turner 1997). As far as coping with stress due to the housing conditions is concerned, Kessler and Turner (1997) found no differences between cats housed singly, in pairs, or in groups in boarding catteries. On the other hand, Smith *et al* (1994) concluded that social contacts between animals in a group negatively affect stress in the first phase of the stay, but help to diminish stress symptoms during a longer one. However, there is considerable variability between individuals in the adaptation process (McCune 1992; Roy 1992; Smith *et al* 1994; Kessler & Turner 1997). Therefore, it can be assumed that individual factors, especially the degree of socialization during infancy, have an influence on which housing condition in the shelter suits which cat best. To date, only McCune (1992) has described one feline factor, namely a bold and friendly temperament, which positively influences the course of stress in caged cats.

The social character of a cat towards people and conspecifics is determined by genetic and ontogenetic factors (Karsh & Turner 1988; McCune 1992). During ontogeny, socialization towards people and towards conspecifics occur independently of each other (Karsh & Turner 1988). However, the body language of cats expressed towards people in general does not differ from that towards conspecifics (Cameron-Beaumont & Bradshaw 1995). Adult cats can be divided into a social, friendly type and a non-social, unfriendly type based on their reactions in the presence of a person unknown to them (Meier & Turner 1985; McCune 1992). A similar categorization of behaviour towards conspecifics has not been described in detail (but see Turner 1995).

Considering the vast number of cats housed in animal shelters, there is insufficient information on how the social attributes of cats influence the adaptation process under spatially and socially different housing conditions. The aim of the present study was to investigate the course of stress under single- and group-housing conditions in cats which were socialized and non-socialized towards conspecifics and people. Socialization towards people and conspecifics was determined with a Socialization-Questionnaire as well as with two behavioural Approach-Tests. The seven-level Cat-Stress-Score (see Kessler & Turner 1997) was applied to assess stress levels. From the results, it should be possible to recommend the most suitable housing type for an individual cat whose socialization status is known.

Methods

Subjects and Housing

One hundred and sixty-nine neutered cats (1–8 years old) were observed in the animal shelter of Zurich Animal Protection. Animals were observed in two single cages and in an outdoor group enclosure. The single cages (0.6x0.9x0.7 m) contained a shelf at the back of the cage 0.3m above the floor with a litter tray underneath. A vertical scratch board was mounted in a front corner. Visual, but not auditory or olfactory, contact between the cats was prevented by blinds between the cages. The group enclosure consisted of a main outdoor area (4.8x4.9x2.2 m) and an adjoining sector (2.4x4.9x2.2 m), which provided shelter from the wind with transparent plastic walls and a roof. One-third of the outdoor area was also covered with a roof. A small passage (0.3x0.3 m) connected the wind-protected sector with the main area. The group room contained a number of elevated boards, retreat areas, scratching surfaces, toys and litter trays.

All cats were delivered to the shelter as unwanted animals. Animals assigned to the group-housing condition were observed in a pre-existing control group. The control group consisted of five control cats (one neutered female, four neutered males) of an average age of 2.9 years (range: 1–8 years). All subjects were common domestic breed mixtures.

A group was considered a control group, if all members of the group had lived for at least 4 weeks in the group enclosure (at a density of less than 0.2 animals m⁻²) where the observations took place. No admissions or discharges were allowed in the 4 weeks before the observations were made. Moreover, all animals in the control group had to be socialized towards other cats. The socialization of the control cats was determined by means of a Socialization-Questionnaire handed out by the shelter staff.

Cat-Stress-Score

The stress level of the cats was recorded by a non-invasive Cat-Stress-Score (Kessler & Turner 1997) which describes seven stress levels based upon postural and behavioural elements of the cat. The scores range from 'fully relaxed' (score 1) to 'extremely stressed' (score 7). The Cat-Stress-Score was assessed after a 1-min observation period without visual interaction between the cat and the observer (see, *Procedure*). All observations were based on the ethogram of the UK Cat Behaviour Working Group (1995) and were made by the same observer.

The Cat-Stress-Score was developed by Kessler and Turner (1997) based on the Cat-Assessment-Score of McCune (1994). For the further development of the Cat-Stress-Score, observations on about 300 cats were made under single-, pair- and group-housing conditions in animal shelters and boarding catteries. The recorded behavioural and postural elements were added to McCune's Cat-Assessment-Score (1994) resulting in a more detailed description of each stress level and allowing a finer differentiation of the score levels, which were defined as follows: 1 = fully relaxed; 2 = weakly relaxed; 3 = weakly tense; 4 = very tense; 5 = fearful, stiff; 6 = very fearful; and 7 = terrorized. In particular, active behavioural elements and a tense sleeping posture were added under score 4. The behaviour of the cats towards humans was not used in this appraisal in order to avoid the influence of socialization of the cats towards humans on scoring. The Cat-Stress-Score can be applied in all housing forms in the animal shelter or boarding cattery, but not when temperatures drop below 15°C, because the animals do not assume a relaxed posture when it is cooler. Kessler and Turner (1997) reported an inter-observer reliability of 0.9 for the scoring, when applied by two trained observers. Observations by shelter staff with less training resulted in a reliability of 0.75.

Approach-Tests

Socialization of the cats towards people was tested by the Human-Approach-Test, a modification of the Stranger-Approach-Test (McCune 1992). Socialization of the cats towards people was tested by a newly developed Cat-Approach-Test. All observations in the Approach-Tests (Cat-Approach-Test and Human Approach-Test) were based on the ethogram of the UK Cat Behaviour Working Group (1995) and were made by the same observer.

At the beginning of the Human-Approach-Test, the observer approached the cage from the front and greeted the cat with 'Hello cat'. Then, the observer stood for 1min in front of the cage, touching the grating with one hand. After this 1-min period, the observer opened the door of the cage for a few seconds before closing it again.

In a pilot study, the behaviour and the position of the cat in the cage was recorded for 100 rescued and boarding cats during the Human-Approach-Test. The analysis of the data resulted in six distinctively different reaction types which were clearly defined for the scoring in the Human-Approach-Test. After each Human-Approach-Test, the behaviour of the cat was scored as follows: 1 = reacts in an extremely friendly way to people; 2 = reacts in a friendly way to people; 3 = turns towards people; 4 = moves away or avoids any form of contact with people; 5 = reacts in an unfriendly way to people; and 6 = reacts in an extremely unfriendly way to people. The Human-Approach-Test was repeated twice a day for 4 days. Cats were defined as socialized towards people (SP) when the mean of eight test ratings resulted in a score below 3.0. Cats were defined as non-socialized towards people (n-SP) when the mean of eight test ratings resulted in a score higher than 4.0.

The Cat-Approach-Test was developed to record the socialization of a cat towards conspecifics. A calm, neutered male cat, which was 4 years old and socialized towards conspecifics, was used for the test. At the beginning of the Cat-Approach-Test this cat was placed in a portable cage, constructed of metal bars (0.3x0.4x0.3 m) and covered with a cloth. This cage was placed at a distance of 1m from the back wall of the single cage housing the cat to be tested. After a 4-min period in which the focal cat in the single cage was allowed to become accustomed to the covered cage, the cover was taken from the front half of the portable cage. Then, the cats were allowed visual contact through the grating for 1min. After this trial period, the portable cage with the male cat was removed. Subsequently, the behaviour of the tested cat was rated along a scale of six possible reactions (from 1 = reacts in an extremely friendly way towards cats, to 6 = reacts in an extremely unfriendly way towards cats). This scale was developed in a similar manner to the scale for the Human-Approach-Test. Cats were defined as socialized towards conspecifics (SC), when the mean of eight test ratings resulted in a score below 3.0. Cats were defined as non-socialized towards conspecifics (n-SC) when the mean of eight test ratings resulted in a score higher than 4.0.

In addition to the ethogram of the UK Cat Behaviour Working Group (1995), friendly and unfriendly behaviour was defined as follows: friendly = tail up, tail vibration, rubbing, purring and chirruping; unfriendly = growling, hissing, spitting, piloerection, ears back and starring. Interactions were also distinguished as active or passive: active = if the distance between the partners during an interaction was changed to less than 1m; and passive = if the distance between the partners during an interaction remained 1m or more.

Socialization-Questionnaire

A second method was used to assess socialization type. A Socialization-Questionnaire was handed out to each person delivering a cat to the shelter.

When testing the Socialization-Questionnaire, we discovered that the owners of the cats know more about the behaviour of their cats towards people than of their behaviour towards other cats. Therefore, more questions could be asked about the behaviour of a cat towards people than towards other cats. The multiple-choice questions referred to the behavioural reactions of the cat in 10 specific situations, each referring to an interaction with a foreign and a familiar person. Moreover, five additional specific situations referred to an interaction with a foreign and a familiar cat. In some of these situations, the cat was the instigator of the interaction, whereas in the other situations it was the interaction partner (with a person or conspecific). The following, are examples of the types of questions asked and scoring of responses: What is the reaction of the cat if a strange or familiar person/conspecific

approaches (friendly/encouraging = 1, neutral = 0, shy/turn away = -1)? Does the cat approach others (often = 1, sometimes = 0, never = -1)? The reaction when touching/stroking/carrying the cat (friendly/encouraging = 1, neutral = 0, shy/turn away = -1)? Does the cat show friendly behaviour, like purring and/or 'head-rubbing' (often = 1, sometimes = 0, never = -1); or does the cat show unfriendly behaviour, like growling and/or spitting at others (often = -1, sometimes = 0, never = 1)?

Cats were defined as SP, if they behaved in a friendly way towards unfamiliar people in at least eight of the 10 given situations (ie a minimum score of 8) and did not behave in an unfriendly way in any situation. Cats were defined as n-SP if they behaved in an unfriendly way towards unfamiliar people in at least seven situations (ie a maximum score of -7) and did not behave in a friendly way in any of the given situations.

Cats were defined as socialized towards conspecifics (SC), if they behaved in a friendly way towards familiar cats in at least four of the five given situations (ie a minimum score of 4) and did not behave in an unfriendly way towards familiar cats in any of the given situations. Cats were defined as non-socialized towards conspecifics (n-SC), if they behaved in an unfriendly way towards familiar conspecifics in at least four situations (ie a maximum score of -4) and did not behave in a friendly way to cats in any of the given situations. Overall cat socialization type towards people and conspecifics was determined through the Socialization-Questionnaire and either the Cat-Approach-Test or the Human-Approach-Test. Only cats which were categorized as being socialized or non-socialized in both the Socialization-Questionnaire and the Approach-Tests were considered in the data-analysis. This resulted in the exclusion of 55 animals.

Procedure

The course of stress in cats housed singly or in groups was recorded for 1 week. Animals observed in the single cages had previously been housed singly while in quarantine for 10–20 days. Animals observed in the group enclosure had previously been housed in another group enclosure with changing compositions for 10–20 days. Therefore, all animals already had experience of the housing type in which they were to be observed. Whether a cat was observed under single- or group-housing conditions was determined by its previous housing condition (which had been randomly chosen).

The Cat-Stress-Score was assessed every 10min during the first hour after placement into the observation cage on day 1 (single- or group-housing condition) then twice (within a 15-min interval) after 6h. Over the following 6 days, two observations were made in the morning, again at an interval of 15min, and two the afternoon. The observations commenced at 1000h and 1600h in the single cages and at 1030h and 1630h in the group enclosure. In the group-housing condition, a single focal cat was added to the control group for a 1-week observation period. Cat-Stress-Scores were recorded for both the focal cat and the control cats. In the group-housing condition, the frequency of friendly and unfriendly interactions initiated and received by the focal cat and its inter-individual distance (the shortest distance between the focal cat and any other individual in the enclosure) were also recorded. These observations took place during the first 60min of the first day of arrival and once more, for 40min, after 6h. On the following days (days 2–7) observations took place at 1030h and at 1630h for a 40-min period.

After recording stress levels in the single- or group-housing condition, each cat was randomly tested twice a day for 4 days, with either the Human-Approach-Test or the Cat-Approach-Test commencing at 1130h and at 1730h each day. Testing with the Human-

Approach-Test or the Cat-Approach-Test was also independent of a cat's Stress-Score levels and the results of the socialization tests, which were evaluated after all observations were completed. The tests with the singly housed cats took place over the 4 days, directly after the 1-week observation period. Cats in the group enclosure for the 1-week observation period were subsequently put into single cages for a total of 8 days, where the Cat-Approach-Test or the Human-Approach-Test was conducted each day on days 5–8.

Socialization towards conspecifics of the animals in the control group and for the male trial cat used in the Cat-Approach-Test could only be investigated through the Socialization-Questionnaire handed out to the shelter staff.

Statistical Analyses

Once observations were complete, the results of the Approach-Tests and the Socialization-Questionnaires were evaluated for each cat. Subsequently, the subjects were divided into eight groups depending on their socialization towards conspecifics or people (see below), and the housing type (single or grouped) in which they had been observed. Cats that could not clearly be assigned to any one socialization type were excluded from the data analysis.

The four Cat-Stress-Scores on each observation day (days 2–7) were averaged for each cat, because the scores on any one day did not differ by more than one score level. On placement days (day 1) the seven Cat-Stress-Scores from the first hour and the two measurements taken after 6h were averaged. From these daily scores, means (and SEMs) of the daily Cat-Stress-Scores were calculated for all 114 cats in each of the eight groupings (depending on the socialization towards conspecifics or people, and the housing type). Means were also calculated for the frequency of behavioural parameters, inter-individual distances and the Cat-Stress-Scores of the five control animals on each observation day in the control group.

Because comparisons of single days were of interest, Mann-Whitney *U* tests were used to detect differences between the daily Cat-Stress-Scores on days 1–7, the frequency of behavioural parameters and inter-individual distances. StatView 4.0® (Abacus Concepts Inc, Berkeley, California, USA) was used for the statistical calculations.

Results

Socialization types

Fifty-five cats were excluded from the data analysis, because they could not clearly be assigned to any one socialization type towards people ($n = 20$) or conspecifics ($n = 35$). The remaining 114 cats were divided into eight groups depending on their socialization towards conspecifics and people (see below), and their housing type (single or grouped) (Table 1).

Since there was a small range in the daily Cat-Stress-Scores within the animals of each group (see below), no individual effects were analysed. In addition, no outliers in behavioural parameters were observed.

Cats, socialized and non-socialized towards conspecifics

Table 2 compares the data of SC ($n = 11$) and n-SC ($n = 14$) towards conspecifics in the group-housing condition. The mean Cat-Stress-Score for the SC was lower on each of the 7 days than for the n-SC. During the first 2 days, the Cat-Stress-Score of the five control animals was higher when a n-SC was added to the control group, than when a SC came into the group. (The stress levels of the control group remained constant over the whole observation period.)

Table 1 Cats, divided into groups, depending on their socialization towards people/conspecifics and the housing type in which they were observed.

	Socialized towards conspecifics (SC)		Non-socialized towards conspecifics (n-SC)	
	singly	in groups	singly	in groups
<i>Housing type</i>				
<i>Neutered females</i>	7	6	6	7
<i>Neutered males</i>	6	5	9	7
<i>Average age (years)</i>	3.4	3.6	3.1	3.9

	Socialized towards people (SP)		Non-socialized towards people (n-SP)	
	singly	in groups	singly	in groups
<i>Housing type</i>				
<i>Neutered females</i>	12	15	3	4
<i>Neutered males</i>	13	8	4	2
<i>Average age (years)</i>	2.9	3.2	3.1	2.9

In the first 5 days of the observation week, the n-SC had a significantly greater inter-individual distance than the SC. Passive and active friendly behaviour, including sniffing of

Table 2 Differences between cats, socialized (SC) and non-socialized (n-SC) towards conspecifics, when housed in a control group for 7 days.

	Mean 1st hour		Mean 1 st to 2 nd day		Mean 3 rd to 5th day		Mean 6 th to 7 th day		Mean 1 st to 7 th day	
	SC	n-SC	SC	n-SC	SC	n-SC	SC	n-SC	SC	n-SC
<i>Cat-Stress-Score</i>										
<i>Focal cat (SC or n-SC)</i>	4.21	4.86*	3.13	3.90*	2.65	3.21**	2.72	3.38**	2.86	3.34**
<i>Control cats' mean score (n = 5) when a SC or n-SC present</i>	2.59	2.75*	2.56	2.68*	2.59	2.66	2.65	2.66	2.59	2.67*
<i>Frequency of interaction during 10min</i>										
<i>Active friendly</i>	0.11	0.00*	0.09	0.03	0.08	0.00*	0.03	0.00	0.07	0.01
<i>Active unfriendly</i>	0.36	0.27	0.09	0.29	0.06	0.17	0.03	0.11	0.06	0.19
<i>Passive friendly</i>	0.27	0.00*	0.29	0.00*	0.10	0.00*	0.03	0.02	0.14	0.01*
<i>Passive unfriendly</i>	0.38	3.37*	0.19	2.90*	0.08	1.83*	0.13	2.00*	0.13	2.19*
<i>Sniffs another cat</i>	0.14	0.02*	0.13	0.00**	0.06	0.03	0.00	0.00	0.06	0.01*
<i>Inter-individual distance (m)</i>	0.72	1.18*	0.65	1.36*	0.63	1.08*	0.86	1.18	0.70	1.19*

* $P < 0.05$, ** $P < 0.01$.

other cats, was displayed more frequently by the SC than the n-SC on several days of the week (Table 2). Active, unfriendly interactions did not differ between the SC and n-SC during the observation week.

The 13 single-housed SC and 15 single-housed n-SC did not differ significantly in their Cat-Stress-Scores on any of the 7 days ($-1.46 > z < -0.12$, $0.91 > P > 0.14$).

Differences between housing types were only found in the n-SC. During the first hour after admission to the observation cage ($z = -2.0$, $P < 0.05$), during day 6 ($z = -2.6$, $P < 0.01$) and during day 7 ($z = -2.7$, $P < 0.01$) the n-SC housed in groups ($n = 14$) had a significantly higher Cat-Stress-Score than the n-SC housed singly ($n = 15$). During the remaining days no significant differences were evident between the single- or group-housed n-SC.

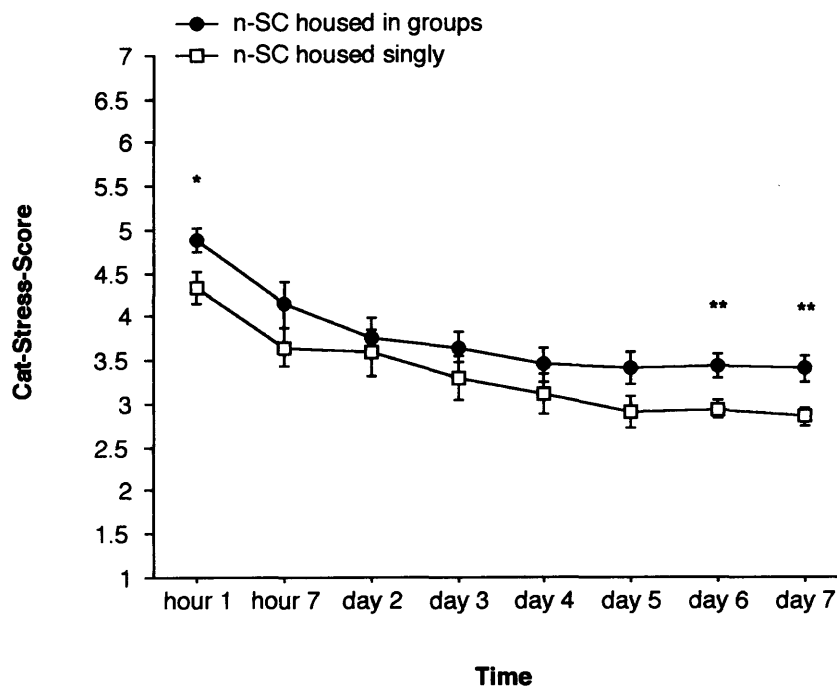


Figure 1 Differences (mean \pm SEM) in the course of stress in cats, non-socialized towards conspecifics (n-SC), during a 1-week stay in a control group or in a single cage. * $P < 0.05$, ** $P < 0.01$.

The n-SC reacted in two different ways to the group-housing situation. About one-third of the n-SC became totally inactive when housed in the group enclosure. These cats spent most of the time 'hidden' in a retreating area of the enclosure and showed passive, unfriendly behaviour when another cat approached. The other n-SC reacted more actively to the group-housing situation. These cats moved about the enclosure, and behaved in an unfriendly way, both actively and passively. Due to the small sample size, differences in Cat-Stress-Scores within the n-SC group were not analysed. However, the SEMs in Figure 1 indicate that there were no pronounced individual differences within the group.

Among the SC, no significant differences in Cat-Stress-Score between the single-housing ($n = 13$) or group-housing ($n = 11$) conditions were found on any of the 7 days ($-0.12 > z > -1.46$, $0.91 > P > 0.08$). In contrast, no clear differences between active and passive SC were observed.

Cats, socialized and non-socialized towards people

In the single cages, the 25 SP had a significantly lower mean Cat-Stress-Score than the 7 n-SP on each of the 7 days (Figure 2a). Additionally, the 23 group-housed SP were less stressed than the 6 group-housed n-SP on each day of the observation week (Figure 2b).

No differences on any day were found between the two housing types (single vs grouped) for the SP ($-0.14 > z > -1.40$, $0.89 > P > 0.16$) or n-SP ($0.00 > z > -0.73$, $1.00 > P > 0.47$). While the mean (and median) Cat-Stress-Score for the SP housed singly and in groups fell below the level of score 3 ('weakly tense'; see Kessler & Turner 1997) from days 3–7, the n-SP always stayed above that level under both the single- and group-housing conditions (see Figures 2a and 2b).

Discussion

In the first hour after admission to the observation cage and in the last 2 days of a 1-week stay, n-SC were less stressed when housed singly than in groups. Moreover, they had a negative effect on the other group members by increasing their stress levels in the first few days after admission. These findings imply that for n-SC, single-housing conditions are to be recommended in shelters.

In contrast to n-SC, there were no differences in stress levels between different housing types for SC. Therefore, both single- and group-housing conditions are to be equally recommended for SC, at least for stays of a short duration.

The animals in this study already had experience with the housing type in which they were housed and observed for 1 week. Therefore, in spite of the short observation period in this study, we suggest that a higher stress level in n-SC when housed in groups is very likely to persist during stays of several weeks in the shelter.

Apart from socialization, Smith *et al* (1994) recommended the single-housing condition for short duration stays to avoid social stress by unfamiliar conspecifics, whereas Kessler and Turner (1997) found no differences in stress levels in boarding cats when housed in the single-, pair- and group-housing condition for 2 weeks. The present study indicates that socialization towards conspecifics influences adaptation to the group-housing condition and therefore has to be taken into account when housing a cat in a shelter or a cattery.

Cats defined as n-SC reacted in two different ways to the group-housing situation. One-third of them became totally inactive when housed in the group enclosure, whereas the remaining n-SC reacted in a more active way and therefore disturbed the other group members much more than the inactive cats. A differentiation into active and inactive personality types has also been described by other authors (Feaver *et al* 1986; Karsh & Turner 1988; McCune 1992). However, in the SC, the differences between active and inactive cats were less pronounced. (Unfortunately, differences in Cat-Stress-Scores within the n-SC or SC could not be analysed.)

Under both single- and group-housing conditions, SP had a lower stress level than n-SP. McCune (1992) reported similar findings for cats caged singly during their first days in a shelter. McCune (1992) concluded that a general difference in stress adaptation depends

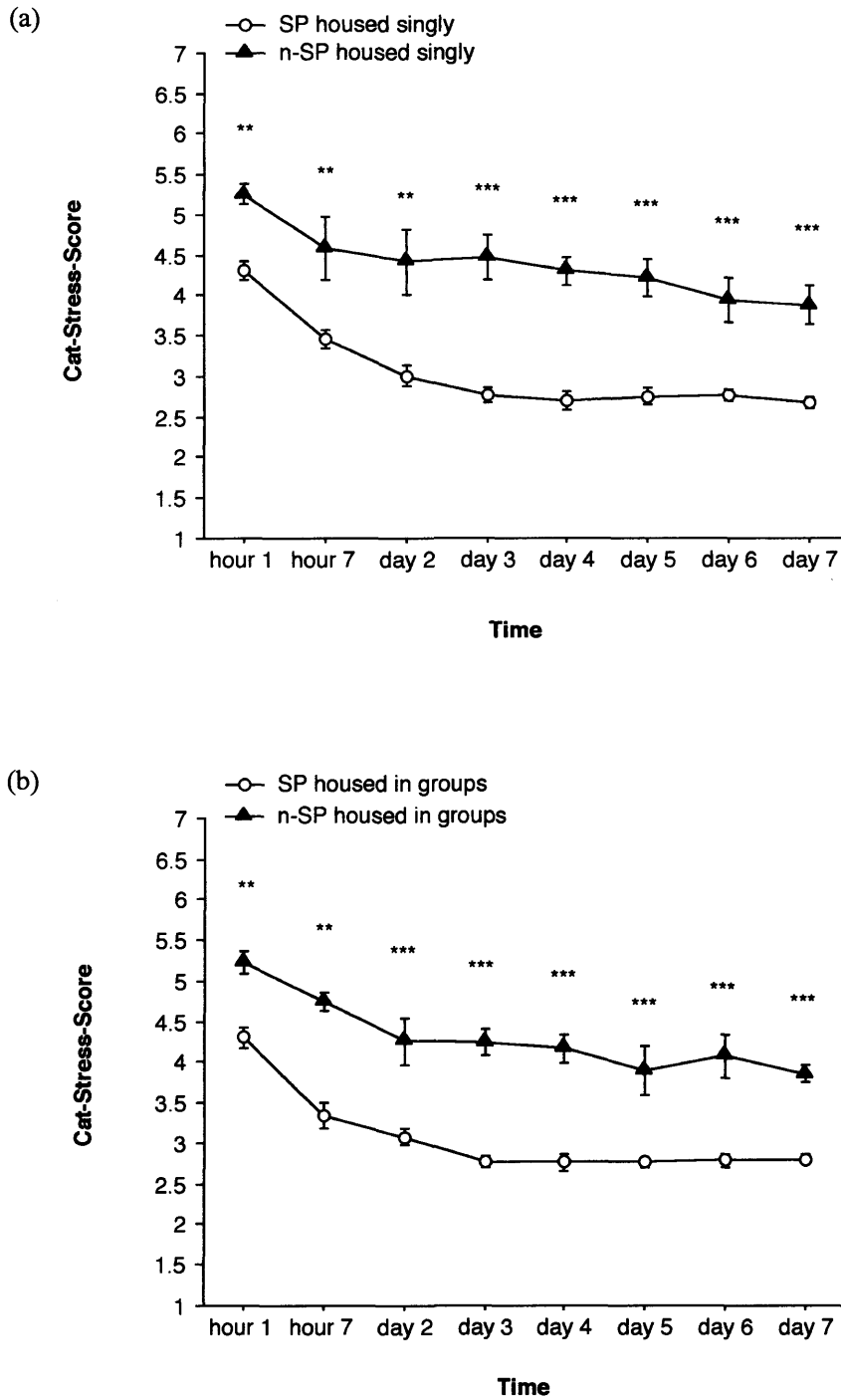


Figure 2 Differences (mean \pm SEM) in the course of stress between cats, socialized (SP) and non-socialized towards people (n-SP): (a) housed singly; (b) housed in a control group. $**P < 0.01$, $***P < 0.001$.

upon the socialization type. Another contributing factor to why n-SP are more stressed in shelters than socialized cats, is the fact that the cats are regularly confronted with shelter staff and clients. Cats, defined as n-SP had a Cat-Stress-Score of 'very tense' (score 4) or higher on each of the 7 days, both when housed singly and in groups, and therefore should not be housed in shelters, if possible.

By applying behavioural tests in combination with a specific questionnaire given to the previous owner of each cat, it was possible to determine the socialization type towards people for 75 per cent of the cats observed and the socialization towards conspecifics for 60 per cent. No clear socialization type was discernible for the remaining cats. On the one hand, it was impossible for many owners to give information on how their cat reacted towards other cats, and the questionnaire was inadequate. On the other hand, the socialization type of some cats could not be determined by either the Cat-Approach-Test or Human-Approach-Test. These cats were often unfriendly at the beginning of testing and then became more friendly in the course of the subsequent Approach-Tests, as they became more familiar with the test person (whereas cats which were clearly defined as socialized or non-socialized consistently showed friendly or unfriendly behaviour during all test sessions). This was probably due to later influences that affect the initial socialization type (Bradshaw 1992; McCune 1992; Turner 1995). Also, the possibility that the socialization types towards humans and cats may have influenced each other must be considered (since each cat was only tested once, either with respect to socialization towards humans or cats). However, during ontogeny, socialization towards people takes place independently of socialization towards conspecifics (Karsh & Turner 1988). Despite these complications, the welfare of more than a half of the cats given to a shelter could still be improved by housing them according to their socialization type.

Animal welfare implications

This study has demonstrated the importance of socialization as a factor influencing the stress levels of cats in different housing types. Therefore, it is recommended that shelters with group enclosures also have a number of single cages, for separating n-SC from conspecifics. Moreover, it is important for the shelter staff to observe or even test the cats' behaviour to recognize n-SC cats in order to assign them to single-housing conditions and to keep this in mind when placing the cats in a new home. For n-SC, alternative solutions have to be found in order to avoid stays under inappropriate conditions in the shelter.

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