Final Report of the BScABT education:

Clicker Training of shelter cats

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Abstract

This study investigates if and to what degree clicker training can be used to alter the behaviour of stressed, fearful, withdrawn and/or aggressive cats in rescue shelters. It is the hypothesis of the study that clicker training will be beneficial in reducing the level of stress in such cats and change their behaviour to be more trusting and outgoing towards their environment and the humans they meet in the shelter.

The study comprises training of 29 cats in two Danish rescue shelters. All cats included in the study were of special concern to the shelter staffs, either because these cats seemed stressed and/or fearful in the shelter, because these cats were withdrawn, and/or because these cats displayed aggressive behaviour. The level of stress of all cats was furthermore assessed by the author of this study before the training was commenced, and each cat was diagnosed as being either in an acute state of stress or in a chronic, or permanent, state of stress, the former of which was scored on a scale from 1 to 7. Each cat was clicker trained individually by the author of this study.

Generally the results of the study are very positive and encouraging: of the 29 cats trained 27 reacted positively to the training after an average of 3-4 training sessions, each lasting 10-40 minutes. The study further shows that for the acutely stressed cats there is a significant increase in the number of trainings sessions needed to observe a first sign of improvement for the cats with an increasing initial level of stress. Contrary to this there is no significant correspondence between the cats' age and the number of sessions until first improvement, i.e. the study indicates that clicker training on the average can help old and young shelter cats equally fast. Moreover the study shows that there is no significant difference in the number of sessions needed on the average to achieve the first sign of improvement in chronically and acutely stressed cats. And finally the study shows that there is no significant difference in the number of sessions needed to reach first sign of improvement in owner surrendered cats versus stray cats brought to the shelters.

All these results are presented and discussed in this report, which is concluded by suggesting ways of implementing clicker training of cats in the daily work in rescue shelters.

Acknowledgments

It is difficult to decide where to start on the list of people (and cats) I wish to thank for supporting me through making this project, and through my education. But firstly I must thank my teacher Bettina Hvidemose for all her support through these 3½ years, for taking us in when we were really lost, for giving us high-quality education, and not least for providing so much cake on every course that we (almost) did not feel the cold of those freezing Hirtshals winters.

Secondly, and equally important, I must thank the Society for Defenceless Animals Denmark's shelter and at the Danish Cat Protection's shelter for allowing me to work on their unsuspecting cats without knowing whether I would turn them into little monsters. It was brave and I am very grateful they both took that chance.

My lovely family and friends, for standing by me and supporting me through the study, believing it could be done, and accepting me being in varying states of stress for long periods of time. Everybody I know have supported this, but I must especially say thanks to my Mother and Birger, to my Father and Sonja, and to Tine, Kjeld, Tina, Bente, Ellen, and Elsebeth who have all excelled in patience, understanding and support. A special thanks must go to my mother and Tine who have both read this report carefully, corrected my numerous spelling errors and suggested different wordings where needed.

My lovely 'sisters in arms', Carol, Tina, Liv, Mette and Sophie! Thanks for many lovely hours in Hirtshals (some even without snow!), at Center for Dyreterapi and at Cafe 2. This could never have been done without the support from our lovely group.

A special thanks to Dr. Sarah Ellis and to Jacqueline Munera (CCBC, PCBC, CAP 2) for corresponding with me regarding previous work about shelter cats, and for encouraging the project.

And finally all the cats! The ones at home, Emil, Emma and little Rylle, who have all taught me that cats can indeed be trained. And to all the cats in this study – for allowing me to experiment on them (not that they had much choice!).

Dedication

Dearest Tine – this is for you! For telling me that I could and *should* do this on that fateful walk around the lakes almost four years ago.

Ayoe Hoff, Copenhagen, October 2011

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Introduction

Several thousand cats (*Felis catus*) are brought into Danish animal rescue shelters each year. These cats have varying backgrounds; some come from homes where it is, for various reasons, not possible to keep them anymore, some are cats found wandering around (feral or tame), and many are 'surplus' kittens, the result of an unneutered queen getting pregnant and the owners being unable to find new homes for the kittens.

Some of these cats may become stressed and/or aggressive in the shelter environment for several reasons: (i) the cats have suddenly been removed from their own environment and everyday routines (this especially concerns cats that have been owned and had a home before ending in the shelter), which can be hard for the territorial cat species (see e.g. Halls, 2009, pp 332-335; Tabor, 1983, Chap. 5.), (ii) the cats are surrounded by unknown cats, which is hard on the semi-social feline (see e.g. Halls, 2009, Chap. 7), and (iii) the cats are surrounded by many unknown people that daily 'invade' their cages to clean, feed, maybe medicate, and wishing to interact with and pet the cats. Dybdall et al. (2007) shows that especially owner surrendered cats are prone to be in a high level of stress during their first days in a shelter.

Some cats, depending on age, temperament, previous history and degree of socialisation to humans and other cats, may react with curiosity and interest to all the new impressions in the shelter. These cats will approach the staff, volunteers and visitors to the shelter with confidence and trust, and they will have high probability of getting adopted.

Other cats will react to the shelter environment with fear and/or aggression. These cats are not necessarily less socialised to humans than the more friendly and outgoing cats, but the upheaval they have been through is too overwhelming for them. Such cats may withdraw from human contact in their cages and show little or no interest in their surroundings. They may hide, if possible, and/or may try to attack humans handling them or their cages.

It is straightforward to conclude that this last group of cats is in a heightened state of stress while in the shelter. Their reaction in itself, i.e. flight (or, the best alternative in a cage, to hide) or fight is quite natural when met with threatening stimuli, and this reaction is closely connected with release of stress hormones (including corticosteroids and adrenaline cf. McFarland, 1999, p 273; Abrantes, 1994, p 61) that enable the individual to react fast when faced with new, unexpected or extreme situations (Abrantes, 1997, p 234; McFarland, 1999, p 273). But if the cat does not habituate to the shelter environment within a reasonable time, the constant release of stress hormones in the body becomes unhealthy (Abrantes, 1994, p 62). The cat may lose appetite, or indulge in overeating (obesity), it may develop diseases and/or abnormal behaviour such as excessive grooming leading to self-mutilation. Such a cat will have a low quality of life, and will be less likely to be adopted than the more confident cats. The last resort may be to euthanize such cats. In a study performed by Kessler and Turner (1997) it was found that about one third of cats admitted to boarding kennels remained slightly tense after two weeks in the kennels, while 4% were very tense after the same period. The same percentages may be taken as a starting point when guessing on the fraction of cats being in a heightened state of stress in rescue shelters for a prolonged period.

Clicker training, i.e. training using positive reinforcement (Chance, 2008, p 128) of the animal's own initiative to emit specific behaviours, has already been shown to have a positive influence on shelter dogs in the United States (Luescher and Medlock 2009, Pryor and Parsons 2002, Pryor 2009 Chapter 3). Clicker training has been used to teach dogs to bark less while in their cages, not to jump on people when approaching, and to teach the dogs basic obedience. These are all exercises that lowers the dogs' level of stress (seeing that barking and high level of excitement when people approach may be stressful for the dogs) and increase their quality

of life and chances of being adopted; many people would rather adopt a friendly quiet dog than a barking dog that jumps all over them.

Clicker training gives the animal the option to emit behaviour that produces predictable outcomes (Luescher and Medlock, 2009, p 64). I.e. the animal learns that it can control certain aspects of its environment, as opposed to not being able to control anything happening to it in the shelter. Or, in other words, the animal realises that it can achieve something nice (the positive reinforcement) through its own actions (or more precisely, through operant behaviour, cf. Killion, 2007, p 21). This may increase the animal's self-confidence and consequently lower the stress level of a nervous of fearful animal (Pryor 2009 chapter 7, Pryor 2002 p 31).

The purpose of the study

Contrary to the reported effect of clicker training on dogs in rescue shelters, little is recorded of the effect of clicker training on shelter cats. Most evidence is at present anecdotal:

- In the chapter 'Clicking cats in the shelter environment' in 'Click! For Life - Clicker Training for the Shelter Environment' (2002) Pryor and Parsons report that clicker training has been used with positive results on feral cats at the DeWitt Animal Hospital, NY.
- Several videos[1] on the internet also demonstrate, and to some degree report, positive results of clicker training of shelter cats.
- Dr. Sarah Ellis emphasises the importance of clicker training for cats in the shelter environment in the UK Feline Advisory Bureau's December 2010 issue of 'Cat Care': '*training can be used to boost confidence in nervous cats and is thus particularly important for those working in the rescue environment where many nervous cats with unknown histories exist. Clicker training can be used to encourage these cats to feel more secure and confident around humans*' (Ellis, 2010).
- When contacted the author of the above mentioned article in 'Cat Care', Sarah Ellis, informs that to her knowledge no published evidence exists on the effect of clicker training on shelter cats.
- The same is said by Certified Cat Behaviour Consultant Jacqueline Munera[2] who has herself worked with clicker training of shelter cats in the US.

It may thus be concluded that a systematic study of the effect of clicker training on cats in shelters is at present missing. Such a study will be of advantage to cat rescue shelters, both in Denmark and abroad, which leads to the *hypothesis* of this study:

> *The hypothesis of this study is that clicker training can be used towards fearful, withdrawn and aggressive cats in shelters to lower their heightened level of stress and make these cats more trusting and outgoing towards their environment and humans.*

The *purpose* of this study has thus been to investigate the hypothesis through practical clicker training work with cats in rescue shelters. Simple contact exercises have been applied when working with fearful or withdrawn cats:

- Reinforcing targeting with nose on target-stick and finger.

[1] For example: http://www.youtube.com/watch?v=UBn5mo7qj-8, http://www.youtube.com/watch?v=qZE3M-ESfvk, http://www.youtube.com/user/PositiveCattitudes

[2] http://www.casinstitute.com/jacqueline.html

- Reinforcing voluntary contact seeking from the cat, such as looking trainer in the eyes, approaching trainer, rubbing against a hand held out by trainer.

The above mentioned target exercises have been used for cats displaying aggression together with combined positive and negative reinforcement of non-aggressive behaviour: ignoring aggressive behaviour under controlled pressure, and reinforcing non-aggressive behaviour by removing the pressure and offering a treat when the cat ceases the aggressive behaviour

Method

The practical training has been performed at the Society for Defenceless Animals Denmark's[3] (SDAD) shelter in Rødovre, Denmark, and at the Danish Cat Protection's[4] (DCP) shelter in Frederiksberg, Denmark. The training has been performed in (almost) daily sessions lasting 10-40 minutes for each cat.

The shelters

The two shelters used in the project differ significantly, both in decisions about which cats are kept in the shelters and in the shelter environment.

SDAD's shelter not only houses cats, but also rescues dogs and small animals. Thus even though the animals are kept in sections isolated from each other, the barking of the dogs can often be heard in the cat sections. The cats are kept in cages of varying sizes, from big floor-to-ceiling cages with access to outdoor runs, to smaller 'two on top of each other' cages. Often two or more cats are kept in the big cages, and up to two cats in the small cages. The cats do not necessarily know each other beforehand when put together in the cages, but the staff takes great care in matching the cats and monitoring them during the first days together in a cage. The shelter receives cats with a wide variety of backgrounds, as the shelter is a base for animals rescued by the Police and Falck, e.g. stray cats and cats left behind when people are put in the hospital, are arrested or die. The shelter has a 'no kill' policy which means that no animal put in the shelter is euthanized, unless the animal is, or becomes, incurably ill, or the animal is assessed impossible to integrate into a new family, e.g. due to unsolvable aggression problems. However, before a decision is taken regarding euthanizing an animal because of behaviour problems, an effort is made to place the animal in a caretaker family, maybe involving a direct training program, thus testing whether it is possible to help the animal to alter its (problematic) behaviour outside the shelter environment.

The DCP's shelter only rescues cats. The environment is as such quieter and more relaxed than at SDAD's shelter. The DCP's shelter houses cats in 'two on top of each other' cages, normally one cat per cage, unless the cats know each other beforehand. Some cats are housed in the offices of the shelter. All cats are let out of their cages on a regular basis, most often several at a time, and the outdoor cats have a spacious secured garden to roam. Thus all cats spend the majority of their time outside their cages both day and night. The shelter's main aim is to rescue stray cats, which is done through a network of cat inspectors that can be called out when one or more cats are observed in an area by the residents. Moreover the shelter takes in many cats that are surrendered by their owners. However, privately surrendered cats are only accepted when space allows. The shelter assesses the temperament as well as health of each cat being brought in, and if a cat is deemed too ill, aggressive or fearful to be in the shelter it is euthanized.

[3] In Danish 'Dyreværnet'. Homepage: http://www.dyrevaernet.dk/
[4] In Danish 'Kattens Værn'. Homepage: http://www.kattens-vaern.dk/

Diagnosing the state of the cats

During the periods of research and observation at each shelter the staff was asked to generally point out cats they assessed as being nervous, fearful, withdrawn and/or aggressive. At SDAD such cats are found in the shelter at a regular basis, given the no-kill policy at this shelter. Fewer cats with such problems are found at the DCP's shelter, as the cats are assessed when entering the shelter as described above.

When a cat was assessed nervous, fearful, withdrawn and/or aggressive by the shelter staff the author of this report (in the following named 'the trainer') initiated the work with the cat by writing down the staff's description of the cat together with basic statistics for the cat such as age and prehistory. The latter only if available as many cats come into the shelters as strays with an unknown prehistory. The next step was to observe the cat's behaviour in the cage and towards the trainer prior to training the cat. During this observation the cat's initial level of stress before training was assessed. Two categories have been used (refer to the theory section below for a further discussion of these):

- Acutely stressed.
- Chronic, or permanent, state of stress.

The cats level of stress have furthermore been continuously monitored throughout the period working with the cat, through a trainings log kept on a daily basis (cf. Appendix B).

Training program

The training of the cats has included all four aspects of the reinforcement/punishment contingency square (cf. Chance, 2008, p 128 and 209), i.e. positive and negative reinforcement and positive and negative punishment, as discussed in the theory section below.

The training process for each cat has been individual, depending on their degree of nervousness/fear, whether they are aggressive or not, and/or the development of the training process. However, some basic elements have been used in the training of all cats, namely making the clicker a secondary positive reinforce (Chance, 2008, p 135), target exercises on target-stick (and later finger), head rubbing on hand exercise, and handling exercises. The first three are outlined in SMAF (Signal, Meaning and Form, cf. Abrantes, 2007) below.

Making the clicker a secondary reinforcer:
Desired Learning Objective (DLO): The cat knows that the sound 'click' means that something desirable (food[5]) is forthcoming.

Expected number of repetitions: Experience has shown that Primary Step (PRS) 1. must be repeated 5-10 times, before the DLO is achieved.

Signals, Reinforcers, Punishers (SRP):
- Click(an unconditioned reinforcer, food, is immediately forthcoming),sound(click)
- "!treat" (unconditioned positive reinforcer, food)

POA (Plan of Action):
PRS (Primary Step) 1. Click,sound ⇒ "!treat"
Repeat PRS1 10 times

[5] Or play: food has been used in most cases in the study as the unconditioned positive reinforcer, but in some cases, e.g. case 4 (Sofus), play turned out to be a stronger unconditioned positive reinforcer. However, in the SMAF outlines of the basic exercises food is used as unconditioned positive reinforcer to describe the procedures.

2. Click,sound ⇒ the cat turns it head towards the sound ⇒ "!treat"
   ALS1[6]. The cat looks for "!treat" ⇒ "!treat"
   ALS2. The cat does not react in any way to Click,sound ⇒ repeat PRS 1.

Target on target-stick[7]:
DLO: The cat touches the target-stick (S^D) with its nose whenever it is presented to the cat.

Expected number of sessions repetitions: Experience shows that PRS1 below must be repeated 3-7 times before the DLO is achieved.

SRP:
- Stick(touch the target-stick with your nose),object(target-stick held in front of cats nose, 2-5 cm from the nose)
- "!click" (conditioned positive reinforcer, the sound of the clicker being pressed)
- "!treat" (unconditioned positive reinforcer, food)
- [?stick] (the target-stick is removed out of eyesight from the cat)

POA (Plan of Action):
PRS 1. Stick,object ⇒ The cat touches the target-stick with its nose ⇒ "!click" + "!treat"
   ALS1. The cat does not touch stick with its nose ⇒ [?stick] ⇒ repeat Stick,object closer to the cat ⇒ the cat touches the stick with its nose ⇒ "!click" + "!treat".
   ALS2. The cat does still not touch the stick ⇒ [?stick] ⇒ repeat Stick,object with the stick dipped in food ⇒ The cat touches the stick with its nose ⇒ "!click" + "!treat"

   Repeat PRS1 until the cat touches the stick in 8 out of 10 trials. Then start moving the stick further from the cat so it has to move after it.

The final exercise described below ('Head rubbing on hand') has not been initiated until the cat targets consistently on a finger, i.e. when the outstretched finger is a well established discriminative stimulus (S^D) for targeting. As such the sight of the outstretched finger is itself a positive reinforcer for the cat, as it signals that a primary positive reinforcer is available if the cat exhibits the targeting behaviour (Pryor, 2002, p 86). As the finger is connected to the hand, the approach of the hand to the cat, before the finger is stretched out, thus signals that the finger may be stretched out, if the cat stays calm, which again signals that it is possible for the cat to perform the target exercise. Thus through this behaviour chain (Pryor, 2002, pp 85-89; Chance, 2008, pp 142-144), it can in this stage of the training process be assumed that the sight of the hand itself is a positive reinforcer for the cat. And consequently that holding out the hand to the cat, as done in the head rubbing exercise described below, is not a positive punisher of the cat showing interest in the trainer, nor that removing the hand if the cat does not rub its head against it is negative reinforcer of the cat not rubbing its head against the hand. Given this assumption it is safe to assume that removing the hand if the cat does not rub its head against it is a negative punishment of the cat not seeking contact (a further discussion

[6] ALS=Alternative Step
[7] Initially in the training process the target-stick has in most cases been used to make contact with the cats using this exercise. Later in the work with the cat, when it has become more confident, the stick has been replaced by the trainer's index finger, using the same procedure.

of the concepts positive and negative reinforcement and punishment is given in the theory section below).

Head rubbing on hand:
DLO: The cat rubs its head against the back of a hand when this is offered to the cat.

Expected number of sessions repetitions: Experience shows that PRS1 below must be repeated 5-10 times before the DLO is achieved.

SRP:
- Hand(rub the back of my hand with your head),object(back of hand held out to the cat 2-5 cm from the cat's head)
- "!click" (conditioned positive reinforcer, the sound of the clicker being pressed)
- "!treat" (unconditioned positive reinforcer, food)
- [?hand] (hand is removed out of eyesight from the cat)

POA (Plan of Action):
PRS 1. Hand,object ⇒ The cat rubs back of hand with head⇒ "!click" + "!treat"
ALS1. The cat does not rub hand with head ⇒ [?hand] ⇒ repeat Hand,object closer to the cat ⇒ the cat rubs hand with its head ⇒ "!click" + "!treat".
ALS2. The cat does still not rub back of hand with head ⇒ targeting the finger may not represent a positive reinforcer for the cat ⇒ go back to target exercises on finger for 1-2 more sessions, then try again.

Theory

In this section the theory behind the methods used in the study is described.

Stress

'Stress is a physiological reaction to internal and/or external factors which makes an animal ready for handling new, unexpected and/or extreme situations' (Abrantes, 1997, p 234; McFarland, 1999, p 273). The stimuli that elicit stress reactions are named *stressors* (McFarland, 1999, p 273) and may be individual from one species to another and within species. The animal that perceives a stimulus as stressful will undergo a fundamental physiological reorganisation (McFarland, 1999, p 273; Kristensson, 2011, p 5). When the brain perceives a stimulus as new, unexpected, challenging or in other ways extreme, it signals to the suprarenal glands from which various (stress-) hormones are released, including corticosteroids and adrenaline (McFarland, 1999, p 273; Abrantes, 1994, p 61; Kristensson, 2011, p 5). The stress hormones are transferred directly to the blood and are thus quickly transferred to the organs, resulting in increased activity of the body. The lungs work faster, the liver releases blood sugar and the heart frequency is increased (Abrantes, 19994. p 61). Consequently the animal's body is in a state of heightened awareness and is ready for coping as effectively as possible with whatever may come

As such stress is basically a healthy physiological mechanism that serves self-preservation in all species (Abrantes, 1997, p 234). Stress may, however, also be unhealthy if the individual is in a state of stress too often or for too long. The same physiological mechanisms that lead to efficient and quick solutions of extreme situations are unhealthy for the organism if elicited too often; the production of protein in the cell decreases, the digestion slows down, and the concentration of hydrochloric in the blood increases, all to save energy (Abrantes, 1994, p 62). If this state is maintained too long it may lead to disease or abnormal behaviour. For cats

stress is e.g. believed to be the cause of Feline Idiopathic Cystitis (FIC), cf. Kristensson (2011, p 5).

The situation for a cat put in a rescue shelter is in many ways unnatural and thus stressful for the cat; it is confined in a small space (the cage) where flight is not possible, and from here the cat is faced with a wide variety of unknown and, from the cat's point of view, threatening stimuli, such as strange people interacting with the cat (shelter staff and volunteers, the veterinary) and the sight, sound and smell of other cats, and maybe even other animals (e.g. dogs) in close proximity. This will initially lead to an acute state of stress in most cats left in the shelter, as discussed below. Some cats will habituate (Chance, 2008, p 11) to the shelter environment, leading to reduction in the state of stress of these cats. But some may find it difficult to habituate to the shelter, and thus transfer to a more chronic state of stress, as discussed below. Dybdall et al. (2007) show that especially cats surrendered by their owners to the shelter are prone to experience a higher level of stress and be stressed for a longer period than cats entering the shelter as strays. This factor will also be investigated in this study.

Diagnosing the level of stress in the cats used in the study

As described above, the work with each cat used in the study has been initiated by assessing the cat's initial level of stress. Two categories have been used:

- Acutely stressed.
- Chronic, or permanent, state of stress.

The two states differ, in the opinion of the author of this report, by whether the cat has developed certain behaviour patterns to compensate for the stress (chronic state of stress) or whether the cat is showing direct acute signs of stress, as characterised by the Cat Stress Score (CSS) developed by Kessler and Turner (Kessler and Turner, 1997). The score characterizes the cat's state of stress by observing 11 attributes: body, belly, legs, tail, head, eyes, pupils, ears, whiskers, activity and vocalisation. The combination of observing each of these attributes for the cats gives a stress score on a scale 1-7, reproduced in short here[8]:

- Fully Relaxed (Cat Stress Score 1): Laid out on side or on back with belly exposed, slow ventilation and fully extended legs. Tail extended or loosely wrapped around cat. Head on the surface with chin upwards or on surface. Eyes closed or half opened, may be blinking slowly, and with normal pupils. Ears half back (normal). Whiskers lateral (normal). No vocalization. Cat sleeping or resting.
- Weakly relaxed (Cat Stress Score 2): May be active or passive, either laid ventrally or half on side or sitting, or standing and moving with horizontal back. Belly may be exposed or not exposed, and with normal ventilation. Tail relaxed and either wrapped loosely around cat or up or loosely downwards. Head may be lying on surface when lying down. Eyes may be closed or half opened or normal opened, with normal pupils. Ears half backwards (normal) or erected to front. Whiskers lateral or forward (both normal). No vocalization. May be sleeping, resting, alert, active and/or playing.
- Weakly Tense (Cat Stress Score 3): May be laid ventrally or sitting, or standing/moving with horizontal back. Belly not exposed and normal ventilation. Tail on the body or curled backwards, or - when active - up and tense and may be twitching. Eyes normally opened with normal pupils. Ears half back (normal) or erected to front or back and forward on head. Whiskers lateral (normal) or forward. May meow or be quiet. And may be resting, awake of actively exploring.

[8] Original stress score table from Kessler and Turner (1997) adapted for this report with direct copying of several formulations, by kind permission from Dr. Dennis C. Turner through personal communication.

- Very tense (Cat Stress Score 4): May be laid ventrally, rolled or sitting, or standing/moving around, with body behind lower than body front. Belly not exposed and normal ventilation. Tail close to body and maybe twitching. Head over body or pressed to body, with little or no movement. Eyes widely opened or pressed together, pupils normal or partially dilated. Ears erected to front or back. Whiskers lateral (normal) or forward. May be (plaintively) meowing or quiet. Cat may be cramped sleeping or actively exploring or trying to escape.
- Fearful, stiff (Cat Stress Score 5): May be laid ventrally, rolled or sitting, or standing/moving around, with body behind lower than body front, and belly concealed. Normal or fast ventilation. Tail (curled forward) close to body. Head on the plane of the body with no movement. Eyes widely opened, pupils dilated. Ears partially flattened. Whiskers lateral (normal), forward or back. May be meowing, yowling or growling or quiet. Cat is alert and may be actively trying to escape.
- Very fearful (Cat Stress Score 6): May be laid ventrally or crouched directly on top of all paws, or may crawl with whole body close to ground, maybe shaking. Belly not exposed and fast ventilation. Tail (curled) close to body. Head near to surface, motionless. Eyes fully opened, pupils fully dilated. Ears fully flattened. Whiskers back. Maybe meowing, yowling or growling or being quiet. Cat may be motionless alert or actively prowling.
- Terrorized (Cat Stress Score 7): Passively crouched on top of all four paws and shaking. Belly not exposed and fast ventilation. Tail close to body. Head lower than body, motionless. Eyes widely opened, pupils fully dilated. Ears fully flattened back on head. Whiskers back. Maybe meowing, yowling or growling or being quiet. Cat is motionless alert.

It should be clear that it was not initially expected to encounter cats with CSS 1-2 in the present study. However one cat[9] turned out to be rather relaxed (and thus assessed to have CSS=2) even though it was described by the staff of the shelter as being shy.

When the cats are in a more chronic, or permanent, state of stress (PSS[10]) the CSS is not deemed applicable to diagnose the cats. A cat may be in a permanent state of stress when it has not been able to habituate to the shelter environment even after two or more weeks. Kessler and Turner (1997) measured two weeks to be the maximum habituation period for 2/3 of cats put in kennels/shelters in their study.

In the present context PSS is defined as a state where the cat has developed certain behaviour patterns to compensate for the stress it experiences in the shelter. The cat may have withdrawn completely from contact with other cats and humans in the shelter and sleep most of the time. The cat may be eating more than average (for a discussion of the physiological factors linking stress and obesity see e.g. Björntorp 2001). The cat may have developed excessive grooming, or *feline psychogenic alopecia*, that may be linked with stress if not caused by physiological conditions (Landsberg et. al., 1997, pp 217-220; Halls, 2005, pp 197-199; Dodman, 1997, chapter 12). Alternatively the cat may have developed aggression towards staff and volunteers in the shelter, but does not show other acute signs of stress.

The reinforcement/punishment contingency square - linked to this study

This study builds on the cats learning to trust humans through operant learning. Operant learning (or conditioning) means that behaviour is strengthened or weakened through its consequences (Chance, 2008, p 124). This is opposed to classical conditioning (Chance, 2008, chapter 3), which is also used to some degree in the study, e.g. in making the clicker a

[9] Case 21, Plet, cf. the data collection section below.
[10] The phrase 'Permanent state of stress', is used in the rest of this report instead of 'Chronic state of stress', to be able to use the abbreviation 'PSS' as opposed to 'CSS' which is used for 'Cat Stress Score'.

secondary positive reinforcer. In classical conditioning learning is effected through pairing a reflex-eliciting stimulus with an initially neutral stimulus, thus resulting in the latter also eliciting the reflex after a number of pairings. Thus while classical conditioning is a passive form of learning where the appearance of the stimuli are outside the control of the learner, operant conditioning is an active form of learning where the appearance of a stimulus is contingent on a behaviour (for a further discussion of the differences between classical and operant conditioning refer to Chance, 2008, pp 132-134)

In operant conditioning the consequences of the behaviour may be either reinforcing or punishing. A stimulus following a certain behaviour is reinforcing if the stimulus results in an increase in the intensity and/or strength of the behaviour (Chance, 2008, p 127). Contrary to this a stimulus following a behaviour is punishing if the stimulus results in a decrease in the intensity and/or strength of the behaviour (Chance, 2008, p 208). When the reinforcing/punishing stimulus is added to the situation it is called positive (Chance, 2008, p 128, p 208), while the stimulus is called negative if it is removed from the situation (Chance, 2008, p 129, p 208). This leads to the contingency square of reinforcement and punishment presented in figure 1 (Chance, 2008, p 128).

Figure 1. The contingency square of reinforcement and punishment

		Strength/frequency of Behaviour	
		Increases	**Decreases**
Consequences	**Stimulus is added**	Positive Reinforcement	Positive Punishment
	Stimulus is removed	Negative Reinforcement	Negative Punishment

In this study reinforcement and punishment are used in the following way:

- *Positive reinforcement*: The sound of the clicker, food and play have been used as positive reinforcers.
- *Negative reinforcement*: Walking away from the cat's cage has been used as negative reinforcement, if the cat's state of fear in the presence of the trainer is so high that it is not possible to get it interested in any positive reinforcer. And in the case of aggressive cats, removing controlled pressure has been used as negative reinforcer, for example keeping the (gloved) hand on the cat if it attacks and first removing the hand when the attack stops and the cat withdraws (this is closely connected to positive punishment of the attacking behaviour, cf. the discussion of the use of positive punishers below).
- *Negative punishment*: Withholding food or play has been used as negative punishers if the cat does not offer contact (later in the training process when the cat is more confident).
- *Positive punishment*: Saying 'No!' or 'Errrr!' has been used as positive punishment if the cat bites/scratches the hand of the trainer (later in the training process when the cat is more confident). This is used for cats that do not as such display aggressive behaviour, but who exchanges targeting with nose with trying to target with the paw by lashing out. For directly aggressive cats[11] a (gloved) hand is kept still during attacks. Thus keeping the hand steady close to or touching the cat during attack is a positive punisher (connected with the negative

[11] See e.g. case 29, Fanta, that is described in details below as a special case.

reinforcer of removing the hand when the attack stops, cf. the discussion above), as the cat expects the hand will be removed when it attacks.

Clicker Training

Clicker training is a technique built on operant conditioning using positive reinforcement. However the method also uses element of classical conditioning. The animal is first taught, through classical conditioning, to connect the sound of a clicker (a small plastic box containing a metal plate giving a 'click' when pressed) with the presentation of a stimulus that is positively reinforcing for the animal (e.g. food or play). As such the click-sound becomes a secondary, or conditioned, positive reinforcer (Chance, 2008, p 135), signalling the appearance of a, to the animal, primary positive reinforcer (Chance, 2008, p 134).

Subsequently the click-sound can be used as a positive secondary reinforcer to mark wanted behaviour exactly when it occurs, at the same time signalling that the primary reinforcer will follow shortly. In this way the click-sound is a useful tool as it can be used for bridging (Pryor, 2002, p 15) the time between the appearance of the behaviour and the delivery of the primary positive reinforcer, which is not always easy to deliver at the exact time the wanted behaviour occurs. But the click-sound is also more than just a useful tool, it is in itself a very powerful reinforcer when first conditioned; research (cf. Pryor, 2009, Chapter 10) has shown that all secondary reinforcers, including the click-sound, are first processed by the amygdala part of the brain, that governs reflexes, breathing, walking, fear conditioning and processing of emotions[12]. The signal from the secondary reinforcer is thus sent from the amygdala to parts of the brain governing emotion and memory. Thus the click-sound is not processed by parts of the brain linked to thinking and analysing. As such the click-sound will very quickly in itself be connected with strong positive emotions (and thus with dopamine bursts) when first conditioned on a primary positive reinforcer. This makes the click-sound a very strong tool in itself for marking wanted behaviour, stronger than the word 'good', even though this is also a secondary reinforcer. The reason being that the click-sound never changes, while 'good' will invariably be said with small differences from one repetition to the next, forcing the processing of the word through the analysing parts of the brain.

Collected data

The practical work has been performed during the months January-July 2011. During this period 29 cats have been trained individually in the two shelters. Of these 22 cats were from the SDAD and 8 from the DCP. By September, 2011, 19 cats had been adopted, 5 had been euthanized and the remaining were still waiting to be adopted. Of the cats euthanized 2 are from the DCP and 3 from the SDAD. The reasons for euthanizing the five cats were:

1) One cat (Case 18, Humle) reacted well to the training but was assessed by the shelter staff to be too reactive when touched and thus not safe in a new family.
2) One, very aggressive, cat (case 26, Store Sylvester) reacted badly to the training in the shelter and was sent to a caretaker away from the shelter. After two months with the caretaker Sylvester was still assessed to be unpredictable and aggressive, and was thus not deemed safe to send to a new family.
3) One cat (case 25, Brune) reacted very well to the training but had to be euthanized due to chronic diarrhoea.
4) One cat (case 24, Sissemor) was diagnosed with pellets in the head and thus euthanized.
5) One cat (case 7, Daisy) kept having strong pains in her back and legs, which affected her strongly and it was decided that it would be most humane to euthanize her.

[12] See also: http://www.scholarpedia.org/article/Amygdala

Table 1. Basic statistics of the 29 cats trained for the study.

Case	Cat	Shelter	Age (years)	Gender	Total Train. Sess.	Train. Sess. before imp.	Adopted
1	Pandora	SDAD	4.93	NF	3	3	Yes
2	Obi	SDAD	5.68	NM	3	3	Yes
3	Rylle	SDAD	0.38	NF	18	2	Yes
4	Sofus	SDAD	0.28	NM	20	6	Yes
5	Pigen	SDAD	0.47	NF	2	2	Yes
6	Mary	SDAD	1.06	NF	10	3	Yes
7	Daisy	SDAD	0.50	NF	8	4	Euth.
8	Snuden	SDAD	1.02	NF	9, 5, 8, 11	6, 4, 5, 3[13]	No
9	Misty	SDAD	2.02	NF	10	8	Yes
10	Maisie	SDAD	1.03	NF	11	9	No
11	Mifer	SDAD	0.69	NF	14	10	Yes
12	Thea	SDAD	1.29	NF	2	1	Yes
13	Foxie	SDAD	1.02	NF	8	3	Yes
14	Sylvester	SDAD	0.23	NM	9, 8	2, 5[14]	Yes
15	Emil	SDAD	1.69	NM	7, 4	1, 1[15]	No
16	Berta	SDAD	1.24	Q	3	2	No
17	Mus	SDAD	5.83	NM	5	4	Yes
18	Humle	DCP	0.86	T	2	1	Euth.
19	Batal	DCP	0.86	NM	6, 2, 2[16]	5, 1, 1	Yes
20	Perle	DCP	0.89	NM	9	3	Yes
21	Plet	DCP	10.87	NF	4	3	Yes
22	Lia	DCP	1.98	NF	4	2	Yes
23	Moster Fine	DCP	1.79	NF	5	3	Yes
24	Sissemor	DCP	1.23	NF	2	NA[17]	Euth.
25	Brune	SDAD	5.98	NM	6	3	Euth.
26	Store Sylvester	SDAD	1.17	NM	3	NA	Euth.
27	Mila	SDAD	5.16	NF	8	4	Yes
28	Juliane	SDAD	4.93	NF	3	2	No
29	Fanta	SDAD	5.68	NF	18	8	Yes

[13] Snuden had a long history in the shelter; first she was in a dog cage with 3 other cats that she had been rescued together with; the first number reflects how quickly she reacted to the training in that cage. Then she was put in a cat cage by herself and got shy again; the second number reflects how quickly she reacted to the training here. Then she got sick, and was shy again when recovered. The third number reflects how many sessions it took to get her around this time. And finally she was put in the cat-'exhibition'- stable; the fourth number is the number of sessions it took her to react to the training there.

[14] There are two almost separate histories with Sylvester, as the trainer went to the DCP shelter for ~2 weeks after working with him for 9 sessions. And while he had become very tame and interested in the 'clicker game' before the trainer left (see Appendix B), he was very withdrawn and suddenly head-shy when the trainer came back to SDAD. So it took some time to get him 'back on track' again.

[15] Emil was trained in two 'separate' runs, first when he was together with all the other cats in the dog cage (he was rescued in the same case as Snuden), and secondly ~1 month later when he had been moved to the stable and was reported a bit shy.

[16] The work with Batal falls in three more or less separate sessions, first when he was in the evaluations zone, second when he was moved inside the shelter and became a bit nervous again and third when the trainer came back to the shelter after working at SDAD for ~1 month.

[17] NA=Not Applicable: Sissemor was diagnosed with pellets in her head after two training sessions and euthanized. However, her case is very interesting and thus kept as a part of the sample.

All 29 cats, and their basic statistical data, are listed in table 1. The basic data are cat's name, the shelter housing the cat, the cat's age when training was initiated, its gender ('NF'/'NM'=Neutered Female/Male, 'Q'=Queen, 'T'=tom), total number of training sessions for the cat, number of training sessions until first improvement is observed and whether the cat was adopted or not by September 15., 2011. A detailed account of each cats pre-history and state of stress before training is given in Appendix B, together with the cat's basic statistics and its trainings log, i.e. the daily notes written down during the training of each cat.

The nature of the 'first sign of improvement' is defined as the cat displaying one or more of the following behaviours:

- Showing signs of interest in and/or seeking out the trainer.
- Showing signs of interest in and/or seeking out the training exercises themselves.
- Showing signs of interest in and/or seeking out the primary reinforcer offered (food/play).
- Reduction in aggressive behaviour towards trainer.
- Reports from staff/volunteers in the shelter that the cat has changed attitude towards them to be more friendly/outgoing and/or less aggressive.

Beyond the basic statistics for each cat, the following parameters have been collected:

- The cat's initial state of stress: This is divided into acutely stressed cats, scored after the Cat Stress Score (CSS) described above, and permanently stressed cats (PSS).
- Whether the cat is found as a stray or owner surrendered to the shelter.

Table 2. The cats' level of stress when training is commenced, and the number of training sessions until first improvement.

Acutely stressed cats				**Permanently stressed cats**			
Case	**Cat**	**CSS**	**Train. Sess. before imp.**	**Case**	**Cat**	**Initial Level of stress**	**Train. Sess. before imp.**
21	Plet	2	3	1	Pandora	PSS	3
18	Humle	3	1	5	Pigen	PSS	2
23	Moster Fine	3	3	6	Mary	PSS	3
7	Daisy	4	4	12	Thea	PSS	1
19	Batal	4	5	25	Brune	PSS	3
2	Obi	5	3				
3	Rylle	5	2				
14	Sylvester	5	2				
16	Berta	5	2				
22	Lia	5	2				
27	Mila	5	4				
4	Sofus	6	6				
8	Snuden	6	6				
9	Misty	6	8				
10	Maisie	6	9				
11	Mifer	6	10				
13	Foxie	6	3				
15	Emil	6	1				
17	Mus	6	4				
20	Perle	6	3				
28	Juliane	6	2				
29	Fanta	6	8				

Note: 'CSS'=Cat Stress Score. 'PSS'=Permanent State of Stress.

The initial levels of stress for the cats are shown in table 2, together with the number of training sessions until first improvement. Refer to Appendix B for a detailed description of each cat's initial state of stress. Cases number 24 and 26, Sissemor and Store Sylvester are left out of table 2 because the training did not lead to any improvement for these two cats. For Sissemor the reason is believed to be brain damage caused by pellets in her head. And Store Sylvester was too stressed in the shelter to react to any kind of reinforcer. Both cases are discussed as special cases below.

Table 3 shows the cats divided into cats that have entered the shelter as strays (thus put there by private persons who have found them, by the police, by cat inspectors or by Falck) and cats that have been surrendered to the shelter by their previous owners. The table also shows the cats initial level of stress together with the number of sessions needed to reach the first sign of improvement for the cats. Again cases number 24 and 26, Sissemor and Store Sylvester, are left out, given the reasons stated above. Moreover cases 5 and 25, Pigen and Brune, are left out, as their previous histories are unknown and case 3, Rylle, as this cat was born in the SDAD shelter.

Table 3. Cats sorted according to whether they have entered the shelter as strays or have been surrendered to the shelter by their previous owners.

Stray				**Owner Surrendered**			
Case	**Cat**	**CSS/ PSS**	**Train. Sess. before imp.**	**Case**	**CSS/ PSS**	**Cat**	**Train. Sess. before imp.**
1	Pandora	PSS	3	2	5	Obi	3
4	Sofus	6	6	6	5	Mary	3
7	Daisy	4	4	17	PSS	Mus	4
8	Snuden	6	6	21	6	Plet	3
9	Misty	6	8	22	2	Lia	2
10	Maisie	6	9	27	5	Mila	4
11	Mifer	6	10	29	5	Fanta	8
12	Thea	PSS	1				
13	Foxie	6	3				
14	Sylvester	5	2				
15	Emil	6	1				
16	Berta	5	2				
18	Humle	3	1				
19	Batal	4	5				
20	Perle	6	3				
23	Moster Fine	3	3				
28	Juliane	6	2				

Note: ‘CSS’=Cat Stress Score. ‘PSS’=Permanent State of Stress.

Data processing

The statistical methods used in this study are described briefly below. For details refer to Appendix A, and to Dunn (1977) and Gujarati (2003).

Ordinary Least Squares linear regression between two variables

Linear regression between two variables *x* and *y* assumes that the relationship between the variables can be described by the equation:

$$y = \alpha + \beta \cdot x \tag{1}$$

Where *y* is the dependent variable (e.g. number of training sessions until the first sign of improvement is observed) and *x* is the explanatory variable (e.g. the age of the cat). *α* is the intercept of the regression line, i.e. where it crosses the *y*-axis when *x=0. B* is the slope of the regression line, i.e. the amount *y* changes when *x* changes by one unit. Equation (1) is in this study fitted, i.e. the parameters *α* and *β* are determined, to observed data using the technique called Ordinary Least Squares (OLS), which is explained in detail in appendix A.

Hypothesis testing regarding regression parameters

When the OLS regression line has been determined it can be tested whether the intercept *α* and slope *β* are significantly different from zero. E.g. if there is a significant increase in the number of sessions needed to train a cat until first improvement when the age of the cat increases. Or whether the number of sessions needed to train a cat until first improvement is significantly equal to or higher than zero when the stress level of the cat is low. Thus both for *α* and *β* the hypotheses is whether these parameters are significantly greater than zero. This requires a 'one-tailed', also called a 'one-sided', test of significance (as opposed to 'two-sided' tests, cf. Appendix A). To perform this test the standard deviations s_α and s_β of *α* and *β* are needed, which are given by equations (a3) and (a4) in Appendix A. Using these the following *t*-values are formed:

$$t_\alpha = \frac{\alpha - 0}{s_\alpha} \quad ; \quad t_\beta = \frac{\beta - 0}{s_\beta} \tag{2}$$

These follow the *t*-distribution with *N-2* degrees of freedom (*N*=sample size). Thus if there is less than *5%* chance to get at least the *t*-values given in equation (2) it is concluded that the parameter (*α* or *β*) is significantly greater than zero at the *5%* level. If on the other hand there is a higher than *5%* chance of getting the *t*-value or higher, it is concluded that the parameter is less than or equal to zero. It must then be investigated whether the parameter is significantly less than zero or not, again using a one-tailed test. For details, refer to appendix A.

Comparison of sample averages

When a sample of N observations can be divided in two groups (e.g. cats that are acutely stressed and cats that are permanently stressed), containing N_1 and N_2 observations ($N_1 + N_2 = N$), it may be of interest to investigate whether some characteristic of the two groups is equal or not (e.g. the number of trainings sessions until first sign of improvement is observed). When this characteristic, or parameter P, is numerical it can be investigated whether the averages of the parameter for the groups are significantly different, using a *t*-test. The group averages ($\overline{P_1}$ and $\overline{P_2}$) and standard deviations (s_1 and s_2) of P are given by equations (a6) and (a7) in appendix A. The zero hypothesis is that $\overline{P_1} = \overline{P_2}$ with the alternative

hypothesis that $\overline{P}_1 \neq \overline{P}_2$. To test this a so-called pooled estimate of the standard deviations s_p is needed, which is given by equation (a8) in Appendix A. Using this, the *t*-value to be tested, with $N_1 + N_2 - 2$ degrees of freedom is given by:

$$t = \frac{\overline{P}_1 - \overline{P}_2}{s_p \cdot \sqrt{1/N_1 + 1/N_2}} \tag{3}$$

If the probability of getting this *t*-value, or its negative (as it is tested whether the two averages are equal or not, and not if one is higher/lower than the other) is less than *5%* the zero hypothesis is rejected and it is concluded that the two averages are significantly different.

Data Analysis

Table 1 shows that the age of the cats when training was commenced varied between 0.23 and 10.87 years. The average age of the cats included in the study is 2.23 years with a standard deviation of 2.52 years. The table further shows that the total number of training sessions varied significantly, from 2 to 33, for the cats included in the study, while the number of sessions performed until the first sign of improvement varied between 2 and 10. The reason for this discrepancy is that the training of the cats usually continued after the first sign of improvement until the cats were adopted or the training stopped for other reasons (e.g. other cats needing training more, or the trainer moving from one shelter to the other). For some cats there was also some way from the first sign of improvement to the cats being generally friendly towards volunteers/staff at the shelter other than the trainer and thus adoptable.

The following questions are justified and investigated in the following:

- Is there a relationship between the age of the cat and its initial level of stress?
- Does the age of the cat influence the number of sessions needed to reach first sign of improvement?
- Is there a difference in the number of sessions needed to reach first sign of improvement between acutely and permanently stressed cats?
- Does the level of stress influence the number of sessions needed to reach first sign of improvement for the acutely stressed cats?
- Is there a difference in the number of sessions needed to reach first sign of improvement between owner surrendered and stray cats?

Influence of age of cat and initial level of stress

In the study by Dybdall et al. (2007) a significant positive relationship was found between the age of the cats and their average stress ratings, i.e. the average stress level of the cats increased with their age. It is in the present context investigated both whether the age of the cats and the initial stress levels of the cats (for acutely stressed cats) influence the number of sessions needed to reach first improvement. However, if there is an underlying relationship between age and stress level this may bias these analyses, and the first questions that must be asked is therefore whether there is a significant relationship between age and the initial cat stress score (CSS) in the sample.

Figure 2 shows the initial CSS plotted against the age of the cat for the 22 acutely stressed cats (combining information from table 1 and 2) included in the statistical evaluations in this study (thus not including cases 24 and 26, Sissemor and Store Sylvester, for the reasons discussed above). Table 4 shows the results of using OLS regression (cf. the data processing section above) to find the parameters of the function $CSS = \alpha + \beta \cdot age$.

Figure 2. Initial Cat Stress Score plotted against cat's age when training started for acutely stressed cats.

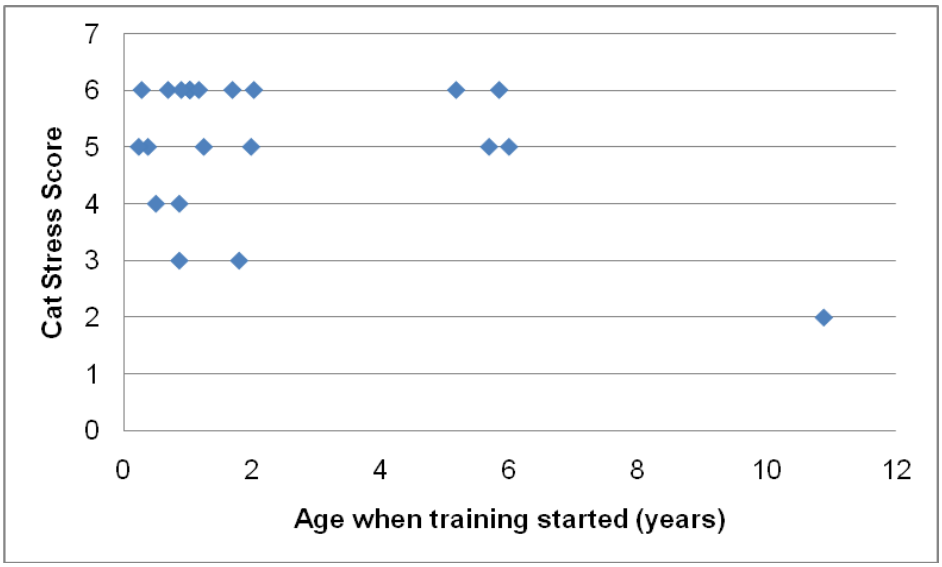


Table 4. Results of Ordinary Least Square regression of CSS (dependent variable) against age of cat when training started (explanatory variable), cf. Figure 2.

Parameter	Value	Standard Deviation	*t*-value	df (n-2)	Probability to get *t* or higher
Intercept (*α*)	5.45	0.33	16.67	20	$1.69 \cdot 10^{-13}$
Slope (*β*)	-0.15	0.09	-1.64	20	0.94

Note: The evaluations of the probabilities have been performed using one sided *t*-tests for both *α* and *β* .

Table 4 shows that the slope of the regression line is negative, and that it is not significantly higher than zero at the 5% level (one-sided test). The slope is not significantly less than zero either, as the probability to get the *t*-value or lower is *1-0.94=0.06*, i.e. still higher than *5%*. It is thus concluded that the slope is significantly equal to zero. This is opposed to the findings by Dybdall et al. (2007) of the existence of a significantly positive relationship between CSS and age. However, the results may in the present context be biased by case number 21, Plet, the oldest cat in the sample (~11 years old). Figure 2 shows that this case, compared with the rest, has a very low stress score, combined with a very high age. As such this case may be seen as an outlier, distorting the overall average picture. An OLS regression has thus been performed for the sample shown in figure 2, minus case 21, the result of which can be seen in table 5. The table shows that if case 21 is removed there is a positive relationship between CSS and cat age, but that this relationship is still not significantly higher than zero at the 5% level. Likewise the slope is not significantly less than zero as the probability of getting the slope's *t*-value or lower is *1-0.31=0.69>0.05.* Thus the slope is still significantly equal to zero. It may thus be concluded that, opposed to Dybdall et al. (2007), the present study does not show a significant relationship between cat age and stress score for the acutely stressed cats. Thus there is no risk that the results presented in the following are biased by such a relationship.

Table 5. Results of Ordinary Least Square regression of CSS (dependent variable) against age of cat when training started (explanatory variable), cf. Figure 2, with case 21 removed.

Parameter	Value	Standard Deviation	*t*-value	df (n-2)	Probability to get *t* or higher
Intercept (*α*)	5.12	0.32	16.22	19	$6.92 \cdot 10^{-13}$
Slope (*β*)	0.06	0.12	0.52	19	0.31

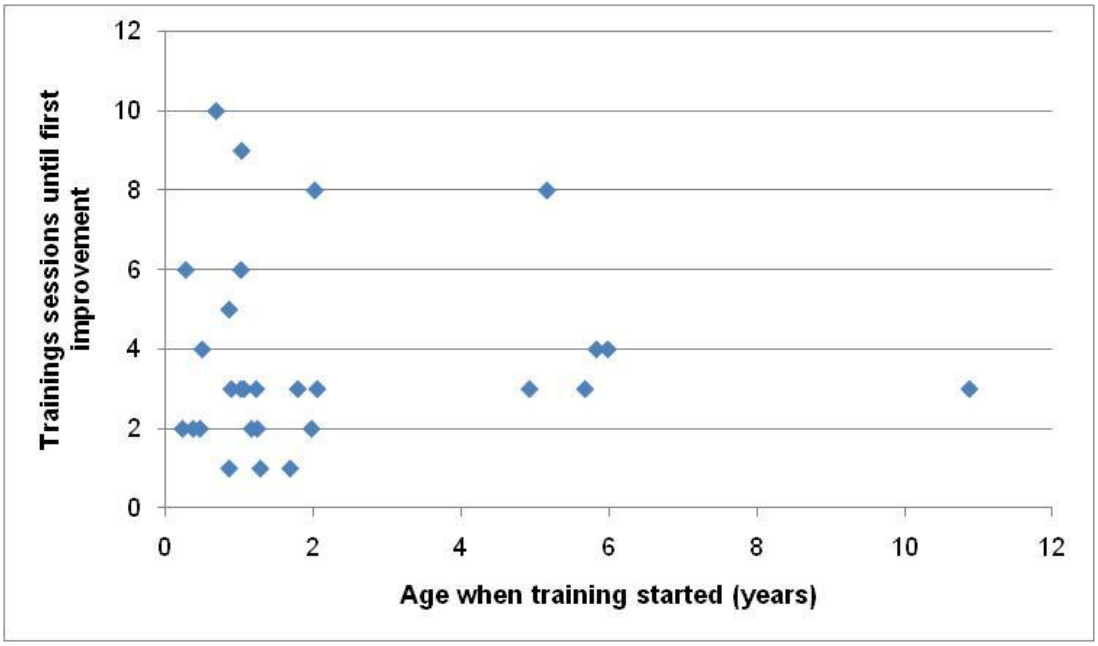
Note: The evaluations of the probabilities have been performed using one sided *t*-tests for both *α* and *β* .

Influence of age on sessions needed to reach first improvement

It may be hypothesised that the older the cat is the longer it will take to influence it using clicker training, or in other words that there is a positive relationship between the age of the cat when the training is started and the number of training sessions until first improvement: Braun and Geiselhart (1959) e.g. found that eyelid conditioning was faster in children and young adults than in older adults (see also Chance, 2008, pp 78-79). On the other hand Bartus et al. (1979) have found that for operant conditioning (discrimination exercises) in rhesus monkeys (*Macaca mulatta*) it is not so much the speed of learning that is affected by age, but rather the speed of reversing the learning, i.e. learning to choose a new object. Thus the older cats may be expected to learn the click (classical conditioning) slower but then learn to target on a target-stick or finger as quickly as the younger cats. Unless the target exercises are in conflict with something the cat has learned outside the shelter (e.g. that human hands pose danger) in which case the learning may be slowed down by age (as learning to target is then reversal of earlier learning).

Figure 3 shows the number of sessions until the first sign of improvement plotted against the age of the cat (cf. table 1). Cases number 24 and 26, Sissemor and Store Sylvester, have not been included in the graph or in the following statistical evaluations, for the reasons discussed above. Thus the number of observations included in this analysis is 27.

Figure 3. No. of sessions to first improvement plotted against cat's age when training started.



The hypothesis has been tested by fitting a linear regression line to the data, using OLS regression, and testing whether the slope of the regression line is significantly higher than zero (given that the hypothesis is that it takes *more* trainings sessions to obtain first sign of improvement the older the cat is). Thus the function $no\text{-}of\text{-}sessions=\alpha+\beta \cdot age$ has been fitted to the data displayed in figure 3 using OLS regression. The result of this is shown in table 6. The table firstly shows that there is a probability of *0.47* that to get the *t*-value for the slope or higher, implying that the slope of the regression line is not significantly higher from zero at the *5%* level. Likewise the slope is not significantly less than zero as the probability of this is *1-0.47=0.53*, which is higher than *5%*. The slope is consequently significantly equal to zero. There is thus *not* a significant increase in the number of sessions needed to see a first improvement for the 27 cats when the age of the cat increases[18].

Given that the slope of the regression line is not significantly different from zero, the intercept gives the average number of sessions it will take to reach first improvement in any cat, independent of age. Thus ~3.8 sessions is needed, on the average, to reach first improvement in the cats included in this study.

Table 6. Results of Ordinary Least Square regression of number of sessions until first improvement (dependent variable) against age of cat when training started (explanatory variable).

Parameter	**Value**	**Standard Deviation**	***t*-value**	**df (n-2)**	**Probability to get *t* or higher**
Intercept (*α*)	3.7782	0.6556	5.7633	25	$2.63 \cdot 10^{-6}$
Slope (*β*)	0.0164	0.1970	0.0834	25	0.47

Note: The evaluations of the probabilities have been performed using one sided *t*-tests for both *α* and *β* .

Influence of state of stress on sessions needed to reach first improvement

It may be hypothesised that there is a difference in the average number of training sessions necessary to reach first improvement, depending on whether the cat is in a permanent state of stress as opposed to acutely stressed. The acutely stressed cats display various defence mechanisms, ranging from hiding in fear to aggression. It may thus be difficult to reach these cats as they are literately trying to flee or fight humans approaching them, and furthermore because it is difficult to interest these cats in food as the digestive system is slowed down when the cat is acutely stressed. Permanently stressed cats on the other hand have developed coping mechanisms as discussed in the theory section, and are as such in many ways functioning in the daily life in the shelter, at least with regard to eating and digesting food. Thus it may be easier to get these cats interested in food as a primary reinforcer and thus get through to the cats this way.

Table 2 shows that 22 cats in this study were assessed to be in an acute state of stress and were therefore scored according to the Cat Stress Score. 5 cats were assessed to be in a permanent state of stress. Cases 24 and 26, Sissemor and Store Sylvester, are left out as discussed above.

[18] It may again be argued that case 21, Plet, is an outlier that may distort the average picture, as this cat is much older than the average cat in the study. However, when case 21 is removed the slope of the regression line becomes 0.11, with a standard deviation of 0.27, and the slope is still not significantly different from zero at the 5% level.

Table 7 shows the average number of sessions needed to reach first improvement for the acutely stressed cats and for the permanently stressed cats, together with the standard deviations of these averages (equation a6 and a7 in appendix A). The table also shows the pooled variance (equation a8 in appendix A) and the *t*-value (equation 3) for testing whether the two averages are equal or not (the zero hypothesis being that they are equal). The table shows that the probability to get the *t*-value or higher, or its negative or lower, is 0.16, i.e. higher than 5%. It may thus be concluded that there is not in this study a significant difference between the number of sessions it takes to reach first improvement for the acutely and the permanently stressed cats. However, as there are only 5 permanently stressed cats in this study this result is only indicative and further research should be performed to investigate this point in more detail.

Table 7. Average number of sessions until first sign of improvement is observed for acutely respectively permanently stressed cats.

		Acutely stressed cats	**Permanently stressed cats**
Number of sessions until first improvement	**Average**	4.13	2.4
	Standard Deviation	2.62	0.89
	Number of cats in sample (N)	22	5
	s_p	2.43	
	t	1.44	
	df	25	
	P	0.16	

Influence of level of stress on number of sessions needed to reach first improvement

It may be hypothesised that for the acutely stressed cats the number of training sessions needed to reach first sign of improvement increases with the cat's level of stress. The reason for this is identical to the reasons stated above when discussing acutely versus permanently stressed cats; as the cat's level of stress increases it gets increasingly focused on either hiding from or attacking humans approaching it, and its interest in anything else, including food, decreases.

Figure 4 shows the number of sessions it takes to reach first improvement for the acutely stressed cats against their stress score (cf. Table 3). The figure indicates that the number of sessions it takes to reach first sign of improvement might increase with the initial level of stress of the cat when the training is started. This is investigated by fitting an OLS regression line to the data shown in the figure. Table 8 shows the results for the regression line. Again only one sided *t*-tests have been used for the intercept and slope. It is firstly seen that the intercept of the regression line (giving the number of sessions needed to reach first sign of improvement for at cat not stressed at all, i.e. with CSS~0) is not significantly higher than zero as the probability to get its *t*-value or higher is 0.46. Likewise the intercept is not significantly less than zero, as the probability for this is *1-0.46=0.54>0.05.* Thus the intercept is significantly equal to zero, indicating that a totally relaxed cat will react to the training (more or less) at once. Table 8 further shows that the slope of the line is significantly higher than zero at the 5% level (but not at the 1% level) as the probability to get its *t*-value or higher is 0.04. This thus indicates that the

number of sessions until first improvement increases with increasing Cat Stress Score, with an average increase of ~0.9 sessions when the CSS increases by one unit.

Figure 4. No. of sessions needed to reach first improvement against the stress score for the acutely stressed cats.

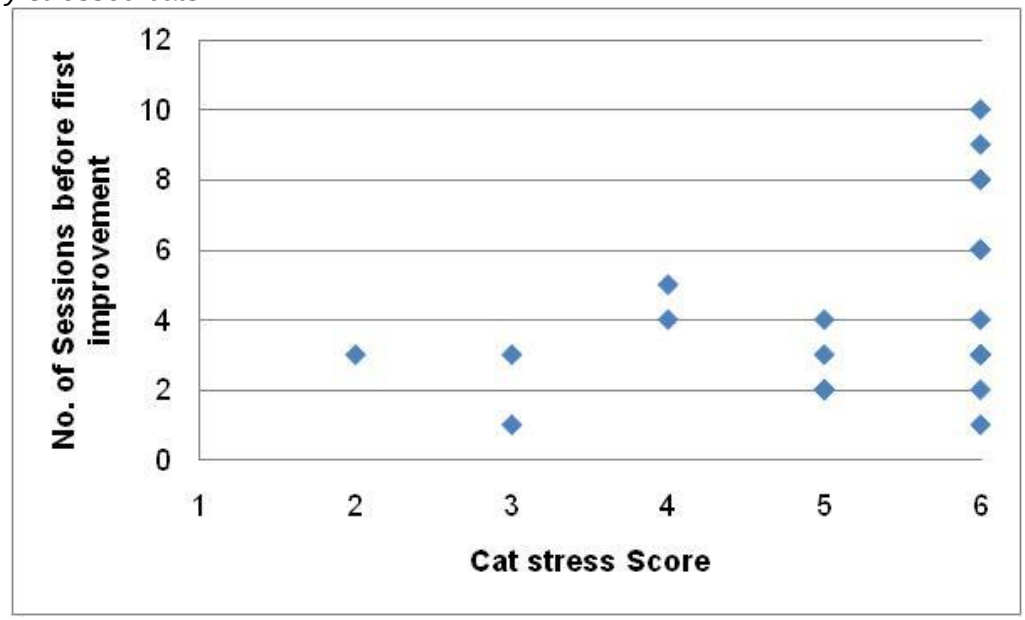


Table 8. Results of Ordinary Least Square regression of number of sessions until first improvement against cat stress score (CSS) when training started for the acutely stressed cats (left part of table 3).

Parameter	Value (V)	Standard Deviation (SD)	*t*-value (V/SD)	df (n-2)	Probability to get *t* or higher
Intercept (α)	-0.26	2.37	-0.11	20	0.46
Slope (β)	0.86	0.45	1.90	20	0.04

Note: The evaluations of the probabilities have been performed using one sided *t*-tests for both *α* and *β* .

Owner surrendered cats versus strays

In the study by Dybdall et al. (2007) it is shown that owner surrendered cats on average have a significantly higher initial stress score, using Kessler and Turner's (1997) stress score, than stray cats brought to shelters. If this is also the case in the present study it must be expected, given the above results, that more sessions should on average be needed to reach first sign of improvement for owner surrendered cats displaying signs of stress, compared with stray cats brought to the shelter.

Table 3 shows that 17 of the cats in the study entered the shelters as strays while 7 cats were surrendered to the shelters by their owners. Five cats, cases 3, 5, 24, 25 and 26, are not included in this table, as discussed above. 15 of the stray cats and 6 of the owner surrendered cats were in an acute state of stress. Table 9 shows the average CSS for these acutely stressed cats in the owner surrendered respectively stray group, together with the *t*-test of whether these averages are significantly different. The table shows that this is not the case, i.e.

that owner surrendered cats does not in the present study display a significantly higher level of stress when compared to stray cats.

Table 9. Average level of stress for strays versus owner surrendered cats displaying acute stress.

		Strays	Owner surrendered
State of stress (CSS)	**Average**	5.20	4.86
	Standard Deviation	1.15	1.35
	Number of cats in sample (N)	15	6
	s_p	1.21	
	t	0.58	
	df	19	
	P	0.57	

It is thus not expected that the owner surrendered cats need more sessions to reach first sign of improvement when compared with stray cats brought to the shelter. Table 10 confirms this. The table shows the average number of sessions needed to reach first sign of improvement for the strays respectively the owner surrendered cats, together with the standard deviations of these averages. The *t*-test of the difference confirms the hypothesis that there is no significant difference between the two averages.

Table 10. Average number of sessions until first sign of improvement is seen for strays versus owner surrendered cats

		Strays	Owner surrendered
Number of sessions until first improvement	**Average**	4.06	3.63
	Standard Deviation	2.84	1.92
	Number of cats in sample (N)	17	7
	s_p	3.25	
	t	0.83	
	df	22	
	P	0.41	

Selected case studies

In the following is given a short presentation of 6 of the case studies that each in its own right represents extreme situations that may be met when clicker training stressed, nervous, fearful,

withdrawn and/or aggressive cats in rescue shelters. All other cases in the study can more or less be categorised as resembling one or a combination of two, of these cases.

Rylle (case 3): The easy 'standard' case where food and no use of force made all the difference

Rylle was born in the SDAD shelter on august 19., 2010. She and her siblings were hit hard by cat flu during the autumn of 2010, and most kittens in the litter died. After the illness Rylle became withdrawn and fearful of everyone in the shelter, maybe because of all the medication they had to give her when she was ill (cats generally do not like to be medicated). When the training started Rylle was hiding under her blanket whenever anyone entered the room her cage was in, and hissing violently at anyone trying to interact with her.

Table 1 shows that it only took 2 training sessions to reach first sign of improvement with Rylle. The initial training focused on reinforcing any sign of interest in food and moving on to targeting on target-stick. As can be seen in her training log in Appendix B Rylle moved very quickly from hiding to being out in the open eating food and targeting during the first 2 trainings sessions, the reason being that she could not resist the wet food offered.

Rylle had been used to all contact being forced on her from the shelter staff; medication when ill, taken out of the cage for cleaning when she did not want to be touched, and 'force-petting'[19] from volunteers. Her natural, and very high, interest in food together with not forcing her to do anything, but on the contrary allowing her to set the pace herself, is believed to have done all the difference in her case. Rylle, who was adopted by the author of this study, is today a *very* confident young cat, showing very little fear in any situation.

Sofus (case 4): The case where food was not enough

Sofus was found as a stray when he was a very young kitten. He had stayed in the SDAD shelter since rescued, in a big cage together with several other kittens. Contrary to the other very outgoing kittens Sofus was withdrawn and hiding in his sleeping box and hissing at anyone trying to approach him. He had attacked a volunteer quite viciously when she petted him one day, sending her to the emergency room.

The initial training of Sofus focused on reinforcing any interest he showed in the food offered, the trainer or the target-stick. There were small signs of improvements with him, but not nearly as quickly as with Rylle described above. As can be seen from his trainings log Sofus did show some interest in the food used as reinforcer but was very hesitant to interact with the trainer, and would not approach the front of the cage. Then, at the 6'th training session the trainer started to use play with a feather stick, instead of food, as positive reinforcer, and what a change that made! Suddenly Sofus would approach the front of the cage, sit on top of his sleeping box, look the trainer in the eye, and target on a finger. A video was shot of Sofus this day, which can be seen here: http://www.youtube.com/watch?v=vVnFiwdaC6Q. A completely different cat than the day before where food was used as reinforcer.

It took 6 sessions to realise that Sofus worked much better for play than food, because this was the first cat that did not react well to food in the study. Thus this case shows that many kinds of primary reinforcers should be tried out rather early in the training process, not to waste

[19] 'Force-petting' is a concept used in the SDAD when interacting with fearful or withdrawn kittens and cats. As long as the cat is not directly aggressive the staff and volunteers pet the cat where it is hiding or take it out and pet it on a lap, even though the cat shows signs of fear. The philosophy behind this 'flooding' (see e.g. Pryor, 2009, p 124) of the cat with petting is that it, through the interaction, will learn that contact with humans can be pleasant.

time. Sofus became a very lovely little cat, who loved to be petted by anyone and crawled all over them. He was adopted by a young couple in the spring of 2011.

Perle (case 20): The case where patience was the key

Perle was found as a stray and brought to the CPD shelter by a man who had taken care of him and fed him outside his house for a while. In the shelter Perle started by having serious panic attacks when taken out of his cage if he could not see a direct path back to his cage again. He was usually lying passively either in his cage or on a scratching post avoiding eye contact with anyone trying to interact with him. He passively accepted petting by people approaching him but did not seem to enjoy it. He had, however, been observed to purr and show his tummy when petted by the male caretaker in the shelter, Kasper, who Perle did not seem afraid of. But generally he was very vary of both strangers and of the other cats in the shelter.

Perle was approached like Rylle and Sofus, obtaining reinforcement for showing any kind of interest in the food, the target-stick, or the trainer. Primary reinforcers used in the beginning was food and moving away from his cage (as he seemed so nervous). In session 3 the trainer managed to get Perle to move after the target-stick instead of just lying passively in the scratching post where the training was performed this day. This session is thus recorded as first sign of improvement. On this day play was also offered to him and he reacted very well to it, so a combination of play and food was used from then on as primary reinforcers of any kind of activity.

However, even though Perle started reacting with some interest in the training by the third session it took several more sessions to get him to roam confidently around on the floor (~6 sessions) and even more sessions to be able to pet him when on the floor (~8 sessions). This was contrary to Rylle and Sofus where progress was fast when the optimal primary reinforcer was identified. Thus Perle's case shows that for some cats the progress is steady, but slow, but as long as some improvement is observed in each session the trainer should not quit. Perle ended by being a confident cat in the shelter, roaming freely around on the floor, not panicking when he could not see the direct way to his cage, and playing with the other cats. He was adopted by a family who already had a cat and is said to be thriving in his new home.

A video shot towards the end of the work with him, where Kasper is instructed in how to reinforce that Perle accepts petting on the floor and generally in interacting with him, can be seen here: http://www.youtube.com/watch?v=UmqEHA6Jhow&feature=related

Store Sylvester (case 26): The case where nothing worked

Store Sylvester is the sad story that shows that not all stressed cats in shelters can be helped by clicker training. Sylvester was owner surrendered, together with another cat Plet, to SDAD and *very* stressed by the situation. Where Plet overcame her stress within a couple of weeks, Sylvester kept hissing and spitting and threatening to attack anyone trying to approach him. This went on for over a month.

The training had no influence at all on Sylvester. He was difficult to approach and dangerous because his attacks were unpredictable. Moreover he was not interested in food or play. He did become a bit more relaxed towards the trainer and Maria, the person with overall responsibility for the cats at the SDAD. But he was still very unreliable; the one minute he could seem friendly and inviting and the next hiss and try to attack. Contrary to Sissemor described below there did not seem to be physical reasons for his behaviour, even though it was difficult to assess as Sylvester became *very* aggressive when examined by the veterinary.

Seeing that Sylvester was so stressed by being in the shelter, with no sign of improvement and no significant reaction to the training after 3 sessions, he was moved out of the shelter to a caretaker. Here he initially became more trusting and relaxed. But after a while he started to show attention-seeking, assertive and threatening behaviour towards the caretaker, and ended up attacking her. He was thus taken back to the shelter but reacted so stressed and aggressive there that it was decided to euthanize him.

Sylvester is an example of a case where a cat is so stressed that nothing, neither food nor play nor moving away from the cat, gets through to it. He never habituated to the shelter environment, so it was not even an option to wait for a while and then try training him again. In such a case it is very difficult, if not impossible, to use clicker training to alter the cat's behaviour and level of stress. Thus Sylvester shows that even though many stressed cats in shelters *can* be helped using clicker training some must sadly be given up.

Fanta (case 29): The very aggressive case

Fanta was surrendered by her owners to the shelter because she was aggressive both towards the wife of the couple that owned her, and because she had displayed aggressive behaviour (lashing out) twice towards their baby son. As her attacks towards the female owner could be quite vicious (uninhibited biting and scratching) they were afraid this would be transferred to the son, and thus dared not keep her anymore. She was, however, also described as a very loving and playful cat when not aggressive. The reason for her behaviour was judged, by the author of this study, to be play aggression that had escalated when she grew up, to become assertive aggression, i.e. aggression used actively by the cat to get what it wants from its owners (see e.g. Halls 2005. Pp 104-105; Landsberg et al., 1997, pp437-439; Delgado, 2008).

Fanta seemed very stressed by suddenly finding herself in the shelter; she hissed at everyone who approached her cage, and tried to attack most people opening her cage (to clean etc.). Towards the trainer, that offered her special treats which she was very fond of, she for a long time oscillated between being very friendly and inviting the trainer to pet her and then she could turn and attack very viciously, with no discernable provocation (the trainer today has scars to prove this!). She did not seem fearful, but on the other hand very confident and outgoing in her aggression.

The training of Fanta started out different from the other cases described above. As Fanta was so unpredictable, the trainer had a solid glove on the one hand that was then calmly moved towards Fanta inside her cage. If Fanta attacked the hand it was kept there until she stopped the attack and put all four paws on the ground, and then the trainer clicked and moved the glove away (negative reinforcement of not attacking), followed by a treat. When Fanta showed friendly behaviour towards the gloved hand (butting her head against it for example) this was also reinforced by click+moving the hand away+treat.

After 3 sessions Fanta seemed very happy to see the trainer every time she arrived, but she still shifted between being very friendly and suddenly attacking violently with no apparent reason for the next 8 sessions. However, the frequency of attacks decreased after an initial increase. After session number 11 Fanta was allowed out of her cage at night and could thus roam the whole room. This helped on the aggressive behaviour seeing that subsequently Fanta only attacked when in the back of her cage, or when taken around the base of the tail. The training proceeded by using controlled pressure on Fanta, reinforcing that she accepted rubbing all over her body, carrying her around, carrying her in and out of her cage, and especially taking her around the base of the tail and rubbing her under the tummy which were

very sensitive spots to Fanta. Around session number 14 Fanta's attacking behaviour was not different from what can be expected of any cat that is being petted on sensitive spots.

At the time of writing this (September, 2011) Fanta has been adopted by a single woman. She is reported to be loving and friendly even though the new owner has seen her being aggressive once when pressured. However, this is what can be expected of many cats in new surroundings. It is thus remarkable that Fanta, who has previously terrorized her former female owner, is now living with a single woman without showing notably signs of aggression.

Fanta is an example of how clicker training can also help cats that have been put in shelters due to aggression problems. Contrary to Store Sylvester described above, Fanta could not resist a certain treat, and this combined with controlled pressure changed her behaviour from unprovoked attacks to being friendly and forthcoming.

Sissemor (case 24): The case affected by externalities

Sissemor is a sad case that must also be mentioned here as it shows that the trainer is sometimes up against unknown externalities, i.e. factors outside the control of the trainer, which affect the process.

Sissemor, a young female cat, came to the DCP as a stray. She was very quiet and withdrawn in the shelter, slept a lot, did not seem interested in anything, and accepted petting passively. The training was commenced to see if she would become more outgoing and interested in her surroundings.

The training was initiated as with the other withdrawn or fearful cats, by offering various kinds of food and play. Sissemor did not really seem interested in anything, but was finally convinced to eat a bit of tuna, which was then used to try to make the clicker a secondary reinforcer. There was small progress with this, and the trainer next started to give Sissemor tuna when she sniffed a finger. And even though she liked the tuna she did not seem to make the connection with sniffing the finger.

After two trainings sessions it was discovered that Sissemor had a pellet behind her ear. When examined with x-ray by a veterinary it was realised that Sissemor also had pellets inside her head and she was euthanized. Thus Sissemor is a case demonstrating that things outside the control of the trainer may affect the training process. Thus factors as sickness and pain should always be taken into consideration if a cat in a shelter seems stressed, withdrawn or very aggressive, and does not react to training initiatives.

Conclusion and discussion

This report has presented the results of a study of to what degree clicker training can be used to alter the behaviour of stressed, fearful, withdrawn and/or aggressive cats in rescue shelters. It is the hypothesis of the study that clicker training will be beneficial in reducing the level of stress in such cats and change their behaviour to be more trusting and outgoing towards their environment and the humans they meet in the shelter.

The study includes training of 29 cats in two Danish rescue shelters during the first half of 2011. All cats were pointed out by the shelter staff as being of special concern, either because they seemed stressed, displayed fear or aggression, or because they were withdrawn and did not want to interact with staff, volunteers or the other cats in the shelter. All cats were further diagnosed by the author of this study before the training was commenced as being either in an

acute state of stress or in a permanent state of stress. Each cat was then clicker trained individually by the author of this report.

Summary of results and conclusion

The study has shown very encouraging results; Of the 29 cats trained 27 reacted positively to the training within an average of 3.8 training sessions each lasting 10-40 minutes.

Only two cats did not react to the training at all, namely cases number 24 and 26, Sissemor and Store Sylvester, both illustrating situations where the use of clicker training can be unsuccessful, as discussed above. One (Store Sylvester) because the cat stayed in such a high level of stress that it could not react to any offered primary reinforcer, and the other (Sissemor) because the cat turned out to affected by a serious injury to the head. Both cats were euthanized. Three more cats were euthanized during the cause of the study, case 7 (Daisy), case 18 (Humle) and case 25 (Brune). Brune and Daisy because of illness not related to behaviour problems, and Humle because the shelter staff assessed that he was too reactive when touched and thus not safe in a new family. However, Humle reacted very well to the training already in the first session, and it is therefore included in the data material as a successful case.

The study has further shown the following results:

- There is in this study no significant increase in the number of sessions needed to see a first improvement for the cats when the age of the cats increases.

- The study indicates that there is no significant difference between the number of sessions it takes to reach first improvement for the acutely and the permanently stressed cats.

- For the acutely stressed cats it has been shown that there is a significant increase in the number of sessions needed to train the cats before first improvement is observed when the level of stress of the cats increases. An average increase in ~0.9 sessions should be expected each time the cat's stress score increases by one unit, starting with ~0 sessions when the cat is fully relaxed and not stressed.

- There is in the present study no difference in the number of sessions needed to reach first sign of improvement for stray cats and owner surrendered cats, and furthermore these two groups do not differ significantly in their initial level of stress.

It is concluded that clicker training can be used with great advantage in rescue shelters to help stressed, fearful, withdrawn and/or aggressive cats to calm down and become more friendly and outgoing.

An average of 3-4 training sessions each lasting 10-40 minutes is needed to see a cat that is hiding under its blanket or sleeping all the time change into being interested in its surroundings and seek contact with staff and visitors in the shelter. The clicker training techniques used to train most of the cats in this study, excepting the aggressive cats (e.g. case 29, Fanta, discussed above), are simple target and contact exercises that are easily learned by most people interacting with animals daily, and thus already using reinforcement techniques, even though they may not have learned the theory behind. With regard to working with play or assertive aggression, calm behaviour combined with solid clothing and gloves is the first step, both things that are generally necessary when working in shelters (even though gloves are only needed some times).

Discussion

The fact that there is a significant increase in number of sessions needed to see first sign of improvement when the acute stress level of the cat increases may lead to the argument that effort should only be given to train moderately stressed cats (Cat Stress Score 3-4) not to waste time and resources. However, even very stressed cats (Cat Stress Score 5-7) will on the average need only 5-7 sessions to reach first sign of improvement, i.e. one session a day lasting 10-40 minutes for at the most a week. The author of this study will thus argue that the benefits resulting when the very stressed and/or fearful cat suddenly relaxes and becomes more outgoing and trusting should outweigh the costs of putting in a bit of extra time and resources. On the other hand experience has shown that some very stressed cats cannot be helped (case 26, Store Sylvester), the indicator being that it is not possible to interest the cat in any positive reinforcer within 1-2 training sessions, not even by leaving the positive reinforcer in the cage and moving away (negative reinforcement). In this case it should also be considered whether the cat suffers from pain or illness (cf. Case 24, Sissemor), and if this is not the case, whether the cat can be helped by other means, e.g. moving the cat to a caretaker family if possible. In the end the question for these cats is what is best for them: to stay in a highly stressed and unreachable state in the shelter or maybe, in the end, euthanization. However, it should be emphasized that this was the final decision for 1 cat out of 29, i.e. ~3%, in the present study.

The fact that the age of the cat when the training is commenced does not influence on the average speed with which it is expected to react to the training is an interesting and very encouraging result, as it means that older cats, showing signs of stress, fear, withdrawal and/or aggression in shelters, should not be given up as impossible cases from the perception that "it is not possible to teach old cats new tricks". On the contrary it takes, on the average, the same number of sessions to reach first improvement in all cats, independent of their age.

In the study by Dybdall et al. (2007) there is a significant correspondence between the cats' age and their average stress level. This is not the case in the present study, and thus there is no risk that such a relationship is the underlying reason for the results discussed above.

It is interesting to note that in the present study there is no significant difference in the initial level of stress for the acutely stressed cats between owner surrendered cats and stray cats brought to the shelters. And thus, accordingly, that owner surrendered cats do not need more training sessions to reach first sign of improvement when compared with stray cats. These results do not correspond with the study by Dybdall et al. (2007) that find a significantly higher level of stress in owner surrendered cats when compared to strays brought to the shelter. The reason for this may firstly be purely statistical. While the present study comprises 15 owner surrendered and 6 stray cats in an acute level of stress, the study by Dybdall et al. (2007) comprises in all 86 cats, 35 owner surrendered and 51 strays. Thus the sample may in the present case not be big enough to display the same trend as Dybdall et al. However other factors may also play a part in the difference. E.g. the shelter environment; do the two Danish shelters have a more calming environment than the shelter employed by Dybdall et al (The Nebraska Human Society Shelter)? And maybe more importantly, the state of the owner surrendered cats when entering the shelter: Dybdall et al. (2007) points out that it is not known *why* the owner surrendered cats are in a heightened level of stress, compared with strays. It may be caused by the separation from loved owners and a known home environment, in which case it is clearly expected for the cats to be very stressed in the unknown shelter environment. But on the other hand cats may be surrendered to a shelter due to behaviour problems, in which case the cats may already have been stressed in their home environment given the conflict with their owners. In this case they may actually relax more in the shelter environment when away from the owners.

Limitations of the study and possible future work

Firstly it is clear that a sample of 29 cats is still small when wanting to obtain reliable and significant indications of the general effect of clicker training on shelter cats. Especially when the cats are divided into subgroups, e.g. owner surrendered versus stray cats, and various parameters of the groups compared. As discussed above the small sample may be one reason why the results in the present study do not correspond with the results presented by Dybdall et al. (2007). It would thus be interesting to expand the study to a larger sample, ideally of the same order of magnitude as the sample employed by Dybdall et al. (2007) or larger. Furthermore it would be very interesting for future work to study factors affecting the initial stress level in owner surrendered respectively stray cats, e.g. how the shelter environment itself and the cat's previous history affects its level of stress when entering a shelter (cf. the discussion above).

Secondly the Cat Stress Score (Kessler and Turner, 1997) applied in this study is to some degree a subjective measure. I.e. the assessed stress score of a cat may vary from one observer to the next. To gain higher accuracy in possible future work it would be ideal to have (at least) two observers of the cats' level of stress, or alternatively supplement with alternative measures of the stress level. E.g. measurement of the level of cortisol in the cat urine, as described by Kristensson (2011, p 6). This is still a fairly simple measurement technique (as opposed to drawing blood samples), as the actual sampling could be performed by e.g. giving the cats plastic pellets in the trays (assuming the cats would want to use the tray in this case). But it would require inclusion of equipment for measuring the amount of cortisol in the urine, e.g. through cooperation with a veterinary.

Thirdly cats from only two shelters have been used in the present study, and unfortunately only 7 cats out of the 29 from the DCP. The results of the study may thus be biased by the specific environment in especially the SDAD. It could be asked whether the average stress level of the cats are significantly different in different shelters and whether there is a significant difference in the fraction of permanently stressed cats in the different shelters. This would however firstly require a larger sample, as discussed above, to obtain reliable results, and secondly inclusion of more shelters in an extended study.

Finally not many aggressive cats were included the study, actually only cases 25 (Brune) and 29 (Fanta). Of these case 29 is the most remarkable (see also the specific description of this case in the section 'Selected case studies') as this cat used aggression assertively to get her way, both with her previous owners and with the shelter staff. Brune on the other hand was young and boisterous and displayed play aggression due to understimulation. He quickly abandoned this behaviour when clicker trained, which shows that clicker training can also help understimulated cats in rescue shelters to vent their excessive energy. However, case 29 is especially interesting in that respect that it is, at least by the opinion of the author of this study, a success; Fanta stopped being violently aggressive during the course of the training and is today living happily with a single woman (where she terrorized the female owner in her previous family!). Numerous cats are abandoned to shelters each year or worse, euthanized, due to aggression towards their owners. When the cats end up in shelters it is often difficult to decide what to do with them as they are potentially dangerous. Thus also in rescue shelters such cats may be euthanized (of course depending on the shelter policy for destroying animals). However Fanta's story suggests that the behaviour of such cats may be altered, if the cat reacts well to clicker training, thus making it possible to rehome such cats to new families. However, how large a fraction of such cats that can be helped, and the average amount of work needed to change their behaviour needs closer study, which could be a very interesting subject for future work.

Integrating clicker training in cat rescue shelters

For me, the author of and trainer in this study, it seems clear that clicker training could and should be used in cat rescue shelters in the future. In my opinion this study clearly indicates the possibilities and potential of implementing simple contact and target exercises in the daily work with cats displaying stress, fear, withdrawal and/or aggression, even though the latter type of cats may demand more complex training methods. However, from being part of the shelter life on an almost daily basis as a volunteer for more than half a year while training the cats, and having also worked myself in a shelter on a part time basis, I recognize the shortage of time, staff and resources which is an almost inevitable part of running rescue shelters. It is clear that it may be difficult to find time and resources to educate shelter staff in the basic principles of clicker training used in most of the work in this study.

However, I believe that the education in the simple target training itself could be completed in a weekend course of 2×6 hours, preferably held at the shelter. The first day should cover (i) general introduction to the concept of stress, (ii) discussion of how stress may influence cats placed in rescue shelters, and (iii) introduction to basic learning theory. These subjects are all touched upon in the theory section of this report. In connection with point (ii) shelter staff should be asked to identify cats they feel are stressed in their shelter, as a preparation for day 2; this day should be initialised with an introduction to clicker training and how to use this for basic target exercises on target-stick and finger, plus for reinforcing any sign of contact seeking from the cats (e.g. rubbing against the hand as outlined in the methods section). Day 2 should be continued with direct supervised work with the cats identified on the first day, and ended with an evaluation session where the staff/students should consider what they did wrong/can do differently/new ideas.

For working with aggressive cats I recommend an extra, third, course day, covering (i) the concept of aggression, (ii) discussing various types of aggression in cats, (iii) introducing the more complicated method of combined positive and negative reinforcement used for working with the aggressive cats in this study, and (iv) preferably again supervised training sessions with aggressive cats in the shelter.

As discussed above it may be difficult to find time and resources to appoint daily training sessions with stressed cats in the shelters. If this is not possible ways to incorporate the clicker training in the daily tasks in the shelter should be considered e.g.: (i) the clicker can be 'charged' by clicking every time food is served in the daily feeding sessions, (ii) during feeding both withdrawn and aggressive cats must exhibit positive (and for the aggressive cats, calm) interest in the handler before being fed[20] (and of course the behaviour must be reinforced with a click before food is served), the interest only needing initially to be movement of the eyes towards the foodbowl and the feeder for the very nervous cats, and (iii) use target training to get cats in and out of the cages during cleaning.

It should also be considered to include dedicated volunteers alongside the shelter staff in the 2-day course described above. Many volunteers participate in the daily feeding and cleaning in the shelter and they could thus also incorporate clicker training in this work as described above, at least for the nervous/fearful cats (for safety reasons volunteers should as a rule not interact with aggressive cats). Many volunteers also aid in the shelters by simply interacting with the cats through petting and grooming, and for these a volunteer training program could be set up, where interested volunteers could be given the 2-day course described above, and then be given specific clicker training tasks (again not for the aggressive cats) in the shelter.

[20] Of course the cats must eventually be fed, but the staff should move on and feed the other cats in the room first if the focus cat does not display the wanted behaviour in the first try.

The future and final thoughts

To end this report I must express what a great experience, inspiration, and learning process this work has been for me. It has been *hard* work, but worth every bit of it. I feel that the practical experience this process has given me is invaluable; theory and techniques read in a book is one thing, but by bringing it to life, seeing the results of applying learning theory and knowledge about cats in practise, making mistakes (and there have been some!) and learning from these, have given me a whole new, and more solid, background for working with cats in the future, both in rescue shelters and in peoples' homes. I hope to be able to continue my work with training stressed and aggressive cats in rescue shelters, and ideally expanding my knowledge about how clicker training can help such cats, hopefully through pursuing one or more of the ideas for future work outlined above. Moreover I am already now, at the time of writing (September 2011), using clicker training more systematically in my individual behaviour therapy; the study has taught me that a large fraction of stressed/nervous/fearful cats *can* be helped through clicker training, which may also aid in changing the behaviour of aggressive cats. Thus when I now meet a fearful or aggressive cat in an individual therapy session, I assess whether simple clicker training techniques, very alike the ones used in this study, may be helpful alongside the rest of the therapy program, that may include activation, environmental changes, and in some cases supplementary remedies. This is opposed to before I commenced this study, where I of course also used training (desensitization, counterconditioning, extinction etc.) in the behaviour programs, but maybe - honestly - in a less systematic way, and with less confidence that it would work. Today I am already getting positive feedback from the first owner of a fearful cat that uses clicker training in the therapy for her cat.

Finally I must say that I am amazed by the huge work put into caring for unwanted animals in the two rescue shelters I have trained cats in, and by the continuous compassion and care shown towards the animals by the staff and volunteers, often under very stressful working conditions. Working in a shelter means heaps of 'highs', cuddling a cute kitten or puppy or seeing a cat or dog being adopted by a new family, but also includes many depressing days, when sickness roams among the animals, maybe killing some, or when an animal is so stressed in the shelter environment that it seems inhuman to keep it there. Shelter staff and volunteers are faced with these 'highs' and 'lows' on a daily basis, which demands compassion but also dissociation, not to break down every time an animal does not make it through the shelter to a new family. I hope this work will be an aid in shelters when faced with fearful/stressed and aggressive cats, and thus turn some daily 'lows' to 'highs' when a cat hissing at the back of the cage suddenly approaches the front with a newly found interest in its surroundings. It *will* demand a bit of extra initial work and resources, learning the training techniques, and finding ways to implement them, but as said above, I feel it is really worth it, and should be seriously considered by rescue shelters, as many cats *can* be helped to a better life in the shelter, and through this given an increased chance of moving on to a new family.

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