

Effects of Early Intervention Social Enrichment on Emotion and Affiliative Behaviour of Cats in an Animal Shelter

by

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Bachelor of Science, University of New Brunswick, 2008

A Thesis Submitted in Partial Fulfillment
of the Requirements for the Degree of

Master of Interdisciplinary Studies

in the Graduate Academic Unit of Interdisciplinary Studies

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This thesis is accepted by the Dean of Graduate Studies

THE UNIVERSITY OF NEW BRUNSWICK

August, 2024

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Abstract

Domestic cats (*Felis catus*) experience stress upon entering an animal shelter due to a change environment, and other factors. The aim of this study was to evaluate the effects of human social enrichment on emotional and affiliative behaviour of cats within the first three days of admission to an animal shelter. Forty-six cats were admitted to an animal shelter in Fredericton, New Brunswick, Canada, and were divided into two groups, enriched and control. Cats in the enriched group participated in daily 7-minute petting sessions. Results indicate that enriched treatment cats displayed a 13% increase in the duration of affiliative behavior and were more content compared to control. Additionally, anxiety in all cats decreased over the three days with enriched cats showing a 2% greater trend towards decreasing time spent in an anxious state. Application of practical approaches to increase shelter cat sociability may increase interactive behaviours and improve adoption potential.

Dedication

I dedicate this study to my study cats and to all the cats of the world, past, present, and future who need help. May this work serve as one small step towards a better life.

Acknowledgements

I would like to express my sincere gratitude and appreciation to my supervisor Dr. Graham Forbes for the guidance and support over the years. I am beyond grateful for my supervising committee member Dr. James Ha for his insightful feedback, guidance, and for sharing his depth of knowledge in the subject area and for serving as my mentor over the entire length of project. Thank you to Dr. Nadine Gourkow for helping me set up the project and for sharing her critical insights. Thank you to Dr. Andy Didyk for serving on the graduate committee and for his manuscript reviews. A big thank you to Annette James and the staff at the Fredericton SPCA, who were helpful and full of real-world education with a shelter environment. Thank you to Ray Allain, my dad, who helped with technical components related to security system set up and odd jobs, and to my mom, Anita Allain, for helping with the family when I was not able to be there. The completion of this thesis would not have been possible without the strong support from my husband, Jeffery White, and encouragement from my children Jacob and Jesse White.

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List of Symbols, Nomenclature, or Abbreviations

ABC	Attachment and Biobehavioural Catch-up
CFHS	Canadian Federation of Humane Societies (Currently Humane Canada)
FSPCA	Fredericton Society for the Protection of Cruelty to Animals
HPA	Hypothalamic-Pituitary-Adrenocortical
NBSPCA	New Brunswick Society for the Prevention of Cruelty to Animals
NSCDC	National Scientific Council on the Developing Child
S-IgA	Secretory immunoglobulin A
SPCA	Society for the Protection of Animals
SPCAI	Society for the Protection of Animals, International

Chapter 1: Introduction

The Society for the Protection of Cruelty to Animals (SPCA) was originally founded in England in 1824 to prevent the abuse and neglect of horses used to pull carriages before the widespread use of automobiles (SPCA International, 2024). The society later expanded its mandate to include dogs (*Canis familiaris*) and cats. The first North American SPCA was established in 1866 (SPCA International, 2024) and the first animal welfare organization in Canada (The Canadian Society for the Prevention of Cruelty to Animals, now known as the Montreal SPCA) was established in 1869 (Montreal SPCA, 2024).

Originally based out of St. John, the New Brunswick SPCA (NBSPCA) was formed in 1881 to serve to protect working horses from abuse. With the decreased use of carriage horses, the NBSPCA shifted focus to smaller animals following an increased interest in public ownership of companion animals. The society continues to assist with the protection of farm animals. A movement to found local SPCAs and animal shelters that could serve to house and care for large numbers of companion animals soon followed (NB SPCA, 2024). While local SPCA's, animal shelters and city pounds house and care for large numbers of animals, struggles in funding and resources continue. In Canada, shelters have traditionally been tasked with caring for the basic physical needs of companion animals, which includes provision of food, water, shelter, and veterinary care. While many shelters do the best they can with limited staff, resources, and funding, many do not have the ability, space, or knowledge to properly care for an animal's emotional health needs. As a consequence of a basic lack of enrichment (promoting an animal's ability to perform instinctive behaviours that it would in nature) (Gourkow & Phillips,

2016), animal welfare declines. When an animal remains in shelter for a long period of time, it often becomes ill or displays behaviour problems, after which the chances of it being adopted decrease. In 2021, in Canada alone, over 7,281 cats were euthanized in animal shelters by rescue groups and municipal pounds. Upper respiratory disease and behaviour issues were cited as the main causes of euthanasia (Humane Canada Annual Report, 2021).

Motivated by a need to reduce illness and euthanasia in shelter, staff have a desire to identify and implement effective, affordable treatment that takes little time and that have been shown to improve physical and emotional health in shelter cats. In addition to an increase in welfare and adoption, effective enrichment practices also reduce operating cost. Enrichment practices effective in improving emotional health for cats in shelter have been shown to have positive outcomes on health, length of stay and adoption rates. Reducing length of stay is particularly important for no-kill or adoption centre type animal shelters where illness or undesirable behaviour may be caused by long term confinement. Improved emotional health can also facilitate learning, enabling animals to more easily approach and interact with caretakers as well as potential adopters (NSCDC, 2010). While some research has been done to improve animal welfare for cats, there are many more areas related to feline behaviour and emotional health that need to be studied to change the way animals are treated, not just in a shelter environment, but also in society. Having a more thorough understanding of therapy methods that can effectively and efficiently improve feline emotional health and increase instances of cat-human interaction in shelters can dramatically increase adoption rates and decrease operating

funds used for medical treatment and, instead restructure staff time budgets from reacting and treating illness to a model of “feel good” preventative care.

1.1 Background

Having spent time working or volunteering in the animal welfare field, I decided to design a project that could result in useful information that could help animals in shelters. I chose to work with cats because they have the highest numbers and the highest euthanasia rates in North America shelters compared to dogs or small animals (CFHS, 2015).

Initially I explored different options to measure stress. After taking on a small pilot study with the SPCA, and doing and further research, it did not seem like a promising path forward. The pilot study which took place April – December 2015, consisted of twice daily measures of behaviour as well as physiological health indicators such as water and food intake and the weight of urine clump and feces. Treatment also took place twice daily. These additional factors required two visits to the shelter daily as well as the assistance of shelter support staff. After the pilot ended, it was clear that the shelter did not have the capacity to provide the staff time commitment required of the research project. In addition, data collection challenges emerged where I was not able to be present during the process and work schedule challenged my ability to visit the shelter twice daily. Improvements and simplifications were made that would still allow for good data collection but resulted in a reduced number of variables that were collected. Although data collection for the actual project did take much longer than I anticipated, I was still able to complete the project.

1.2 Animal Behaviour

Information transmitted to and from the mammalian brain is a continuous set of processes that are always at play to help an animal survive. Stimuli observed or felt by an animal must very quickly be perceived as good, bad, or neutral while assigning some level of degree. If a threat is perceived as imminently threatening to life, an almost instantaneous set of responses must occur both at the physiological and behavioural levels if the animal is to survive. Threat responses are characterized as flight (run away), freeze (stay still) or fight the perceived danger. If this split-second set of reactions does not occur fast enough, the animal may not survive. Conversely, if the animal has a perceived sense of safety, and its biological (physical, emotional, cognitive) needs are met, then a state of homeostasis is achieved, and the animal should thrive.

The least invasive manner for researchers to decipher what is taking place at a physiological level within an animal is to observe the animal's displayed behaviour, simply defined as anything an animal does. If the observed behaviour has been correlated multiple times with various physiological biomarkers, then the analysis of the behaviour becomes further supported decreasing or removing the need to continuously measure invasive physiological biomarkers.

1.3 Emotion

There is no clear consensus on the definition of emotion, particularly as it pertains to animals (Izard, 2010). However, scientists agree that although the conscious experience of emotion cannot be assessed directly, neural, behavioural, and physiological indicators of emotion can be measured (Mendl et al., 2010). Furthermore, Mendl et al., (2010)

developed an integrative and functional framework to assess an animal's mood (long term emotional state). Gerrig et al., (2002) define emotion as “a complex pattern of changes, including physiological arousal, feelings, cognitive processes, and behavioral reactions, made in response to a situation perceived to be personally significant” (Gerrig et al., 2002). For the purpose of developing the UQ Indices of Emotions for Cats, (Gourkow, 2012) provided a working definition of feline emotion as “a biological process that can be triggered by external conditions meaningful to the animal's sense of wellbeing which alters behavioural and immune responses such that the animal may attempt to meet survival, safety or comfort needs” (p.30). Strongly considered an adaptive advantage, emotions can be perceived or interpreted differently by individuals, however when each individual experiences an emotion such as fear, the physiological and behavioural responses are similar. A key function of an animal's emotional (affective) system is to respond in a species-specific manner to stimuli which may be harmful or helpful. (Lang et al., 1993; Fox, 2008).

Recent research in animal welfare is putting greater emphasis on finding the behavioural and physiological biomarkers of emotions associated with poor physiological health and psychological wellbeing of animals in captivity. Gaining a greater understanding of species-specific stressors and the coping mechanisms of an animal's response is important. It is vital to additionally focus more holistically on measuring positive affective states to gain a better understanding into what constitutes good animal welfare in a shelter environment. It is by striving to achieve positive emotional states in cats that shelters will begin to see a decrease in stress-induced illness.

1.4 Stress

Typically, stress is defined as a failure to cope with factors in an animal's environment. More specifically, stress is a biological response activated when an animal experiences a threat to its homeostasis (Moberg & Mench, 2000). Perceived or real, any threat to an animal's internal environment can represent a stressor. Some stressors, however, can have a positive impact on an animal's health, ensuring survival, and allowing for adaptation to environmental changes (Moberg & Mench, 2000). Concern arises when an animal's response to stress causes "distress" and initiates harm to an individual's biological state (Moberg & Mench, 2000).

Stress is an important physiological indicator to recognize because it is associated with immunosuppression and disease. The stress response that accompanies emotional states such as fear was shown to have a significant impact on the respiratory health of cats in animal shelters (Gourkow et al., 2014a). Similarly in other species, it has been documented that captivity can increase stress, and have a negative impact on an animal's behaviour and physiological health (Wielebnowski et al., 2002). The author reports that exposing an animal to novel stimuli, including olfactory, auditory, or visual introductions which may be perceived as fearful, can induce anxiety and fear behaviour, and simultaneous associated physiological response.

1.5 Stress in a shelter environment

Many domestic cats experience a significant amount of stress upon entering an animal shelter environment (Gourkow et al., 2014a). Cats entering an animal shelter environment may experience a drastic change in routine and familiarity of surrounding.

Stressors within an animal shelter environment can include unfamiliar sights, sounds, and smells such as strange places (i.e. cages, or cat rooms), items, other animals or people. Animals such as dogs and other cats who enter their personal space can also be a significant source of stress for shelter cats (Stella et al., 2013). Left untreated, increased stress can greatly increase the likelihood that an animal will develop disease and remain in shelter for long periods or be euthanized (Jones et al., 1997; Gourkow et al., 2014a; CFHS, 2015).

Owner surrendered cats can be subject to an increase of stress from a loss of attachment from a previous owner (Edwards et al., 2007). In fact, one study showed that owner surrendered cats were more likely to experience higher levels of behavioural stress upon arrival compared to stray cats. Also, of all cats deemed unsuitable for adoption due to disease, occurrence of illness (i.e. upper respiratory infections) arose sooner in owner surrendered cats compared to strays entering shelters. Such an increase in stress can negatively impact a cat's behaviour and immune function, which can, in turn, decrease its adoption probability (Gourkow & Fraser, 2006; Dybdall et al., 2007; Gourkow et al., 2014a).

1.6 Stress applied to animal welfare

In a 2001 report, animal welfare scientists described welfare as “not merely the absence of stress, illness, and negative affective states; rather, it includes the experience of positive affective states” (Broom, 2001). Animal welfare has also been described as the animal's health condition as it tries to cope with its surroundings (Broom, 1988; Stella et al., 2013). Stress is a significant indicator of animal welfare. While stress is a useful indicator of poor welfare, the lack of observed stress behaviours is not necessarily an

indication of good animal welfare (Broom, 2001). An animal's ability to cope in a stressful situation is measured by its ability to reduce its physiological activation by performing certain behaviours that either change the intensity of the stressor (externally), such as moving away from a source of stress, or reduce its emotion related to the anxiety provoking situation (Stella et al., 2014). Unfriendly behaviours including avoidance, defensive aggression and/or frustration, can lengthen an animal's stay within a shelter environment, particularly when welfare needs aren't being met (Vojtkovská et al., 2022). Frustrated behaviours such as escape attempts, consistent meowing, hissing (Urrutia et al., 2019) can effectively reduce an animal's likelihood of adoption because potential adopters may view such individuals as unfriendly (Gouveia et al., 2011; Gourkow, et al., 2014a).

“Sickness behaviour”, described as an evolutionary means of survival, can be defined as a group of observed behavioural symptoms that can reflect physiological acute or chronic stress. These sickness behaviours appear to change the animal's normal drive to pursue routine activities such as searching for food and participating in social behaviours, to ones that reduce metabolic activity to encourage healing (Stella et al., 2014).

Characteristics of socialized cats experiencing good animal welfare include friendliness, playfulness, interactiveness, healthy appetite, and displaying interest in shelter staff and visitors. Such cats are more easily handleable, enjoy freedom from or reduction in illness, and get adopted more quickly (Gourkow et al., 2014a). Conversely, behaviours such as a decrease in appetite and activity, as well as an increase in defensive aggression and frustration, can lengthen an animal's stay within a shelter environment,

particularly when welfare needs aren't being met. Such behaviours can effectively reduce an animal's likelihood of adoption as potential adopters may view such individuals as unfriendly (Gouveia et al., 2011; Gourkow et al., 2014a). It has been suggested that allowing caretakers sufficient time to interact and establish a positive human-animal relationship can be an effective mechanism for a reduction in anxiety, an increase in content behaviours and thus improved animal welfare (Tanaka et al., 2017).

1.7 Stress and health

Inadequate animal welfare practices in an animal shelter environment can lead to changes in behaviour and physiology which may in turn decrease immune function, initiating development of disease at a more rapid rate, as well as increasing the likelihood of acquiring other stress related health issues (Wielebnowski et al., 2002; Cameron et al., 2004; Gourkow, et al., 2014b). Inflammation of the urinary bladder of unknown cause has been suggested by several authors to relate strongly with stressful events, increasing the likelihood of development of the disease (Cameron et al., 2004). When an animal experiences stressful conditions such as those encountered in an animal shelter environment, there is an increase in exposure to respiratory pathogens (Pedersen et al., 2004).

There is a strong link between stress and disease occurrence of upper respiratory infections correlated to residency time in an animal shelter where the longer an animal is in a shelter environment, the higher the probability the animal will contract an illness (Dinnage et al., 2009). With upper respiratory infections being the most common health concern and cause for euthanasia in shelters, it has recently been found that immunity, measured using a mucosal antibody (Secretory immunoglobulin A (S-IgA)), secreted by

different mucosal sites of the body (such as the nasal and mouth cavities) can prevent respiratory pathogens that are inhaled or ingested from penetrating the epithelial wall (Hannant, 2002; Gourkow et al., 2014b). One study on shelter cats examining correlations between behaviour and S-IgA found that the antibody was decreased in cats exhibiting anxious and frustrated behaviours (Gourkow et al., 2014a).

1.8 In-study measurements of health

It is common for researchers to use glucocorticoid analysis (ie. cortisol) as a physiological biomarker or indicator of stress. Activation of the hypothalamic-pituitary-adrenocortical (HPA) neuroendocrine system is widely thought to be the body's primary response to stress. While high levels of cortisol have been associated with high levels of negative stress, it can also be associated with an increase in excitement or pleasurable activities (Gourkow et al., 2014b). Anticipation of food, time of day, as well as eating, for example, has been found to be correlated with increases in cortisol (Saul et al., 2011; Gourkow, et al., 2014b). Therefore, attempting to correlate behavioural indicators of heightened stress with increases in cortisol can be difficult potentially providing limited information and as such was not attempted in this study.

Loss of appetite is a commonly observed response to negative stress in cats and is a pro-inflammatory cytokine induced sickness behaviour (Stella et al., 2013). Cytokine analysis has included measurement of interleukin-1 beta, interleukin-6, and tumor necrosis factor; all of which are thought to play an important role in expression of sickness behaviours (Raison & Miller, 2003). These cytokines communicate the presence of inflammation in the brain resulting in behaviour response by the animal (Raison & Miller, 2003; Dantzer & Kelley, 2007).

There are several observable indicators of behavioural anxiety such as hiding, as well as contentment behaviour indicators including maintenance of a healthy appetite and friendly approach to humans which, among many other marker behaviours, (see Appendix I) have been categorized into three distinct emotional profiles and validated with changes in S-IgA production and cortisol (Gourkow et al., 2014a). Although this study will not directly measure cortisol or S-IgA, examining behaviour expressions classified into three distinct emotional profiles, such as those found in the Gourkow et al., (2014b) study, that have been previously validated with cortisol and S-IgA, can lead us to identify emotional state more accurately at the behaviour level in an animal shelter environment (see Appendix I) and was measured in this study.

Multiple studies reveal a significant increase in observed sleep, pacing, tensing, inactivity (also termed “freezing”), and hiding behaviours which have all been correlated to high fecal corticoid concentrations (McCune, 1992; Kessler & Turner, 1997; Wielebnowski et al., 2002; Edwards et al., 2007). A clouded leopard (*Neofelis nebulosa*) study also showed that cortisol concentrations were higher in those animals exhibiting self injuring behaviours such as fur plucking or tail chewing (Wielebnowski et al., 2002). The study also recorded other observed behaviours, such as affiliative to attempt to correlate them with an emotional state (See appendix II).

1.9 Human socialization – treatment affects emotion

There has been research on the subject of stress related to animals in confinement as it relates to caretaker routine and involvement. A study involving clouded leopards confined to zoo settings found that fecal corticoid concentrations were increased in facilities where average number of hours spent per week per keeper were low and

decreased when the number of keepers were high (Wielebnowski et al., 2002). The amount of human interaction and types of care have been associated in various studies using glucocorticoid as a measurement (Carlstead, Brown, & Strawn, 1993; Pederson, 1994; Pederson, 1998; Hemsworth, 2000; Hemsworth, 2003). Another study involving rats (*Rattus norvegicus*) showed that short, timed socialization in the forms of play and petting type handling displayed a marked decrease in stress behaviour and physiological measures (Cloutier et al., 2012). In a study involving pigs (*Sus domesticus*), where chronic stress from aversive housing conditions was high, improvements in emotional state was observed through positive human-animal interactions and enhanced caretaking routines (Pederson, 1998). In domestic cats, laboratory housed animals were exposed to stress-inducing caretaking procedures, and analysis revealed suppressed exploratory and play activity with an increase in attempting to hide (Carlstead Brown, & Strawn, 1993). It has been suggested that allowing caretakers sufficient time to interact and establish a positive human-animal relationship can be an effective mechanism for a reduction in anxiety, an increase in content behaviours and thus improved animal welfare (Wielebnowski et al., 2002). Emphasis on high predictability, quality, and amount of care, including minimizing distress, are important factors to consider when seeking good animal welfare in a captive environment (Carlstead, Brown, & Seidensticker, 1993; Carlstead, Brown, & Strawn, 1993; Mellen, 1993).

1.10 Attachment Theory

Originally defined in a relationship scenario between a human mother and infant or young child, attachment is best described as the process by which a set of behaviours is organized to form a connection between a child and a preferred person. The result of the

process involved in building this connection or enduring relationship is called a bond (Ainsworth, 2015).

Healthy attachment is an emotional state of being observed through a set of species-specific behaviours that ensures survival of species and involves closeness between mother and child as well as maintaining close proximity to another animal to obtain protection and body warmth (Ainsworth & Ainsworth, 1978). Secure attachment can occur in conspecific animal relationships as well as human-animal relationships, often also referred to as “bonding.” In humans, when looking at newly admitted infants in a foster care system where any attachment with a parent figure has been broken, researchers created a relational intervention program called Attachment and Biobehavioural Catch-up (ABC) targeted to build nurturance, increase mutually responsive interactions, and foster caring relationships, enhancing children’s ability to regulate behaviour and physiology. The study found that children in foster care whose caregiver had participated in the ABC program, showed lower initial levels of cortisol than the control group, upon arriving to a test lab for a Strange Situation analysis (which tests the quality of an infant’s attachment to their primary caregiver). Levels of cortisol displayed among children given the relational intervention were like those found in a comparison group of children who have never been in foster care. Such results suggest that a type of relational intervention may affect the biology of animals entering a temporary care situation such as an animal shelter environment (Dozier et al., 2008).

There is evidence that such a bond can also be formed in interspecies relationships such as those between a person and a dog (Zilcha-Mano et al., 2012). Cats may experience separation behaviours if a bond was disrupted between themselves and their

previous owner or another animal (Hennessy, 1997; Edwards et al., 2007). In cats and some other animals, it has been found that a condition related to separation behaviours can occur called “separation anxiety” (Edwards et al., 2007). Described more commonly in dogs, separation anxiety in cats reveals behaviours that include episodes of anxiety, inappropriate urination and defecation, excessive vocalization, destruction of objects, and self-mutilation (Schwartz, 2002). One study involving cats found that when an owner leaves the room, cats spend more time in an inactive or “freeze” state, which may be indicative of anxiety (Edwards et al., 2007).

This decrease in activity and increase in cortisol levels when stressed has been found in other studies involving cats and has been termed a state of “freezing” (Carlstead et al., 1992; Hemsworth, 2000). Just as in human infant attachment studies, cats display an increase in exploration, and play while in the presence of an owner, both of which behaviours are indicative of a safe environment-instilling confidence, potentially using its owner as a “safe base” (Ainsworth & Ainsworth, 1978; Zilcha-Mano et al., 2012).

In a shelter environment, developing an early bond between cats and their caretaker may be important to nurture trust and reduce stress in a largely unfamiliar and perceivably unpredictable situation. This study sought to develop the thought that the earlier this bond can be established through human socialization, the sooner the cat may experience a more rapid decreased state of anxiety, an increase in positive emotional state expressed through content and affiliative behaviours, as well as a reduction in susceptibility to the development of stress-induced disease.

1.11 Expressed Affiliative Behaviours

One of the goals this research project was to build a case for easily observed affiliative behaviours that have been previously observed and supported by physiological biomarkers in mammals to serve as an indicator of a content emotional state. Affiliative behaviours are defined broadly as behaviours that support or improve the building of relationships or cohesion between individuals. Mammals do not typically display affiliative behaviours while under great stress unless a well-known affiliate such as another animal or person is present and used as a supportive figure (Bowlby & Hinde, 1969; Takeda et al., 2024). When an animal develops a bond with another animal (including a person), affiliative behaviours are displayed more frequently and can be a sign of good animal welfare. While many studies focus on cortisol as a physiological sign of stress, which may indicate poor animal welfare (Wielebnowski et al., 2002; Gourkow et al., 2014b), a lack with elevated cortisol and associated behavioural response does not necessarily equate good animal welfare (Broom, 2001).

In addition, research is showing that neuropeptides such as oxytocin and vasopressin that are released during bonding sessions can have a suppressive effect on the stress response system (Neumann et al., 2000; DeVries et al., 2003). Advancing research in biomarker and behavioural indicators that demonstrate increases in frequency and duration of affiliative behaviours will provide valuable data to help evaluate animal welfare concerns as well as support a shelter management framework where staff understand and utilize science-based techniques to reduce stress while building much needed social bonds needed to maintain good health and for successful adoption.

While there are many similarities among species in types of affiliative behaviours displayed, there are also many differences among species. When observing affiliative behaviours between intra-species animals, behaviours that are understood, displayed, and reinforced between receptive individuals, can function to build bonds within a relationship.

When attempting to form or strengthen social bonds, cats display several types of affiliative behaviours between other cats as well as with humans (see Appendix II). Expressions of such affiliative behaviours in cats include: allogrooming (Van Den Bos & De Vries, 1996), touching noses (Natoli et al., 2001a), face rubbing (Natoli et al., 2001b; Stella et al., 2014 (Natoli et al., 2001b), proximity to attachment figure (Bradshaw & Hall, 1999; Natoli et al., 2001b), tail up (intention to interact amicably) (Cafazzo & Natoli, 2009), rolling in front of another cat, (Van Den Bos & De Vries, 1996; Natoli et al., 2001b; Van Den Bos & De Vries, 1996), social sniffing and body rubbing (Van Den Bos & De Vries, 1996; Stella et al., 2014; Van Den Bos & De Vries, 1996) as well as social play (Van Den Bos & De Vries, 1996). Another possible affiliative behaviour studied between dogs and people (Nagasawa et al., 2017) as well as between cats and people (Bradshaw & Cook, 1996) is termed “eye gazing” and refers to the animal communicating or interpreting human behaviour by looking directly into their eyes for an extended period of time.

Although dogs are often credited with the highest level of interspecies bonding with humans, a 2005 study comparing communicative abilities between cats and humans with dogs and humans determined that there were no significant differences in the species’ ability to respond to human signals such as pointing to locate an object (Miklósi

et al., 2005). In a different experiment however, the same study also found that cats were not as able as dogs to use their species-specific communicative abilities to attract the attention of their owners in an attempt reveal the location of a hidden object, therefore speculating that humans may not be as apt to interpret cat communication attempts (Miklósi et al., 2005). The ability for both dogs and cats to interpret and understand human communication signals is quite remarkable and may also be one of the reasons why “devoted pet owners” believe that the two species are also able to interpret and respond to human emotion.

1.12 Research Objectives

The objective of the study was 1: to measure changes in the behaviour and emotional state of cats in an animal shelter when exposed to daily social enrichment by a familiar person after three days post intake as compared to baseline and 2; to examine a possible correlation between changes in emotional states and expression of affiliative behaviour.

1.13 Research Goal

My research examined the effects of social enrichment by a familiar human on qualifying cats admitted to the FSPCA. Changes in anxiety-related, contentment, frustration and affiliative behaviour were measured. The project determined the effects of a 7-minute social enrichment treatment on the health of cats and noted days until adoption.

We observed and analyzed behaviours that were previously validated with physiological measures of emotional health including anxious behaviours such as hiding

and content behaviours such as grooming to determine the effects of treatment. In addition, this study applied a novel approach to determine if the adapted treatment would affect the number of affiliative or bonding behaviours that cats display towards caretakers and attempted to correlate the behaviours displayed with the animal's emotional state.

My hypothesis stated that cats provided with a 7-minute social enrichment treatment will experience a significant decrease in anxiety-related behaviour, and an increase in both content and affiliate behaviour and that displayed affiliative behaviours will serve as an indicator of a content emotional state. Subsequently, treated cats will experience a greater number of healthy days in shelter and have a shorter time to adoption than cats not provided with enrichment (control group).

Chapter 2: Methods, Results and Conclusions

2. Methods

2.1 Intake and housing

Cats were initially examined by a trained shelter staff. Those older than nine months of age and found to be free of signs of infection, injury or poor dental health were placed in a cage in the intake room. There were no cats who were identified as pregnant during the study however, two were identified as lactating. One cat who entered the study, was reclaimed by their owner, and was released therefore not included in data collection. Cats had been vaccinated on first arrival by shelter staff with Felocell FVRCP modified live virus which protects against Rhinotracheitis, Calicivirus and Panleukopenia and de-wormed using Strongid T (Pyrantel Pamoate). In addition, to control for external parasites, cats were given Revolution (Selamectin). Spay and neuter surgeries were delayed until after cats had completed the study.

We recorded age, sex, neuter status, breed, weight, and intake situation (such as stray or owned status at time of entry) of selected cats. Cats were assigned to a Treatment (T) or Control (C) group and placed in a single housing stainless steel cage (28" x 28" x 22") with food, water, litter box, perch, and towel for bedding. Cages were cleaned and disinfected once daily after morning observation and sampling efforts by removing all litter and bedding material and wiping walls and floors with Preoxigard 7% accelerated hydrogen peroxide. Fresh water was provided daily, and cats were fed twice daily with a predetermined brand. The study was conducted under the University of New Brunswick's

Animal Care Committee permit# 10811, following the Canadian Council of Animal Care Standards.

Each cat remained within the study and in their group for three days. While intake order was alternated to ensure a relatively even sample size within each group, the initial order was randomly determined.

Efforts were made to assess cats on the day after arrival however, shelter management pressures to complete the study more quickly caused procedures to change, and therefore 7/47 (15%) cats were assessed on the day of arrival (Day 1).

2.2 Baseline assessment

A behavioural assessment was done to obtain information on the cat's baseline emotional state. Each cat was observed for 15 minutes with the researcher outside of the room. Observations were made using a Wi-Fi enabled Swann security system. After the 15-minute observation period, the experimenter entered the room to conduct a Human-Approach Test, adapted from Kessler & Turner (1997) and Gourkow & Phillips, (2015). The process was carried out as follows:

- 1) The experimenter stood in front of the cage (door closed) without interaction, no eye contact or verbal greeting for 2 minutes.
- 2) The experimenter spoke to the cat in a high-pitched soft tone looking at the cat with eyes partly closed for 1 minute.
- 3) Process was repeated with the door open followed by an approach of the hand without touching the cat for 1 minute. If the cat responded aggressively by growling, hissing and/or attempting to scratch or bite, the door was closed immediately. Responses that

were deemed negative included defensive aggression and retreat behaviour such as hissing, striking, flattens body and retreat. Responses that were deemed positive included calm and friendly behaviour such as relaxed body, raises head when petted on chin, approaches experimenter, and eat and drink during assessment.

The combination of viewing the cat from the monitor in the first hour combined with the Human-Approach test determined the cat's baseline Emotional Profile (Gourkow et al., 2014a) and general response towards humans.

2.3 Social enrichment sessions

Adapted from Gourkow (2014), treatment involved positive human interaction for one period of 7 minutes on each day between days 1-3. All treatment sessions were held after hours due to researcher schedule, delivered in a similar time window and by the same person each day. Positive human interaction or “gentling” is defined as stroking of the head and neck area of the cat together with soft, low, vocalization. Cats were gentled by stroking the cheek, under the chin, and between the ears with continuous vocal interaction. Depending on the emotional response of the cat, treatment conditions varied slightly to accommodate.

All gentled cats were greeted initially with a 30-second-high pitched tone of voice with the researcher visible, but the door closed followed by a 30-second greeting with the door open and no physical interaction (Table 1). Next, the researcher extended a hand and gentled the cat for 60 seconds. This step was followed by a 30-second withdrawal, during which time the researcher closed the cage door, stood beside the cage out of view and observed the cat's response on a computer screen. If the cat stretched his/her neck with

focus on the left front of the cage within the retreated 30 second period, then gentling was initiated immediately. If not, gentling was initiated at the end of the 30 second interruption. After the 30 second retreat, the researcher opened the cage, extended a hand and began gentling the cat again for a period of 120 seconds followed by a 30-second retreat (similar to above). After the 30 seconds, the researcher opened the cage door again and began gentling the cat for a period of 120 seconds. The door was then closed, and the researchers immediately left the room for 5 minutes. The control group experienced no specific treatment however the researcher stood in front of the cage for 7 minutes in full view of the cat. All other interaction was done as usual by shelter staff. The following modifications to treatment were made depending on the cat's response:

Modification Type 1: Cat aggressive response

A modified gentling routine for anxious cats was introduced to cats with an aggressive response during greeting, such as growling and/or hissing with or without a paw strike. In this case, the gentling was performed with the use of a stroking "tool" with a round rubber tip (Target stick, The Clicker Company, Canada: www.clickercompany.com). The door remained closed, and the tool was slid through the bars along the floor and raised up to the cat's chin initially, then over the cheeks and between the ears. Cycling followed the above protocol, where intermittent periods of visual and tactile stimuli were continued for 7 minutes.

Modification Type 2: Friendly forward response to human

If the cat responds positively (stood, walk, rub experimenter, or walk to food bowl to eat), then gentling was not interrupted and not limited to the head area.

The control group received typical or routine handling for feeding and cleaning, but there will be no additional time spent for socializing. To rule out the human presence factor, the experimenter stood in front of the cage with the door closed looking away from the cage and without vocal interaction for 7 minutes.

Table 1. Gentling treatment protocol for shelter cats.

Treatment Step	Duration (seconds)
Greet door closed	30
Greet door open	30
Extend hand and gentle	60
Retreat – no view by cat	30
Extend hand and gentle	120
Retreat – no view by cat	30
Extend hand and gentle	120

2.4 Indicators of emotion and stress

The following physiological and behavioural stress indicators were analysed in the study:

Table 2. List of emotion and stress indicators for measure in study (adapted from the University of Queensland Cat Emotion Indices (QC-CEI) (Gourkow et.al., 2014)

Type of Indicator	Name of Assessment	Definition of Assessment or Measure	Response Choice	Function of Stress Indicator and Prediction
Behavioural / Emotional Indicator	Emotional Profile Gourkow, (2014a)	Dimension 1, 2, 3 states of emotion: specific set of behaviours measured by frequency and duration.	Dimension 1 (anxiety) behaviours include: crawl, stand (flat), freeze, hiding, retreat, startle. Dimension 2 (frustration) behaviours include: crouch, scan,	-Reflective of emotional state; (Behaviours validated with cortisol and S-IgA); -Increases in dimensions 1 and 2 may reveal

		Other incidental behaviour observed	aggressive, pushing, pace, front escape, escape bouts, meow. Dimension 3 (content) behaviours include: stand (tall), on back (ventral high), *friendly to humans, *groom, *front sit, walk, eat, drink, sleep, *rub, on back (lie on side).	increased risk of development of upper respiratory infection and other stress precipitated or exacerbated illness (i.e. FLUTS/D); -Increase in dimension 3 is an indication of a positive emotional state with reduced risk of illness; may correlate with increased oxytocin
Behavioural / Indicator of Content Emotion and/or seeking relationship with human.	Affiliative Behaviours in presence of human	Specific set of bonding behaviours measured by frequency and duration.	Affiliative behaviours displayed towards humans include rubbing (face/body), tail up, sniffing, licking (representing allogrooming), proximity to humans, rolling, play	Unknown in literature except for behaviours which overlap with content

* These behaviours overlap with affiliative behaviours.

2.5 Data collection

Behaviour observation took place before, during and after treatment. A night-vision-enabled Swann security system was installed with six cameras mounted directly across from each cage to capture baseline as well as post treatment behaviour. Cameras recorded 24-hours daily. Video was automatically written over after 9 days. Post treatment focal sampling (5-minute total) was collected and analysed.

During treatment video sampling was taken with a GoPro camera mounted to the experimenter's body (head) to best capture affiliative behaviours. Treatment sessions were recorded 7-minute durations and later analysed (see Appendix III for full treatment schedule).

2.6 Statistical Analysis:

Data were tested for homoscedasticity and normality; no unusual bias was noted. Four primary analyses of the effects of the independent variables Treatment Group and Study Day for the total duration of time spent in one of the four observed behavior states were performed using Multivariable General Linear Modeling, with Treatment Group and Study Day treated as categorical variables and including the interaction term between the two independent variables: essentially, a Two-way ANOVA. Post-hoc establishment of mean differences was performed using visual observation of 95% confidence limits. Further analyses of the relationships between Treatment Group and other measures, such as Time in Shelter, were also run using GLM techniques. All statistics were conducted in Systat v13 (Systat, Inc). An alpha of 0.05 was used, with a "trend" defined as a probability (p) between 0.05 and 0.10.

3. Results

Incoming cats deemed suitable to enter the study were categorized as stray (22/46 (48%)), transfer from NBSPCA (3/46 (7%)), owner surrender (19/46 (41%)), and abandoned (2/46 (4%)). Initial emotional profile assessment revealed that (27/46 (59%)) of cats were content, (18/46 (39%)) were anxious, and (1/46 (2%)) of cats were frustrated. Results of initial human approach test revealed that (29/46 (63%)) of cats were friendly to humans and (17/46 (37%)) of cats were anxious/avoidance.

The study examined two sets of data. One set was recorded during treatment by head-mounted GoPro camera and thus with human presence; the other data set was recorded immediately after treatment via security camera after the human left the room. A

combined 27.4 hours (98,580 seconds) of video footage were used for analysis including 15.9 hours (57,234 seconds) for treatment with human presence and 11.5 hours (41,345 seconds) post-treatment with no human presence. Affiliative behaviours were only observed while the human was present. For the study, cats were categorized in a way that split a content emotional state into two forms including content emotional state expressed through content behaviours (CC) and content emotional state expressed through affiliative behaviours (CA). The CC and CA groups were categorized independently from each other.

3.1 Data Set 1 (Human presence during treatment, visible only for control)

Four generalized linear models, one for each behaviour category were generated in the first set of data. Results showed that 40% variability of the total duration of "affiliative" behaviours was attributed to study day and group. Affiliative behaviours, independent of treatment, increased daily over the three days (Figure 1). There was a significant relationship found between group and study day and an increase in affiliative behaviours ($F(2,131)=5.831, p=0.004$). There was a very strong, significant relationship with the treatment which revealed a dramatic increase in affiliative behaviours reporting ($F(1,131)=69.405, p=0.000$).

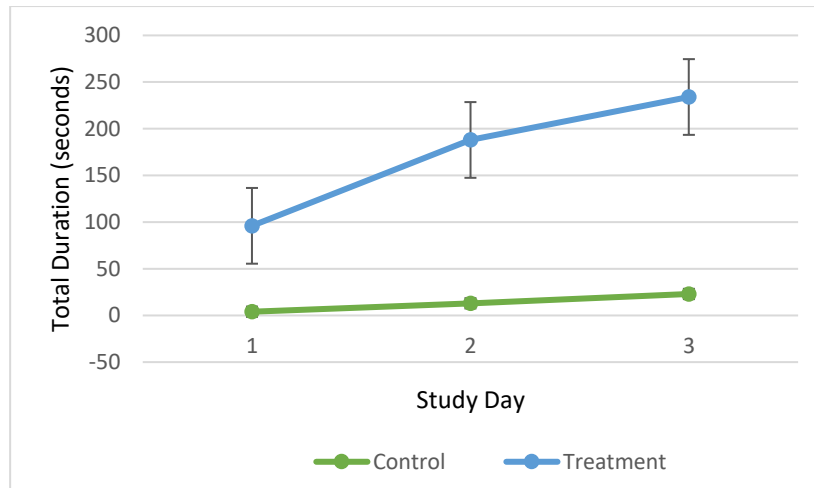


Figure 1. Human presence affiliative behaviour differences between control and enriched treatment at day 1, 2, and 3.

Combined, time and treatment resulted in a significant increase in the total duration of affiliative behaviours with an ($F(2,131)=3.472$, $p=0.034$). For “content” state behaviours, results demonstrated that 9% of the variability seen in the duration of a content state was attributed to study day and group. Content behaviour, independent of treatment, increased on each of the three days but were not significant ($F(2,131)=1.434$, $p=0.242$). However, there was a significant increase in the total duration of content state behaviours over time which can be attributed to the treatment effect reporting ($F(1,131)=9.966$, $p=0.002$) (Figure 2).

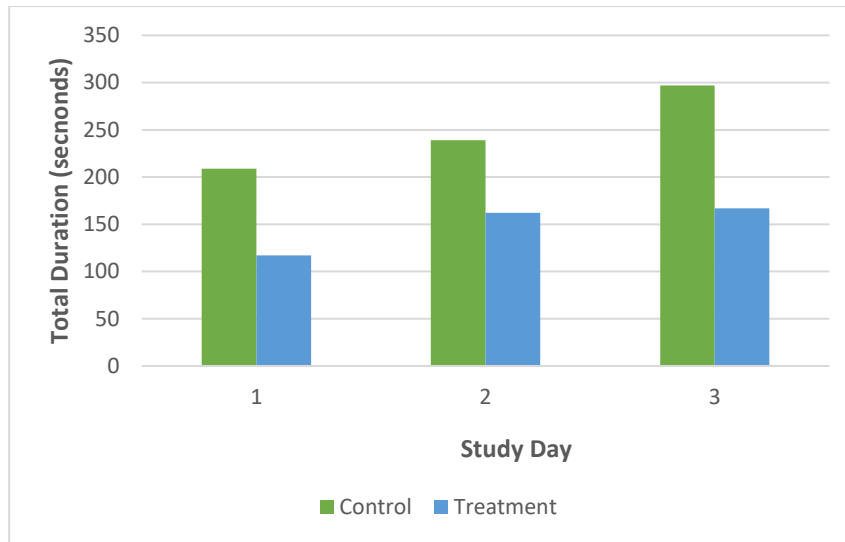


Figure 2. Human presence content behaviour differences between control and enriched treatment at day 1, 2, and 3.

For “Frustrated” state behaviours, results revealed that 6% of the variability seen in the duration of a frustrated state was attributed to study day and group. Frustrated behaviours, independent of treatment, decreased on each of the three days but not significantly with ($F(2,131)=1.439$, $p=0.241$). There was no significant decrease in the total duration of frustration state behaviours over time which could be attributed to the treatment effect reporting ($F(1,131)=2.535$, $p=0.114$). Considering “anxious” state behaviours, results demonstrated that 10% of the variability seen in the duration of an anxious state was a result of study day and group. We did observe a significant effect on anxious behaviours between study day, independent of treatment with ($F(2,131)=6.170$, $p=0.003$). There was a trend found where treatment effect decreased the duration of anxious state behaviours over time with mild significance revealing ($F(1,131)=2.751$, $p=0.100$) (Figure 3).

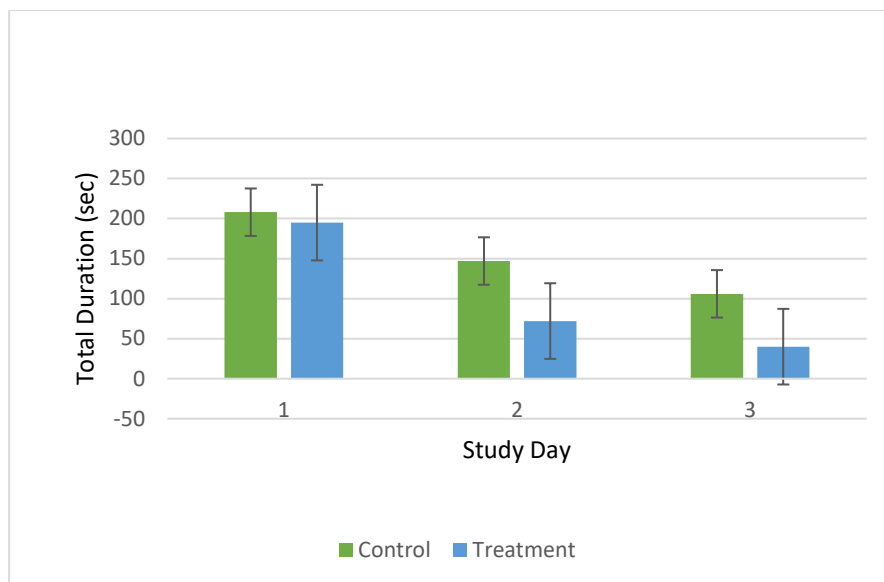


Figure 3. Human presence anxious behaviour differences between control and enriched treatment at day 1, 2, and 3.

3.2 Data Set 2 (Post treatment, nonhuman presence data)

Three generalized linear models for three behaviour categories were generated in the second set of data. Results showed that 13% of the variability of the total duration of "content" behaviours was attributed to study day and group. Content behaviours, independent of treatment, rose on all three days. Time had a large significant effect in improving animal welfare measures ($F(2,127)=8.167, p=0.000$). Treatment appeared to have some positive effects on emotion trending upwards as well, however this requires further investigation ($F(1,127)=0.718, p=0.398$). For "Frustrated" state behaviours, results demonstrated that 6% of the variability seen in the duration of a content state was attributed to study day and group. Frustrated behaviours, independent of treatment, decreased on each of the three days but not significantly ($F(2,129)=1.426, p=0.244$). There was no significant change in the total duration of frustration state behaviours over

time which can be attributed to the treatment effect ($F(1,129)=2.442, p=0.121$).

Considering “Anxious” state behaviours, results demonstrated that 9% of the variability seen in the duration of an anxious state was a result of study day and group. Anxious behaviours, independent of treatment, decreased significantly on each of the three days ($F(2,129)=5.516, p=0.005$). There was a trend found where treatment effect decreased the duration of anxious state behaviours over time however, this was not significant and requires further investigation ($F(1,129)=1.549, p=0.216$) (Figure 4).

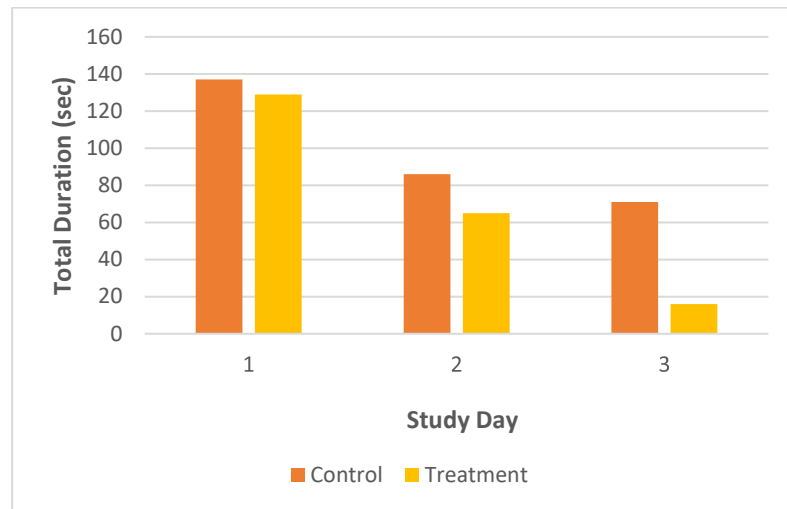


Figure 4. Non-human presence anxious behaviour differences between control and enriched treatment at day 1, 2, and 3.

3.3 Outcomes

Treatment had no significant causal association to type of outcome which included adopted, euthanized, foster, and return to owner. There was no significant difference found in length of stay for treatment or control group and no difference in outcome between groups. Two-way cross tabulation - Pearson Chi-Square tests of

association of outcomes for group and outcome revealed a p-value of 0.261 (no significant effect).

3.4 Additional Factors

Intactness had no significant correlation with emotional state. Anxiety decreased significantly with time in shelter. There was no difference between sexes in the overall treatment group and the duration of an anxious state. No correlation was found between intactness and results of non-human presence assessment category nor the human approach test category. Two-way cross tabulation - Pearson Chi-Square tests of association for intactness and emotional profiles (Anxious, Content and Frustrated) revealed a p-Value of 0.698 (no significant effect) (Table 3). Two-way cross tabulation - Pearson Chi-Square tests of association for intactness and emotional profiles (Anxious, Content and Affiliative) revealed a p-Value of 0.812 (no significant effect).

4. Discussion

The present study investigated the effects of early human social enrichment on shelter cats upon the first 3 days on admission. To our knowledge, this may be the first study to investigate the effects of short-duration human social enrichment on early admission shelter cats with a focus on emotion and affiliative behaviour as indicators for improved animal welfare. The results support our hypothesis that human social enrichment decreases anxiety and increases content emotion and affiliative behaviours in shelter cats. Although results showed a strong significance for social treatment on affiliative behaviour and moderate increase in content emotional state, further research is needed to determine additional impacts on anxiety.

Data set 1 revealed several important findings. First, short-duration human socialization treatment delivered by the same person, appears to have a great impact on cats, increasing affiliative behaviours. This finding is important because shelters with limited time and financial resources may be more likely to manage a practical, no cost treatment that can be done in as little as 7-minutes a day and has been shown to significantly improve animal welfare. Moreover, cats that display increased affiliative behaviour are content and interactive (Elzerman et al., 2020). These cats may interact more with potential adopters and increase their chances of finding a home, thereby decreasing length of stay (Southland et al., 2019; Brown & Stephan, 2021) and susceptibility to prolonged stress related and communicable illness (Gourkow et al., 2013).

Second, the treatment group had a significant increase in content behaviours over time. Animals who are content will be active, more visible, eat and drink more as well as play (Gourkow & Phillips, 2016) . All these types of behaviours are indicators of a healthy cat, but also may appeal more to potential adopters. These are the cats that typically, after initial holding periods, can be placed immediately on the adoption floor under the Capacity for Care (C4C) shelter program (Karsten et al., 2017). Under the program, content, friendly cats are termed “fast trackers” as their care needs are minimal compared to a sick cat or one with severe anxiety or other behaviour issues. Upon intake they are placed on the adoption floor as soon as possible.

Third, anxious behaviours decreased each day due to a combination of time and treatment. It has been previously documented that time alone within the first few days of entry to shelter will greatly reduce anxiety (Van Der Leij et al., 2019). Our study did

observe a trend where treatment also decreased anxiety more than just time, however further research will be needed to investigate this relationship further. Human socialization treatment has been observed to dramatically decrease anxiety however, previous studies have examined longer and repeated daily treatment times, where this study examined potential effects of a once a day, 7-minute treatment. It is encouraging to see that a shorter duration treatment within shelter may produce a reduction in anxiety for shelter cats in addition to time.

Data set 2 analyses security footage taken immediately after treatment after the human left the room. Content behaviours increased on all three days. Time alone had a large effect on decreasing anxiety and increasing content behaviours. Treatment appears to have a positive effect increasing content behaviours, trending upwards, however further investigation will be needed. There is a strong indication that the combination of time (including cats that remain in same cage), as well as treatment delivered over the first 3-days minimum, by a familiar friendly person will deliver better emotional improvement results, decreasing anxiety and increasing content behaviours, within a shelter setting. The second data set also revealed a large decrease in anxious behaviours that can be attributed to time. There was also a trend found where treatment effects decreased anxious behaviours, however, further investigation would be needed to determine such changes more clearly.

Our study did not find a significant decrease in frustrated behaviours over time. These results reflect the fact that we did not receive many cats that were assessed as truly frustrated. With so few cats in the study that fell into the category, it was not possible to draw any conclusions.

Outcomes were defined based on four groupings including adopted, euthanized, foster, and return to owner. The study found no significant causal effect on outcomes or decrease in length of stay. These findings are likely the result of several factors. Largely due to space at the shelter and volume of cats already on the adoption floor (space), as well as timing of cats entering the adoption floor. Some cats appeared to be held back from the adoption floor to allow more time to acclimate as well as due to a vet resourcing backlog for spay/neuter surgery times. In addition, some cats were sent directly to foster to adopt and, in some cases, returned to shelter for health or behaviour issues. Various restrictions and shelter closures over the time frame of the study including the Covid-19 Pandemic and two contagious disease outbreaks caused the shelter to close to the public thereby removing the potential for cats to be adopted. Two cats from the study were euthanized, one due to human aggression issues and the other due to a positive case of feline immunodeficiency virus (FIV) combined with aggression issues.

There were no significant correlations between initial (entry day 1) anxiety levels, including results of assessment and human approach test, and intactness. There was also no association between treatment decreasing anxiety and overall duration of anxious state related to sex.

Challenges throughout the course of the study included the part-time nature related to availability of researcher, communication related to staff changing and shifting cat cage locations after cleaning, and instruction and understanding of the project as staffing changes occurred. A presentation was delivered to staff on the project early on however, additional forms of communication were needed including small notes placed on the cages of each study cat with instructions to ensure study cats were returned to the

same cage post cleaning. Open communication and regular meetings with the shelter manager were also initiated over time to help keep the project on track and to relay important information about the cats in the study or shelter updates in general.

5. Conclusions

Cats provided with short duration human social enrichment each day during the first three days of admission to shelter present remarkably increased affiliative behaviours towards people and a rise in the total duration of content emotional state behaviours over time. Time in shelter also revealed a decrease in anxious behaviours. Treatment revealed a trend towards a reduction in anxiety. These findings are supported by behavioural observations using a predetermined ethogram. Future studies are needed to support greater changes in anxious behaviours using short-duration human social enrichment.

Chapter 3: Future Direction

3.1 Real World Application

Given that potential adopters are more likely to choose cats who are visually and emotionally appealing to them, there is a need for more research into how behaviour modification and/or training can be used to improve quality of life in shelter and to increase adoption rates. We know that cats of a certain colour are appealing to adopters but what about interactive and/or affiliative cats as opposed to cats who cower, hide, or show aggression? A growing body of research is helping us to better understand the decision factors involved in cat selection with respect to all physiological characteristics and behaviour (Gourkow & Fraser, 2006; Weiss et al., 2012; Sinn, 2016; Southland et al., 2019; Brown & Stephan, 2021). There appears to be a consensus among researchers that adopters choose a cat for the most part based on a cat's affectionate (affiliative) behaviours towards them. Cats that are friendly and interactive are also important characteristics that adopters consider.

To implement a program in a shelter that strives to increase adoption rates by augmenting expressed affiliative behaviours and decrease anxiety in cats, shelters may need to set up a space and training program that would require some resourcing. First, a shelter needs to be properly outfitted with security cameras in the intake room where cats stay within their first few days of a mandatory hold period. In some cases, this is a separate quiet area, in other cases, cats may be placed directly on an adoption floor but kept in shelter until the mandatory hold is over. Security cameras allow staff to monitor behaviour change without the presence of humans in the room which often results in an increase in noise and activity of all animals in the room. Once a shelter has a camera

system for monitoring animals remotely, assessment can take place. Observational assessment is easy to undertake however, some training needs to be involved in helping staff better understand the types of behaviour they are seeing and what to look for. Staff can also be trained to conduct a human approach test to determine how the cat responds to humans in general upon admission. If a similar procedure to the current project is followed, these two simple assessments take 22 minutes to complete. Together, they provide a picture of the emotional state of the cat upon admission and can serve to better prepare staff for a variety of treatment including vaccines, microchip, and health assessments as well as social treatments over the next few days. Having staff trained in behaviour assessments can also add benefit in helping staff more quickly identify changes in behaviour due to health or other reasons as well as improve safety for staff.

Whether a cat is anxious or content upon admission, positive social treatment is highly recommended. If a cat is assessed as frustrated, then a better approach, based on previous research, may include cognitive enrichment (Gourkow & Phillips, 2016), common room placement, and/or seeking foster care as soon as possible. There may be a benefit however, if a foster cannot be found, to implement a counter-conditioning clicker train program for frustrated cats targeted towards the increasing content and affiliative behaviour. Further research on this is needed.

Next, to deliver treatment to anxious and content cats, a staff member or regular volunteer (ideally someone who regularly interacts with the cats) could be trained to deliver the 7-minute treatment at a minimum of once daily, ideally at approximately the same time each day. Emotional state can then be re-assessed after 3 days or prior to the cat being put up for adoption. The treatment may be of further use if cats are moved onto

an adoption floor after their mandatory hold. Even after the stress of moving cages, they may become less stressed if a familiar person continues to provide positive human socialization during a time of change. Further research is needed to see if benefits are retained. Elements of the treatment could even be taught to adopters to help increase behaviour education and reassure an adopted cat as they enter a new home. Tools such as a reaching scratcher could be provided to each adopter to help encourage interaction without overwhelming cats in a new home. Caution should be taken as this treatment has not been tested in and is not recommended for use in feral (unsocialized) cats.

3.2 Applied Animal Behaviour Factors

In the field of Applied Animal Behaviour, one of the more recently encouraged approaches to treating animals with anxiety comes from Operant Conditioning theory and involves pairing food with a novel stimulus to increase the occurrence of a behaviour. Using such a process allows for the food (treat) to be used as a primary reinforcer to positively reinforce a behaviour or an emotion expressed through a behaviour. If the study had paired food with gentling, we may have seen a greater positive response.

The application of a human hand or a stroking tool used in this study to provide the gentling treatment may in some cases, such as with an anxious cat, be perceived as a lack of choice for the cat in that the cat may not have the option to hide or run away from the treatment. There is research that has occurred in recent years to suggest that choice for animals is an important consideration for animal welfare (Rust et al., 2024). Some of the studies have focused on choice as it relates to enclosure access, food, and enrichment devices. However, there does not appear to be a clear or strong positive impact in the limited literature to date. Further research is needed to determine the types of choice

which provide a strong positive impact on animal welfare. There is also a need to better understand choice of hiding for example as it relates to improved outcomes of shelter cats. Using hiding boxes may provide a decrease of stress for cats entering a shelter however, if no human interaction happens until the cat emerges and voluntarily chooses to interact with caretakers, this may result in cats remaining in shelter much longer, resulting in an increased state of stress and being exposed to various illnesses within shelter. Therefore, there may be an argument for supporting early positive human socialization in a shelter for anxious cats even though an element of choice is removed for a short time to improve overall animal welfare outcomes.

3.3 Challenges to implementation in a shelter environment

The challenge of new treatments in shelter often comes down to lack of resources including money and time. If a shelter has 20 cats who qualify, then the staff time needed for daily treatments is 140 minutes (2.3 hours). If a shelter is overwhelmed by cats, they could minimize treatment to include only the first three days. If there are 3 cats a day to assess then staff would need approximately 29 minutes to complete the assessment and one treatment. In total, treatment of 20 cats with assessments on 3 of them would take 206 minutes (3.4 hours). A shelter would have to determine if the time spent providing cats with social enrichment treatment and any associated health benefits are worth the return on investment. Behavioural rounds need to be implemented by the shelter as a valued and important aspect of good quality of care. Benefits may go beyond shelter health of cats to education of staff and adopters as well as continued improvements in the cat's health at home. Again, further research is needed in this area.

3.4 Anxiety Triggers

The initial behavioural assessment determined an initial emotional profile for each cat upon admission and tested human interaction tolerance. These assessments were done to provide the researcher important information about the need for a modified treatment approach (if cats were aggressive towards people) as well as safety. The data collected was not part of the study analysis. While conducting the initial assessments, we discovered that cats fell into three basic categories or triggers of anxiety. Some cats were anxious of the environment but not to people, some were anxious of people, but relaxed when alone, and some were anxious of both the environment and people. Further research is needed to determine whether tailored treatment approaches would show additional benefits for cats who fell into each of the categories.

3.5 Future Research Direction

If research was to continue into this area, I feel that the next step would be to design a pilot project where treatment was implemented in shelter, baseline data taken, and follow up assessments re-taken every 3 days and then adoption rates tracked. Shelter variables in care routine should be minimized and length of stay within each area should be carefully managed and following a protocol. A second component to the research could be to train adopters in the approach and to continue to reassess each cat's emotional profile in a home for the first 3 months. Teaching both shelter staff as well as new adopters to recognize a content vs anxious cat and to encourage positive interaction may strengthen the bond between adopter and cat. Educating adopters on normal (content) vs abnormal behaviour for their cat would help pet owners recognize illness early and treatment may be sought sooner. Adopting cats is important but helping to support

adopters with their cats while in home is just as important and would likely result in a reduced rate of return of animals.

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Appendix I

Table 3. Criteria used for the rating of mood (emotional profile) for intake assessment (15-minute observation) (adapted from Gourkow et al., 2014).

Mood / behaviour	Description
Anxious Behaviour observed > 80% per 24hour	
Flat	Low body posture when lying down, sitting, or standing for locomotion.
Freeze	Tense, flat body posture remains completely immobile, body and head flattened, eyes wide open.
Hide	Body fully or partially hidden under bedding, behind or in litter box.
Startle	Sudden retreat or flatten to back of cage. Brief tensing of the body.
Crawl	Slow locomotion while keeping body and head flattened close to ground.
Retreat or retreated	Avoidance of human usually by retreating to the back of cage and flattening body (often accompanied by lip licking*). <i>Jen Added: Also considering this to have already retreated so position at back of cage. Head still (not up looking around). Stiff body posture. Possibly trying to hide parts of body (appendages tucked close to body)</i>
<i>Inhibition</i>	<i>Sleep, grooming, locomotion, drink / eat (particularly in the presence of humans)</i>
<i>Absent</i>	<i>All other Contentment and all Frustration behaviours. Sleep or rest with lie on side, sit, front, walk</i>
Frustrated Behaviour observed >10 % of awake time	
Meow	Persistent and loud meowing, not related to anticipation of food
Escape bouts	Engaging in one or more behaviour in a repetitive or persistent pattern: standing on hind limbs, pawing wall or floor, pushing paw through door, pushing on door latch, hanging on cage door with body inverted, biting or licking cage bars*.

Scan	Persistent visual scanning of all areas of the cage
Push	Hits or throws objects around the cage in a destructive manner using head, body, or paws (not related to play) Spills food bowls, and litter. Pressing body or head on cage door.
Pace	Persistent, repetitive, and rapid locomotion at cage door or circle pattern.
Aggression	Unpredictable, short burst of aggression such as biting or scratching during otherwise friendly interaction with a human (<i>not accompanied by defensive behaviour or vocalizations</i>).
<i>Absent</i>	<i>All Anxiety behaviours and lie on side.</i>
Content Behaviour observed > 80% per 24hour	
Sleep / rest	Lying down, relaxed body posture with eyes closed or semi closed.
Lie on side	Lying on flank, body and tail stretched, neck and ventral area exposed.
Front sit	Sitting upright at the front of the cage, calmly observing activities.
Groom	Licks body or paws, rubs head with paws (without chewing or pulling coat).
Eat / Drink	Takes food or water into mouth. Does not spill food or water around the cage.
Walk	High body posture, normal gait, functional locomotion to access areas of the cage (not on-going or repetitive).
Rub	Rubs body or head on objects and cage door (while person not present).
<i>Absent</i>	<i>All Anxiety and Frustration behaviours.</i>

Appendix II

Table 4. Criteria used for rating of responses to humans as positive or negative (adapted from Gourkow, et al., 2015).

Response Type	Response sub-type	Description of responses
Negative	Defensive aggression	Hissing, growling and paw strike
	Defensive Retreat	Flattens body and ears, freezes or retreats
Positive	Calm	Relaxes body, lowers the head when petted between ears, raises the head when petted on the chin. Absence of defensive aggression or retreat
	Friendly	Stands close to, or approaches the experimenter; alternatively remains in a sitting or lying down posture, rubs themselves on the experimenter's hands, maintains themselves in a relaxed body posture; may also walk to the food bowl and eat during treatment

Appendix III

Table 5. List of affiliative behaviours observed in the presence of humans.

<p>Affiliative state is characterized by behaviours that include seeking human.</p> <p>*Behaviours found to overlap with “content” emotional profile in previous research</p>	
Tail up	Tail high in air pointed forward in direction of approach to person
Sniff nose or social sniff	Cat sniffing person within close proximity (touching or nearly touching)
Allogrooming	Cat licking human
Rub Person/Face	Cat rubbing nose or face against person
*Proximity to person	Close proximity to person (front of half of cage while person is standing in front)
Rolling	Cat roll upside down in front of person
Body Rub*	Cat rubs one whole side of body against person
Knead	Rhythmic motion of pushing paws into floor, claws alternately extended and retracted
Purr	Rumbling auditory vocalization made while a person is present. (added 2023)
Rub Object	Rubs body or head on objects and cage door. (*while person IS present - I think this should be affiliative)
Social Play	Combination of friendly biting, wrestling, running, and tossing objects; postures are assumed which do not indicate any agonistic interactions

Appendix IV

Table 6. Daily data collection schedule.

Step	Shelter Days - Data Collection	Shelter Day(s)	Day 1	Day 2	Day 3	Day 4
1	Set up for data collection (check cameras, computer screen, print data collection sheets and procedure instructions as needed).	1-3	x	x	x	
2	Set up go pro (Velcro stick to wall across cage) for out of room observation of new cat.	1	x			
3	Gather information on new cat from card and staff and add to file.	1	X			
4	Write out instructions for staff to identify study cat and to return to cage after cleaning. Tape to front of cage.	1	x			
5	Observe cat on camera for 15 minutes from outside room. Determine emotional state and note in file.	1	x			
6	Conduct human approach test and make notes of all behaviours observed at each timeframe for later determination of test results.	1	x			
7	Repeat steps as necessary with all new incoming cats.	1	x			
8	Set up go pro camera as a head mount, conduct treatment/non-treatment (control procedure) on each cat.	1-3	x	x	x	
9	Download video footage from GoPro to laptop and storage drive (6 TB).	1-3	x	x	x	
10	Download daily video footage from Security System to one of two USB drives (28 GB).	2-4		x	x	x
11	Upload Security System video footage to storage drive (6 TB) and store to appropriate folder.	2-4		x	x	x

12	Cat has completed study and note is removed so that staff is aware that cat can be moved from intake room.	4				x
13	Transfer all handwritten notes taken from both assessments to master data collection spreadsheet.	4				x
14	Determine assessment results (emotional profile and human approach test) for each new cat and add result to master data collection spreadsheet.	4				x

Curriculum Vitae

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Effects of early intervention social enrichment on emotion and affiliative behaviour of
cats in an animal shelter. University of New Brunswick.