

Cat and Human Personality

Saethra Darling

A dissertation

submitted in partial fulfillment of the
requirements for the degree of

Doctor of Philosophy

University of Washington

2020

Reading Committee:

Michael D. Beecher, Chair

Robin L. Foster

James C. Ha

Program Authorized to Offer Degree:

Psychology

©Copyright 2020

Saethra Darling

University of Washington

Abstract

Cat and Human Personality

Saethra Darling

Chair of Supervisory Committee:

Michael D. Beecher

Psychology

Recent decades have seen a surge of interest in animal personality. Most recently we have begun to investigate the personalities of pet animals, and while most work has been done with pet dogs, research into cat personality is increasing, often with the goal of improving their welfare. This dissertation first examines a current cat personality measurement program (Feline-ality™) designed to improve adoption rates and decrease euthanasia rates, followed by an evaluation of associations between human and cat personality traits that might predict cat owners' satisfaction with, and attachment to, their cats.

In the first chapter, I consider the possible relationship between the personality dimensions measured by the Feline-ality™ behavioral assay and subject variables of cats (age, sex, color). I then investigate elements of the convergent validity of Feline-ality™ by comparing it with an established survey-based human personality measurement tool (IAS-R). Finally, in an effort to address possible confirmation bias in the survey measurement of cat personality, I evaluate relationships between the survey measure and cat signalment variables. Results indicate that neither Feline-ality™ nor the IAS-R correlate with cat age, sex, or color, nor was there evidence of confirmation bias in the survey. The two personality dimensions measured by Feline-ality™ were strongly correlated with each other, and one was moderately correlated with a similar dimension of the IAS-R.

The second chapter describes process and outcome evaluations of Feline-ality™, following its implementation at the Seattle Animal Shelter (SAS). Feline-ality™ was practiced at SAS in 2017 – I consider data from a five-year span (2015-2019) in order to evaluate any changes in cat adoption rates, euthanasia rates, return rates, and length of time spent in the shelter that could be attributed to Feline-ality™. I also examine process errors. Results indicate an extremely high error rate in implementation of the program, such that no changes in any outcomes could be reliably attributed to Feline-ality™. It should be noted that errors in the Feline-ality™ data were corrected prior to analysis in our first chapter.

Chapter three returns to a consideration of the IAS-R as a possible replacement for Feline-ality™. The IAS-R measures two personality trait dimensions that characterize human interpersonal interactions (Agency and Communion) and that have been previously demonstrated in cats (Zeigler-Hill & Highfill, 2010). Similarity in Communion within cats-owner dyads, as

well as reciprocity in Agency, was shown to predict owner-cat relationship satisfaction (Zeigler-Hill & Highfill, 2010). Using a large internet dataset, I attempted to replicate this finding. I extended the replication to include variables suggested by the original authors (cat age and cat sex), and looked not only at relationship satisfaction, but also at owner attachment to their cats. Results indicate partial replication: similarity in Communion was positively correlated with relationship satisfaction, though with a small effect size. Neither similarities nor differences in Agency or Communion were related to attachment, although relationship satisfaction and attachment were strongly correlated.

The final chapter begins with further exploratory analyses of the dataset used in the previous chapter. In this instance, I examined not only intradyadic similarities and differences in Agency and Communion between cats and their owners, but also individual cat and human scores on each dimension independent of and in interaction with each other, along with years of ownership (as a control), cat age, cat sex, all in both linear and curvilinear relation to relationship satisfaction and attachment. The results of the exploratory analyses were then tested on a different dataset comprised of recently adopted cats in confirmatory analyses, with the addition of a measurement of overall attitude towards pets as a control (replacing years owned). The results of the confirmatory analyses indicate that, controlling for attitude towards pets, only cat Agency was predictive of relationship satisfaction. No other variable, outside of attitude towards pets, predicted attachment to pet cats. I further describe important limitations in our field that include the lack of reliable and valid measurement tools for cat personality and the lack of a standardized nomenclature, both of which are necessary for further advancement in this area of inquiry.

TABLE OF CONTENTS

Chapter 1. The Relationship Between Feline-ality™, the Interpersonal Circumplex, and Cat Signalment.....	9
1.1 Introduction.....	9
1.2 Methods.....	17
1.3 Results.....	22
1.4 Discussion.....	22
1.5 Tables and Figures	26
1.6 References.....	32
Chapter 2. Feline-ality™ in Real Life: A Program Evaluation	36
2.1 Introduction.....	36
2.2 Methods.....	40
2.3 Results.....	49
2.4 Discussion.....	51
2.5 Tables and Figures	65
2.6 References.....	85
Chapter 3. Complementary personality traits, relationship satisfaction, and attachment between people and their cats: A replication and extension.	87
3.1 Introduction.....	87
3.2 Methods.....	94

3.3 Results.....	101
3.4 Discussion.....	105
3.5 Tables and Figures	112
3.6 References.....	115
Chapter 4. Cats are Extraverted and Agreeable.....	122
4.1 Introduction.....	122
4.2 Methods.....	127
4.3 Results.....	135
4.4 Discussion.....	137
4.5 Tables and Figures	146
4.6 References.....	155

ACKNOWLEDGEMENTS

Thank you to James Ha and Michael Beecher, for your guidance and support throughout the entirety of my post-baccalaureate and graduate careers. And though my area of focus is cats, your inclusion of me in your work with crows and song sparrows was instrumental to my education. Thank you to Robin Foster for your time and insight, academic and otherwise. Your experience in applied animal behavior and your willingness to share that experience were not only valuable but also inspirational. Thank you to Aaron Wirsing for your engagement with my work that went well above and beyond your role as my Graduate School Representative. I am especially grateful to all of you for your support throughout the writing process, which has taken place entirely during the SARS-CoV-2 global pandemic and shutdown.

I would also like to thank the University of Washington Psychology Department for providing me with funding throughout my graduate career via teaching positions that were invaluable opportunities to learn and grow as an instructor. I was also a lucky recipient of the Psychology Department Scholars award, allowing me to take this most recent, and most bizarre, summer off from teaching to focus solely on writing.

I am grateful to the Seattle Animal Shelter for allowing me to work with the cats, the adopters, the management, the staff, and the volunteers. Not only did they make much of this dissertation possible, but they also provided insight into the animal sheltering world which, as an applied animal behavior scientist, is invaluable. I also owe a debt of gratitude to the many moderators of online sites that kindly allowed me to share my survey links, as well as to all of the individual donors who supported me via Experiment.com.

Finally, special thanks to my undergraduate research assistant, Margret Miller, for her attention to detail, and generosity of spirit, and to Carly and Elise, my biggest cheerleaders.

Chapter 1. THE RELATIONSHIP BETWEEN FELINE-ALITY™, THE INTERPERSONAL CIRCUMPLEX, AND CAT SIGNALMENT

Saethra Darling, James C. Ha

1.1 Introduction

Cats continue to die at high rates in animal shelters, despite their popularity. The purpose of the work presented herein is to explore ways that an established feline behavioral assay and/or a validated human personality survey might be harnessed to improve cat adoption success.

Cats are popular pet animals in the United States of America, numbering approximately 47 million, with approximately 25% of American households owning at least one cat (Brulliard & Clement, 2019; HSUS, 2020). Nevertheless, approximately 860,000 cats are estimated to be euthanized in American animal shelters every year (ASPCA, n.d). In fact, approximately 70% of all cats that end up in shelters may be euthanized (Gartner et al., 2014; Johnson & Cicirelli, 2014; Spehar & Wolf, 2018). Aside from spay and neuter programs, shelter efforts to address this issue are generally two-pronged, aimed at preventing cats from ending up in the shelter (i.e., keeping cats in their homes) and handling them once they are there (i.e., rehoming cats) – essentially, improving successful adoptions of pet cats.

Improving adoption success decreases euthanasia rates (ASPCA, 2007). Successful adoptions are defined here as those in which the animal remains in the adopted home permanently. Many shelters institute programs aimed at increasing adoption rates of cats and decreasing return rates of adopted cats. These efforts are often expensive and labor intensive (e.g., discounts on adoption fees for certain animals, advertising and marketing on social media, special adoption events, pre-adoption counseling, and post-adoption support). Focusing on

adoption success, as opposed to adoption rates, has the potential to decrease return rates (and therefore euthanasia rates), and require less sustained effort in post-adoption support. One way to increase adoption success is to concentrate on improving initial matching of potential owners with their potential pets prior to adoption. One aspect of this matching process is the ability to provide information to the potential owner about what sort of behavior they can expect from their new pet at home. Behavioral issues, unrealistic owner expectations, and the inability to predict cats' behavior are the biggest risks to successful adoptions (ASPCA, 2007; Houpt et al., 1996; Miller et al., 1996; Patronek et al., 1996; Salman et al., 1998; Salman et al., 2000; Shore, 2005; Weiss et al., 2015).

Predicting a cat's behavior in the home improves adoption success (ASPCA, 2007).

Applied animal behavior scientists have taken two overall approaches to predicting pet behavior in the home: 1) behavioral tests and 2) personality tests. Most of the work in this area has been done on pet dogs (Gartner, 2015; Jones & Gosling, 2005), but recent years have seen an increase in interest in applying these concepts to pet cats (Gartner & Weiss, 2013; Turner, 2017). The behavioral tests take the form of informant surveys from animal caretakers that answer questions about how frequently a cat engages in certain behaviors (e.g., Kaleta et al., 2016; Stelow et al., 2016; Wilhelmy et al., 2016), or behavioral assays, wherein the cat is put through a set of tasks or exposed to one or more experiences and their responses recorded (e.g., Fukimoto et al., 2019; Weiss et al., 2015). The personality tests might also ask animal caretakers about specific behavioral responses to various situations but more frequently they are surveys based on an adjectival approach (Bennett et al., 2017; Delgado et al., 2012; Gartner et al., 2014; Ha & Ha, 2017; Lee et al., 2007; Litchfield et al., 2017; Zeigler-Hill & Highfill, 2010). In some cases, a behavioral assay may be used to ascertain not only personality traits but also to predict specific

behaviors. One such test is the ASPCA's Meet Your Match® Feline-ality™ test (ASPCA, 2007; Weiss et al., 2015). Feline-ality™ has been shown to successfully predict in-home behavior, as well as adoption satisfaction (ASPCA, 2007; Weiss et al., 2015).

Feline-ality™ is an 11-item behavioral assay that results in a personality description of each cat along two trait dimensions: Valiance (which is related to the cat's response to novel stimuli) and Independent-Gregarious (which refers to the cat's social interaction style with humans; ASPCA, 2007). As a measure of response to novel stimuli, Valiance scores predict how quickly a cat will adjust to a new home, how the cat is likely to react to visitors in the home, and how the cat would behave for veterinary care. The Independent-Gregarious (IG) scale in turn describes how much time a cat is likely to spend in the company of its owner, whether or not a cat will solicit and/or accept petting, and the likely response of the cat to interaction with human children (ASPCA, 2007; Weiss et al., 2015; see Table 1 for a description of the items; see the ASPCA Feline-ality™ Manual and Training Guide (available online; ASPCA, n.d.) for a detailed description of the assay). Along with describing these two personality dimensions, responses to particular items in the assay also predict specific behaviors, such as vocalization (Item #2, Item #6), playfulness (Item #9), and tolerance of being handled or held (Item #8, Item # 10, Item #11; ASPCA, 2007; Weiss et al., 2015). The initial creation and validation of Feline-ality™ were not published in a peer-reviewed journal, though a summary of the findings is available in the ASPCA MYM® Training Manual (ASPCA, 2007). However, a later modification of Feline-ality™ was scientifically assessed and those results largely supported the contentions made in the training manual, namely that Feline-ality™ does predict some behaviors, does predict satisfaction, and that shelters using the system report higher adoption rates, fewer returns, shorter length of stay at shelter, and fewer euthanasias (Weiss et al., 2015). But, the MYM®

program, and especially the Feline-ality™ aspect of the program, has shortcomings as well, which include time (18 hours spent acclimatizing the cats to the shelter prior to assessment, as well as staff time of approximately 15 minutes per assessment), space (for housing the animals during the wait period, as well as a room appropriate for conducting the assay), and materials. Given these logistical constraints, and the fact the people often choose cats based on their signalment (e.g., age, sex, appearance), it would be helpful to identify potential predictive signalment-related proxies for these two dimensions of Feline-ality™.

Generally, people choose cats largely based on their appearance, but they keep cats based on their personality as perceived through their behavior (Delgado et al., 2012; DiGangi et al., 2006; Podberscek & Blackshaw, 1988). There is a plethora of appearance-related beliefs about cat behavior that likely inform these adoption decisions. For example, Google’s autocomplete predictions that are based on frequent searching habits of the users of the Google search engine, reveal that people commonly explore the ideas that “orange cats are nice”, that “black cats are the sweetest”, that “calico cats are mean”, that “tortoiseshell cats are crazy”, and that “tabby cats are the smartest”. The Google predictive algorithm is supported by survey findings: for example, 189 people surveyed reported that orange and bi-colored cats are perceived as more friendly, and that tri-colored cats (e.g., calicos) are perceived to be more aloof and intolerant (Delgado et al., 2012). Wilhelmy et al. (2016) reported, based on a survey sample of 574 purebred cats, that inter-cat aggression (tabby cats), fear aggression (orange cats), and playfulness (sepia Burmese cats) were weakly associated with coat color and pattern, after controlling for breed. In 2017, using another online survey with 1274 participants, Stelow, Bain, and Hass (2016) reported that increased aggression was perceived by owners in sex-link-colored female cats (i.e., calico and tortoiseshell), and grey-and-white cats. Laypeople often have behavior- or personality-related

beliefs associated with other elements of signalment as well, such as sex and age, for which there is some evidence, though again, all of it based on survey (and therefore owner perception). When cat personality studies have included age or sex information at all, they have found correlations (both positive and negative) variously between age and social/curious behavior, play behavior, activity level, and response to novelty (Bennett et al., 2017; Gartner et al., 2014; Kaleta et al., 2016; Lee et al., 2007; Weiss et al., 2015) as well as correlations between sex and sociality, aggression, and response to novelty (Ha & Ha, 2017; Kaleta et al., 2016; Weiss et al., 2015). Ostensibly, potential adopters are using these signalment-related beliefs as potential predictors for the behavior they might expect from their cat. Therefore, it would be valuable to examine further which, if any, of these perceptions are supported by behavioral evidence. If that were to be the case, shelters could then perhaps rely on signalment information in place of Feline-ality™ or other assessments as predictors for appropriate adoption placements, which could decrease the amount of resources currently spent processing each cat. Here we describe two studies, one focused on the possible relationship between signalment and Feline-ality™, and the second focused on elements of confirmation bias, convergent validity, and predictive validity.

Study One investigates whether there is a correlation between scores on the Feline-ality™ behavioral assay and signalment (age, sex, color). There is evidence that appearance can be linked genetically to behavioral traits. In the famous Siberian domestication experiments (Belyaev, 1979; Trut, 1999), foxes selectively bred specifically to be behaviorally less aggressive toward humans (i.e., more “dog-like”) began to look more “dog-like” as well (i.e., floppy ears, curly tails, wider faces, and spots). Cats have been domesticated and it is therefore possible that behavior and appearance might have covaried in a similar fashion due to artificial selection

pressures (Trut et al., 2009; Turner et al., 2000). The emphasis of Study One was on color, though age and sex data were also examined.

The primary goal of Study Two was to see if the Feline-ality™ behavioral assay could be correlated with an established adjective-based personality survey measure, such that the survey could then be used to predict the same important in-home personality traits. Feline-ality™ is not the only method available for attempting to establish appearance-related behavioral correlates that might be useful in predicting in-home behavior and therefore adoption success. Other options include survey data that attempt to link personality traits to signalment, generally focusing on personality traits (e.g., amiability, aggression) which are assumed to serve as proxies for the likelihood of affiliative or agonistic behaviors, respectively (Bennett et al., 2017; Delgado et al., 2012; Fogle, 1992; Gartner et al., 2014; Ha & Ha, 2017; Lee et al., 2007; Stelow et al., 2016; Weiss et al., 2015). The limitations of the existing survey methods include possible bias on the part of owners/caretakers and a dearth of established elements of construct validity, such as convergent and predictive validities.

The most likely bias in play with the survey measures that have been used to date is that of confirmation bias, the unconscious tendency for one to perceive things that support what one already believes. There are pervasive societal signalment-related stereotypes regarding cat personality and behavior, making it highly likely that owners will see the cat personality traits or behaviors that confirm these stereotypes and fail to see contradictory evidence, if it exists (for a classic example of confirmation bias, read about the infamous Dartmouth versus Princeton football game of 1951 (Hastorf & Cantril, 1954)).

Convergent validity is established by comparing one measure against another, already validated, measure; if scores on both measures are correlated, then it can be inferred that both measures are measuring a similar underlying construct – in this case, personality traits (for example, one would expect scores on the Beck Depression Inventory to correlate strongly with the Hamilton Depression Scale, as they do (Winter et al., 1999)).

Predictive validity is established when a measure accurately predicts an outcome, which can be a discrete behavior, or a score on another measure (for example, the SAT should correlate with college first year GPA, which it does, though perhaps not as strongly as is commonly believed (Kobrin et al., 2008)). Feline-ality™ has predictive validity in that it is correlated with specific behaviors in the home, as well as with owner satisfaction ratings as to how good a “fit” that cat is in their household (Weiss et al., 2015). Therefore, if Feline-ality™ scores could be correlated with an already validated survey measure (convergent validity), then that survey measure could potentially be used to predict the same outcomes.

The Interpersonal Adjective Survey, Revised (IAS-R) is an established, validated personality assessment tool in humans (McCrae & Costa, 1989; Trapnell & Wiggins, 1990; Wiggins et al., 1988). The IAS-R measures the interpersonal circumplex (IPC), capturing two personality dimensions that describe human social behavior and are commonly referred to as Agency and Communion (Freedman et al., 1951; Leary, 1957; Leising & Bleidorn, 2011; Locke, 2006; Wiggins, 1979). Agency can be understood as capturing a spectrum of dominance and submission related to status-seeking, power, control, leadership, and obedience in humans. Communion captures affiliative tendencies, ranging along a spectrum of friendliness, love, and warmth, to coldness, and hostility (Leising & Bleidorn, 2011). Complementarity along these two

dimensions has been shown to predict relationship satisfaction between humans, as well as between owners and their cats (Zeigler-Hill & Highfill, 2010). There are two basic models of complementarity: the Leary/Carson model and the similarity model (Byrne, 1971; Carson, 1969; Leary, 1957). The Leary/Carson model predicts that people who have similar levels of Communion and opposite levels of Agency are more likely to have positive social interactions and report greater relationship satisfaction. The similarity model predicts greater satisfaction when the two humans have similar scores on both Agency and Communion. For cats, the current evidence indicates that owners are more likely to report greater relationship satisfaction with their cats when the dimensions conform to the Leary/Carson model (Zeigler-Hill & Highfill, 2010). Given that the two dimensions captured by Feline-ality™ have also been correlated to adoption satisfaction, it is reasonable to surmise that the two different instruments might be measuring the same two personality dimensions. And, if so, there exists the possibility of replacing the labor and time-consuming Feline-ality™ behavioral assay with the simpler IAS-R survey measure. The primary goal of the second study was to characterize the relationship between the IAS-R and Feline-ality™, if any.

The secondary goal in Study Two was to investigate the possibility of confirmation bias in the IAS-R as applied to cats. The intent of the first study was to investigate the possible relationship between Feline-ality™ scores and signalment variables. If the IAS-R should be found to correlate with Feline-ality™ scores in the second study, so too should it correlate with those same (if any) signalment variables found in Study One. If instead, correlations between the survey measure and signalment differ, then that would be interpreted as evidence of potentially the same confirmation bias we attribute to the existing survey measures. That is to say, if, for example, Valiance were not correlated with cat sex in Study One, Valiance was correlated with

Agency in Study Two, then Agency should not be correlated with cat sex, and if Agency were correlated with cat sex, we could interpret that as a bias in owner perception (perhaps that male cats are more confident than females).

Our overall objectives across both studies are to explore Feline-ality's™ relationship with signalment (if any), characterize the relationship between Feline-ality™ and the IAS-R (if any), and to investigate the possibility of confirmation bias in the IAS-R as applied to cats. The evidence for signalment correlations with elements of personality in cats is equivocal and therefore does not lend itself to specific hypotheses. Results from our work in Study One, as the first to use a behavioral assay rather than survey data, may therefore support all, some, or none of the existing work. For Study Two, we expect to see a correlation between the two dimensions of Feline-ality™ and the two dimensions of the IAS-R. If such correlations exist, we will then expect Feline-ality™ and the IAS-R to correlate similarly with any significant signalment variables resulting from Study One.

1.2 Methods

Study One

Study Site

Behavioral data were gathered from the Seattle Animal Shelter (SAS), an open-admission urban shelter located in Seattle, WA, USA. During the study period, SAS used the ASPCA® MYM® adoption program and evaluated cats using the Feline-ality™ assessment protocol program, which is designed to pair people with cats based on, in conjunction with owner

expectations, two elements of cat personality that have been shown to predict cat behavior in the home and adoption satisfaction (ASPCA, 2007; Weiss, et al., 2015).

Measures

The Feline-ality™ behavioral assay measures two dimensions of feline personality. The scores for each dimension range as follows: Independent/Gregarious ranges from two to thirty-two; Valiance ranges from zero to forty-three. Each dimension is subdivided into 3 categories that when combined form a matrix of nine possible Feline-alties™, each with their own description (Fig. 1 and Fig. 2): Private Investigator, Secret Admirer, and Love Bug (low valiance cats, scoring 0-13); The Executive, Sidekick, and Personal Assistant (the medium valiance cats, scoring 14-28); and MVP, Party Animal, and Leader of the Band (high valiance, scoring 29-43).

Subjects

Records were examined for 196 cats that completed the Feline-ality™ behavioral assay between February 12, 2017 and February 6, 2018. Cats were 47% male and 98.5% altered (only three females were unaltered or could not be verified as spayed either visually or via palpation of an abdominal scar). Cats ranged in age from nine months to eighteen years ($M=6.6y$, $SD=4.5y$). Of the 196 cats, primary colors were broken down as follows, following genetic guidelines (Vella et al., 1999): 100 cats (51%) had black as their primary color (including 33 (16%) cats that appeared grey, the dilute form of black), 49 cats (25%) had brown, and 46 cats (23%) had orange as their primary color. Only one cat was solid white and was removed from consideration, as that sample size would be too small to be meaningfully interpreted, leaving a final sample size of 195 cats. Within these primary colors, cats showed the following five color

patterns: tabby (striped; 38 cats), pied (white patches; 48 cats), tabby with pied (38 cats), solid (47 cats), and x-linked coloration (tortoiseshell/calico/torbie; 24 cats), and could be considered either typically-colored (139 cats) or atypically-colored (57 cats) (e.g., pointed or dilute (such as the grey cat), or both pointed and dilute), again based on the genetic underpinnings of cat coat coloration (pointed cats are those with a genetically-based form of temperature-sensitive albinism and dilute cats have a pair of the recessive dense pigment alleles (Vella et al., 1999, pp. 140-141)). The distribution of observed Feline-alties™ in this SAS sample was as follows: Private Investigator = 24.6%, Secret Admirer = 19%, Love Bug = 0.0%; The Executive = 1%, Sidekick = 29.2%, Personal Assistant = 21.3%, MVP = 0.0%, Party Animal = 0.0%, and Leader of the Band = 5.1%.

Animal Care and Housing

The cats were housed in metal cages, some with one clear plastic wall so they were visible to visitors. During quarantine, stress, or while meeting potential adopters, the cats may have been housed in other smaller rooms, though still singly. Cats were provided with litterboxes, bedding, and toys. Most cats were provided hiding areas. Dry cat food was available at all times and canned food was provided twice daily. Water was refreshed twice daily. Cat handling, cage cleaning, and feeding were carried out primarily by multiple trained staff members. Both staff and trained volunteers provided physical interaction to the cats, including brushing, petting, and playing.

Design

Variables were defined as follows: Age: Years; Sex: binomial; Male or Female; Main Color: multinomial; Black, Brown, and Orange; Color Pattern: multinomial; Pied, Tabby, PiedTabby, Solid, and X-linked; Color Features: binomial; Atypical (either dilute and/or pointed) and Typical (neither dilute nor pointed).

Four a priori analyses were performed. Multiple linear regressions investigating the possible relationship between the Feline-ality™ Independent/Gregarious (IG) scores and Valiance scores, respectively, with age, sex, main color, color pattern, and color features, as described above were completed using R (R Core Team, 2020). The possible relationships between the Feline-ality™ scores and Age, Sex, and Main Color were examined separately from the possible relationships between the Feline-ality™ scores and Color Pattern and Color Features, due to the non-independence of Color Pattern from sex (x-linked coloration), and the non-independence of dilution from Main Color (e.g., grey and black).

Study Two

Study Site, Adoption Procedures, Animal Care and Housing

Same as Study One.

Measures

Feline-ality™ was the same as described in Study One. The Interpersonal Adjective Scale, Revised (IAS-R), is made up of 64 adjectival items that are answered using a Likert-like agreement scale that indicates how accurately each adjective describes the person or the cat (each

participant answered the survey both for themselves and for their cat; Wiggins et al., 1988). The answer scale is made up of eight choices, ranging from extremely inaccurate to extremely accurate. Adjectives are provided along with definitions, e.g., “assertive: tends to be aggressive or outspoken with others”. The only difference between the IAS-R that the owner completed for themselves and the one completed for their cat was that in every instance where a definition referred to “others” in the self-report version, it was changed to “people” in the informant version (e.g., “assertive: tends to be aggressive or outspoken with people”). IAS-R data were collected using Qualtrics (Qualtrics, Provo, UT).

Subjects

Records were examined for 46 cats that completed the Feline-ality™ behavioral assay at SAS and whose caretakers also later completed the informant version of the IAS-R for the cat. Representation of cat demographics in Study Two was similar to that in Study 1. Cats were 48% male and 100% altered. Cats ranged in age from ten months to eighteen years ($M = 6.9y$, $SD = 4.7y$). Of the 46 cats, primary colors were broken down as follows: 22 cats (48%) had black as their primary color (including 8 (17%) cats that appeared grey, the dilute form of black), 12 cats (26%) had brown, and 12 cats (26%) had orange as their primary color. Within these primary colors, cats showed the following five color patterns, which differed somewhat from the sample for study one: tabby (striped, 9 cats), pied (white patches, 17 cats; 24% versus 37%), tabby with pied (9 cats), solid (4 cats; 24% versus 1%), and x-linked coloration (tortoiseshell/calico/torbie, 8 cats; 12% versus 17%), and could be considered either typically-colored (32 cats) or atypically-colored (14 cats).

Design

Signalment variables were defined as in Study One. We calculated Pearson's r for all possible correlations between the four personality dimensions. We then repeated the same four multiple linear regressions as in Study One (see above), having replaced Agency and Communion as our outcome variables.

1.3 Results

Study One

There were no statistically significant relationships between either IG or Valiance and any of the signalment variables.

Study Two

Agency was correlated with Independent/Gregarious (IG) at $r = .38, p = .009$. IG and Valiance were correlated at $r = .85, p < .0001$. The correlation between Agency and Valiance ($r = .26$) was trending toward significance at $p = .08$. No significant correlations were found between Agency and Communion, nor between IG and Communion, nor Valiance and Communion. There were no statistically significant relationships between Agency or Communion, respectively, and any of the signalment variables.

1.4 Discussion

Feline-ality™ has been described as predictive of behavior in the home, as well as adoption satisfaction (ASPCA, 2007; Weiss et al., 2015). If the dimensions of Feline-ality™

were predictably associated with signalment, then those obvious physical traits could be used as a helpful shortcut in the adoption process. However, there were no statistically significant relationships between either of the personality dimensions and any of the signalment variables examined in Study One. The fact that Feline-ality™ nevertheless predicts behavior in the home indicates that it does capture some elements of personality that are unrelated to physical appearance.

The goals of the second study were to characterize the relationship between the IAS-R and Feline-ality™, and to investigate the possibility of confirmation bias in the IAS-R as applied to cats. Feline-ality™ is labor intensive and a survey-based alternative such as the IAS-R could be a valuable replacement for Feline-ality™. Results from Study Two indicated a moderate, significant correlation between Agency and Independent/Gregarious, a strong significant correlation between IG and Valiance, a trend toward a significant correlation between Agency and Valiance, and no correlation between IG/Valiance and Communion, nor Agency and Communion. Results also indicated no significant relationship between Agency or Communion and signalment.

The lack of correlation between Agency and Communion was as expected and further demonstrates that these two constructs are independent factors of personality. The strong correlation between IG and Valiance was surprising. In most personality work, there is an attempt to find trait dimensions that are independent of each other, or orthogonal factors (e.g., the Five Factor Model in humans: Costa & McCrae, 1995; Digman, 1990). If two trait dimensions are not independent (i.e., highly correlated), then they may instead be considered as facets underlying some other, higher-order factor. In other words, to a large extent, both IG and

Valiance appear to be measuring the same broader construct. There is no evidence that this correlation between IG and Valiance has been discovered previously; the description of the creation of Feline-ality™ in the ASPCA training manual does not provide that level of detail regarding statistical methods and results, and the subsequent paper published when Feline-ality™ was modified from its original form also does not provide this information (ASPCA, 2007; Weiss et al., 2015). Therefore, to the best of our knowledge, our paper represents the first evidence of the lack of independence between these two trait dimensions. In light of this finding, and given the correlation between Agency and IG, and the trend towards a significant correlation between Agency and Valiance, we propose that IG and Valiance are facets of the Agency factor of personality. In that case, Agency alone may be an acceptable proxy for all of the personality-measuring aspects Feline-ality™ (so, not the specific behaviors that certain items in Feline-ality™ can predict, such as vocalization or play preferences).

There remains as yet no objective evidence that personality or behavior in cats are meaningfully related to physical appearance, sex, or age. Given this lack of association, it is potentially problematic that prospective owners nevertheless rely largely on signalment when choosing cats to adopt. The MYM® program and Feline-ality™ have the potential to mitigate this problem by providing personality and behavioral information that can improve adoption success. However, because of the logistical constraints to instituting the program, it is vital to create a valid survey-based tool. The IAS-R has the potential to serve as the basis for such a tool. Based on the correlations in Study Two, there is evidence that Agency could be a proxy for IG and Valiance. The lack of correlation between Agency or Communion and signalment also demonstrates an absence of evidence of signalment-related bias. Therefore, the IAS-R might be a viable alternative to Feline-ality™. This could be especially useful as animal sheltering moves

towards decentralization (the foster-home model), rendering subjective surveys more practicable than behavioral assays. While this IAS-R survey-based model might be most effective in a foster home situation, it has been demonstrated that so-called “subjective” survey-based measures can be equally, if not more reliable, than “objective” behavioral assays, making this a practicable option for in-shelter evaluation as well (Gartner et al., 2014; Gosling, 2001; Vazire et al., 2007).

While evidence suggests that the IAS-R could serve as an acceptable proxy for Feline-ality™, the power of using an interpersonal circumplex model exists in the ability predict relationship satisfaction between two individuals, rather than simply to predict the behavior of one individual. The two IPC compatibility models have been examined previously in cat/owner dyads, with equivocal findings: in 2010, the Leary/Carson model of complementarity, in which dyads are similarly matched along the Communion axis and reciprocally matched along Agency, was demonstrated to predict compatibility as measured by relationship satisfaction of humans with their cats (Zeigler-Hill & Highfill, 2010), whereas in 2007, neither the Leary/Carson model, nor the similarity model predicted attachment to pet cats (Woodward & Bauer, 2007). In an effort to resolve this discrepancy, and prior to proceeding with any attempt to adapt the IAS-R for use in the shelter system, our next study will be an attempted replication of Zeigler-Hill & Highfill (2010).

1.5 Tables and Figures

Table 1

The MYM® Feline-ality™ behavioral assay (ASPCA, 2007; Weiss et al., 2015).

Item	Observer instructions	Listed possible behaviors	Scores
1. Body Posture	Quietly approach the cat's cage door and while standing in front of the cat's cage, take a quick mental snapshot of the cat's body posture. Choose one of the following Responses.	Soft and relaxed	+1
		Tense body with twitching tail	+1
		Flattened body with dilated pupils	-1
2. Greeting Approach	Immediately after taking a mental snapshot of the cat's body posture during item #1, begin to speak to the cat in a soft, normal tone of voice. Observe the cat's response to your presence through the closed cage door. Choose one of the following responses.	At front of cage, soliciting attention by rubbing, chirping, etc.	+3
		Comes to the front of the cage after you encourage	+2
		Does not approach but meows, chirps, or blinks (circle all that apply)	+1
		Does not approach	0
		Attempts to hide	-1
		Hisses or growls	-2
		Charges	-3
3. Cage Condition	While quietly standing in front of the cat's cage, observe and note its condition. Choose one of the following.	Bedding/cage paper moved, cat hiding under	-1
		Cage rearranged, cat on top or not hiding	+1
		No change	0
		Other, please describe	0
4. Social Response when door is opened	After completing items 1 through 3, calmly and slowly open the cage door while watching the cat. This should be done without talking. Observe the cat at the moment the door is initially opened. Choose one of the following responses.	Remains relaxed and soft, approaches me	+1
		Remains relaxed and soft, does not approach	0
		Becomes stiff with tight tail flicks and standing	+1
		Crouches, body stiff	-1

Table 1 continued.

Item	Observer instructions	Listed possible behaviors	Scores
5a-b. Introduction to a Novel Room	Take the cat out of the cage and place him into a plastic crate (cleaned and allowed to air) for transport to the Novel Room. Ideally the cat should be loaded into the crate from above (turn crate so door is facing the ceiling). Throughout this item, you will be recording the amount of time the cat is either interacting or not interacting with you. In order to obtain an accurate assessment of time spent in each activity, use two stopwatches — one to keep the total time (start when you open crate door, end at five minutes), and the second to keep track of time interacting with you. Click on the second stopwatch whenever an interaction begins and click it off once the interaction ends. IMPORTANT: OTHER THAN EYE CONTACT, DO NOT INITIATE, ENGAGE WITH OR RESPOND TO THE CAT. INTERACTION INCLUDES EYE CONTACT OR OTHER BEHAVIOR EVEN WHEN THE CAT IS IN THE CARRIER. Interactive behaviors include meows, chirps, looks, blinks, rubbing against you, touching you, and being in your lap. Be sure to include those behaviors made while inside the carrier after the door has been opened.	(5a) Exits carrier in 25 seconds or less with a tall body posture	+1
		(5a) Exits the carrier in 25 seconds or less with crouched body posture	+1/2
		(5a) Exits the carrier within 25 seconds and quickly scoots to hiding place, keeping body low to the ground	-1/2
	5a - choose one (if applicable)	Investigates room while standing tall	+1
		Investigates room in a low body posture	+1/2
		Races out of carrier to one spot in the room and stays there	-1/2
	5b	(5b) Time spent interacting with evaluator (as determined by second stopwatch)	__sec
		(5b) Time not spent interacting with the evaluator	__sec
	5b - choose one	Interacts for more than 60 seconds	+1 1/2
		Interacts for 30-60 seconds	+1
		Interacts for less than 30 seconds	0

Table 1 continued.

Item	Observer instructions	Listed possible behaviors	Scores
6. Call and Approach	Crouch down on the opposite side of the room from the cat and about five to six feet away, start the stopwatch, and call the cat several times. Extend one hand, closed in a fist, toward him. Stop the stopwatch when the cat approaches and makes contact with your hand or body. Allow the cat up to 30 seconds to approach. Be sure to talk softly and encourage forward with voice. Check all behaviors that occur.	Makes eye contact	+1
		Does not make eye contact	-1
		Approaches	+3
		Sniffs or head butts	+3
		Rolls on back or rolls over	+2
		Meows, purrs and/or chirps (circle all that apply)	+1
		Watches with no approach	0
		Retreats	-1
		Hisses and/or growl	-2
7. Open Hand	While still crouching, extend an open hand to the cat. Your hand should be lower than the cat's head. If the cat did not approach you in item #6, walk toward and crouch next to the cat. Check all behaviors that occur.	Sniffs or head butts	+3
		licks or rubs on hand	+3
		Rolls on back or rolls over	+2
		Meows, purrs and/or chirps (circle all that apply)	+2
		Retreats/defensive position	-2
		Hisses and/or growls	-2
		Swats/attempts to swat hand	-2
		Bites/attempts to bite hand	-3
8. Stroking	While talking to the cat, use your open hand, slightly cupped, to stroke the cat in long strokes along the head, back and sides. Continue for 4-5 long slow strokes if possible. Check all behaviors that occur.	Rubs against legs or hand	+3
		Head butts	+3
		Circles you attentively	+2
		Meows, purrs and/or chirps (circle all that apply)	+2
		Rolls on back or rolls over	+2
		Shows initial fear but then relaxes	0
		Retreats/defensive position	-1
		Hisses and/or growls	-2
		Swats or attempts to swat hand	-2
		Bites or attempts to bite hand	-3
9. Play	Beginning a couple of feet away from the cat, slowly move a piece of string/yarn along the floor to initiate play. Observe that cat's reaction. Then try to engage the cat in play with two other toys from the following list (for a total of three different toys): Ball, Toy Mouse, Cat Charmer, and Feather Wand. Do not use catnip toys during the Feline-ality™ Assessment. Check all behaviors that occur. Circle the toy preferences on the score sheet so the adopter will know which toys the cat prefers, if any.	Watches toy intently	+3
		Chases toy	+3
		Comes back for stroking	+2
		Ignores toys	0
		Attends to something else	-1
		Avoids eye contact	-1

Table 1 continued.

Item	Observer instructions	Listed possible behaviors	Scores
10. Hug	Call the cat again until he approaches, or approach him slowly yourself. Begin to stroke the cat again and if he is calm, gently pick him up and cradle him against your chest, his body sideways to your chest for a full two seconds. Check all behaviors that occur.	Is relaxed	+3
		Extends paw to evaluator's neck or shoulder in an affiliative manner	+3
		Meows, purrs and/or chirps (circle all that apply)	+2
		Accepts hold but remains a bit tense	+2
		Struggles to escape	-1
		Hisses/growls	-2
		Stiffens and extends claws	-2
		Swats/attempts to swat hand	-3
		Bites/attempts to bite hand	-3
11. Sensitivity	Sit on the ground and allow the cat to approach if he chooses. Wait at least 60 seconds before you stroke the cat along his back and gently grasp the cat's tail firmly at the base and pull up with a steady pressure just enough almost, but not quite, move his back feet off the floor. Hold for 1 second. Check all behaviors that occur.	Rolls on back or rolls over	+3
		Shows no reaction	+3
		Meows, purrs and/or chirps (circle all that apply)	+1
		Struggles/tries to escape	0
		Hisses/growls	-1
		Swats/attempts to swat	-2
		Bites/attempts to bite	-3

Figure 1

Item scores from the assay provide a total Independent-Gregarious score (ranging from 2-32) which is then located along the top of this chart and corresponds to the level of sociability that the cat is likely to show, as well as a total Valiance score (ranging from 0-43), which is compared to the left side of the chart, indicating the level of Valiance (or confidence) a given cat is likely to demonstrate (ASPCA, 2007; Weiss et al., 2015).

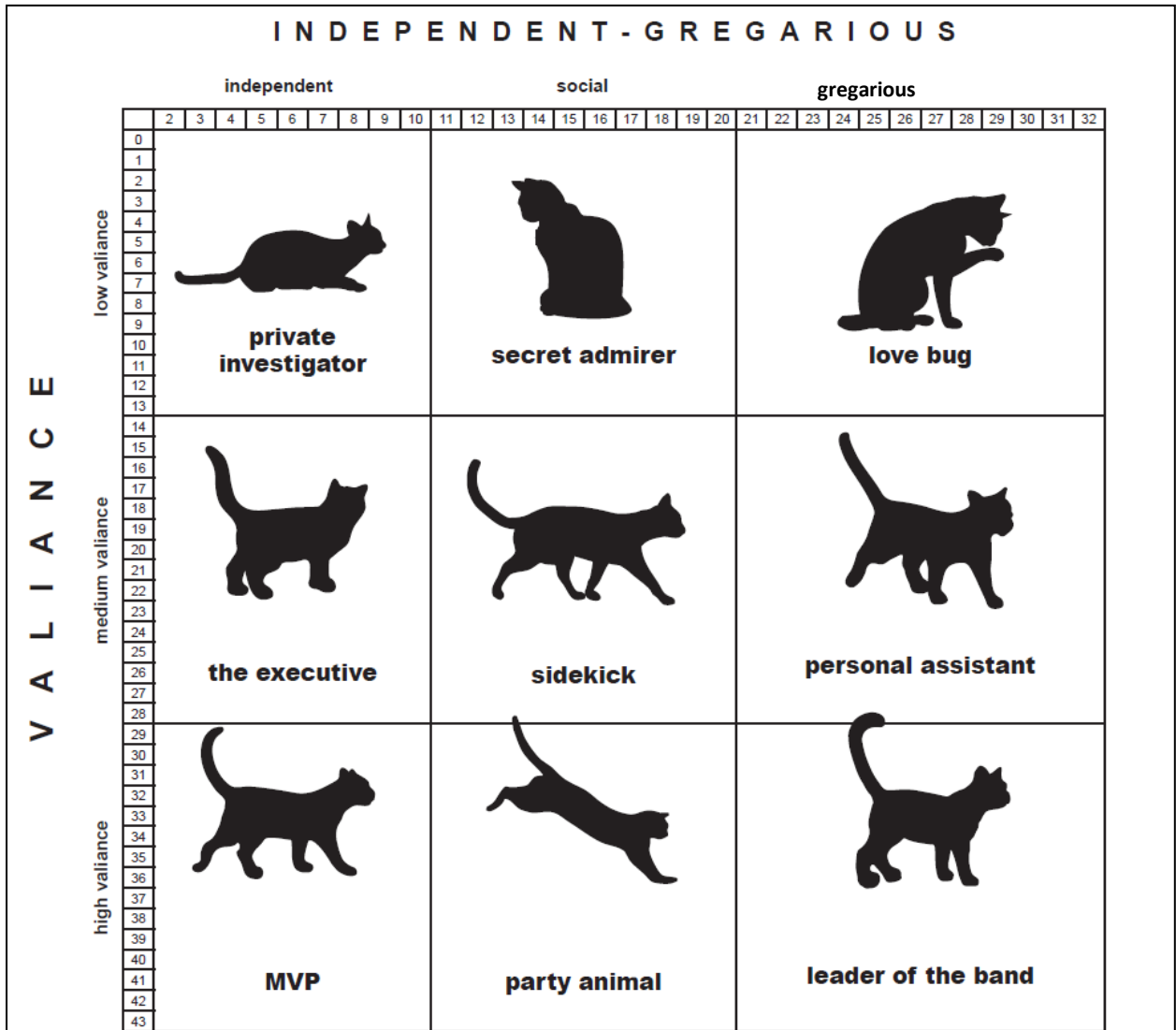


Figure 2

Description of the nine Feline-alties™ (ASPCA, 2007).

	love bug Do you seek affection? I do! If you also like petting, purrs, and paws kneading your lap, I think we might have A LOT in common. I'm looking for "someone who enjoys quiet times and togetherness." Could that someone be you?
	secret admirer When it comes to relationships, I'm very level-headed. I don't leap in paws first, if you know what I mean. But give me a little time, and then I'll shower you with purrs, head-butts, and plenty of lap time. In the meantime, you may not see a lot of me—but I'll be thinking a lot of you.
	private investigator I'm working undercover to keep an eye on you and your household. You may not even know you're under surveillance. I can vanish into thin air if anyone or anything interferes with my investigation. If you need a cat who knows how to stay out of trouble and will always keep your secrets, I just might take your case.
	personal assistant You're working on the computer? Let me press the keys. Reading the paper? I'll hold the pages down for you. Watching TV? I'll just plop in your lap so you can pet me. I love an orderly household, don't you? I'll help you with all your chores, and I'll help you relax when we're done. You'll wonder how you ever managed without me.
	sidekick Like all sidekicks, I'm just plain good company. I like attention, and I also like my solitude. I don't go looking for trouble but I'm no scaredy-cat, either. If you are looking for a steady companion to travel with you on the road of life, look no further.
	the executive I have to say, I'm a busy cat. First, I've got to check out what's happening out the window. Next, I'll see if any closets or cupboards need looking into. And then there are my naps—can't be late for those. I can fit a little socializing into my schedule. Shall we plan on breakfast and dinner? I hope you like kibbles.
	leader of the band I'm a cat who does everything in a big way. I not only like to be in the middle of things—I like to lead the parade. I'm an adventurous cat, but I'll still make plenty of time to show you my affectionate side. I'm the demonstrative type, you might say. Want a cat who's brimming with confidence? That's me.
	party animal I'm a cat on a mission: PARTY! I love to play and explore and test my limits. I'd love to play with you, but I can make a toy out of anything: pencils, post-it notes, potatoes. If you're looking for some laughs and someone to liven up the party, think about inviting me.
	MVP I'm a savvy cat who knows the score. I'm pretty unflappable, too. I don't mind entertaining myself, but a human companion at the other end of the couch and a nice scratch behind the ears always make my day. If you're looking for a resourceful addition to your team, think about signing this Most Valuable Pussycat.

1.6 References

- American Society for the Prevention of Cruelty to Animals [ASPCA]. (n.d.). *Pet Statistics*. Retrieved July 2, 2020, from <https://www.asPCA.org/animal-homelessness/shelter-intake-and-surrender/pet-statistics>.
- ASPCA. (n.d.). *Meet Your Match® Survey and Guides to Download*. Retrieved July 9, 2020, from <https://www.asPCapro.org/resource/meet-your-matchr-survey-and-guides-download>
- ASPCA. (2007). *Meet Your Match® Feline-ality™ Training Manual*. American Society for the Prevention of Cruelty to Animals.
- Belyaev, D. K. (1979). Destabilizing selection as a factor in domestication. *Journal of Heredity*, 70(5), 301–308. <https://doi.org/10.1093/oxfordjournals.jhered.a109263>
- Bennett, P. C., Rutter, N. J., Woodhead, J. K., & Howell, T. J. (2017). Assessment of domestic cat personality, as perceived by 416 owners, suggests six dimensions. *Behavioural Processes*, 141, 273–283. <https://doi.org/10.1016/j.beproc.2017.02.020>
- Brulliard, K., & Clement, S. (2019). *How many Americans have pets? An investigation of fuzzy statistics*. The Washington Post. <https://www.washingtonpost.com/science/2019/01/31/how-many-americans-have-pets-an-investigation-into-fuzzy-statistics/>
- Byrne, D. E. (1971). *The attraction paradigm*. Academic Press, 172.
- Carson, R. C. (1969). Perspectives in personality. In *Interaction concepts of personality*. Aldine.
- Costa, P. T., & McCrae, R. R. (1995). Domains and facets: Hierarchical personality assessment using the revised NEO personality inventory. *Journal of Personality Assessment*, 64(1), 21–50. https://doi.org/10.1207/s15327752jpa6401_2
- Delgado, M. M., Munera, J. D., & Reevy, G. M. (2012). Human perceptions of coat color as an indicator of domestic cat personality. *Anthrozoos*, 25(4), 427–440. <https://doi.org/10.2752/175303712X13479798785779>
- DiGangi, B. A., Crawford, P. C., & Levy, J. K. (2006). Outcome of cats adopted from a biomedical research program. *Journal of Applied Animal Welfare Science*, 9(2), 143–163. https://doi.org/10.1207/s15327604jaws0902_4
- Digman, J. M. (1990). Personality structure: Emergence of the five-factor model. *Annual Review of Psychology*, 41(1), 417–440. <https://doi.org/10.1146/annurev.ps.41.020190.002221>
- Fogle, B. (1992). *The cat's mind: Understanding your cat's behavior*. Howell Book House.
- Freedman, M. B., Leary, T. F., Ossorio, A. G., & Goffey, H. S. (1951). The interpersonal dimension of personality. *Journal of Personality*, 20(2), 143–161. <https://doi.org/10.1111/j.1467-6494.1951.tb01518.x>
- Fukimoto, N., Howat-Rodrigues, A. B., & Mendonça-Furtado, O. (2019). Modified Meet Your Match® Feline-ality™ validity assessment: An exploratory factor analysis of a sample of domestic cats in a Brazilian shelter. *Applied Animal Behaviour Science*, 215, 61–67. <https://doi.org/10.1016/j.applanim.2019.03.013>
- Gartner, M. C. (2015). Pet personality: A review. *Personality and Individual Differences*, 75, 102–113. <https://doi.org/10.1016/j.paid.2014.10.042>

- Gartner, M. C., Powell, D. M., & Weiss, A. (2014). Personality structure in the domestic cat (*Felis silvestris catus*), scottish wildcat (*Felis silvestris grampia*), clouded leopard (*Neofelis nebulosa*), snow leopard (*Panthera uncia*), and African lion (*Panthera leo*): A comparative study. *Journal of Comparative Psychology*, *128*(4), 414–426. <https://doi.org/10.1037/a0037104>
- Gartner, M. C., & Weiss, A. (2013). Personality in felids: A review. *Applied Animal Behaviour Science*, *144*(1–2), 1–13. <https://doi.org/10.1016/j.applanim.2012.11.010>
- Gosling, S. D. (2001). From mice to men: What can we learn about personality from animal research? *Psychological Bulletin*, *127*(1), 45–86. <https://doi.org/10.1037/0033-2909.127.1.45>
- Ha, D., & Ha, J. (2017). A subjective domestic cat (*Felis silvestris catus*) temperament assessment results in six independent dimensions. *Behavioural Processes*, *141*, 351–356. <https://doi.org/10.1016/j.beproc.2017.03.012>
- Hastorf, A. H., & Cantril, H. (1954). They saw a game; a case study. *Journal of Abnormal and Social Psychology*, *49*(1), 129–134. <https://doi.org/10.1037/h0057880>
- Haupt, K. A., Honig, S. U., & Reisner, I. R. (1996). Breaking the human-companion animal bond. *Journal of the American Veterinary Medical Association*, *208*(10), 1653–1659.
- Humane Society of the United States [HSUS]. (2020). *Pets by the numbers*. Humane Society of the United States. Retrieved May 1, 2020 from <https://www.animalsheltering.org/page/pets-by-the-numbers>
- Johnson, K. L., & Cicirelli, J. (2014). Study of the effect on shelter cat intakes and euthanasia from a shelter neuter return project of 10,080 cats from March 2010 to June 2014. *PeerJ*, *2014*(1), e646. <https://doi.org/10.7717/peerj.646>
- Jones, A. C., & Gosling, S. D. (2005). Temperament and personality in dogs (*Canis familiaris*): A review and evaluation of past research. In *Applied Animal Behaviour Science* (Vol. 95, Issues 1–2, pp. 1–53). Elsevier. <https://doi.org/10.1016/j.applanim.2005.04.008>
- Kaleta, T., Borkowska, N., & Goral-Radziszewska, K. (2016). The study of domestic cat (*Felis catus*) personality based on survey in Poland. *Annals of Warsaw University of Life Sciences - SGGW, Animal Science*, *55*(1), 39–46.
- Kobrin, J. L., Patterson, B. F., Shaw, E. J., Mattern, K. D., & Barbuti, S. M. (2008). Validity of the SAT® for predicting first-year college grade point average. In *College Board*.
- Leary, T. (1957). *Interpersonal diagnosis of personality; a functional theory and methodology for personality evaluation*. Ronald Press.
- Lee, C. M., Ryan, J. J., & Kreiner, D. S. (2007). Personality in domestic cats. *Psychological Reports*, *100*(1), 27–29. <https://doi.org/10.2466/PRO.100.1.27-29>
- Leising, D., & Bleidorn, W. (2011). Which are the basic meaning dimensions of observable interpersonal behavior? *Personality and Individual Differences*, *51*(8), 986–990. <https://doi.org/10.1016/j.paid.2011.08.003>
- Litchfield, C. A., Quinton, G., Tindle, H., Chiera, B., Kikillus, K. H., & Roetman, P. (2017). The ‘Feline Five’: An exploration of personality in pet cats (*Felis catus*). *PLoS ONE*, *12*(8). <https://doi.org/10.1371/journal.pone.0183455>

- Locke, K. D. (2006). Interpersonal circumplex measures. In S. Strack (Ed.), *Differentiating normal and abnormal personality* (pp. 383–400). Springer Publishing Company.
- McCrae, R. R., & Costa, P. T. (1989). The structure of interpersonal traits: Wiggins's circumplex and the five-factor model. *Journal of Personality and Social Psychology*, *56*(4), 586–595. <https://doi.org/10.1037/0022-3514.56.4.586>
- Miller, D. D., Staats, S. R., Partlo, C., & Rada, K. (1996). Factors associated with the decision to surrender a pet to an animal shelter. *Journal of the American Veterinary Medical Association*, *209*(4), 738–742.
- Patronek, G., Glickman, L., Beck, A., McCabe, G., & Ecker, C. (1996). Risk factors for relinquishment of cats to an animal shelter. *Journal of the American Veterinary Medical Association*, *209*(3), 582–588.
- Podberscek, A., & Blackshaw, J. (1988). Reasons for liking and choosing a cat as a pet. *Australian Veterinary Journal*, *65*(10), 332–333. <https://doi.org/10.1111/j.1751-0813.1988.tb14523.x>
- Qualtrics. (2019). Qualtrics XM // The Leading Experience Management Software. In *Qualtrics*.
- R Core Team. (2020). R: A Language and Environment for Statistical Computing. In *R Foundation for Statistical Computing* (4.0.0).
- Salman, M., Hutchison, J., Ruch-Gallie, R., Kogan, L., New, J. C., Kass, P. H., & Scarlett, J. M. (2000). Behavioral reasons for relinquishment of dogs and cats to 12 shelters. *Journal of Applied Animal Welfare Science*, *3*(2), 93–106. https://doi.org/10.1207/s15327604jaws0302_2
- Salman, M., New, Jr., J. G., Scarlett, J., Kass, P., Ruch-Gallie, R., & Hetts, S. (1998). Human and animal factors related to relinquishment of dogs and cats in 12 selected animal shelters in the United States. *Journal of Applied Animal Welfare Science*, *1*(3), 207–226. https://doi.org/10.1207/s15327604jaws0103_2
- Shore, E. R. (2005). Returning a recently adopted companion animal: Adopters' reasons for and reactions to the failed adoption experience. *Journal of Applied Animal Welfare Science*, *8*(3), 187–198. https://doi.org/10.1207/s15327604jaws0803_3
- Spehar, D., & Wolf, P. (2018). The impact of an integrated program of return-to-field and targeted trap-neuter-return on feline intake and euthanasia at a municipal animal shelter. *Animals*, *8*(4), 55. <https://doi.org/10.3390/ani8040055>
- Stelow, E. A., Bain, M. J., & Kass, P. H. (2016). The relationship between coat color and aggressive behaviors in the domestic cat. *Journal of Applied Animal Welfare Science*, *19*(1), 1–15. <https://doi.org/10.1080/10888705.2015.1081820>
- Trapnell, P. D., & Wiggins, J. S. (1990). Extension of the interpersonal adjective scales to include the Big Five dimensions of personalit. *Journal of Personality and Social Psychology*, *59*(4), 781–790. <https://doi.org/10.1037/0022-3514.59.4.781>
- Trut, L. N. (1999). Early canid domestication: The farm-fox experiment: Foxes bred for tamability in a 40-year experiment exhibit remarkable transformations that suggest an interplay between behavioral genetics and development. *American Scientist*, *87*(2), 160–169.

- Trut, L., Oskina, I., & Kharlamova, A. (2009). Animal evolution during domestication: The domesticated fox as a model. *BioEssays*, *31*(3), 349–360. <https://doi.org/10.1002/bies.200800070>
- Turner, D., & Bateson, P. (2000). *The domestic cat: The biology of its behaviour*. Cambridge University Press.
- Turner, D. C. (2017). A review of over three decades of research on cat-human and human-cat interactions and relationships. *Behavioural Processes*, *141*, 297–304. <https://doi.org/10.1016/j.beproc.2017.01.008>
- Vazire, S., Gosling, S. D., Dickey, A. S., & Schapiro, S. J. (2007). Measuring personality in nonhuman animals. In *Handbook of research methods in personality psychology* (pp. 190–206).
- Vella, C., Shelton, L., McGonagle, J., & Stanglein, T. (1999). *Robinson's genetics for cat breeders and veterinarians*. Oxford University Press.
- Weiss, E., Gramann, S., Drain, N., Dolan, E., & Slater, M. (2015). Modification of the Feline-ality™ assessment and the ability to predict adopted cats' behaviors in their new homes. *Animals*, *5*(1), 71–88. <https://doi.org/10.3390/ani5010071>
- Wiggins, J. S. (1979). A psychological taxonomy of trait-descriptive terms: The interpersonal domain. *Journal of Personality and Social Psychology*, *37*(3), 395–412. <https://doi.org/10.1037/0022-3514.37.3.395>
- Wiggins, J. S., Trapnell, P., & Phillips, N. (1988). Psychometric and geometric characteristics of the Revised Interpersonal Adjective Scales (IAS-R). *Multivariate Behavioral Research*, *23*(4), 517–530. https://doi.org/10.1207/s15327906mbr2304_8
- Wilhelmy, J., Serpell, J., Brown, D., & Siracusa, C. (2016). Behavioral associations with breed, coat type, and eye color in single-breed cats. *Journal of Veterinary Behavior*, *13*, 80–87. <https://doi.org/10.1016/j.jveb.2016.03.009>
- Winter, L. B., Steer, R. A., Jones-Hicks, L., & Beck, A. T. (1999). Screening for major depression disorders in adolescent medical outpatients with the Beck Depression Inventory for Primary Care. *Journal of Adolescent Health*, *24*(6), 389–394. [https://doi.org/10.1016/S1054-139X\(98\)00135-9](https://doi.org/10.1016/S1054-139X(98)00135-9)
- Woodward, L. E., & Bauer, A. L. (2007). People and their pets: A relational perspective on interpersonal complementarity and attachment in companion animal owners. *Society and Animals*, *15*(2), 169–189. <https://doi.org/10.1163/156853007X187117>
- Zeigler-Hill, V., & Highfill, L. (2010). Applying the interpersonal circumplex to the behavioral styles of dogs and cats. *Applied Animal Behaviour Science*, *124*(3–4), 104–112. <https://doi.org/10.1016/j.applanim.2010.02.012>

Chapter 2. FELINE-ALITY™ IN REAL LIFE: A PROGRAM EVALUATION

Saethra Darling, Margret A. Miller, James C. Ha

2.1 Introduction

Program evaluation is an important component of applied animal behavior science that is not often found in the published literature. Despite the popularity of evidence-based practice in virtually all arenas of organizational life, program evaluation is less common than it should be. For example, a 2017 government-wide report from the Government Accountability Office describes implementation of program evaluation in only approximately 40% of governmental programs in the United States (GAO, 2017). Information about the rate of program evaluation in private or not-for-profit entities is difficult to estimate, and even program evaluations in the public domain are not widely disseminated in scientific literature. In applied animal behavior science, where the main goals are to improve the care, management, and welfare of animals, there is a dearth of available data on evaluation of programs instituted by the largest animal welfare organizations.

Many large and influential animal welfare organizations, including the American Society for the Prevention of Cruelty to Animals (ASPCA), have their own applied animal behavior research teams that not only conduct and publish applied research on domestic animals, but also use the results of their work to inform their own policies and practices. Specifically, as applied to the area of animal sheltering, one such program is the ASPCA's Meet Your Match® (MYM®). Originally designed to pair potential adopters with available pet dogs, the program was extended to include pet cats in 2007, and modified into its current form in 2015 (ASPCA, 2007; Weiss et al., 2015). The research conducted in designing the feline side of the program was not published

in a peer-reviewed journal; a brief summary of that research can be found in the ASPCA's MYM[®] Feline-ality[™] training manual (ASPCA, 2007). A modification of the original Feline-ality[™] program was undertaken in 2015 in response to logistical concerns from participating shelters (e.g., 72-hour hold before assessment could be performed) and a comparison of the modified program with the original program was published (Weiss et al., 2015). No further work evaluating the implementation of (process evaluation) or effects of (outcome evaluation) the MYM[®] Feline-ality[™] program has been published subsequent to its adoption by at least 100 animal shelters (Kridel, 2007). The purpose of our study is to evaluate MYM[®] Feline-ality[™].

The MYM[®] Feline-ality[™] program comprises a behavioral assay administered to eligible cats and a survey completed by prospective owners. The behavioral assay is an 11-item test based on observing and recording a cat's behavior in various situations (Table 1), and results in the assignment of one of nine possible "Feline-alities[™]" or cat personality types (Figure 1). Each of these Feline-alities[™] is made up of scores along two personality dimensions labeled "Valiance" and "Independent/Gregarious" that describe a cat's response to novelty and social attitude toward humans, respectively (Figure 2). The assignment of the specific Feline-ality[™] is indicated by a colored card (purple, orange, or green) with a personality description placed on each cat's cage. Prospective adopters complete the Cat Adoption Survey (CAS) in which they indicate their expectations for their ideal cat, as well as describe their lifestyle (Figure 3). Based on the score from the CAS, a person is provided with a compatible Feline-ality[™] and also given a colored card that matches the cards found on cages housing appropriate cats, as a tool to refer to when browsing available cats. In initial testing during the design phases, as well as in the subsequent modification study, the period following implementation of the MYM[®] Feline-ality[™] program was characterized by an increase in cat adoption rates, decreased euthanasia

rates, decreased return rates, and shortened length of stay in the shelter for cats (ASPCA, 2007; Weiss et al., 2015). Not all of these improved outcomes were attributable to owners adopting cats that matched the indicated Feline-ality™, as 45% of pairings examined were not exact matches (ASPCA, 2007). In a follow up survey to the 2007 beta-testing, respondents indicated that the cats they had adopted largely behaved as they expected them to, based on the information they had obtained during the MYM® process. Accurate expectations for a new pet have been demonstrated as contributive to adoption success (ASPCA, 2007; Houpt et al., 1996; Miller et al., 1996; Patronek et al., 1996; Salman et al., 1998, 2000; Shore, 2005; Weiss et al., 2015).

Accurate expectations of cat behavior during MYM® are not obtained solely by the survey results and resulting cat personality description. In addition to the overall assignment of expected compatibility, it is assumed that the prospective owner will be led through the cat selection process by a shelter representative. The training materials support this assumption by providing advice on how best to talk to an owner about each item on the assay and how each should be interpreted in light of responses to the CAS – essentially, adoption counseling. This level of adoption counseling necessitates a high degree of training on the specific items in the assay and questions on the survey. It is not clear how shelter staff were trained to perform MYM® during initial testing (though it may be safely assumed that they were trained by the researchers); currently, training is achieved at no monetary cost via online videos (ASPCA, 2018) and a 68 page training manual available for free download from the ASCPA professional website (ASPCA, n.d.). Along with conceptual training on the components of the program necessary to adequately counsel a potential adopter, shelter staff members also need training in the logistics of performing the assay, scoring the assay, and scoring the CAS. Each shelter is responsible for making sure that their staff and volunteers are trained sufficiently. There are no

available data regarding shelter staff or adopter perception of the experience with implementation of the MYM[®] program outside of the pilot and beta-testing (ASPCA, 2007).

Overall satisfaction with the MYM[®] Feline-ality[™] program was described as high during the original beta-testing, both for adopters and shelter staff (ASPCA, 2007). Five shelters participated in the beta-testing (the Animal Refuge League of Greater Portland; the Wisconsin Humane Society in Milwaukee; the Hamilton-Burlington SPCA in Ontario, Canada; the Kansas Humane Society of Wichita; and the Humane Society of Boulder). All five shelters were private, not-for-profit organizations; two were open-admission shelters, three were closed-admission (open-admission means that owners can surrender their animal at any time and for any reason, closed-admission means that the shelter limits what animals they are willing to accept). Pilot testing was completed in multiple phases using boarding facilities and shelters. Two of the shelters used in the pilot testing were also used in beta testing (the Animal Refuge League of Greater Portland and the Hamilton-Burlington SPCA). One of the shelters used in the pilot testing was also used in the 2015 modification study (the Humane Society of Boulder (open-admission)). Data regarding satisfaction following implementation of MYM[®] Feline-ality[™] in shelters outside of the 2007 pilot and beta-testing are not available in the scientific literature, nor is any further evidence that the program is associated with the favorable changes in adoption, euthanasia, returns, and length of stay reported. Information about the results of adoption of this program in the wider animal sheltering system would help applied animal behaviorists make evidence-based decisions about allocation of the scarce resources available in animal care, management, and welfare.

In order to evaluate the MYM[®] Feline-ality[™] program, and in collaboration with the Seattle Animal Shelter (SAS), we considered three aspects of program evaluations: needs assessment, process evaluation, and outcome evaluation. Needs assessment involves identifying gaps in current practices that might interfere with desired outcomes and providing suggestions for ways to ameliorate obstacles. The needs assessment relevant to, but independent of, this present study was provided by the second author (JCH). The stated purpose was to improve adoptability by “mov[ing] animals out of the shelter and into permanent homes more quickly, and to improve psychological well-being for animals while in the shelter...” (Ha, 2016). In that assessment, JCH identified multiple areas needing improvement, including standardizing the assessment of cats, for which he recommended using the MYM[®] Feline-ality[™] program. The needs assessment is discussed and a process evaluation (analysis of implementation) and outcome evaluation (analysis of the effectiveness of a program) are examined herein.

To our knowledge, the present study represents both the first process evaluation and the first outcome evaluation of the MYM[®] Feline-ality[™] program since its introduction into sheltering practice. Using data from a five-year period (2015-2019), and based on findings described in the available literature on the program, we expected to see a significant favorable change in adoption, euthanasia, return, and length of stay for cats at SAS following implementation of the program. As part of a retrospective process evaluation, we also examined errors made during implementation of the program.

2.2 Methods

Study Site

Data were collected in partnership with the Seattle Animal Shelter (SAS), a large urban open admission animal shelter located in King County, WA, USA. The cats were generally housed in metal cages, some with one clear plastic wall so they were visible to visitors. During quarantine, stress, or while meeting potential adopters, the cats may have been housed in other smaller rooms, though still most often singly. Cats were provided with litterboxes, bedding, and toys. Many cats were provided hiding areas. Dry cat food was available at all times and canned food was provided twice daily. Water was refreshed twice daily. Cat handling, cage cleaning, and feeding were carried out primarily by multiple trained staff members. Volunteers provided physical interaction to the cats, including brushing, petting, and playing. The study was reviewed and approved by the University of Washington Office of Animal Welfare (Protocol #2858-09).

Shelter Adoption Procedures

For the study period (2017), SAS used the ASPCA MYM[®] adoption program and evaluated cats using the Feline-ality[™] assessment protocol (ASPCA, 2007; Weiss et al., 2015). This program is designed to pair people with cats based on cat behavior and owner expectations. Potential adopters begin the process by completing a Cat Adoption Survey (CAS; Figure 3), following which, the person is assigned a Feline-ality[™] that they would best pair with (Figure 2). Shelter staff then directs the potential adopter towards the appropriate cats, as measured by the Feline-ality[™] behavioral assay (Table 1; Figure 2). The animal control officers were responsible for all adoptions. Each of these six staff members, as well as one manager, received 14 hours of training in 2016. Following the training, and after staff had time to practice the assay on shelter cats, each employee was required to accurately score a CAS and complete a Feline-ality[™] assessment correctly. All training and evaluation were provided by the primary author (SD). The final evaluative Feline-ality[™] assessment was completed in tandem with SD and in

order to be correct, the staff member must have categorized the test cat as the same Feline-ality™ as did SD.

Staff training was conducted as an interactive discussion-based class, using materials provided by the ASPCA via their website (ASPCA, n.d.), as well as earlier materials from the original CR-ROM version of the MYM® Feline-ality™ program. Staff were trained to complete the modified Feline-ality™ assay (Weiss et al., 2015), but some videos from the original assay (ASPCA, 2007) were still useful as additional practice opportunities during the training. In response to feedback from the staff, supplementary materials were created by SD (one document that outlined which behaviors each specific assay item should be associated with, and one document that condensed the general flow of the assay into one page for quick reference while practicing). SAS also requested a shelter-specific version of the training manual that delineated exactly how and where the assay should be done in their specific physical plant (this, and all other training materials are available by request from SD). While staff members were the only people allowed to conduct adoptions, the shelter did have volunteers who interacted with potential adopters as they perused the available cats. Therefore, volunteers were also trained in the MYM® program. Volunteer training did not focus on performing the behavioral assay, but rather on how the results of the assay, combined with the CAS, could best be interpreted, and used as a tool for guiding potential adopters in their decision-making process. Two four-hour volunteer training classes took place in person, and for other (or future) volunteers, a shelter-specific training video was created by SD and provided to the shelter, along with a quiz and self-test materials. Self-test materials for future training of staff members were also provided; training for any staff hired after the initial training provided by SD was completed by already-trained

staff (this applied to one additional animal control officer who joined the team in March of 2017).

The decision to implement the ASPCA MYM[®] protocol was made independently of this research, as a result of the broad needs assessment previously solicited by SAS and provided by the second author (JCH) prior to the conception of this study. In the years 2015, 2016, 2018, and 2019, adoption procedures did not include MYM[®] Feline-ality[™]. The initial needs assessment indicated that standardized adoption procedures were not in place prior to MYM[®] (Ha, 2016); information about adoption procedures subsequent to cessation of the MYM[®] program were unavailable. This pattern of adoption procedures allowed us to compare our focal study year (2017) to the two years prior and the two years after implementation of MYM[®] Feline-ality[™].

Subjects

Longitudinal Shelter Data (Outcome Evaluation)

Computerized records for 5 years (2015-2019) from the Seattle Animal Shelter (SAS) were examined to ascertain data regarding length of stay in the shelter, adoption rates, euthanasia rates, transfer rates, and return rates (following adoptions). Only cats that could have hypothetically benefited from the Feline-ality[™] program were considered. Therefore, any animals whose age estimate was below 9 months of age or for which no age estimate existed were excluded from analysis, as well as any cat for whom there was no outcome listed (missing data). All cats who died in care, arrived deceased, or were euthanized due to injury, illness, or other emergency less than 18 hours after arrival at the shelter, as well as all cats labeled feral or wild, were also removed from consideration. Owned cats were excluded: strays that were subsequently returned to the rightful owner; cats who entered legally-required bite quarantine and subsequently returned home; all cats who visited the shelter only for services through the

shelter-run veterinary clinic; and cats being held for safekeeping during domestic violence situations (returned to owner). Cats brought to the shelter solely for the purpose of humane euthanasia at the request of the owner were also excluded. It should be noted that the number of returned cats listed for each year does not equal the number of cats that had two visits within that calendar year; some cats were adopted in a different calendar year and then returned during the year in question, a difference that was often an arbitrary side effect of the cut-off dates chosen for analysis (such as adopted in December of 2014 and returned in January of 2015). Also, outcomes (adoptions, euthanasias, and transfers) were counted as unique events, rather than individual animals (some cats had two or more different outcomes), so the number of unique cats admitted each year was necessarily lower than the sum of the possible outcomes. Animals that remained following the guidelines above are described in Table 2.

A second sample of cats from another shelter located in Portland, Oregon were also collected ($N_{2015} = 2609$; $N_{2016} = 2639$; $N_{2017} = 2767$; $N_{2018} = 2401$; $N_{2019} = 2581$). The level of detail described (above) for our primary dataset was not available for the second dataset, which means that the outcomes (adoptions, euthanasias, and transfers) do contain an unknown number of kittens and feral cats and should be interpreted accordingly. Also, in the primary dataset there were more outcomes than unique cats, which appears to differ from the comparison group (whose outcomes and number of cats total up to 100%).

Feline-ality™ Data (Process Evaluation)

Records were examined for 183 cats that completed the Feline-ality™ behavioral assay between February 14th, 2017 and December 31st, 2017 (34.7% of eligible cats taken in during that year). Of these, cats were 52.5% female and 98.3% altered (three females were unaltered or

could not be verified as spayed either visually or via palpation of an abdominal scar). These cats ranged in age at intake from nine months to eighteen years ($M = 6.5y$, $SD = 4.5y$).

The Feline-ality™ behavioral assay consists of 11 test items that measure two dimensions of feline personality: Independence/gregariousness (a measure of sociability) and Valiance (a measure of confidence/shyness achieved by recording responses to novel stimuli) (ASPCA, 2007; Weiss et al., 2015). The scores for each dimension range as follows: Independent/Gregarious ranges from two to thirty-two; Valiance ranges from zero to forty-three. Each dimension is subdivided into 3 categories that when combined form a matrix of nine possible Feline-alties™, each with their own description (Figure 1): Private Investigator, Secret Admirer, and Love Bug (low valiance cats, scoring 0-13); The Executive, Sidekick, and Personal Assistant (medium valiance cats, scoring 14-28); and MVP, Party Animal, and Leader of the Band (high valiance cats, scoring 29-43). The distribution of observed Feline-alties™ in this SAS sample was as follows: Private Investigator = 25%, Secret Admirer = 17.5%, Love Bug = 0.0%; The Executive = 1.1%, Sidekick = 30.1%, and Personal Assistant = 20.8%; and MVP = 0.0%, Party Animal = 0.0%, and Leader of the Band = 5.5%. Training materials provided by the ASPCA describe the results of the original validation testing as having a “majority” of medium valiance cats, a “fair amount” of low and high valiance cats, and “few” Executives and MVPs (ASPCA, 2007), which seems to resemble our sample. The modification study cites the three most common Feline-alties™ as Personal Assistant, Leader of the Band, and Sidekick, which resembles our sample in that those three Feline-alties™ make up 56.4% of our sample, though we did not have many Leaders of the Band ($N = 10$).

Design

Outcome Evaluation: Longitudinal Shelter Data and Variables

Retrospective statistical analyses of computerized records kept for each cat were performed, using a quasi-experimental interrupted time-series design at the level of averages across years, including and comparing data from two years prior to the implementation of the MYM[®] program (2015, 2016), the year in which the program was implemented (2017), and two years subsequent (2018, 2019). Ideally, in order to make inferences about the effect of Feline-ality[™], a true experimental design would be employed. However, as is common in real-world applications, the level of experimental control required to maintain the sufficiently high internal validity necessary to make causal inferences and extrapolate results to a broader population was not an option. With the institution of corporate or governmental programs, the researcher most often does not control who is exposed to the intervention, removing one keystone of experimental designs: random assignment to treatment groups. Quasi-experimental designs are those that resemble experimental designs in structure and include additional elements to attempt to mitigate the potential effects due to the lack of randomization. While quasi-experimental designs do improve the ability to interpret the effect of the intervention on the sample, they should not be solely depended upon to infer that these effects, if any, would be repeatable in a different sample, or necessarily apply to a larger population. True statistical inference is not possible here; all data should be viewed as descriptive in nature and should inform any large decision only in concert with other work. For an excellent explanation and classic examples of this type of design, see Campbell and Ross (1968).

In the present study, our quasi-experimental design resembles a repeated measures experimental design in that there is measurement prior to the intervention (pre-test), a “treatment

period”, and then a measurement after the intervention (post-test). Our design improves on this simple pre-test/post-test design by adding multiple pre- and post- measurements, and by including a non-equivalent control group, and is therefore referred to as a multiple interrupted time series design. The appropriate way to control for many threats to internal validity in quasi-experimental designs is to include a non-equivalent control group for comparison. A non-equivalent control group is one that is similar to the treatment group but did not experience the treatment. The ideal non-equivalent control group in our study was a municipal shelter operating in a nearby city of similar size. Records from the Multnomah County Animal Shelter located in Portland, Oregon are publicly available and were our best option for a non-equivalent control group (MCAS, n.d.)

Variables for our non-equivalent control group were limited by available public records and included only cat adoptions, euthanasias, and transfers to another facility as outcome measures. Variables for our primary data set were defined as follows: *Length of stay*: the amount of time between admission to the shelter and being released from the shelter, calculated from the exact date and time that each cat was entered into the computer by staff as having arrived and left the shelter; *Outcome*: adoption, euthanasia, or transfer to another facility; *Returned cats*: cats recorded as returned in the database; any cat that had been previously adopted from this shelter and then surrendered back to this shelter within each calendar year from 2015 through 2019 (though not always marked as returns in the database), as well as cats that were recorded as returned but had been adopted previously in a different calendar year. It should be noted that the number of cats recorded as returned was always less than the number of cats that actually had more than one surrender (failed adoption) to the shelter per each calendar year, pointing to a

problem in data accuracy at the shelter level. Due to these discrepancies, it is likely that return estimates in this sample are conservative.

Process Evaluation: Feline-ality™ Data and Variables

The ASPCA MYM® program is made up of two parts, the Feline-ality™ behavioral assay and the Cat Adoption Survey (CAS). The behavioral assay is made up of 11 items, described in detail in the ASPCA training manual and available online (ASPCA, 2007; ASCPA, n.d.; Weiss et al., 2015). See Table 1 for a description of the assay, as well as Figure 4 for scoring information, Figure 2 for the chart used to translate the final scores along the two dimensions into specific Feline-ality™, and Figure 1 for descriptions of each Feline-ality™. The CAS is provided in Figure 3. Examined variables were composed of possible implementation errors.

Possible errors in the Feline-ality™ assay included: a) mathematical errors in which negative numbers were incorrectly added or subtracted, resulting in an incorrect score for the category; b) errors when transferring individual item scores to the last page where scores were finally summed; and/or c) mathematical errors in summing the scores in individual items and in the final summation. All of these errors have the potential to affect the assigned Feline-ality™.

Possible errors in the Cat Adoption Survey (CAS) included: a) incomplete owner information – failure to answer any question on the survey renders it unscorable. This issue came up especially with question number six, regarding children in the home (a fourth option, “Children do not often come to my home” is offered in a column that is not counted for scoring and once selected, seemed to lead people to not select one of the other three options that are required for scoring (see Figure 3); b) staff error – these often included math errors, especially

with question six (which needs to be used twice in the calculations) and question one, which was often left out altogether; c) failure to recommend the correct Feline-ality™ to a potential owner, even with correct math; d) failure to record an assigned Feline-ality™ despite correct and complete owner information; e) failure to complete a CAS at all.

Statistical Tests

Changes in the outcome variable Length of Stay across years (a continuous variable) were examined using one-way analysis of variance. Changes in other outcomes (adoption, euthanasia, transfer, and returns) were examined using chi-square tests of independence (frequency data). Return rates were analyzed separately from adoption, euthanasia, and transfers, as returns were an outcome that only applied to animals that were adopted, a subset of our sample. Significance levels were set to $\alpha = .05$, and Cramer's v was calculated for effect size of chi-square tests (Cohen, 1988; Cramér, 1946). Interpretation of Cramer's v for contingency tables with more than two categorical variables depends on the chi-sq degrees of freedom; our results should be interpreted therefore using the following heuristic: as small > 0.035 , medium > 0.11 , and large > 0.18 . No statistical comparisons or inferences were made using the Feline-ality™ data; the results are descriptive only.

2.3 Results

Longitudinal Shelter Data (Outcome Evaluation)

Primary Shelter Data (SAS)

A one-way analysis of variance showed no significant differences between average length of stay across years 2015-2019 ($F(3, 2331) = 1.54, p = .19$; Figure 5). A chi-square test of independence was performed to examine the possible relationship between year and frequency of outcome (adoption, euthanasia, or transfer to another facility). The relationship between year and outcome was significant and small ($\chi^2(8, N = 2336) = 27.79, p < .001, v = .08$; Figures 6, 7, & 8). The significant χ^2 was driven by lower than expected transfers in 2015, higher than expected transfers in 2017, higher than expected euthanasia rates in 2018, and lower rates of euthanasia and higher rates of transfer in 2019 (Table 3). A chi-square test of independence was also performed to examine the relationship between year and frequency of returned adoptions. The relationship between these two variables was not significant ($\chi^2(4, N = 1950) = .79, p = .94$; Figure 9).

Non-Equivalent Comparison Shelter (MCAS)

The relationship between year and outcome was significant and small ($\chi^2(8, N = 12997) = 49.08, p < .001, v = .04$; Figure 10, 11, & 12). The significant χ^2 was driven by higher than expected rates of euthanasia and lower than expected rates of transfer in 2015, followed by lower than expected rates of euthanasia in 2016, and lower than expected rates of adoption and higher than expected rates of transfers in 2019 (Table 4).

Feline-ality™ Data (Process Evaluation)

Errors in calculating the results of the Feline-ality™ behavioral assay created small but important mathematical differences that resulted in some cats being assigned the incorrect Feline-ality™. Out of 183 Feline-ality™ assessments available for review from 2017, 26

(14.2%) had errors, 8 of which resulted in the incorrect Feline-ality™ being assigned. Of the 183 adoptions in 2017 in which Feline-ality™ assessments were available for review, 102 had no Cat Adoption Survey (CAS). Of the remaining 81 CASs, 68 (84%) had one or more errors, with the most common being incomplete owner information (78%).

Of the 183 cats, 129 had either no CAS or no Feline-ality™ recommendation recorded as having been suggested to their adoptive owner, so it is impossible to say if those cats were correctly matched using the MYM® system. Of those for whom recommendations were made (54), 9 cats were correctly matched with adopters on both IG and Valiance, 3 cats were matched correctly on Valiance only, and 42 cats were not matched as indicated by the test and survey results. Overall, a total of 3 cats were matched correctly with no errors in either the CAS or Feline-ality™, a 1.6% overall success rate.

2.4 Discussion

The outcome evaluation presented herein, when viewed in tandem with the process evaluation that revealed an extremely high error rate, provided no evidence of any effect of the MYM® Feline-ality™ program at our study shelter. The MYM® program was begun in early 2017 and continued through the end of that year. Outcomes were examined for 2 years prior to Feline-ality™, the year of its implementation, and two years subsequent (2015-2019).

Length of stay was predicted to decrease after Feline-ality™ began (2017); length of stay did not significantly change across years. The return rate was also predicted to decrease; the return rate did not change significantly across years. Adoption was expected to increase in 2017, and euthanasia and returns were expected to decrease in 2017; we had no prediction regarding

the transfer rate as Feline-ality™ makes no claims regarding an effect on transfers. We also had no specific predictions for 2018 or 2019. The frequency of adoption, euthanasia, and transfer to other facilities changed significantly across the five-year study period. The overall adoption rate fell across the 5 years, as did euthanasia rates. The changes in adoption rate and euthanasia rate in 2017 were negligible (and running counter to our prediction), followed by an increase in euthanasia in 2018. The transfer rates increased overall and the changes year-over-year in transfer rates contributed the most to the overall significant chi-square. The euthanasia rate initially was trending downward across 2015 through 2017, spiked upward in 2018, and appeared to be decreasing again in 2019. The euthanasia rate pattern seems to be the opposite of the transfer out rate pattern: as more cats are transferred to other facilities, the need for euthanasia may go down (and vice versa). This inverse correlation between euthanasia and transfer is sufficient to explain the significant differences seen in our data. If there was any effect of MYM® in 2017, this effect does not appear to have persisted beyond that year, not unsurprisingly given the extremely small effect size describing the differences in outcome variables between years. These small and short-lived effects seem to indicate either that the MYM® Feline-ality™ is an ineffective program and/or that it was poorly implemented.

Non-experimental designs are subject to threats to internal validity; that is to say, identifying whether the intervention in question actually caused any observed effect. Quasi-experimental designs are able to address some of these threats to internal validity to varying degrees. The main threats to internal validity, or inferring causality, are: maturation, testing, instrumentation, regression to the mean, selection, history, and attrition (Campbell, 1957; Campbell et al., 1963; Flannelly et al., 2018). Testing threats do not apply to our study (there were not multiple tests administered to participants that could have had an effect on subsequent

tests). The time-series itself (more than one pre- and post-test period) allowed us to look for any possible threats due to regression to the mean. Had there been evidence of regression to the mean, we would expect to see a peak high in euthanasia, and a nadir in adoptions prior to the implementation of the new program (these metrics would have been the triggers for such an implementation); we did not see this pattern and it is therefore safe to say that regression to the mean does not explain our findings. An instrumentation threat was also a possibility in our study: the computer system used for tracking animals changed after 2015. According to the shelter, the length of stay information collected in 2015 using that database was potentially faulty (Seattle Animal Shelter, 2018). However, the multiple time points over the subsequent years and the lack of significant changes in length of stay across subsequent years, support the idea that instrumentation issues were not a significant problem in our study. It is possible that the change in computer database might also have affected other outcome variables; *post hoc* analysis of all variables, omitting all data from 2015, produced the same patterns of significance and lack thereof for all outcome variables.

Our study was also able to address possible instrumentation effects, and investigate possible maturation or history effects (internal or external processes or events that might have occurred during the treatment period or cooccurred with the treatment), as well as selection threats (our study shelter being markedly different from the outset from other shelters), by including a non-equivalent control group. Our non-equivalent control group was the Multnomah County Animal Shelter (MCAS). Though similar to our primary shelter (MCAS is a municipal open-admission shelter located in Portland, Oregon), there were some important non-equivalencies that should be mentioned. We limited our primary dataset to only cats that might have been theoretically affected by Feline-ality™ (e.g., over the age of nine months, not feral,

etc., – see previous subjects description for details); we were unable to access that detailed information for the MCAS dataset. Also, our primary dataset counted outcomes, not individual cats (some cats who visited the shelter more than once had different outcomes at each visit, as described previously). Therefore, there were more outcomes than unique cats (on average, 5% more outcomes than cats across the five years), which appears to differ from the comparison group. With these caveats, and bearing in mind that a non-equivalent control group is exactly that, nevertheless, the additional data from MCAS were considered useful to look at broad trends in outcomes across years in a similar shelter. Instrumentation effects are unlikely – the trends in outcome variables that we were able to compare are similar and would be expected to be different if the change in computer database at our primary shelter (SAS) were a large problem. Selection threats cannot be definitively ruled out, as the starting percentages of adoptions and transfers were markedly different (e.g., about half of cats were adopted at MCAS and approximately 40% were transferred out of MCAS, whereas at our primary shelter, those same outcomes were approximately 85% and 10%, respectively). Overall, transfer rates increased in both shelters, and adoption and euthanasia rates decreased (no data for return rates or length of stay were available from the comparison shelter). The apparent spike at our study shelter in euthanasia in 2018, mirrored by the 2018 dip in transfer rates, is the only deviation from the similarity in overall patterns between the two shelters. However, when compared to publicly available data on overall trends in transfers and “other than live releases” (which include euthanasia and other deaths) for our study shelter (2016-2019), this same mirrored spike occurred shelter-wide (including all species handled by SAS) and is therefore not limited to cats, nor attributable to Feline-ality™ (Shelter Animals Count, n.d.). Furthermore, the similarity in trends across years for the two shelters fails to rule out the possibility that history or maturation

effects occurred at SAS; it is possible and even likely that the trends in both shelters were due to some alternative explanation(s), the most likely of which might be overall changes in shelter practices and attitudes over that time period. Since the Asilomar Accords of 2004, during which a group of 20 animal sheltering stakeholders (including the ASPCA) called for a national database to track sheltered animals and their outcomes (SAC, n.d.), there has been a concerted effort and some success in the animal sheltering community at large to increase the live release rate and decrease euthanasia, often by transferring animals taken in by large or municipal shelters to other animal rescue organizations (Weiss et al., 2013). This explanation explains our data better than MYM[®] Feline-ality[™].

Program evaluation is made up of multiple components, the first of which is a needs assessment. In the needs assessment provided by JCH, SAS was advised regarding multiple areas that could be changed in order to improve overall adoption success and well-being. The complete needs assessment is available upon request from SD or JCH. For cats specifically, aside from the MYM[®] Feline-ality[™] program, it was also suggested that the shelter should improve training of volunteers and staff in basic feline maintenance and behavior, provide enrichment to cats (e.g., olfactory stimulation, food-puzzles, and auditory enrichment), and change and codify cage housing procedures for cats (e.g., provide hiding areas, limit exposure to dogs, place outgoing cats in more exposed cages, while reserving quiet cages for new or scared cats). Given our quasi-experimental design, it is important to consider what effect, if any, the needs assessment might have had on our results.

In terms of the needs assessment, any effect caused by its existence and dissemination, or changes made as a result of its suggestions (outside of the MYM[®]), would fall under the category

of historical, or external, threats to inferring causality. Simply being exposed to the needs assessment, prior to any further intervention, could induce behavioral changes in shelter staff that might improve outcomes for cats, as staff attempt to ameliorate problems that they have now become aware of (e.g., seemingly-aggressive cats transferred out rather than euthanized), or might alter the outcome data in other ways, such as lowering the average length of stay, as more cats are transferred out. The needs assessment was conducted in early 2016 and shared with the shelter in May of 2016; transfer rates did indeed begin to increase in 2016 and reached significant levels of change in 2017. However, if there was an effect of the needs assessment that drove transfer rates initially, that effect disappeared by 2018 and therefore cannot explain the significant rebound in 2019. Given that transfer was not specifically mentioned as a suggestion in the needs assessment, we consider any effect of the assessment on transfer rates to have been unlikely to induce any lasting change in cat outcomes.

Specific suggestions made in the assessment might also pose history threats to the internal validity of our outcome evaluation. Improving training for staff and volunteers regarding cats overall is one such possibility. As staff became more aware of species-specific considerations and behavioral indicators related to which would benefit from a foster home, which might benefit from transfer to another facility and which were likely to do well in a shelter environment, it is logical to assume that outcomes could be influenced. However, outside of the intensive Feline-ality™ training provided by SD, there is little evidence that other training and education was undertaken at an appreciable scale. The progress report summarizing the behavior program in May 2018 indicated that written volunteer materials were updated, and that four volunteers and two staff members (comprising the Cat Behavior Team) met with another area shelter with a well-established cat behavior program, and received training in learning theory

(Seattle Animal Shelter, 2018). The Cat Behavior Team focused largely on cat behavior modification but, per the progress report, the need for such behavioral interventions decreased after changes in housing and enrichment, and the Cat Behavior Team was not expanded (Seattle Animal Shelter, 2018). It is unknown how much of an effect this additional training might have had, but given the small number of people involved, it is reasonable to assume that it is unlikely to explain our results. Based on personal observation, many of the other recommendations regarding enrichment, housing, and exposure to dogs were either not instituted or instituted haphazardly or inconsistently, and therefore were unlikely to have influenced our results in a systematic fashion.

Another alternative explanation, suggested by a staff member in an internal program evaluation submitted to management at the end of 2017, attributed falling euthanasia rates in 2017 to a hospice care program (“Fospice”), instituted in 2016, in which cats with a diagnosed illness and a prognosis of less than six months were placed in long-term palliative foster care, rather than euthanized (Seattle Animal Shelter, 2017). However, while Fospice does indeed delay euthanasia, it does not prevent it, and this delay in euthanasia does not do a better job of explaining the subsequent pattern we saw in euthanasia rates in 2018 (spike) and 2019 (drop), than does the change in transfer rates. It is more likely that the Fospice program would have affected the average length of stay for cats, as animals that would have previously been euthanized due to terminal illness instead lived longer in foster care. However, LOS did not change significantly over the study period.

The same 2017 internal staff evaluation also suggested that there might have been an effect on cat outcomes related to the hiring of full-time veterinary staff and/or the creation of a

cat adoption follow up team (Seattle Animal Shelter, 2017). However, it reasonably follows that an increase in diagnosis and in-shelter treatment of manageable medical conditions would have increased the pool of cats that would now be deemed adoptable, and that the diagnosis of unmanageable and terminal illnesses would either increase the euthanasia rate or increase the number of cats eligible for Fospice, (which if happening at a significant rate, should have showed up in our LOS data), none of which explain the changes in adoption rates or euthanasia rates in our data, either in 2017 or in years following. Return rates did not change significantly, providing no evidence that the cat adoption follow-up team was a significant factor in our findings.

Whereas the lack of substantive effect may indicate that MYM[®] Feline-ality[™] does not perform as purported, it is equally as likely (if not more so) that this absence of evidence of any results reasonably attributable to Feline-ality[™] has occurred because the error rate in implementation of the program was very high. The retrospective process evaluation revealed that only three cats were matched with their adopters along both Feline-ality[™] dimensions without any errors in either the assay or the survey. Nine cats were matched correctly along both dimensions despite errors in the underlying paperwork. In the original work creating the MYM[®] Feline-ality[™] program, the ASPCA describes that approximately 55% of cats were matched perfectly to their new owners, as compared to 4.9% at our primary study shelter (ASPCA, 2007). Furthermore, the majority of cats were paired without any record of the adoptive owner having completed a CAS. Of those that did complete the CAS, the error rate was 85%. The Feline-ality[™] behavioral assay also showed errors. However, the assay could more flexibly absorb errors due to the range of numbers allowable by the scales; errors caused a cat to be incorrectly labeled as the wrong Feline-ality[™] in only 4.4% of the cases. The fact that a poorly implemented

program necessarily impacts the results of an outcome evaluation underscores the need for process evaluation concurrent with implementation.

The lack of effect may have occurred because the error rate in implementation of the program was very high. It may also have occurred because SAS stopped implementing the MYM[®] program as it was designed. In early 2018, the shelter reported that it had modified the program such that most cats were “fast-tracked” and only a subset of less well-socialized cats were given the entire Feline-ality[™] assessment. Fast-tracking was described as follows in an internal staff report:

Once the cat has eaten on its own, been in the shelter a minimum of 18 hours, and is medically sound enough to go through a Feline-ality[™] assessment, the assessment can start. The Assessment will start as any normal Feline-ality[™] would, however if the cat has an aggregate score of 5 or higher on items #1 through #4, the cat will be fast tracked. If the aggregate score is below a 5, the remainder of the Feline-ality[™] will be performed and the cat routed accordingly. Likely we would only be performing a completed Feline-ality[™] on what would be deemed purple cats (Private Investigator / Secret Admirer / Love bug), which are also the harder adoption cases aside from cats that are medically fragile or have more profound behavior concerns (forwardly aggressive). We would still keep the application process the same and there would be no changes done to the “cat adoption survey” at this time (Seattle Animal Shelter, 2017).

Fast-tracking may have started earlier than management was made aware of. There also may have been attrition in completion rates (another threat to internal validity). Either could account for the fact that only 183 cats were recorded as having undergone the Feline-ality[™] testing in 2017, despite the fact that 527 cats that theoretically could have been assessed were taken in during 2017. Fast-tracking could also explain why our distribution of Feline-ality[™] is 42.5% “purple” or lower valiance cats, and only 5.5% are “green” or high valiance cats (it is impossible to assess whether our distribution is statistically significantly different from previous

distributions, as the distributions of Feline-ality™ in the ASPCA training manual (2007) and Weiss et al. (2015) were not described in detail).

SAS suspended Feline-ality™ assessments between January 2018 and April 2018 in order to evaluate whether length of stay (LOS) would be affected. According to their internal analysis, average LOS was not affected by the suspension of the assessment and remained stable, though variability appeared to decrease (Seattle Animal Shelter, 2018). The shelter interpreted the results of their evaluation to indicate that the MYM® program was not delivering the desired outcomes but that perhaps simply training staff to better recognize body language and understand feline behavior was improving overall cat adoption decisions (Seattle Animal Shelter, 2018). It was their final conclusion that they should therefore “continue to train Animal Care staff on a formal program to recognize cat body language and behavior that leads to good routing decisions” (Seattle Animal Shelter, 2018). However, the technique used to evaluate the change in LOS and the change in variability in LOS was not statistically rigorous. Monthly averages in LOS for all cats over the age of 6 months were visually compared from January 2016 through March 2018 (see Figure 13). Based on the variance gleaned from the data presented in this chart, we were able to investigate variability by comparing the variance in LOS across the months prior to the introduction Feline-ality™ and subsequent to its introduction. This was done in three ways: removing the most extreme values that might be a statistical side effect of regression to the mean (January 2017 being the most extreme LOS duration (and therefore perhaps evidence of the impetus for instituting a program at all)) and February of 2017, the extreme nadir); comparing the same months to each other between the two years (including extremes), or splitting the data at February of 2017, the month in which the program was formally introduced (including extremes). In our *post hoc* analysis, we looked at these data in all three ways listed

above and applied Levene's test of homogeneity of variance to each; all were non-significant (p values: .61, .56, and .31 respectively), which indicates that variability did not differ between the time prior to Feline-ality™ and the time after (the Levene test proposes the null hypothesis that variance between two groups is the same. If the p value for the test is significant, then that null hypothesis is violated and there is evidence that the variances of the two groups are in fact different). In light of this homogeneity of variance, the extreme decrease in LOS in February of 2017 is likely attributable to the statistical phenomena of regression to the mean, and does not represent an effect of Feline-ality™, nor can the variability be interpreted as evidence of an effect of general cat behavioral training.

At this point, it is unclear whether any form of the MYM® program remained in place after January of 2018, nor is it clear what, if any, formal cat behavior training continued after this date. All of these things combined with poor implementation of the program may explain the falling adoption rates, rising return rates, and increasing lengths of stay that appeared to be recurring by the end of the study period. It is, however, both impossible to attribute any changes to MYM® Feline-ality™, and equally as impossible to rule out any effect; without proper implementation, an outcome evaluation is uninterpretable.

We briefly alluded to possible selection threats to the internal validity of our design above when we noted that initial rates of adoption, euthanasia, and transfers were markedly different between the two shelters. It is also possible that our study shelter may have differed in other ways that could have directly contributed to the poor implementation of the MYM® Feline-ality™ program. Specifically, the study shelter suffered from inadequate staffing levels and an inefficient distribution of labor (Ha, 2016). However, regardless of possible issues at our study

shelter, which may or may not be unique to our site, our work has also revealed some weaknesses inherent in the MYM[®] Feline-ality[™] program that also contribute to difficulties in implementation.

First and foremost, the fact that the CAS allows for no human error is simply not practicable. Any of the first ten questions not answered or answered incorrectly, and not caught and corrected by the staff, can and did lead to errors that prevented accurate matching between prospective adopters and appropriate cats. A difference in just one point in scoring the CAS can lead to assignment of the incorrect Feline-ality[™] match (the behavioral assay is more robust to human error because of the larger range of values that describe the Feline-ality[™] ; small math errors are less likely to have an effect). It is not reasonable to assume that staff will catch all errors on the CAS and some error rate in the overall program is to be expected. However, the high error rate seen here may, at least in part, indicate that the training provided by the ASPCA is inadequate.

The materials available for training in the MYM[®] Feline-ality[™] program are lacking in some key areas. There is one video for practicing the entire behavioral assay and one portion of a video that walks through the scoring of the CAS. Because we had access to the DVD from the original program, we were able to piece together an additional video of the full assay for use as practice in the training sessions, as well as two additional CAS practice videos. As part of their training, staff also practiced the full assessment on live cats during training, with SD there to provide feedback, as well as practiced scoring new CASs provided by SD, with oversight from SD. Furthermore, the CASs provided by the ASPCA for scoring practice did not include any errors, so learners would not have the opportunity to practice catching errors; in our training, this

was provided. Additionally, the ASCPA materials do not provide any other opportunities for self-evaluation, such as quizzes; we created quizzes and incorporated them into both staff and volunteer training. All of this means that our study shelter actually had more extensive training on the assay and the CAS than they would if they had only used the ASCPA materials. There is no information that describes how other shelters might use or improve upon the materials provided by the ASPCA; there is likely to be variability in the this aspect of the program implementation, which points to weaknesses in elements that are necessary prior to the successful adoption of a new program, namely diffusion, and specifically dissemination and replication (for a useful definition of these terms, see Goldman, 2003).

Another potential area of weakness is in the training surrounding adoption counseling. As far as we are aware, there are no data regarding the efficacy of this aspect of the online training (communicating the results of the Felinality assay, and the CAS effectively to potential adopters). The focus of this part of the training material is on presenting the information to adopters using specific soft skills (such as keeping one's tone positive or ascending, using open-ended questions, paraphrasing to indicate listening, etc.). Soft skills are notoriously difficult to train and even more so via non-interactive online media (Mahadevan et al., 2017; Yan et al., 2019). During training at our study shelter, we did roleplay adoption counseling and it is possible that other shelters might do this, too. However, based solely on the materials from the ASCPA, it is unlikely that adoption counseling techniques would be affected, which could also adversely affect the implementation of the MYM[®] Feline-ality[™] program.

To our knowledge, this study represents the first systematic program evaluation of MYM[®] Feline-ality[™]. The results of our evaluation indicate that successful implementation of

the program requires proper consideration of the process of implementation, ideally both concurrent with and subsequent to implementation, and that without attention to that process, the error rate in implementation may render any outcome evaluation problematic, as it did here.

From an applied science perspective, this is concerning. If funding allocation decisions are made based on an outcome evaluation that is in turn based on poor implementation, the risk of either rejecting useful programs or continuing to fund useless programs is unacceptably high.

2.5 Tables and Figures

Table 1

The Meet Your Match Feline-ality™ behavioral assay (ASPCA, 2007; Weiss et al., 2015).

Item	Observer instructions	Listed possible behaviors	Scores
1. Body Posture	Quietly approach the cat's cage door and while standing in front of the cat's cage, take a quick mental snapshot of the cat's body posture. Choose one of the following Responses.	Soft and relaxed	+1
		Tense body with twitching tail	+1
		Flattened body with dilated pupils	-1
2. Greeting Approach	Immediately after taking a mental snapshot of the cat's body posture during item #1, begin to speak to the cat in a soft, normal tone of voice. Observe the cat's response to your presence through the closed cage door. Choose one of the following responses.	At front of cage, soliciting attention by rubbing, chirping, etc.	+3
		Comes to the front of the cage after you encourage	+2
		Does not approach but meows, chirps, or blinks (circle all that apply)	+1
		Does not approach	0
		Attempts to hide	-1
		Hisses or growls	-2
		Charges	-3
3. Cage Condition	While quietly standing in front of the cat's cage, observe and note its condition. Choose one of the following.	Bedding/cage paper moved, cat hiding under	-1
		Cage rearranged, cat on top or not hiding	+1
		No change	0
		Other, please describe	0
4. Social Response when door is opened	After completing items 1 through 3, calmly and slowly open the cage door while watching the cat. This should be done without talking. Observe the cat at the moment the door is initially opened. Choose one of the following responses.	Remains relaxed and soft, approaches me	+1
		Remains relaxed and soft, does not approach	0
		Becomes stiff with tight tail flicks and standing	+1
		Crouches, body stiff	-1

Table 1 continued.

Item	Observer instructions	Listed possible behaviors	Scores
5a-b. Introduction to a Novel Room	Take the cat out of the cage and place him into a plastic crate (cleaned and allowed to air) for transport to the Novel Room. Ideally the cat should be loaded into the crate from above (turn crate so door is facing the ceiling). Throughout this item, you will be recording the amount of time the cat is either interacting or not interacting with you. In order to obtain an accurate assessment of time spent in each activity, use two stopwatches — one to keep the total time (start when you open crate door, end at five minutes), and the second to keep track of time interacting with you. Click on the second stopwatch whenever an interaction begins and click it off once the interaction ends. IMPORTANT: OTHER THAN EYE CONTACT, DO NOT INITIATE, ENGAGE WITH OR RESPOND TO THE CAT. INTERACTION INCLUDES EYE CONTACT OR OTHER BEHAVIOR EVEN WHEN THE CAT IS IN THE CARRIER. Interactive behaviors include meows, chirps, looks, blinks, rubbing against you, touching you, and being in your lap. Be sure to include those behaviors made while inside the carrier after the door has been opened.	(5a) Exits carrier in 25 seconds or less with a tall body posture	+1
		(5a) Exits the carrier in 25 seconds or less with crouched body posture	+1/2
		(5a) Exits the carrier within 25 seconds and quickly scoots to hiding place, keeping body low to the ground	-1/2
	5a - choose one (if applicable)	Investigates room while standing tall	+1
		Investigates room in a low body posture	+1/2
		Races out of carrier to one spot in the room and stays there	-1/2
	5b	(5b) Time spent interacting with evaluator (as determined by second stopwatch)	__sec
		(5b) Time not spent interacting with the evaluator	__sec
	5b - choose one	Interacts for more than 60 seconds	+1 1/2
		Interacts for 30-60 seconds	+1
		Interacts for less than 30 seconds	0

Table 1 continued.

Item	Observer instructions	Listed possible behaviors	Scores
6. Call and Approach	Crouch down on the opposite side of the room from the cat and about five to six feet away, start the stopwatch, and call the cat several times. Extend one hand, closed in a fist, toward him. Stop the stopwatch when the cat approaches and makes contact with your hand or body. Allow the cat up to 30 seconds to approach. Be sure to talk softly and encourage forward with voice. Check all behaviors that occur.	Makes eye contact	+1
		Does not make eye contact	-1
		Approaches	+3
		Sniffs or head butts	+3
		Rolls on back or rolls over	+2
		Meows, purrs and/or chirps (circle all that apply)	+1
		Watches with no approach	0
		Retreats	-1
		Hisses and/or growl	-2
7. Open Hand	While still crouching, extend an open hand to the cat. Your hand should be lower than the cat's head. If the cat did not approach you in item #6, walk toward and crouch next to the cat. Check all behaviors that occur.	Sniffs or head butts	+3
		licks or rubs on hand	+3
		Rolls on back or rolls over	+2
		Meows, purrs and/or chirps (circle all that apply)	+2
		Retreats/defensive position	-2
		Hisses and/or growls	-2
		Swats/attempts to swat hand	-2
		Bites/attempts to bite hand	-3
8. Stroking	While talking to the cat, use your open hand, slightly cupped, to stroke the cat in long strokes along the head, back and sides. Continue for 4-5 long slow strokes if possible. Check all behaviors that occur.	Rubs against legs or hand	+3
		Head butts	+3
		Circles you attentively	+2
		Meows, purrs and/or chirps (circle all that apply)	+2
		Rolls on back or rolls over	+2
		Shows initial fear but then relaxes	0
		Retreats/defensive position	-1
		Hisses and/or growls	-2
		Swats or attempts to swat hand	-2
		Bites or attempts to bite hand	-3
9. Play	Beginning a couple of feet away from the cat, slowly move a piece of string/yarn along the floor to initiate play. Observe that cat's reaction. Then try to engage the cat in play with two other toys from the following list (for a total of three different toys): Ball, Toy Mouse, Cat Charmer, and Feather Wand. Do not use catnip toys during the Feline-ality Assessment. Check all behaviors that occur. Circle the toy preferences on the score sheet so the adopter will know which toys the cat prefers, if any.	Watches toy intently	+3
		Chases toy	+3
		Comes back for stroking	+2
		Ignores toys	0
		Attends to something else	-1
		Avoids eye contact	-1

Table 1 continued.

Item	Observer instructions	Listed possible behaviors	Scores
10. Hug	Call the cat again until he approaches, or approach him slowly yourself. Begin to stroke the cat again and if he is calm, gently pick him up and cradle him against your chest, his body sideways to your chest for a full two seconds. Check all behaviors that occur.	Is relaxed	+3
		Extends paw to evaluator's neck or shoulder in an affiliative manner	+3
		Meows, purrs and/or chirps (circle all that apply)	+2
		Accepts hold but remains a bit tense	+2
		Struggles to escape	-1
		Hisses/growls	-2
		Stiffens and extends claws	-2
		Swats/attempts to swat hand	-3
		Bites/attempts to bite hand	-3
11. Sensitivity	Sit on the ground and allow the cat to approach if he chooses. Wait at least 60 seconds before you stroke the cat along his back and gently grasp the cat's tail firmly at the base and pull up with a steady pressure just enough almost, but not quite, move his back feet off the floor. Hold for 1 second. Check all behaviors that occur.	Rolls on back or rolls over	+3
		Shows no reaction	+3
		Meows, purrs and/or chirps (circle all that apply)	+1
		Struggles/tries to escape	0
		Hisses/growls	-1
		Swats/attempts to swat	-2
		Bites/attempts to bite	-3

Table 2

Summary subject and descriptive data, SAS. The “Admissions” column shows the number of unique cats who fulfilled criteria that were admitted in each year, as well as the number of those cats who had two or more visits to the shelter during that same year. The “Sex” column also reports the percentage of animals that were verified to be altered. Some cats were unaltered or could not be verified as spayed either visually or via palpation of an abdominal scar; it is a reasonable assumption that all animals were desexed before being adopted, as per shelter policy.

Year	Admissions	Adoptions	Euthanasias	Transfers	Returns	Age	Average Length of Stay	Sex
2015	248; 16	236	18	10	17	Range: three months to 17 years (M = 5.85y, SD = 4y)	1.7 months (M = 50.4d, SE = 7.9d)	53% male; 99.2% altered
2016	558; 24	493	38	51	35	Range: nine months to 20 years (M = 5.65y, SD = 3.9y)	1.3 months (M = 40.2d, SE = 4.3d)	54% female, 0.01% unknown; 95.5% altered.
2017	527; 27	451	34	72	34	Range: nine months to 28 years (M = 5.55y, SD = 4.2y)	1.3 months (M = 39.3d, SE = 4.2d)	56% female, 0.01% unknown; 96.5% altered.

Table 2 continued.

Year	Admissions	Adoptions	Euthanasias	Transfers	Returns	Age	Average Length of Stay	Sex
2018	444; 15	379	41	41	23	Range: nine months to eighteen years (M = 6.15y, SD = 4.75y)	1.5 months (M = 46.3d, SE = 4.8d)	54% female, 0.001% unknown; 95.5% altered
2019	451; 21	391	22	59	26	Range: nine months to twenty years (M = 6.5y, SD = 4.75y)	1.8 months (M = 53.8d, SE = 6d)	53% female, 0.004% unknown; 97.1% altered.

Table 3*Frequency Table for Primary Shelter (SAS). Observed (Expected) [Contribution to overall χ^2]*

Study Shelter	2015	2016	2017	2018	2019
Adoption	236 (220.38) [1.11]	493 (485.83) [0.11]	451 (464.96) [0.42]	379 (384.82) [0.09]	391 (394.01) [0.02]
Euthanasia	18 (17.29) [0.03]	38 (38.12) [0.00]	34 (36.48) [0.17]	41 (30.19) [3.87]	22 (30.91) [2.57]
Transfer Out	10 (26.33) [10.13]	51 (58.05) [0.86]	72 (55.56) [4.87]	41 (45.98) [0.54]	59 (47.08) [3.02]

Table 4*Frequency Table for MCAS. Observed (Expected) [Contribution to overall χ^2]*

MCAS	2015	2016	2017	2018	2019
Adoption	1337 (1290.55) [1.67]	1342 (1305.38) [1.03]	1393 (1368.70) [0.43]	1154 (1187.66) [0.95]	1203 (1276.70) [4.25]
Euthanasia	332 (268.19) [15.18]	235 (271.27) [4.85]	272 (284.43) [0.54]	237 (246.81) [0.39]	260 (265.31) [0.11]
Transfer Out	940 (1050.26) [11.58]	1062 (1062.34) [0.00]	1102 (1113.87) [0.13]	1010 (966.53) [1.95]	1118 (1038.99) [6.01]

Figure 1

Descriptions of the nine possible Feline-alties™ (ASPCA, 2007).

	love bug Do you seek affection? I do! If you also like petting, purrs, and paws kneading your lap, I think we might have A LOT in common. I'm looking for "someone who enjoys quiet times and togetherness." Could that someone be you?
	secret admirer When it comes to relationships, I'm very level-headed. I don't leap in paws first, if you know what I mean. But give me a little time, and then I'll shower you with purrs, head-butts, and plenty of lap time. In the meantime, you may not see a lot of me—but I'll be thinking a lot of you.
	private investigator I'm working undercover to keep an eye on you and your household. You may not even know you're under surveillance. I can vanish into thin air if anyone or anything interferes with my investigation. If you need a cat who knows how to stay out of trouble and will always keep your secrets, I just might take your case.
	personal assistant You're working on the computer? Let me press the keys. Reading the paper? I'll hold the pages down for you. Watching TV? I'll just plop in your lap so you can pet me. I love an orderly household, don't you? I'll help you with all your chores, and I'll help you relax when we're done. You'll wonder how you ever managed without me.
	sidekick Like all sidekicks, I'm just plain good company. I like attention, and I also like my solitude. I don't go looking for trouble but I'm no scaredy-cat, either. If you are looking for a steady companion to travel with you on the road of life, look no further.
	the executive I have to say, I'm a busy cat. First, I've got to check out what's happening out the window. Next, I'll see if any closets or cupboards need looking into. And then there are my naps—can't be late for those. I can fit a little socializing into my schedule. Shall we plan on breakfast and dinner? I hope you like kibbles.
	leader of the band I'm a cat who does everything in a big way. I not only like to be in the middle of things—I like to lead the parade. I'm an adventurous cat, but I'll still make plenty of time to show you my affectionate side. I'm the demonstrative type, you might say. Want a cat who's brimming with confidence? That's me.
	party animal I'm a cat on a mission: PARTY! I love to play and explore and test my limits. I'd love to play with you, but I can make a toy out of anything: pencils, post-it notes, potatoes. If you're looking for some laughs and someone to liven up the party, think about inviting me.
	MVP I'm a savvy cat who knows the score. I'm pretty unflappable, too. I don't mind entertaining myself, but a human companion at the other end of the couch and a nice scratch behind the ears always make my day. If you're looking for a resourceful addition to your team, think about signing this Most Valuable Pussycat.

Figure 2

The sum of items 1, 2, 4, 5b, 6, 9, 10, and 11 provide a total Independent-Gregarious (IG) score that is then located along the top of the chart and corresponds to the level of sociability that the cat is likely to show. Items 3, 5a, 6, 7, 8, and 9 are summed and compared to the chart on the left side, indicating the level of valiance (or confidence) a given cat is likely to demonstrate (ASPCA, 2007; Weiss et al., 2015).

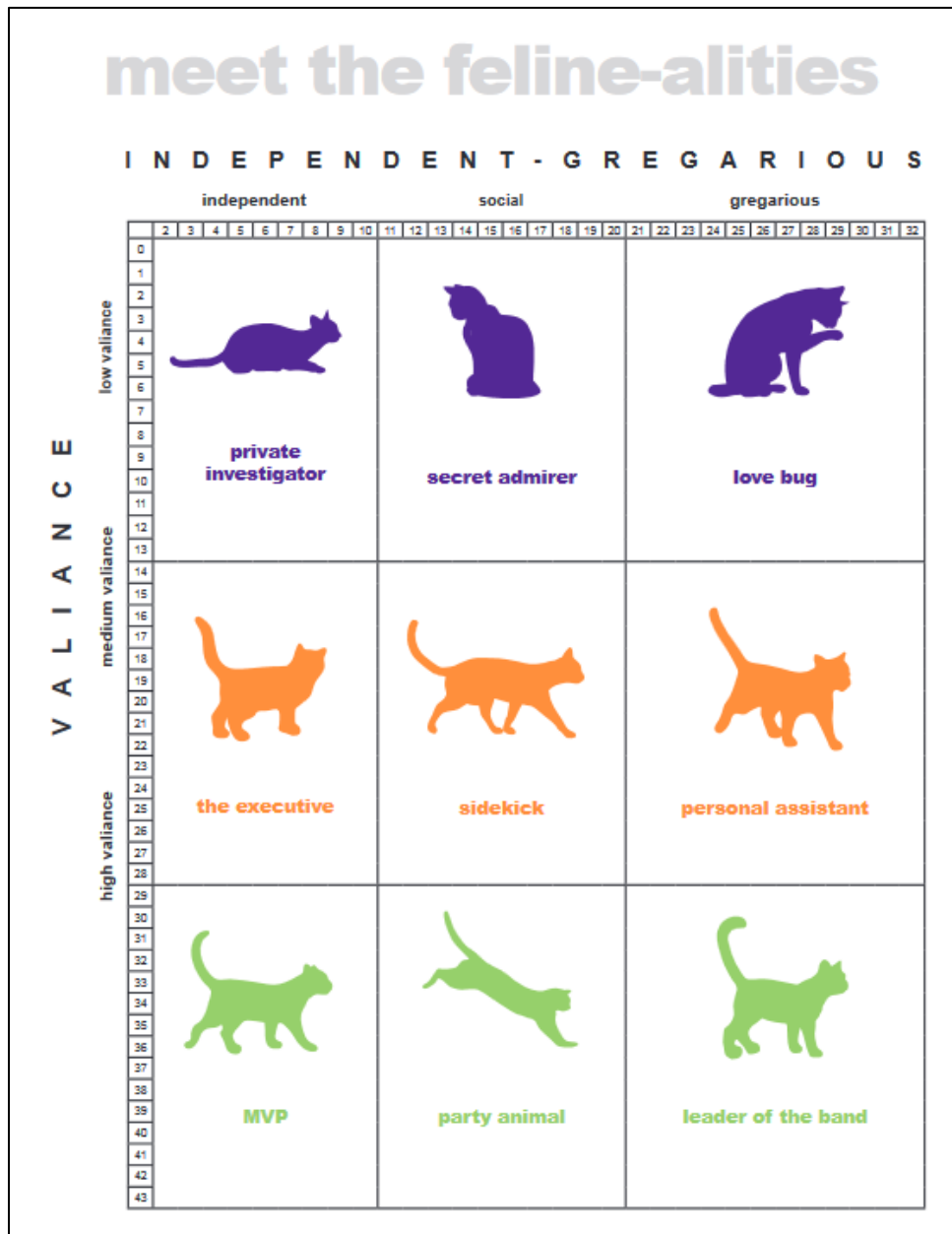


Figure 3

Items one through nine are required in order to accurately score the CAS and item six must be counted twice (the sum of 1-6, and then the sum of 6-9), for each column. Items 10 through 16 are for information purposes only. Questions in the fourth column, regardless of item number, are not included in final calculations. The suggested matching Feline-ality™ is recorded on the bottom and owners are directed towards those cats whose behavioral assay result corresponds to their CAS result. See ASPCA (2007) for detailed description of scoring.

cat adopter survey		MYM MEET YOUR MATCH			
first name	last name	date			
address		apt. #			
city	state	zip			
home phone ()	work phone ()	email			
1	I would consider my household to be like	A library	Middle of the road	A carnival	
2	I am comfortable with a cat that likes to play "chase my ankles" and similar games	No	Somewhat	Yes	
3	I want my cat to interact with guests that come to my house	Little of the time	Some of the time	All of the time	
4	How do you feel about a boisterous cat that gets into everything?	Love them but rather not to live with them	Depends on the situation	Fine by me	
5	My cat needs to be able to adjust to new situations quickly	Not important	Somewhat	Yes	
6	I want my cat to love being with children in my home	It's not important whether my cat loves being with children	Some of the time	Most of the time	Children do not often come to my house
7	My cat needs to be able to be alone	More than 9 hours per day	4 to 8 hours per day	Less than 4 hours per day	
8	When I am at home, I want my cat to be by my side or in my lap	Little of the time	Some of the time	All of the time	
9	I want my cat to enjoy being held	Little of the time	Some of the time	Most of the time	
10	I need my cat to get along with (circle all that apply)				Dogs Cats Birds Other
11	My cat will be	Inside	Inside and Outside	Outside	
12	I have lived with cats before	No		Yes Date _____	Currently
13	I prefer my cat to be talkative	No		Yes	It's not important if my cat is talkative
14	I want my cat to play with toys	Little of the time	Sometimes	Often	
15	I want my cat to be active	Not very active at all	Somewhat	Yes, very	
16	It is most important to me that my cat _____ (fill in the blank)				
FOR OFFICE USE ONLY	RECOMMENDED COLOR MATCH: PURPLE ORANGE GREEN				
	RECOMMENDED FELINE-ALITY™ (IES) _____				

Copyright © 2009 The American Society for the Prevention of Cruelty to Animals®. Reprinted with permission of the ASPCA®

Figure 4

Final page of the Feline-ality™ assessment where scores on the 11 items are summed and a feline-ality is assigned. Items 1, 2, 4, 5b, 6, 9, 10 and 11 are summed, and items 3, 5a, 6, 7, 8, and 9 are summed – note that items 6 and 9 are used in both summations. See ASPCA (2007) for step-by-step details on the procedure for conducting and scoring the assay.

overall score		
item #1		
item #2		
item #3		
item #4		
item #5a		
item #5b		
item #6		
item #7		
item #8		
item #9		
item #10		
item #11		
	independent-gregarious	valiance
total score		

Figure 5

The average length of stay (LOS) for adult cats across a five-year period at SAS. The Meet Your Match[®] program was implemented in 2017. Error bars represent standard error. The LOS did not change significantly across 2015-2019.

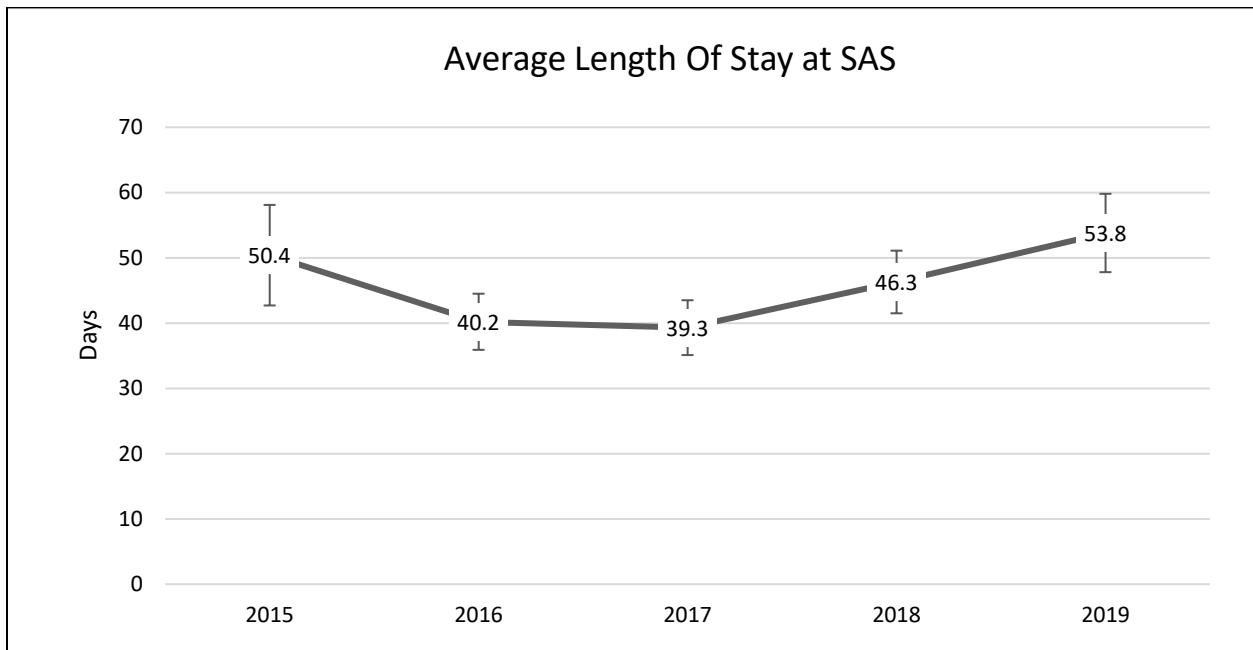


Figure 6

The percentage of adult cat adoptions across the five-year period (SAS). The adoption rate did not change significantly between 2015-2019.

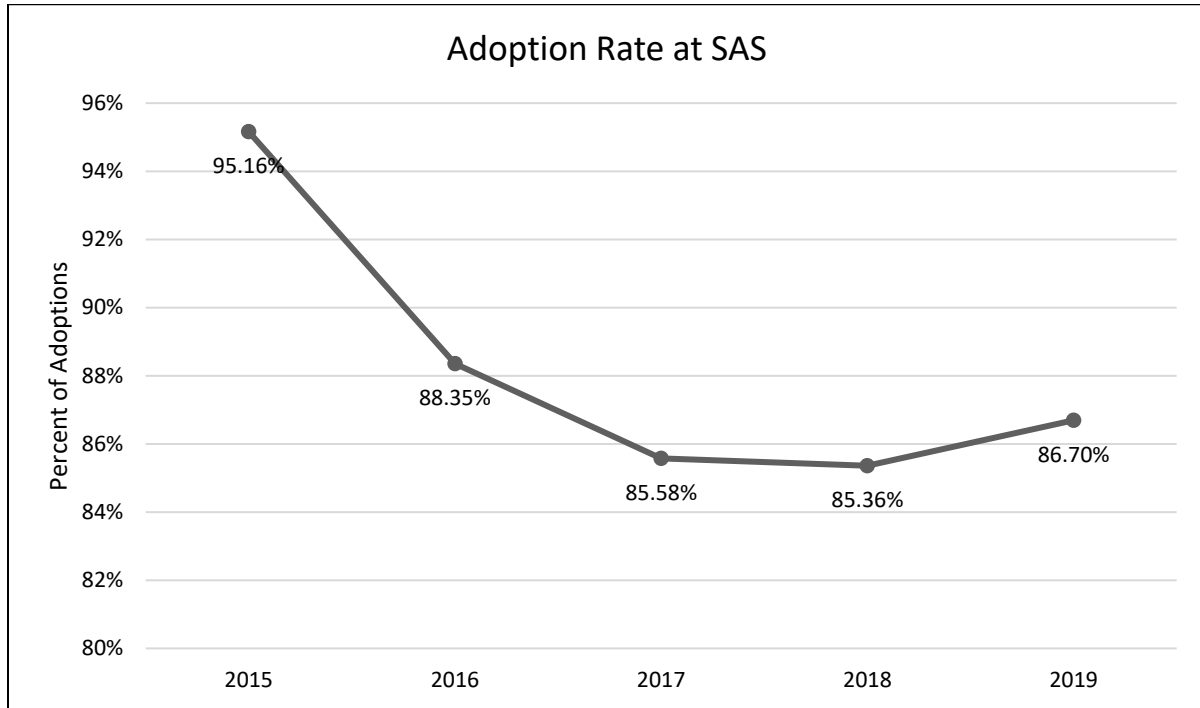


Figure 7

The percentage of adult cat euthanasias across the five-year period (SAS). There were significantly more euthanasias in 2018, and significantly fewer in 2019.

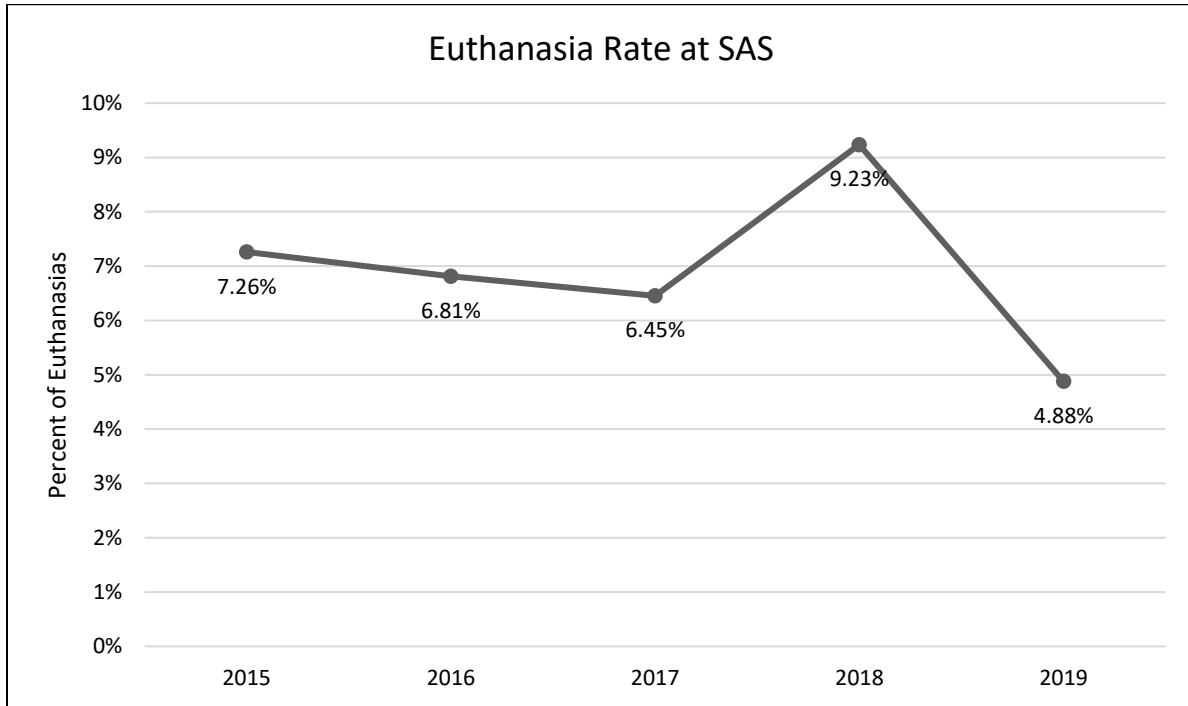


Figure 8

The percentage of adult cat transfers to other sheltering facilities and organizations during the five-year period (SAS). Transfers were significantly lower than expected in 2015 and significantly higher in 2017 and 2019.

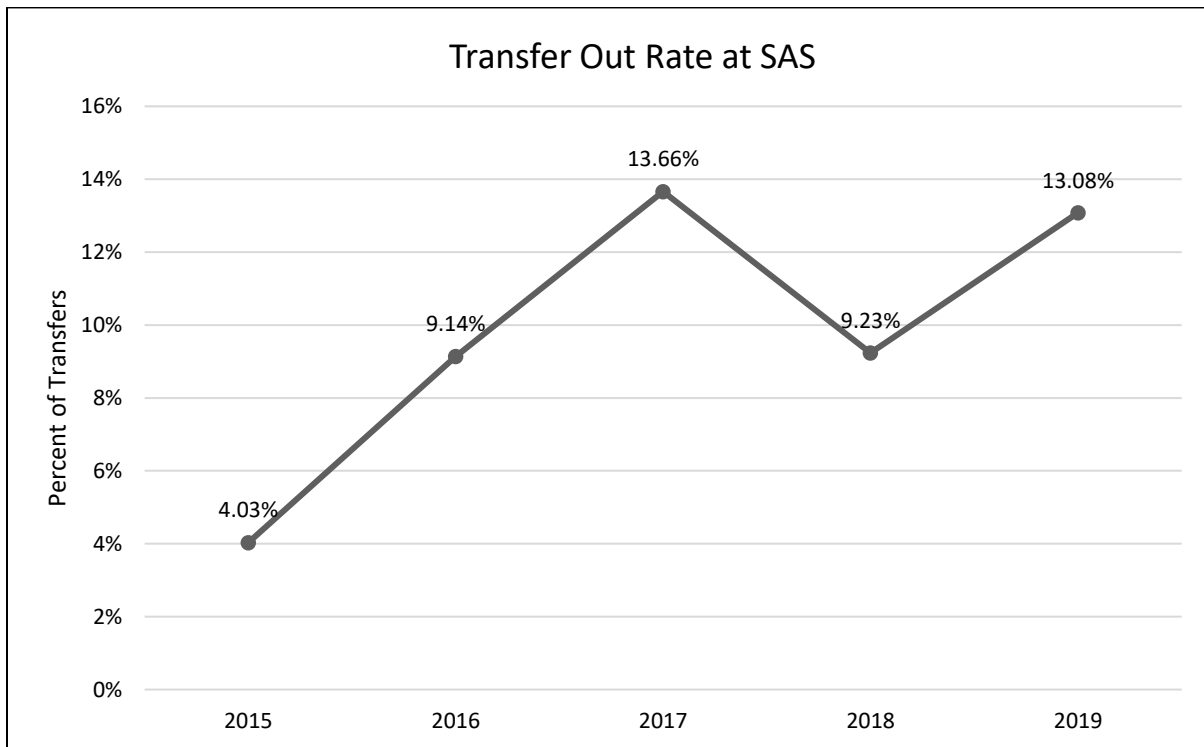


Figure 9

The percentage of adopted adult cats returned to the shelter after adoption across the five-year period (SAS). There was no significant change in return rates across 2015-2019.

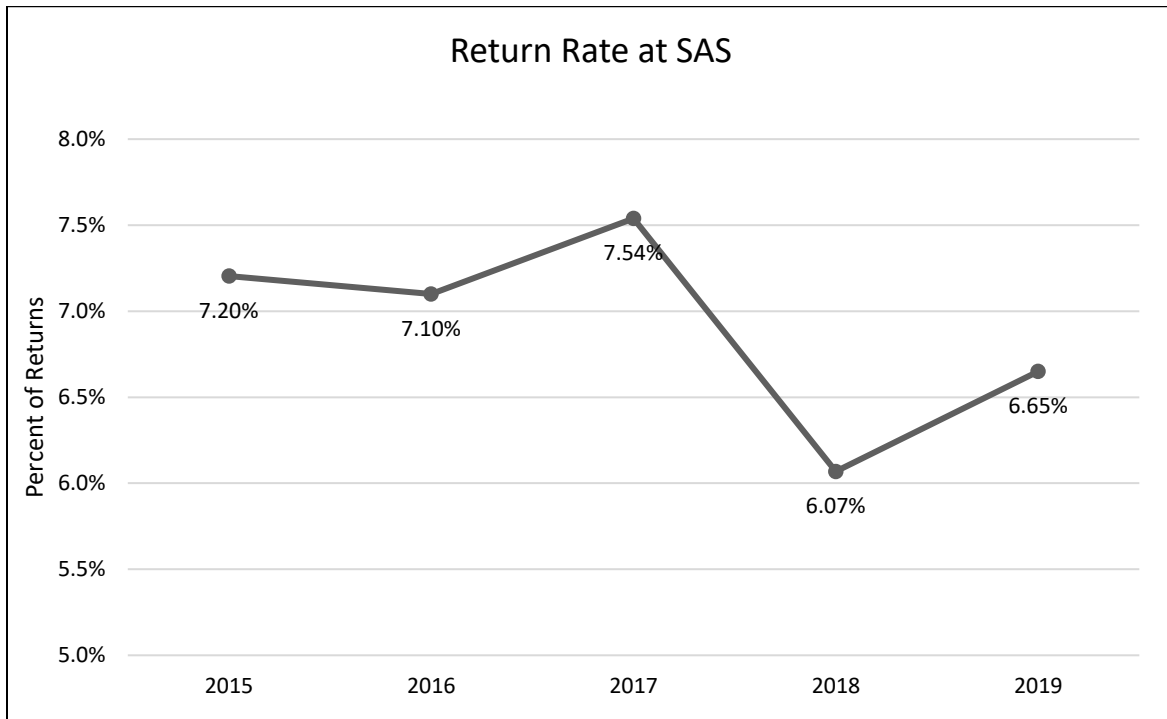


Figure 10

The percentage of adult cat adoptions across the five-year period at two shelters. In the comparison shelter (MCAS), there were lower than expected rates of adoption in 2019.

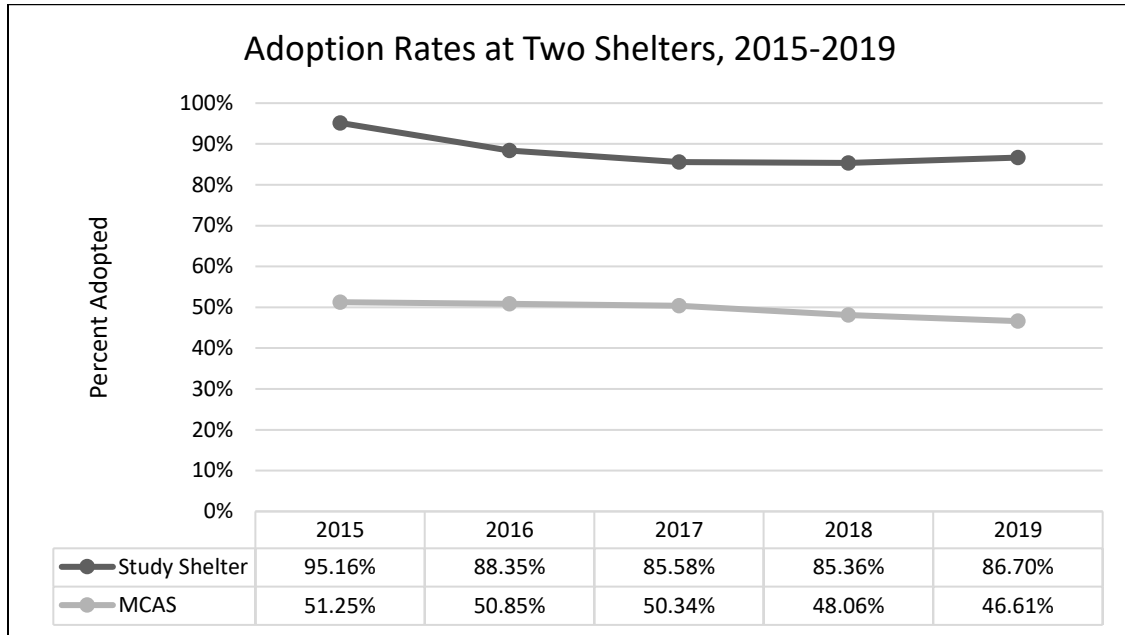


Figure 11

The percentage of adult cat euthanasias across the five-year period in two shelters. In the comparison shelter (MCAS), there were higher than expected rates of euthanasia in 2015 and lower than expected rates of euthanasia in 2016.

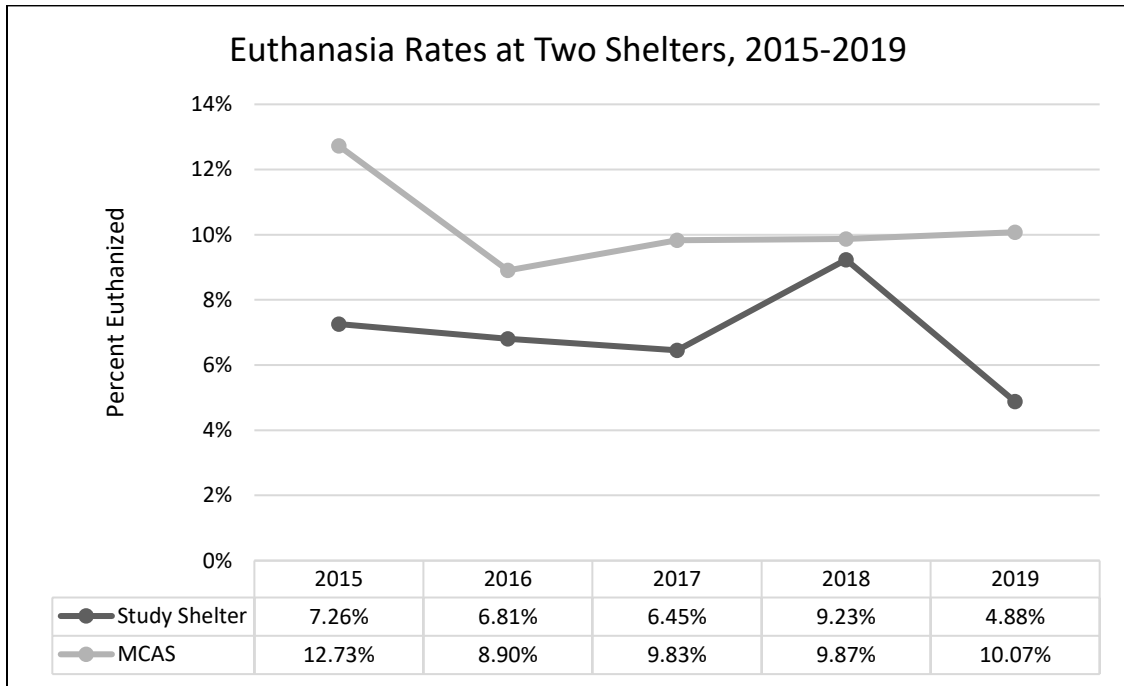


Figure 12

The percentage of adult cat transfers to other sheltering facilities and organizations during the five-year period at two shelters. At the comparison shelter (MCAS), transfer rates were lower than expected in 2015 and higher than expected in 2019.

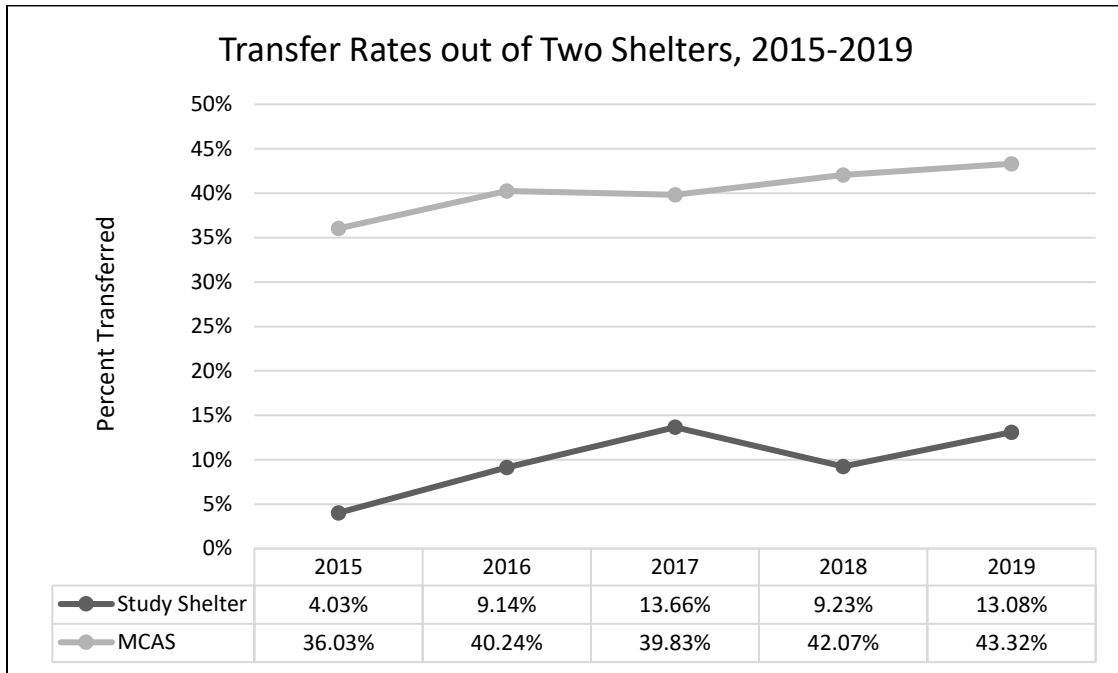
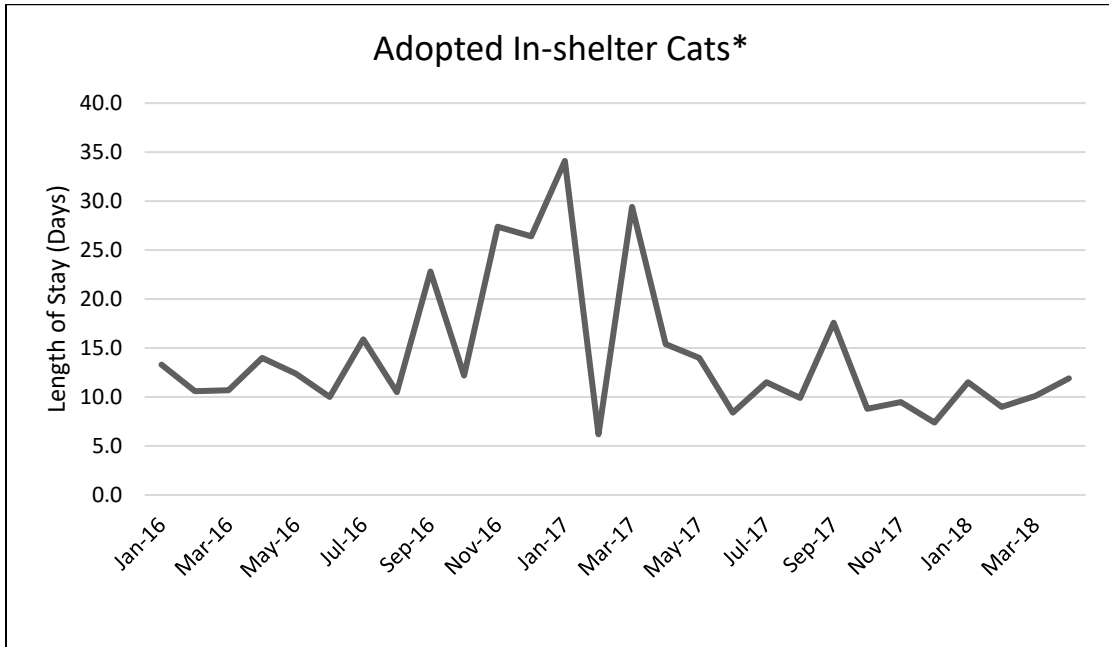


Figure 13

*Graph from in-house outcome evaluation (Seattle Animal Shelter, 2018), used to examine changes in LOS. * = 6 months of age and older*



2.6 References

- American Society for the Prevention of Cruelty to Animals [ASPCA]. (2007). *Meet Your Match® Feline-ality™ Training Manual*. American Society for the Prevention of Cruelty to Animals.
- ASPCA. (n.d.). *Meet Your Match® Survey and Guides to Download*. Retrieved July 9, 2020, from <https://www.aspcapro.org/resource/meet-your-matchr-survey-and-guides-download>
- ASPCA. (2018). *All Feline-ality - YouTube*.
https://www.youtube.com/playlist?list=PLH6HdpinGr_YHDGa9zO0Q2ew7bZaLNZUy
- Campbell, D. T. (1957). Factors relevant to the validity of experiments in social settings. *Psychological Bulletin*, 54(4).
- Campbell, D. T., & Ross, H. L. (1968). The Connecticut crackdown on speeding: Time-series data in quasi-experimental Analysis. *Law and Society Review*, 3(1), 33–54.
- Campbell, D. T., & Stanley, J. C. (1966). Experimental and quasi-experimental designs for research. In *Experimental and quasi-experimental designs for research*. Houghton Mifflin.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hoboken, NY: Academic.
- Cramér, H. (1946). Mathematical methods of statistics. In *Princeton University Press*.
- Flannelly, K. J., Flannelly, L. T., & Jankowski, K. R. B. (2018). Threats to the internal validity of experimental and quasi-experimental research in healthcare. *Journal of Health Care Chaplaincy*, 24(3), 107–130. <https://doi.org/10.1080/08854726.2017.1421019>
- GAO. (2017). *Program evaluation: Annual agency-wide plans could enhance leadership support for program evaluations*. <https://www.gao.gov/assets/690/687526.pdf>
- Goldman, K. D. (2003). Planning for program diffusion. *Californian Journal of Health Promotion*, 1(1), 123–139. <https://doi.org/10.32398/cjhp.v1i1.1669>
- Ha, J. C. (2016). Seattle animal shelter: Review of behavior management processes and proposal for operational improvements. *Animal Behavior Associates of Washington, LLC*.
- Houpt, K. A., Honig, S. U., & Reisner, I. R. (1996). Breaking the human-companion animal bond. *Journal of the American Veterinary Medical Association*, 208(10), 1653–1659.
- Kridel, K. (2007, December 5). *Swanky new animal shelter feels just like home--almost - Hartford Courant*. Hartford Courant. https://www.courant.com/chi-paws_05dec05-story.html
- Mahadevan, A., Strehlow, M. C., Dorjsuren, K., & Newberry, J. A. (2017). Comparison of live versus online instruction of a novel soft skills course in Mongolia. *Cureus*, 9(11). <https://doi.org/10.7759/cureus.1900>
- Miller, D. D., Staats, S. R., Partlo, C., & Rada, K. (1996). Factors associated with the decision to surrender a pet to an animal shelter. *Journal of the American Veterinary Medical*

- Association*, 209(4), 738–742.
- Multnomah County Animal Shelter [MCAS]. (n.d.) *Reports and Agency Statistics*. Retrieved July 30, 2020, from <https://multcopets.org/reports-and-agency-statistics>
- Patronek, G., Glickman, L., Beck, A., McCabe, G., & Ecker, C. (1996). Risk factors for relinquishment of cats to an animal shelter. *Journal of the American Veterinary Medical Association*, 209(3), 582–588.
- SAC. (n.d.). *Mission*. Retrieved August 4, 2020, from <https://shelteranimalscount.org/who-we-are/history>
- Salman, M., Hutchison, J., Ruch-Gallie, R., Kogan, L., New, J. C., Kass, P. H., & Scarlett, J. M. (2000). Behavioral reasons for relinquishment of dogs and cats to 12 shelters. *Journal of Applied Animal Welfare Science*, 3(2), 93–106. https://doi.org/10.1207/s15327604jaws0302_2
- Salman, M., New, Jr., J. G., Scarlett, J., Kass, P., Ruch-Gallie, R., & Hetts, S. (1998). Human and animal factors related to relinquishment of dogs and cats in 12 selected animal shelters in the United States. *Journal of Applied Animal Welfare Science*, 1(3), 207–226. https://doi.org/10.1207/s15327604jaws0103_2
- Seattle Animal Shelter. (2017). *Proposed Adjustment to Feline-ality assessment*.
- Seattle Animal Shelter. (2018). *Progress Report, Behavior Program, Seattle Animal Shelter Foundation*.
- Shelter Animals Count [SAC]. (n.d.). *Data dashboards*. Retrieved July 29, 2020, from <https://shelteranimalscount.org/data/Explore-the-Data>
- Shore, E. R. (2005). Returning a recently adopted companion animal: Adopters' reasons for and reactions to the failed adoption experience. *Journal of Applied Animal Welfare Science*, 8(3), 187–198. https://doi.org/10.1207/s15327604jaws0803_3
- Weiss, E., Gramann, S., Drain, N., Dolan, E., & Slater, M. (2015). Modification of the feline-ality™ assessment and the ability to predict adopted cats' behaviors in their new homes. *Animals*, 5(1), 71–88. <https://doi.org/10.3390/ani5010071>
- Weiss, E., Patronek, G., Slater, M., Garrison, L., & Medicus, K. (2013). Community partnering as a tool for improving live release rate in animal shelters in the United States. *Journal of Applied Animal Welfare Science*, 16(3), 221–238. <https://doi.org/10.1080/10888705.2013.803816>
- Yan, L., Yinghong, Y., Lui, S. M. (Carrie), Whiteside, M., & Tsey, K. (2019). Teaching “soft skills” to university students in China: The feasibility of an Australian approach. *Educational Studies*, 45(2), 242–258. <https://doi.org/10.1080/03055698.2018.1446328>

Chapter 3. COMPLEMENTARY PERSONALITY TRAITS, RELATIONSHIP
SATISFACTION, AND ATTACHMENT BETWEEN PEOPLE AND THEIR CATS: A
REPLICATION AND EXTENSION.

Saethra Darling, James C. Ha

3.1 Introduction

Millions of pet dogs and cats enter shelters every year (HSUS, 2020). In an industry that is most often underfunded and understaffed, there is an urgent need to find more efficient ways to manage routing decisions for these animals, decisions that are almost always matters of life and death. Often, some animals with behaviors that are challenging for their current owners populate these shelters and it is imperative for the shelter staff to decide whether each individual animal is adoptable or not (Casey et al., 2009; Coe et al., 2014; Patronek et al., 1996; Salman et al., 1998, 2000; UC Davis Koret Shelter Medicine Program, 2019). For those deemed unadoptable, euthanasia is often the end result; for those that are deemed adoptable, it becomes a matter of deciding how to redistribute these animals back into the pet-owning population in a manner such as to keep them out of the shelters permanently (HSUS, 2012; Lepper et al., 2002). To this end, an increasing amount of work has been done to characterize the personalities of dogs and cats, in an effort to provide shelter staff and adopting owners with information designed to support successful adoptions.

Most personality work in domestic pets has been done with dogs (at least 95 studies as of 2014; Gartner, 2015; Jones & Gosling, 2005). Despite the fact that cats are second only to dogs as the most popular pet in the US (American Pet Products Association, 2019; American Veterinary Medical Association, n.d.), and that they make up at least 50% of the shelter

population and are at high risk for euthanasia in shelters (American Society for the Prevention of Cruelty [ASPCA], n.d.; HSUS, 2020), far fewer studies have been done with domestic cats (23 reported in reviews of pet personality (Gartner, 2015; Gartner & Weiss, 2013) and 9 subsequent to those reviews (Bennett et al., 2017; Elvers & Lawriw, 2019; Evans et al., 2019; Fukimoto et al., 2019; Gartner et al., 2014; Ha & Ha, 2017; Kaleta et al., 2016; Litchfield et al., 2017; Weiss et al., 2015)). Evidence suggests that while people often choose their pet cats based on appearance, they also choose them based on demonstration of preferred behaviors, and keep them based on behavior and personality (Delgado et al., 2012; DiGangi et al., 2006; Neidhart & Boyd, 2002; Podberscek & Blackshaw, 1988; Salman et al., 1998; Sinn, 2016). Furthermore, accurate expectations of cat personality and behavior in the home contributes to adoption success (ASPCA, 2007; O'Connor et al., 2016; Patronek et al., 1996). Therefore, more scientific study of cat personality and behavior is warranted, especially that which might lead to the creation of reliable and valid assessment tools that aid in adoption placement decisions.

Beginning with the Feline Temperament Profile (FTP) test (Lee et al., 1983), an assessment designed to place appropriate cats in nursing homes, there have been multiple tools suggested in the literature, both behavioral assays and survey measures. However, there has also been a lack of rigorous reliability and validity work done in support of these measures. In their 2013 review of felid personality research, Gartner and Weiss (2013) reported that 40% of studies shared no reliability data; of those that did report reliability data, the most common was interrater reliability. In the thirteen studies published subsequent to 2013, six (46%) did not report any reliability data. This lack of reliability is problematic, as reliability is a necessary precursor to establishing construct validity, the most important aspect of which, from an applied perspective, is predictive validity.

One way to help establish reliability of instruments is to replicate the studies used to create them; demonstration that similar results can be obtained using different samples indicates consistency in measurement. The recently and highly publicized “replication crisis” highlights the need for this aspect of reliability testing (Camerer et al., 2016, 2018; Diener & Biswas-Diener, n.d.; Everett & Earp, 2015; Maxwell et al., 2015; Mede et al., 2020; Open Science Collaboration, 2015; *Replication Crisis*, n.d.; Yong, 2018). Despite this need, in applied feline personality research, direct replication is rare. When newer studies do use older instruments, they often modify those instruments (e.g., Fukimoto et al., 2019). The proposed instruments, which already have very little reliability information, once modified, may have no reliability at all. Any substantive change to an existing instrument must have its psychometric properties re-established before proceeding, as does happen in human personality research (e.g., Costa et al., 1991; McCrae & Costa, 1987; Wiggins et al., 1988). Even when new studies in cat personality do maintain the original structure of an older instrument, they most often are choosing instruments that already have limited reliability information from the original study, and are not performing any additional reliability testing within their own new study. This lack of systematic reliability testing is markedly different from personality research in the human arena. Furthermore, many studies choose to use entirely new measurement instruments created for the purpose of that study, and therefore lacking in reliability data. Despite the lack of formal reliability investigation, the combined results from the entire body of research in this area do indicate that cats have personalities; that is, cats consistently demonstrate individual differences in behavior, and many of their personality traits resemble those found in humans. Therefore, the continued pursuit of a reliable and valid way to measure feline personality is justifiable.

Given the fact that there is a recurring overlap in personality traits between cats and humans regardless of the measurement instruments used, and given the extensive reliability (and validity) testing that instruments used in human personality research undergo, it is a reasonable approach to use these established human personality measurement instruments in cat personality research (Bennett et al., 2017; Elvers & Lawriw, 2019; Evans et al., 2019; Fukimoto et al., 2019; Gartner, 2015; Gartner et al., 2014; Gartner & Weiss, 2013; Gosling & Bonnenburg, 1998; Ha & Ha, 2017; Kaleta et al., 2016; Litchfield et al., 2017; Martínez-Byer et al., 2020; Weiss et al., 2015). Capitalizing on reliable and valid measures taken from the human arena, combined with replication of their application to cat personality is therefore a logical way forward in the comparatively nascent field of feline personality research.

From an applied perspective, and specifically regarding animal sheltering, however capable a measure is in reliably measuring feline personality, we must then consider how that information can be translated into a pragmatically useful tool. Historically, most behavioral or personality assessment tools (that is, instruments designed with the intention of providing actionable information regarding future pet behavior following placement into a new living environment) have focused on predicting the likelihood of specific concrete behaviors (e.g., biting, scratching, playing) that an owner may desire (or not) or may believe will fit well within their household. Again, most of this work has been done with pet dogs, beginning in 1991 (van der Borg et al., 1991), and has primarily focused on predicting aggression and anxiety-based behaviors that contribute to the relinquishment and return of dogs to shelters (Haverbeke et al., 2015). As in the feline literature, there is a dearth of reliability and validity testing for the various assessment tools suggested (Haverbeke et al., 2015), to the extent that, despite 29 years of concerted effort, there does not yet exist a tool that can be depended upon to provide the desired

post-adoption behavioral information about shelter dogs (Patronek & Bradley, 2016). The science in shelter cat assessment differs in that there is a behavioral and personality assessment instrument that has some history of reliability and validity testing and therefore may be able to provide accurate behavioral information about cats: the ASCPA's Meet Your Match[®] Feline-ality[™] program (ASPCA, 2007; Fukimoto et al., 2019; Weiss et al., 2015).

Feline-ality[™] is an 11-item behavioral assay that appears to be able to predict both specific behaviors in the home, as well as identify two personality traits that are associated with adoption success (ASPCA, 2007; Weiss et al., 2015). Feline-ality[™] was based in part on the only feline behavioral assessment that has ever undergone specific reliability (test-retest and inter-rater) and validity (predictive and convergent) testing, the Feline Temperament Profile (ASPCA, 2007; Lee et al., 1983; Siegford et al., 2003). The Feline-ality[™] assessment interpretation was expanded during its creation in such a way as to use the scores obtained on the behavioral assay to not only predict the likelihood of specific behaviors (e.g., vocal behavior, playfulness, handling tolerance) but also general sociability and confidence (termed “independent-gregarious” and “valiance”, respectively; ASPCA, 2007), two personality axes that provide additional information regarding what an owner can expect from each individual cat after adoption (e.g., likelihood of cat to seek attention from the owner, how quickly a cat might adapt to a new home). It is this latter aspect of the Feline-ality[™] program that signaled the beginning of a shift in focus for how pet cats might best be evaluated specifically to facilitate adoption success, moving from strictly predicting concrete behaviors to predicting the more nebulous concept of compatibility. Given the fact that individuality and compatibility contribute to owner satisfaction and protect against relinquishment to shelters, this is likely a productive shift (Neidhart & Boyd, 2002; Salman et al., 1998; Siegford et al., 2003). As a result, much of

the work in recent years has moved away from behavioral assays and instead focused on personality surveys, mimicking the measurement methods of personality and compatibility in humans, many of which have been demonstrated to be effective across multiple species (Gosling, 2001; Gosling & Bonnenburg, 1998; Jones & Gosling, 2005; Zeigler-Hill & Highfill, 2010). It is therefore now possible to use many human instruments that have a wealth of reliability and validity data supporting them, in studies investigating feline personality, with the intention of predicting owner-cat relationship satisfaction and adoption success.

One study that took advantage of the reliability and validity of a human personality measurement tool, and examined how both human and feline personality might contribute to relationship satisfaction, was reported by Zeigler-Hill and Highfill (2010), and it is a replication (with extension) of that work that is the subject of our current study. Both studies used the Interpersonal Adjective Survey, Revised (IAS-R), an established, validated personality assessment tool in humans (McCrae & Costa, 1989; Wiggins et al., 1988). The IAS-R measures the interpersonal circumplex (IPC), capturing two personality dimensions that describe human social behavior and are commonly referred to as Agency and Communion (Freedman et al., 1951; Leary, 1957; Leising & Bleidorn, 2011; Locke, 2006; Wiggins, 1979). Agency can be understood as capturing a spectrum of dominance and submission related to status-seeking, power, control, leadership, and obedience in humans. Communion captures affiliative tendencies, ranging along a spectrum of friendliness, love, and warmth, to coldness, and hostility (Leising & Bleidorn, 2011). Both dimensions seem to resemble those that have the strongest convergent validity support in the feline literature, namely dominance and sociability (Bennett et al., 2017; Gartner & Weiss, 2013), and have also been demonstrated to resemble the more well-known human personality factors, Extraversion and Agreeableness (McCrae & Costa, 1989;

Trapnell & Wiggins, 1990). Agency and Communion also appear to correlate with the personality dimensions found using Feline-ality™ (Chapter One of this dissertation). Complementarity along Agency and Communion has been shown to predict relationship satisfaction between humans, as well as between owners and their cats (Ziegler-Hill and Highfill, 2010). There are two basic models of complementarity: the Leary/Carson model and the similarity model (Byrne, 1971; Carson, 1969; Leary, 1957). The Leary/Carson model predicts that people who have similar levels of Communion and opposite levels of Agency are more likely to have positive social interactions and report greater relationship satisfaction. The similarity model predicts greater satisfaction when the two humans have similar scores on both Agency and Communion. For cats, the current evidence indicates that owners are more likely to report greater relationship satisfaction with their cats when the dimensions conform to the Leary/Carson model (Ziegler-Hill and Highfill, 2010).

In keeping with the recent trend towards identifying an effective survey-based personality assessment tool for cats that aids in the decision-making process for placement in adoptive homes, with an eye towards improving reliability, we attempted replication of Zeigler-Hill and Highfill (2010) herein. To that end, we used the IAS-R to measure both owner and pet cat personality. In our replication, we also addressed a limitation pointed out by the original authors, namely the lack of a reliable and valid outcome measurement tool. We therefore used the Relationship Assessment Scale (RAS) to measure relationship satisfaction (Hendrick, 1988; Hendrick et al., 1998; Vaughn & Matyastik Baier, 1999; White et al., 2004). We predicted that we would find support for the Leary/Carson model of complementarity (similarity in Communion scores for humans and cats, as well as divergence in Agency scores between humans and cats would predict higher relationship satisfaction, controlling for length of

ownership of the cat). We then proceeded to address two other limitations referenced by the original authors in our first extension of the replication: the lack of cat age or sex data. The evidence for sex and age differences in feline personality is equivocal, therefore we did not propose a directional hypothesis (Bennett et al., 2017; Gartner et al., 2014; Ha & Ha, 2017; Kaleta et al., 2016; C. M. Lee et al., 2007; Weiss et al., 2015). And finally, we included the Lexington Attachment to Pets Scale (LAPS; Johnson et al., 1992) in the second extension model. The LAPS is a reliable and valid outcome measure designed specifically to measure attachment to pets, included based on the theory that attachment and relationship satisfaction would be separate but correlated constructs that might both contribute to adoption success and be predicted by the complementarity hypothesis (Elvers & Lawriw, 2019). Therefore, our hypothesis was again that similarity along the axis of Communion and differences in Agency would predict stronger attachment to a pet cat, controlling for cat age and sex; we also predicted that the RAS and the LAPS would be positively correlated.

3.2 Methods

Measures

The electronic survey comprised the following components:

1. Informed consent affirmation, 1 item
2. Demographic questions, which included age, sex, color, neuter status, and length of ownership of cat, as well as age, gender, and location of residence information for the owner, 10 items
3. Interpersonal Adjective Scale, Revised (IAS-R), informant version, 64 items
4. Feline Personality Scale (FPS; Gartner & Weiss, 2013), 50 items
5. IAS-R, self-report version, 64 items

6. Lexington Attachment to Pets Scale (LAPS), 23 items
7. Relationship Satisfaction Scale (RAS), 7 items

The IAS-R (both versions) is an adjectival degree-of-agreement survey measure of two dimensions of personality (Agency and Communion). Words associated with personality traits are presented along with definitions (e.g., “Introverted: feels more comfortable by oneself; is less interested in other people”). Eight possible answers are available in the Likert-like response scale, ranging from “extremely inaccurate” to “extremely accurate” and there is no neutral option. The informant version and the self-report version differed only in the instructions (“Please rate how accurately each word describes your cat in terms of how he/she interacts with humans” versus “Please rate how accurately each word describes you as a person), as well as in pronouns (“he/she” versus “you”), and the replacement of the word “others” with the word “people” when appropriate in the cat survey. The survey was scored using the technique outlined in Trapnell and Wiggins (1990).

The LAPS measures owner attachment to pet cats and consists of a set of statements accompanied by a four-option Likert-like degree of agreement scale anchored by “Agree Strongly” and “Disagree Strongly”, with a fifth option: “Don’t know or Refuse” (e.g., “My cat and I have a very close relationship.”). Two items are reverse coded. Possible scores range from 0 to 69.

The RAS measures relationship satisfaction between two adult humans by asking questions that are answered using seven different Likert-like response scales, each with five choices. Every answer scale is anchored in the middle with the response “Average”, and on either end ranging variously from “Poorly” to “Extremely Well” (e.g., “How well does your cat

meet your needs”), “Never” to “Very Often” (e.g., “How often do you wish you had never gotten into this relationship”), etc. The RAS was modified for use in this study solely to clarify that the relationship in question was that between the participant owner and their pet cat. Possible scores range from 7-35.

The FPS data were collected concurrently for use in a separate study and is not reported here.

Design

Cross-sectional survey data were collected using Qualtrics (Qualtrics, 2019). A convenience sample of participants was recruited using social media and Amazon Mechanical Turk (MTurk). Requests for participation were posted with permission via Reddit (subreddits: r/SampleSize, r/Pets, r/animalwelfare, r/likeus, r/cats, r/kickstarter, and r/Indiegogo), Facebook, and Twitter. Two undergraduate research assistants also contacted a minimum of five animal organizations in every US state with requests for participation and dissemination of the survey on their social media pages.

Both unit and item non-response bias within those who accessed the surveys via social media were evaluated. Unit non-response was characterized by those participants who completed only demographic information and did not attempt the surveys. Item non-response was characterized by those participants who, after completing the demographic information and consent portions of the request, and viewing at least part of the study surveys, chose not to fully complete the surveys. Before samples collected via social media and the MTurk sample were

combined for analysis, possible differences between the two methods of collection were also assessed. Results indicated that it was acceptable to combine datasets (see below).

After the data collected from the two sampling methods were combined, the distribution of the final sample (N=929) was compared to the distribution of the data used for validation of the original IAS-R (Trapnell & Wiggins, 1990; Wiggins et al., 1988), to evaluate whether or not the IAS-R calculations (Agency and Communion) that depended upon the means and standard deviations from the original sample of undergraduates differed from those that depended upon the mean and standard deviations of our sample. Based on the results of those analyses (see below), the choice was taken to use our sample means and standard deviations for further calculations, as is allowed by the scoring key and used in the Zeigler-Hill and Highfield paper (*Research Measures*, n.d.; Trapnell & Wiggins, 1990; Zeigler-Hill & Highfill, 2010).

Next, we subjected the data to analysis that replicated elements of Zeigler-Hill and Highfield (2010), examining the complementarity hypothesis in which deviations from Agency and Communion scores within human-cat dyads (intra-dyadic deviation) were predictive of the human's satisfaction with the relationship with their cat, controlling for the length of time that the cat had been owned. The only difference between our data collection methods and that of the original work was the addition of a measure of relationship satisfaction (RAS), which is a validated seven item scale, as opposed to the three-item scale created for the purposes of the Zeigler-Hill and Highfield study.

We then extended our analyses to address some of the additional limitations mentioned in the Zeigler-Hill and Highfield (2010) paper. Specifically, we included a measure of attachment to pets as an outcome variable (LAPS), as well as age and sex information for the cats. Our

initial measure of relationship satisfaction (RAS) was an improvement over the original outcome scale used but RAS has only been validated for interpersonal relationships between humans, while the LAPS specifically measures feelings of attachment towards pets. While attachment and satisfaction may not be the same constructs, they may both contribute to adoption success (Elvers & Lawriw, 2019).

Our first extension model tested the relationship between cat age, cat sex, deviation along the two personality dimensions, and RAS, controlling for length of ownership. In our second extension model, we replaced the outcome variable (RAS) with the LAPS and kept the predictor variables the same. We tested the correlation between RAS and LAPS, which was sufficiently high ($r = .55$) to justify using the LAPS as a more fine-grained outcome variable (23 items) than that of the original work (3 items) as well as the initial replication here (7 items).

Participants

Data collected via social media

1644 surveys were begun, 143 participants provided no information at all, 856 participants responded to at least part of the survey, and 645 completed nothing beyond demographic information, one of which did not provide their age, 14 of which were under the age of 18 and therefore not eligible, and two of which did not provide their gender. Of the 856 responders, two did not report their age, 631 finished the entire battery of questions. 640 surveys were completed sufficiently to include in the replication section of this study (cat IAS-R, human IAS-R, and the RAS).

Data collected via MTurk

311 surveys were begun, 21 responses were removed (six had no information at all, six completed nothing beyond demographic information, nine completed the surveys so quickly that it must be assumed they were not engaging (as indicated by the time spent on the first page recorded as zero seconds)). Of the remaining 290 responders, 289 finished the entire battery of questions.

Replication Only Data Set

After incomplete data were removed and the data collected via two sampling methods were combined, descriptive statistics for the replication were as follows: N=929; human participants ranged in age from 18 to 77 years ($M = 34.7$, $SD = 11.7$), and were 74.6% female; cats ranged in age from 6 months to 22 years ($M = 7.1$, $SD = 4.6$), and were 49.8% female (95.7% altered).

Replication Extension Data Set

Participant descriptive statistics for the extension were distributed exactly as above, despite removing 12 participants due to lack of completion of portions of the survey beyond that required for the replication (e.g., LAPS).

Statistical Tests

Statistical analysis was completed using R software (R Core Team, 2020). Possible gender and age effects relating to non-response bias were tested using Chi-square tests of independence and Welch's independent groups t-tests. Possible gender and age differences between the sample collected via social media and that of MTurk were also tested using Chi-

square test of independence and Welch's independent groups t-test. Welch's t-test was chosen because it is robust to violations of several key standard assumptions for parametric tests when handling large data sets (Delacre et al., 2017; Derrick & White, 2016). Effect size for chi-square tests was calculate using Cramer's phi (ϕ_c), and effect size for t-tests was calculated using Hedge's g (Cramér, 19406; Hedges, 1981). Hedge's g allows for the calculation of an effect size between groups that differ in size.

Comparison of our sample distribution of Agency and Communion using our sample means and standard deviations versus the distribution of Agency and Communion using Wiggins' original sample means and distributions was completed with paired t-tests. Effect size was calculated using Cohen's d (Cohen, 1988).

The replication and extension analyses were completed using multiple linear regression, which is robust to violations of assumptions when working with large sample sizes (Ernst & Albers, 2017). Predictor and outcome variables were as described above, and see Tables 1, 3, & 5 for summary statistics.

The LAPS included a question that allowed respondents to select "Don't know or refuse to answer", essentially representing item nonresponse problems. These were corrected for using mean imputation.

Familywise error was controlled using a Bonferroni correction for the omnibus tests conducted in each family (each set of tests examining a different outcome variable).

Procedure

The study was reviewed and categorized exempt from further oversight by the University of Washington Human Subjects Division (STUDY00000517). All participants provided informed consent before accessing the surveys. The first set of questions gathered demographic information about the human participants and their cats. Participants verified that they were over the age of 18 before proceeding to the personality surveys. The first survey provided to each participant was the informant IAS-R in which they answered questions about their cat. The second survey was the FPS, also answering questions about the cat. Next was the self-report IAS-R, where participants answered questions regarding their own personalities. This was followed by the LAPS and the RAS, where participants reported on their attachment to their pet cat, as well as their satisfaction with the relationship between themselves and their cat. Finally, participants had the option to enter a drawing to win a \$50 gift card for a pet supply store as compensation for their participation. Funding for the gift cards, for MTurk, and for undergraduate assistants, was obtained via Experiment.com. The funding source had no further involvement with the study.

3.3 Results

Non-response bias

Unit Non-Response

A chi-square test of independence showed a small significant relationship between gender and frequency of response to any portion of the survey beyond demographic information:

$\chi^2(1, N = 1485) = 6.61, \varphi_c = .07, p = .01$. Those identifying as female were more likely to attempt some portion of the survey.

A Welch's independent groups t-test showed no significant difference in ages between those who attempted (but did not complete) the survey ($N = 85, M = 32.7, SD = 10.7$) and those who did not attempt the survey (complete anything beyond demographic information) ($N = 630, M = 33.9, SD = 12.3$), $t(1439.6) = -2.03, g = .10, p = .042$.

Item Non-response

A chi-square test of independence showed a small significant relationship between gender and frequency of *completion* of the surveys: $\chi^2(1, N = 1455) = 6.77, \varphi_c = .09, p = .009$. Female participants were more likely to complete the survey.

A Welch's independent groups t-test showed a small significant difference in ages between those who finished the survey ($N = 634, M = 34.5, SD = 12.5$) and those who did not ($N = 221, M = 32.2, SD = 11.3$), $t(419.86) = -2.56, g = .19, p = .01$. On average, those who completed the survey were 2.3 years older.

Sample collection type comparison

A chi-square test of independence showed a moderate significant relationship between gender and method of sample collection type: $\chi^2(1, N = 929) = 210.34, \varphi_c = .48, p < .0001$. The sample collected via social media had a higher frequency of female participants than that collected via MTurk.

A Welch's independent groups t-test showed no significant difference in ages between those who completed the survey via MTurk ($N = 289$, $M = 34.9$, $SD = 9.8$) as compared to those who accessed and completed the survey via social media ($N = 639$, $M = 34.6$, $SD = 12.5$), $t(699.03) = 0.42$, $p = .68$).

Replication Data Set analyses

A paired t-test showed a small but significant difference between average human Agency scores calculated using the sample means and standard deviations ($N = 929$, $M = 2.4 \times 10^{-18}$, $SD = 0.11$) as compared to those using the means and standard deviations from Wiggins ($N = 929$, $M = -.007$, $SD = 0.14$), $t(928) = 62.2$, $d = 0.13$, $p < .0001$). On average, Agency was lower using our sample means and standard deviations.

A paired t-test showed a small but significant difference between average human Communion scores calculated using the sample means and standard deviations ($N = 929$, $M = -4.7 \times 10^{-18}$, $SD = .009$) as compared to those using the means and standard deviations from Wiggins ($N = 929$, $M = .02$, $SD = .14$), $t(928) = -177.89$, $d = -.04$, $p < .0001$). On average, Communion was lower using our sample means and standard deviations.

Replication

Multiple linear regression indicated that intra-dyadic deviation along the Communion factor was predictive of relationship satisfaction, controlling for the number of years that a cat had been owned ($F(3,925) = 5.46$, $R^2 = .017$, $R^2_{adjusted} = .014$, $p = .001$; Tables 1 & 2). As the intra-dyadic deviation within communion increased, relationship satisfaction decreased. Intra-dyadic deviation along the agency factor was not significantly related to relationship satisfaction.

Extension

Years Owned, Cat age, Cat sex, Agency deviation and Communion deviation regressed on RAS

Three responses were removed due to inaccurate (impossible) cat ages (77 yrs., 60 yrs., and 33 yrs.). Multiple linear regression on relationship satisfaction including predictor variables length of ownership, cat age and cat sex along with agency deviation and communion deviation, indicated that intra-dyadic deviation along the communion factor remained significant. Cat age was also significant; as cat age increased, relationship satisfaction decreased ($F(5,920) = 4.36$, $R^2 = .02$, $R^2_{adjusted} = .02$, $p < .001$; Tables 3 & 4).

Correlation between RAS and LAPS

There was a strong significant positive correlation between relationship satisfaction and attachment ($r = .55$, $p < .0001$). As attachment increased, so too did relationship satisfaction.

Years Owned, Cat age, Cat sex, Agency deviation and Communion deviation regressed on LAPS

Multiple linear regression on attachment to pet cats of predictor variables length of ownership, cat age, sex, Agency deviation, and Communion deviation, was not significant, ($F(5,911) = 1.99$, $R^2 = .01$, $R^2_{adjusted} = .005$, $p = .08$; Table 5)

3.4 Discussion

Our replication of Zeigler-Hill and Highfill's (2010) original inquiry into the Leary/Carson complementarity hypothesis found partial support: similarity in Communion was significantly positively correlated with relationship satisfaction in both studies, but deviation in Agency was not a significant predictor of relationship satisfaction in our study.

Before combining data collected from multiple sources, we also examined possible response bias and sampling bias effects. Those identifying as female were more likely to attempt and complete the surveys, as has been reported previously (Curtin, 2000; Moore & Tarnai, 2002; Singer et al., 2000). There was no age difference between those who attempted the surveys and those who did not, though those who completed the surveys were on average slightly older. The sample collected via social media consisted of more female participants than that collected through MTurk; there was no age difference between samples. The effect sizes of these differences were small, except for that demonstrating the gender difference between sampling methods; combining the samples allowed us to introduce more people not identifying as female into our overall sample, which better resembles the general cat-owning public (Bedford, 2019).

After combining the two data streams into one larger sample, we then compared our dataset to the dataset used in the validation testing of the IAS-R (Wiggins et al., 1988). Overall, scores on both axes of personality were slightly lower in our human sample than in the original work. Given that there is some evidence that pet owners in general and cat owners in particular differ from non-pet owners and dog owners, we made the choice to use our data calculated with our sample means and standard deviations (Gosling et al., 2010; Saunders et al., 2017).

Zeigler-Hill and Highfill (2010) suggested future work that included a validated measure as an outcome variable. In our replication, we did use a validated test (RAS) but as the RAS has been validated only for human/human relationship satisfaction, we also chose to look at the LAPS, as it was created to measure attachment specifically between humans and pet animals, thereby potentially increasing both face and external validity. The RAS and the LAPS were strongly correlated, indicating this was a reasonable decision. Post-hoc analysis also revealed a potential ceiling effect of the RAS when applied to cats (36% of respondents scored in the top 15% of the range of possible scores; 32.7% scored the most extreme score possible); no such ceiling effect was found for the LAPS. Zeigler-Hill and Highfill also suggested including information about cat age and sex as potential predictor variables. Our first extension model found the same relationship as in our replication, namely that, controlling for length of ownership, similarity in warmth predicted relationship satisfaction. We also found that the age of the cat accounted for relationship satisfaction over and above that confounded with length of ownership (the two variables were correlated (post-hoc analysis) at $r = .87$), such that owners reported greater satisfaction with younger cats. It should be noted that years of ownership was positively correlated with satisfaction, while cat age was negatively correlated, despite the strong positive correlation between the two variables. This finding might be driven by higher dissatisfaction with cats adopted at an older age (and therefore not owned for as long).

Our second extension model tested the relationship between the same predictor variables as in the first extension model but regressed on the LAPS. This model was not significant, despite the strong correlation between the RAS and the LAPS. Neither intra-dyadic deviation in Communion nor Agency explained pet attachment, providing no evidence to support a complementarity model of attachment between owners and their cats, nor evidence to support the

further use of the LAPS in the place of the RAS. The models in both the replication and extension were linear regressions models. It is possible that there exists some non-linear relationship between Agency, Communion, or deviation along those axes, and relationship satisfaction or attachment – this is something we will explore in future work.

There currently exists only one published programmatic approach to using elements of feline personality to improve adoption success in animal shelters: the ASPCA’s MYM[®] Feline-ality[™] adoption program. Though based in part on an assay that has undergone explicit reliability and validity testing (the FTP; Siegford et al., 2003), no such testing on the MYM[®] Feline-ality[™] program itself has been published to date. A recent conceptual replication of Feline-ality[™] reported some evidence for construct validity in that similar personality dimensions were found, but the assay was changed so dramatically that items that corresponded to one dimension in the published MYM[®] Feline-ality[™] program appeared to provide evidence for a third dimension in the Brazilian sample (Fukimoto et al., 2019). As with so many studies in this area, this provides evidence that cats do indeed have personality dimensions, but does not advance the goal of a reliable measurement tool.

Moreover, our previous work has demonstrated that aspects of the MYM[®] adoption program are highly vulnerable to human error (Chapter Two of this dissertation). Specifically, the proper use of the survey that collects lifestyle information from the potential owner (the CAS) is prone to many types of errors, leading to an inability to match the potential adopter to the “correct” cat (i.e., the cat with the Feline-ality[™] that would fit best with the adopter). The MYM[®] program is also time and labor intensive, requiring a minimum of 18 hours after admission to the shelter before the Feline-ality[™] behavioral assay can be performed, and taking

approximately 15 minutes to do so with each cat. A reliable survey-based approach that is robust to human error would address these issues. To this end, our previous work also looked at the possible relationship between the personality traits measured by Feline-ality™ and the personality traits measured by the IAS-R. We found that Agency was strongly correlated with I/G ($r = .55$; Chapter One of this dissertation). We also found the I/G was strongly correlated with Valiance ($r = .85$), such that these two elements of personality are not factors in the sense of the FFM (i.e., orthogonal, independent trait spectra, e.g., Extraversion or Agreeableness), but rather are likely to more closely resemble two facets of a larger factor, as described by the FFM (i.e., the correlated elements that make up each factor, e.g., the Extraversion factor is supported by 6 facets: Warmth, Assertiveness, Gregariousness, Activity, Positive emotion, and Excitement-seeking; Costa & McCrae, 1995). Therefore, it is possible that Agency alone is adequate to capture enough of the personality traits measured by Feline-ality™ to be used in a new survey-based adoption program. Combined with our findings here, specifically that Communion is related to relationship satisfaction between cats and humans, it may be reasonable to continue exploring the use of the IAS-R in cat adoptions. However, the effect sizes were quite small (a change of one standard deviation in intra-dyadic deviation on Communion accounted for only a change of .07 standard deviations in relationship satisfaction – from an applied perspective, this is unlikely to be useful).

As with any study, there were methodological limitations. Our sample was obtained non-randomly and may have biases associated with convenience sampling and self-selection sampling (including an over-representation of those identifying as female). We addressed these issues to the best of our ability by evaluating unit and item non-response, as well as including data obtained via MTurk, which has been demonstrated to more closely resemble the general

population (and also allowed us to have more males in the sample; Buhrmester et al., 2011)). However, it is possible that our sample was nevertheless systematically different from the broader population of cat owners. Thus, our findings should be interpreted within the context of the larger body of work in this field of study.

We provided space for participant feedback. The most common relevant comments described:

1. Dissatisfaction with the length and repetitiveness of the survey battery.
2. “Anthropomorphism” as perceived by being asked to apply what were clearly human trait descriptors to cats.
3. The difficulty owners experienced in answering questions or replying to adjectives that described elements of their cat’s personality that appear to differ across situations. Specifically, they suggested that their cat might show a different level of various trait descriptors depending on whether the cat was interacting with an unfamiliar human, with a familiar human who was not the owner, and with the owner.
4. The desire to be able to complete the surveys for every cat in their household, rather than just one.

At 219 questions total, the survey battery was long. It is likely that fatigue was an issue for some participants. Based on the data collected, and the feedback from participants, a more refined version of the survey battery is necessary if we undertake any follow-up work. It is important to remember though, that in the real world, no one person will be requested to complete such a long survey before adopting a cat. If the IAS-R were to be implemented as part of an adoption improvement strategy, potential owners would complete only the 64 item IAS-R, and only once, for themselves, and a separate cat evaluator would do the same for the cat.

Fatigue should therefore not be an ongoing issue in the applied arena. Repetitiveness would also

likely be ameliorated in the real world. While some adjectives are “repeated” (in that their antonym is presented, or a word that seems to mean something similar is used) within the 64 questions of the IAS-R, this would likely be less bothersome if a participant were completing only that one survey (as it would avoid the literal repeating of the same words in the self-report and the informant versions encountered in this study).

Comments about anthropomorphism pointed to a lack of face validity. The IAS-R and the RAS were purposefully adapted only minimally to refer to cats rather than people. This choice was made because changing one question or adjective too much could affect the established validity of the measures. However, some words may not easily seem to apply to cats (e.g., “boastful”, “charitable”). We gathered data concurrently using a species-specific personality survey (Gartner & Weiss, 2013), along with the surveys explored in this paper, in order to have the ability to address face validity in future work by potentially replacing words that seem to only refer to humans with words that are similar and appropriate for cats. Within this current work, it is possible that difficulty answering human-centric questions when describing a cat affected the results. However, the bugaboo of anthropomorphism should not be used to dismiss these potentially useful findings. As the influential animal behaviorist Robert Hinde (1923-2016) put it, “Fear of the dangers of anthropomorphism has caused ethologists to neglect many interesting phenomena, and it has become apparent that they could afford a little disciplined indulgence” (Hinde, 1982).

As for participants’ concerns regarding how cat personality might differ depending on the degree of familiarity with a particular person, we believe that it is likely that human participants in our study were able to respond to questions about their cats’ personality in much the same way

that humans respond to questions about their own personalities or the personalities of other humans (as in informant surveys). Humans automatically aggregate data across situations when responding to trait measures (Vazire et al., 2007), so despite the fact that participating owners found it difficult to respond to questions about their cats because of the cats' different behavior in various situations, there is reason to believe that they were nonetheless able to come to some sort of average that encompassed all the situations in which they had observed their cat across the entirety of their acquaintance.

The final point raised most commonly by participants is perhaps the most problematic limitation. Participants who owned more than one cat were limited to reporting only about one of them, but were not provided with directions for how to choose a cat. It is possible that that choice might have been systematically biased. For example, perhaps owners chose the cat with which they enjoyed the closest relationship (their "favorite"). That possibility could account for some percentage of the extreme values seen in the RAS responses. Furthermore, we did not ask owners if they had multiple cats. It is possible that cats living in multiple-cat households vary systematically from those who do not, just as it is possible that humans who choose to own multiple cats might vary from those who choose to own only one. Further research on multi-cat households is most definitely needed.

3.5 Tables and Figures

Table 1

Means and standard deviations for all variables from replication dataset used in multiple linear regression (N=929).

Variable	<i>M</i>	<i>SD</i>
Years Owned	5.99	4.58
Agency Deviation	0.1043	0.0848
Communion Deviation	0.0865	0.0737
RAS	31.63	3.75

Table 2

Unstandardized Beta coefficients with standard error and β (standardized coefficients) for replication model predicting relationship satisfaction with a pet cat.

Predictor Variable	Beta	<i>SE</i>	β	<i>p</i>
Intercept	31.29	0.28	0	< .001***
Agency Deviation	0.68	1.45	0.02	.64
Communion Deviation	-3.74	1.67	-0.07	.04*
Years Owned	0.09	0.03	0.11	.0004***

*Significance levels: $p < 0.001 = ***$; $p = <.01 = **$; $p = <.05 = *$.*

Table 3

Means and standard deviations for all continuous variables in extension dataset (N=926) used for extension model #1 (regressed on RAS).

Variable	M	SD
Years Owned	5.98	4.56
Cat Age	7.09	4.61
Agency Deviation	0.1044	0.0849
Communion Deviation	0.0868	0.0737
RAS	31.62	3.75

Table 4

Unstandardized Beta coefficients with standard error and β (standardized coefficients) for extension model #1 predicting relationship satisfaction with a pet cat.

Predictor Variable	Beta	SE	β	p
Intercept	31.5	0.32	0	< .001***
Agency Deviation	0.75	1.45	0.02	.61
Communion Deviation	-3.37	1.67	-0.07	.04*
Cat Age	-0.13	0.05	-0.16	.02*
Cat Sex	n/a	n/a	n/a	.85
Years Owned	0.21	0.06	0.26	.0001***

*Significance levels: $p < 0.001 = ***$; $p = <.01 = **$; $p = <.05 = *$.*

Table 5

Means and standard deviations for all continuous variables in extension dataset (N=917) used for extension model #2 (regressed on LAPS).

Variable	<i>M</i>	<i>SD</i>
Years Owned	5.99	4.58
Cat Age	7.09	4.61
Agency Deviation	0.1047	0.0851
Communion Deviation	0.0864	0.0735
LAPS	52.94	10.66

3.6 References

- American Pet Products Association. (2019). *Pet Industry Market Size & Ownership Statistics*. https://www.americanpetproducts.org/press_industrytrends.asp
- American Society for the Prevention of Cruelty [ASPCA]. (n.d.). *Pet Statistics | Shelter Intake and Surrender | ASPCA*. Retrieved November 3, 2020, from <https://www.asPCA.org/animal-homelessness/shelter-intake-and-surrender/pet-statistics>
- American Veterinary Medical Association. (n.d.). *U.S. pet ownership statistics*. Retrieved November 3, 2020, from <https://www.avma.org/resources-tools/reports-statistics/us-pet-ownership-statistics>
- ASPCA. (2007). *Meet Your Match® Feline-ality™ Training Manual*. American Society for the Prevention of Cruelty to Animals.
- Bedford, E. (2019). *Pet ownership among U.S. Millennials 2017, by gender and pet*. Statista. <https://www.statista.com/statistics/831452/pet-ownership-united-states-millennials-cat-dog/>
- Bennett, P. C., Rutter, N. J., Woodhead, J. K., & Howell, T. J. (2017). Assessment of domestic cat personality, as perceived by 416 owners, suggests six dimensions. *Behavioural Processes*, *141*, 273–283. <https://doi.org/10.1016/j.beproc.2017.02.020>
- Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk. *Perspectives on Psychological Science*, *6*(1), 3–5. <https://doi.org/10.1177/1745691610393980>
- Byrne, D. E. (1971). The attraction paradigm. *Academic Press*, 172.
- Camerer, C. F., Dreber, A., Forsell, E., Ho, T. H., Huber, J., Johannesson, M., Kirchler, M., Almenberg, J., Altmejd, A., Chan, T., Heikensten, E., Holzmeister, F., Imai, T., Isaksson, S., Nave, G., Pfeiffer, T., Razen, M., & Wu, H. (2016). Evaluating replicability of laboratory experiments in economics. *Science*, *351*(6280), 1433–1436. <https://doi.org/10.1126/science.aaf0918>
- Camerer, C. F., Dreber, A., Holzmeister, F., Ho, T. H., Huber, J., Johannesson, M., Kirchler, M., Nave, G., Nosek, B. A., Pfeiffer, T., Altmejd, A., Buttrick, N., Chan, T., Chen, Y., Forsell, E., Gampa, A., Heikensten, E., Hummer, L., Imai, T., ... Wu, H. (2018). Evaluating the replicability of social science experiments in Nature and Science between 2010 and 2015. *Nature Human Behaviour*, *2*(9), 637–644. <https://doi.org/10.1038/s41562-018-0399-z>
- Carson, R. C. (1969). Perspectives in personality. In *Interaction concepts of personality*. Aldine.
- Casey, R. A., Vandenbussche, S., Bradshaw, J. W. S., & Roberts, M. A. (2009). Reasons for relinquishment and return of domestic cats (*Felis silvestris Catus*) to rescue shelters in the UK. *Anthrozoos*, *22*(4), 347–359.
- Coe, J. B., Young, I., Lambert, K., Dysart, L., Nogueira Borden, L., & Rajić, A. (2014). A scoping review of published research on the relinquishment of companion animals. *Journal of Applied Animal Welfare Science*, *17*(3), 253–273. <https://doi.org/10.1080/10888705.2014.899910>

- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). L. Erlbaum Associates.
- Costa, P. T., & McCrae, R. R. (1995). Domains and facets: Hierarchical personality assessment using the revised NEO personality inventory. *Journal of Personality Assessment*, *64*(1), 21–50. https://doi.org/10.1207/s15327752jpa6401_2
- Costa, P. T., McCrae, R. R., & Dye, D. A. (1991). Facet scales for agreeableness and conscientiousness: A revision of the NEO personality inventory. *Personality and Individual Differences*, *12*(9), 887–898. [https://doi.org/10.1016/0191-8869\(91\)90177-D](https://doi.org/10.1016/0191-8869(91)90177-D)
- Cramér, H. (1946). *Mathematical methods of statistics*. In *Princeton University Press*.
- Curtin, R. (2000). The effects of response rate changes on the index of consumer sentiment. *Public Opinion Quarterly*, *64*(4), 413–428.
- Delacre, M., Lakens, D., & Leys, C. (2017). Why psychologists should by default use Welch’s t-test instead of Student’s t-test. *International Review of Social Psychology*, *30*(1), 92. <https://doi.org/10.5334/irsp.82>
- Delgado, M. M., Munera, J. D., & Reevy, G. M. (2012). Human perceptions of coat color as an indicator of domestic cat personality. *Anthrozoos*, *25*(4), 427–440. <https://doi.org/10.2752/175303712X13479798785779>
- Derrick, B., & White, P. (2016). Why Welch’s test is Type I error robust. *The Quantitative Methods for Psychology*, *12*(1), 30–38. <https://doi.org/10.20982/tqmp.12.1.p030>
- Diener, E., & Biswas-Diener, R. (n.d.). *The Replication Crisis in Psychology*. Retrieved November 3, 2020, from <https://nobaproject.com/modules/the-replication-crisis-in-psychology>
- DiGangi, B. A., Crawford, P. C., & Levy, J. K. (2006). Outcome of cats adopted from a biomedical research program. *Journal of Applied Animal Welfare Science*, *9*(2), 143–163. https://doi.org/10.1207/s15327604jaws0902_4
- Elvers, G. C., & Lawriw, A. N. (2019). The behavioral style of the cat predicts owner satisfaction. *Anthrozoos*, *32*(6), 757–768. <https://doi.org/10.1080/08927936.2019.1673038>
- Ernst, A. F., & Albers, C. J. (2017). Regression assumptions in clinical psychology research practice - a systematic review of common misconceptions. *PeerJ*, *5*, e3323. <https://doi.org/10.7717/peerj.3323>
- Evans, R., Lyons, M., Brewer, G., & Tucci, S. (2019). The purrfect match: The influence of personality on owner satisfaction with their domestic cat (*Felis silvestris catus*). *Personality and Individual Differences*, *138*, 252–256. <https://doi.org/10.1016/j.paid.2018.10.011>
- Everett, J. A. C., & Earp, B. D. (2015). A tragedy of the (academic) commons: Interpreting the replication crisis in psychology as a social dilemma for early-career researchers. *Frontiers in Psychology*, *6*, 1152. <https://doi.org/10.3389/fpsyg.2015.01152>
- Freedman, M. B., Leary, T. F., Ossorio, A. G., & Goffey, H. S. (1951). The interpersonal dimension of personality. *Journal of Personality*, *20*(2), 143–161.

<https://doi.org/10.1111/j.1467-6494.1951.tb01518.x>

- Fukimoto, N., Howat-Rodrigues, A. B., & Mendonça-Furtado, O. (2019). Modified Meet Your Match® Feline-ality™ validity assessment: An exploratory factor analysis of a sample of domestic cats in a Brazilian shelter. *Applied Animal Behaviour Science*, *215*, 61–67. <https://doi.org/10.1016/j.applanim.2019.03.013>
- Gartner, M. C. (2015). Pet personality: A review. *Personality and Individual Differences*, *75*, 102–113. <https://doi.org/10.1016/j.paid.2014.10.042>
- Gartner, M. C., Powell, D. M., & Weiss, A. (2014). Personality structure in the domestic cat (*Felis silvestris catus*), scottish wildcat (*Felis silvestris grampia*), clouded leopard (*Neofelis nebulosa*), snow leopard (*Panthera uncia*), and African lion (*Panthera leo*): A comparative study. *Journal of Comparative Psychology*, *128*(4), 414–426. <https://doi.org/10.1037/a0037104>
- Gartner, M. C., & Weiss, A. (2013). Personality in felids: A review. *Applied Animal Behaviour Science*, *144*(1–2), 1–13. <https://doi.org/10.1016/j.applanim.2012.11.010>
- Gosling, S. D. (2001). From mice to men: What can we learn about personality from animal research? *Psychological Bulletin*, *127*(1), 45–86. <https://doi.org/10.1037/0033-2909.127.1.45>
- Gosling, S. D., & Bonnenburg, A. V. (1998). An integrative approach to personality research in anthrozoology: Ratings of six species of pets and their owners. *Anthrozoos*, *11*(3), 148–155. <https://doi.org/10.2752/089279398787000661>
- Gosling, S. D., Sandy, C. J., & Potter, J. (2010). Personalities of self-identified “dog people” and “cat people.” *Anthrozoos*, *23*(3), 213–222. <https://doi.org/10.2752/175303710X12750451258850>
- Ha, D., & Ha, J. (2017). A subjective domestic cat (*Felis silvestris catus*) temperament assessment results in six independent dimensions. *Behavioural Processes*, *141*, 351–356. <https://doi.org/10.1016/j.beproc.2017.03.012>
- Haverbeke, A., Pluijmakers, J., & Diederich, C. (2015). Behavioral evaluations of shelter dogs: Literature review, perspectives, and follow-up within the European member states’s legislation with emphasis on the Belgian situation. *Journal of Veterinary Behavior: Clinical Applications and Research*, *10*(1), 5–11. <https://doi.org/10.1016/j.jveb.2014.07.004>
- Hedges, L. V. (1981). Distribution theory for Glass’s estimator of effect size and related estimators. *Journal of Educational Statistics*, *6*(2), 107–128. <https://doi.org/10.3102/10769986006002107>
- Hendrick, S. S. (1988). A generic measure of relationship satisfaction. *Journal of Marriage and the Family*, *50*(1), 93. <https://doi.org/10.2307/352430>
- Hendrick, S. S., Dicke, A., & Hendrick, C. (1998). The relationship assessment scale. *Journal of Social and Personal Relationships*, *15*(1), 137–142. <https://doi.org/10.1177/0265407598151009>
- Hinde, R. A. (1982). *Ethology, its nature and relations with other sciences*. Oxford University

Press.

- Humane Society of the United States [HSUS]. (2012). *All Shelters Are Not Alike – The Important Differences That Can Affect the Mission*.
<https://www.humanesociety.org/sites/default/files/docs/all-shelters-are-not-alike.pdf>
- HSUS. (2020). *Pets by the numbers*. Humane Society of the United States.
<https://www.animalsheltering.org/page/pets-by-the-numbers>
- Johnson, T. P., Garrity, T. F., & Stallones, L. (1992). Psychometric Evaluation of the Lexington Attachment to Pets Scale (Laps). *Anthrozoös*, 5(3), 160–175.
<https://doi.org/10.2752/089279392787011395>
- Jones, A. C., & Gosling, S. D. (2005). Temperament and personality in dogs (*Canis familiaris*): A review and evaluation of past research. *Applied Animal Behaviour Science*, 95(1–2), 1–53. <https://doi.org/10.1016/j.applanim.2005.04.008>
- Kaleta, T., Borkowska, N., & Goral-Radziszewska, K. (2016). The study of domestic cat (*Felis catus*) personality based on survey in Poland. *Annals of Warsaw University of Life Sciences - SGGW, Animal Science*, 55(1), 39–46.
- Leary, T. (1957). *Interpersonal diagnosis of personality; A functional theory and methodology for personality evaluation*. Ronald Press.
- Lee, C. M., Ryan, J. J., & Kreiner, D. S. (2007). Personality in domestic cats. *Psychological Reports*, 100(1), 27–29. <https://doi.org/10.2466/PR0.100.1.27-29>
- Lee, R., Delta Society, & California Veterinary Medical Association. (1983). *Animals in nursing homes: Guidelines*.
- Leising, D., & Bleidorn, W. (2011). Which are the basic meaning dimensions of observable interpersonal behavior? *Personality and Individual Differences*, 51(8), 986–990.
<https://doi.org/10.1016/j.paid.2011.08.003>
- Lepper, M., Kass, P. H., & Hart, L. A. (2002). Prediction of adoption versus euthanasia among dogs and cats in a California animal shelter. *Journal of Applied Animal Welfare Science*, 5(1), 29–42. https://doi.org/10.1207/S15327604JAWS0501_3
- Litchfield, C. A., Quinton, G., Tindle, H., Chiera, B., Kikillus, K. H., & Roetman, P. (2017). The ‘feline five’: An exploration of personality in pet cats (*Felis catus*). *PLoS ONE*, 12(8).
<https://doi.org/10.1371/journal.pone.0183455>
- Locke, K. D. (2006). Interpersonal circumplex measures. In S. Strack (Ed.), *Differentiating normal and abnormal personality* (pp. 383–400). Springer Publishing Company.
- Martínez-Byer, S., Urrutia, A., Szenczi, P., Hudson, R., & Bánszegi, O. (2020). Evidence for individual differences in behaviour and for behavioural syndromes in adult shelter cats. *Animals*, 10(6), 962. <https://doi.org/10.3390/ani10060962>
- Maxwell, S. E., Lau, M. Y., & Howard, G. S. (2015). Is psychology suffering from a replication crisis?: What does “failure to replicate” really mean? *American Psychologist*, 70(6), 487–498. <https://doi.org/10.1037/a0039400>

- McCrae, R. R., & Costa, P. T. (1987). Validation of the five-factor model of personality across instruments and observers. *Journal of Personality and Social Psychology*, 52(1), 81–90. <https://doi.org/10.1037/0022-3514.52.1.81>
- McCrae, R. R., & Costa, P. T. (1989). The structure of interpersonal traits: Wiggins’s circumplex and the five-factor model. *Journal of Personality and Social Psychology*, 56(4), 586–595. <https://doi.org/10.1037/0022-3514.56.4.586>
- Mede, N. G., Schäfer, M. S., Ziegler, R., & Weißkopf, M. (2020). The “replication crisis” in the public eye: Germans’ awareness and perceptions of the (ir)reproducibility of scientific research. *Public Understanding of Science*. <https://doi.org/10.1177/0963662520954370>
- Moore, D., & Tarnai, J. (2002). Evaluating nonresponse error in mail surveys. In R. J. A. Groves, R. M., Dillman, D. A., Eltinge, J. L., and Little (Ed.), *Survey Nonresponse* (pp. 197–211). John Wiley & Sons, New York.
- Neidhart, L., & Boyd, R. (2002). Companion animal adoption study. *Journal of Applied Animal Welfare Science*, 5(3), 175.
- O’Connor, R., Coe, J. B., Niel, L., & Jones-Bitton, A. (2016). Effect of adopters’ lifestyles and animal-care knowledge on their expectations prior to companion-animal guardianship. *Journal of Applied Animal Welfare Science*, 19(2), 157–170. <https://doi.org/10.1080/10888705.2015.1125295>
- Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. *Science*, 349(6251), aac4716–aac4716. <https://doi.org/10.1126/science.aac4716>
- Patronek, G. J., & Bradley, J. (2016). No better than flipping a coin: Reconsidering canine behavior evaluations in animal shelters. *Journal of Veterinary Behavior: Clinical Applications and Research*, 15, 66–77. <https://doi.org/10.1016/j.jveb.2016.08.001>
- Patronek, G. J., Glickman, L., Beck, A. M., McCabe, G. P., & Ecker, C. (1996). Risk factors for relinquishment of cats to an animal shelter. *Journal of the American Veterinary Medical Association*.
- Podberscek, A., & Blackshaw, J. (1988). Reasons for liking and choosing a cat as a pet. *Australian Veterinary Journal*, 65(10), 332–333. <https://doi.org/10.1111/j.1751-0813.1988.tb14523.x>
- Qualtrics. (2019). Qualtrics XM // The Leading Experience Management Software. In *Qualtrics*.
- R Core Team. (2020). R: A Language and Environment for Statistical Computing. In *R Foundation for Statistical Computing* (4.0.0).
- Replication crisis*. (n.d.). Wikipedia. Retrieved November 3, 2020, from https://en.wikipedia.org/wiki/Replication_crisis
- Research measures*. (n.d.). Retrieved September 10, 2020, from <http://paultrapnell.com/measures/>
- Salman, M., Hutchison, J., Ruch-Gallie, R., Kogan, L., New, J. C., Kass, P. H., & Scarlett, J. M. (2000). Behavioral reasons for relinquishment of dogs and cats to 12 shelters. *Journal of*

- Applied Animal Welfare Science*, 3(2), 93–106.
https://doi.org/10.1207/s15327604jaws0302_2
- Salman, M., New, Jr., J. G., Scarlett, J., Kass, P., Ruch-Gallie, R., & Hetts, S. (1998). Human and animal factors related to relinquishment of dogs and cats in 12 selected animal shelters in the United States. *Journal of Applied Animal Welfare Science*, 1(3), 207–226.
https://doi.org/10.1207/s15327604jaws0103_2
- Saunders, J., Parast, L., Babey, S. H., & Miles, J. V. (2017). Exploring the differences between pet and non-pet owners: Implications for human-animal interaction research and policy. *PLOS ONE*, 12(6), e0179494. <https://doi.org/10.1371/journal.pone.0179494>
- Siegford, J. M., Walshaw, S. O., Brunner, P., & Zonella, A. J. (2003). Validation of a temperament test for domestic cats. *Anthrozoos*, 16(4), 332–351.
<https://doi.org/10.2752/089279303786991982>
- Singer, E., Van Hoewyk J., & Maher, M. P. (2000). Experiments with incentives in telephone surveys. *Public Opinion Quarterly*, 64(2), 171–188. <https://doi.org/10.1086/317761>
- Sinn, L. (2016). Factors affecting the selection of cats by adopters. *Journal of Veterinary Behavior: Clinical Applications and Research*, 14, 5–9.
<https://doi.org/10.1016/j.jveb.2016.06.001>
- Trapnell, P. D., & Wiggins, J. S. (1990). Extension of the interpersonal adjective scales to include the Big Five dimensions of personality. *Journal of Personality and Social Psychology*, 59(4), 781–790. <https://doi.org/10.1037/0022-3514.59.4.781>
- UC Davis Koret Shelter Medicine Program. (2019). *Developing Intake and Adoption Decision Making Criteria*. <https://www.sheltermedicine.com/library/resources/?r=developing-intake-and-adoption-decision-making-criteria>
- van der Borg, J. A. M., Netto, W. J., & Planta, D. J. U. (1991). Behavioural testing of dogs in animal shelters to predict problem behaviour. *Applied Animal Behaviour Science*, 32(2–3), 237–251. [https://doi.org/10.1016/S0168-1591\(05\)80047-4](https://doi.org/10.1016/S0168-1591(05)80047-4)
- Vaughn, M. J., & Matyastik Baier, M. E. (1999). Reliability and validity of the relationship assessment scale. *American Journal of Family Therapy*, 27(2), 137–147.
<https://doi.org/10.1080/019261899262023>
- Vazire, S., Gosling, S. D., Dickey, A. S., & Schapiro, S. J. (2007). Measuring personality in nonhuman animals. In *Handbook of research methods in personality psychology* (pp. 190–206).
- Weiss, E., Gramann, S., Drain, N., Dolan, E., & Slater, M. (2015). Modification of the Feline-ality™ assessment and the ability to predict adopted cats' behaviors in their new homes. *Animals*, 5(1), 71–88. <https://doi.org/10.3390/ani5010071>
- White, J. K., Hendrick, S. S., & Hendrick, C. (2004). Big five personality variables and relationship constructs. *Personality and Individual Differences*, 37(7), 1519–1530.
<https://doi.org/10.1016/j.paid.2004.02.019>
- Wiggins, J. S. (1979). A psychological taxonomy of trait-descriptive terms: The interpersonal

domain. *Journal of Personality and Social Psychology*, 37(3), 395–412.
<https://doi.org/10.1037/0022-3514.37.3.395>

Wiggins, J. S., Trapnell, P., & Phillips, N. (1988). Psychometric and geometric characteristics of the Revised Interpersonal Adjective Scales (IAS-R). *Multivariate Behavioral Research*, 23(4), 517–530. https://doi.org/10.1207/s15327906mbr2304_8

Yong, E. (2018). *Psychology's Replication Crisis Is Real, Many Labs 2 Says - The Atlantic*. The Atlantic. <https://www.theatlantic.com/science/archive/2018/11/psychologys-replication-crisis-real/576223/>

Zeigler-Hill, V., & Highfill, L. (2010). Applying the interpersonal circumplex to the behavioral styles of dogs and cats. *Applied Animal Behaviour Science*, 124(3–4), 104–112.
<https://doi.org/10.1016/j.applanim.2010.02.012>

Saethra Darling, James C. Ha

4.1 Introduction

Animals have personalities. This statement was at one point in time considered controversial in serious scientific circles but over the past decades, the supporting evidence has mounted convincingly (Gosling, 2001, 2008) Non-human animals ranging from fruit flies to elephants have been shown to demonstrate individually consistent differences in behavioral patterns ranging from the rudimentary to the complex, demonstrating continuity that confirms Darwin's statement "The difference in mind between man and the higher animals, great as it is, certainly is one of degree and not of kind" (Darwin, 1871).

Domestic animals, including pets, fall within the range of species that have personalities. One motivation for studying personality in pet animals is to find ways to use personality to address welfare issues, including improving outcomes for pets in animal shelters. In order to reach that point, we need to establish what personality traits pets have, and how (or if) those personality traits might influence relationship satisfaction and attachment between owners and their pets. Domestic dogs make up most pet personality research (at least 95 studies published as of 2014; Gartner, 2015; Jones & Gosling, 2005), but in the last twenty years, as cats have become the second-most populous pet in the United States (HSUS, n.d.), studies examining personality in pet cats have proliferated (32 as of 2020, with 9 of those published since 2015; Bennett et al., 2017; Elvers & Lawriw, 2019; Evans et al., 2019; Fukimoto et al., 2019; Gartner, 2015; Gartner & Weiss, 2013; Ha & Ha, 2017; Kaleta et al., 2016; Litchfield et al., 2017; Martínez-Byer et al., 2020; Weiss et al., 2015). While we likely have yet to fully describe every

aspect of feline personality (Vitale Shreve & Udell, 2015), convergence across all studies provides evidence for at least two personality dimensions. Unfortunately, and likely due at least in part to the specter of anthropomorphism leading to resistance to labeling these constructs as “personality”, there is as of yet no agreed upon terminology to name these dimensions.

One of the most commonly understood systems of personality nomenclature in general parlance stems from The Big Five model (Briggs, 1992; Digman, 1990; Judge et al., 2013; McCrae et al., 1998; McCrae & Costa, 1987, 2008; McCrae & John, 1992). The Big Five or the Five Factor Model (FFM) is a model of human personality made up of five independent dimensions (factors): Extraversion, Agreeableness, Openness, Neuroticism, and Conscientiousness (Costa et al., 1991; Costa & McCrae, 1995). Each factor is made up of six correlated facets and each of those six facets, while correlated, lend their own unique contribution toward explaining the variance within the larger factor (e.g., Extraversion is made up of Warmth, Gregariousness, Positive Emotion, Assertiveness, Activity, and Excitement Seeking; Costa & McCrae, 1995). Each of the facets are in turn generally measured using a survey in which participants respond to a set of adjectives or statements (e.g., Warmth may be measured by how much a participant agrees that they 1) keep people at a distance, 2) are gregarious, 3) are talkative, 4) tend to arouse liking in people, 5) have warmth and are compassionate; Costa & McCrae, 1995). Regardless of the labels employed in pet cat personality work (which are often similar to facet names (e.g., warmth), or behavioral terms (e.g., social)), when the measurement tools are compared, the labels used to name the two personality dimensions present in every study on cat personality best resemble those adjectives and statements used to capture Extraversion and Agreeableness. For example, Bennet et al. (2017), identified a personality factor that they labeled “demandingness”, made up of the facets

persistent, demanding, needy, persevering, and loud, which closely resemble the facets of Extraversion, especially when the statements used to measure facets are compared (e.g., behaves in an assertive fashion, doesn't give up in the face of frustration, talkative).

However, the FFM is not the only personality framework available that might prove useful in cat personality research. The Interpersonal Circumplex (IPC) is a two-dimensional model of human personality that has the added benefit of predicting relationship quality between humans (Freedman et al., 1951; Leary, 1957; Leising & Bleidorn, 2011; Locke, 2006; Markey & Markey, 2007; Wiggins, 1979). The two dimensions of the IPC are Agency and Communion. Agency and Communion are made up of eight octants (which are similar to facets), generally labeled using the letters A through P (i.e., PA, BC, DE, FG, HI, JK, LM, NO), with each label corresponding to a blend of Agency and Communion that can also be referred to with paired adjective labels (e.g., PA = Assured-Dominant, NO = Gregarious-Extraverted, LM = Warm-Agreeable, etc.; Trapnell & Wiggins, 1990; Wiggins et al., 1988; Figure 1). As with facets, each octant is measured using a survey in which participants respond to a set of adjectives (with definitions), which again, are similar to those used in the FFM, as well as those used to measure and label trait dimensions in cat personality work (Trapnell & Wiggins, 1990; Wiggins et al., 1988). For example, PA is made up of the adjectives Assertive, Dominant, Forceful, Self-assured, Domineering, Firm, Self-confident, and Persistent, the definitions of which (if not the adjective themselves) resemble the “demandingness” dimension referred to above (e.g., tends to be aggressive and outspoken, likes to command and take charge, steadfast and does not give in easily, etc.; Costa & McCrae, 1995; Trapnell & Wiggins, 1990; Wiggins et al., 1988; Figure 2). Two studies have used the IPC to measure cat personality and have demonstrated that cats do possess these two personality dimensions (Woodward & Bauer, 2007; Zeigler-Hill & Highfill,

2010). Agency and Communion are also equivalent to the FFM's Extraversion and Agreeableness, respectively, which have also been found in cats, lending further support to the use of Extraversion/Agency and Agreeableness/Communion as appropriate labels for the two personality constructs demonstrated in every study on cat personality (Costa & McCrae, 1995; Gosling & Bonnenburg, 1998; Trapnell & Wiggins, 1990). For the purpose of our study, because we used the IPC to measure personality, we shall refer to these two personality traits most often as Agency and Communion but Extraversion and Agreeableness may be interchanged, especially when discussing other work that did not use the IPC (which is the majority).

Cats can be Extraverted and Agreeable. And the perhaps unsurprising consensus amongst all studies who have examined the question is that owners tend to prefer cats who are more Extraverted and more Agreeable (Bennett et al., 2017; Elvers & Lawriw, 2019; Evans et al., 2019; Zeigler-Hill & Highfill, 2010). The question then becomes can we tease out this overall preference in some way to differentiate between which individual cats and which individual humans might be best suited by measuring these personality traits in both species and matching owners to cats based on similarities or difference between them? Four published studies have attempted to answer this question to date, two using the IPC, and two using factorial-based survey methods similar to the FFM (Elvers & Lawriw, 2019; Evans et al., 2019; Woodward & Bauer, 2007; Zeigler-Hill & Highfill, 2010).

Woodward & Bauer (2007) found that while interpersonal complementarity (in this case, similarity between owners and their cats in Agency and Communion) did contribute to owner opinion of an "ideal cat", this did not translate to explaining attachment to an actual cat. Zeigler-Hill & Highfill (2010), again using the IPC, found that owner satisfaction with pets (dogs and

cats) was higher when their pets showed higher levels of Agency and Communion and though this did not differ between the two species, they did find a difference between species when looking at complementarity between humans and cats, namely that people were more satisfied with their cats when they were similar in Communion and reciprocal in Agency. In Chapter Three of this dissertation we described a replication of the complementarity aspect of Zeigler-Hill and Highfill (2010), in which we found evidence for a relationship between owner satisfaction and similarity in Communion between owners and their cats. Evans et al. (2019), using a factorial-based survey, found that owners were more satisfied with cats who scored higher on an “agreeableness” dimension and that they were also more satisfied when there was a dissimilarity between owner Dominance and cat agreeableness (the label “agreeableness” here is presented in lower case, as it was not measured using a FFM-related tool and therefore cannot be assumed to be the same dimension; Dominance in humans was measured using a test of The Dark Triad which measures personality dimensions not included in the Big Five). Finally, Elvers & Lawriw (2019), found that owners were more satisfied when cats were more “amiable” and less “demanding” and that there was a (positive) trend towards higher owner satisfaction when owner Agreeableness and cat “demandingness” interacted. Close examination of the measures in the three studies that found some kind of interplay between human and cat personality that contributed (or trended towards contributing) to owner satisfaction with pet cats showed that the supporting adjectival items were similar, such that cat “demandingness” might be conceived of as Agency, or at least as an octant of Agency (PA), that human Dominance might also be similar to Agency, or the PA octant of Agency, and that “amiability” might resemble Communion, or the LM octant of Communion.

Taken as a whole, we have some evidence of a relationship that may explain satisfaction between similarities and/or differences in the same personality trait between cat-owner dyads (e.g., both similar in Communion) and/or in interactions between two different personality traits within cat-owner dyads (e.g., owner Communion and cat Agency), and/or similarities/differences in the underlying octants of the IPC (the latter of which no study to date has examined). We therefore used our large dataset from a previous study (Chapter Three of this dissertation) to explore all of these possible relationships, as well as any other predictors of relationship satisfaction and attachment that might emerge. Exploratory analyses are described here, followed by confirmatory analyses, using a new dataset, testing the ability for variables that came from exploratory analysis to predict relationship satisfaction and/or attachment between owners and their cats. All data is available upon request from the primary author (SD).

4.2 Methods

Study Site

Data were gathered at the Seattle Animal Shelter, an open admission urban animal shelter located in Seattle, WA, USA.

Animal Care and Housing

The cats were housed in metal cages, some with one clear plastic wall so they were visible to visitors. During quarantine, stress, or while meeting potential adopters, the cats may have been housed in other smaller rooms, though still singly. Cats were provided with litterboxes, bedding, and toys. Most cats were provided hiding areas. Dry cat food was available at all times and canned food was provided twice daily. Water was refreshed twice daily. Cat

handling, cage cleaning, and feeding were carried out primarily by multiple trained staff members. Both staff and trained volunteers provided physical interaction to the cats, including brushing, petting, and playing.

Measures

Our exploratory analyses were completed using the dataset collected via the measures described in detail in Chapter Three of this dissertation: Interpersonal Adjective Scale, Revised (IAS-R; Wiggins et al., 1988); Feline Personality Scale (FPS; Gartner & Weiss, 2013); Lexington Attachment to Pets Scale (LAPS; Johnson et al., 1992); Relationship Satisfaction Scale (RAS; Hendrick et al., 1998). The FPS data was collected concurrently for use in a separate study and is not reported here.

Our confirmatory analyses were conducted using the same measures listed above, with the addition of the Pet Attitude Scale-Modified (PAS-M; Munsell et al., 2004) and the Cat Adopter Survey (CAS; ASPCA, 2007). The PAS-M measures the favorableness of attitudes towards to pets and consists of a set of 18 statements accompanied by an eight-option Likert-like degree of agreement scale anchored in the middle by “Unsure” and at either end by “Strongly Disagree” and “Strongly Agree”. Six items are reverse coded. Possible scores range from 18-126. The CAS data was collected concurrently for use in a separate study and is not reported here.

Design

The same cross-sectional electronic survey data collected for Chapter Three of this dissertation was analyzed for the exploratory portion of this paper; see Chapter Three for a

detailed description of that study design. Predictor variables explored in this paper: cat Agency and Communion scores on the IAS-R, human Agency and Communion scores of the IAS-R, intra-dyadic deviation in Agency and in Communion between humans and their cats, the quadratic, cubic, and quartic terms of each of the variables listed thus far, the interaction between human Communion and cat Agency, the interaction between human Agency and cat Communion, and interactions between two lower-order facets of human and cat Agency and Communion, PA (part of Agency) and LM (part of Communion). Our outcome variables were scores on the RAS (relationship satisfaction) and on the LAPS (attachment). Best fit models were created for subsequent use in confirmatory testing.

A second dataset was collected from adoptive owners in partnership with the Seattle Animal Shelter (SAS) for confirmatory analyses. Data were collected between January 31st, 2017 and February 6th, 2018. We began data collection using paper survey packets that shelter staff would ask new adopters to complete. By May 2017, shelter staff participation had decreased, so we gradually switched over to collecting data online using Qualtrics (Qualtrics, 2019). Immediately after adoption, email requests for participation were sent out, and by July 2017, all adopter surveys were completed online. Data were collected at two timepoints: adoption or immediately thereafter, and at approximately 1 month after adoption. We assessed non-response bias and calculated our overall and usable response rate. We then attempted to replicate our exploratory findings using our new sample. Our predictor variables of interest in confirmatory testing were as follows: PAS-M score reported at time of adoption or shortly thereafter (as a control), cat age, cat Agency score on the IAS-R, cat Communion score on the IAS-R, human Agency score on the IAS-R, and an interaction term that included both human Communion score and cat Agency score (requiring that we also include the human Communion score as a variable,

in order to maintain the statistical validity of the interaction term). Years owned was not a variable in the confirmatory analysis as all of the cats were newly adopted. Our outcome variables were scores on the RAS and scores on the LAPS.

Participants

A detailed description of participants that comprised the original dataset for our exploratory work can be found in Chapter Three of this dissertation. For the exploratory work, three cats that had been removed from consideration due to errors in age in that study were replaced into the dataset using mean imputation for the missing ages. Summary statistics were as follows: $N=920$; human participants ranged in age from 18 to 77 years ($M = 34.7$, $SD = 11.7$), and were 74.6% female; cats ranged in age from 6 months to 22 years ($M = 7.1$, $SD = 4.6$), and were 49.8% female (95.7% altered).

The shelter participants were as follows: 131 new adoptive owners were asked to participate in the study either at the time of adoption ($N=56$) or shortly after adoption ($N=75$). Following the request to continue to participate at least one month after adoption, 71 people responded. One response had to be removed because the person who adopted the cat returned the cat to the shelter and was not the same person (a subsequent adopter) who completed the follow-up surveys. Our overall response rate was 53%. Of those who responded, 12 surveys were incomplete, yielding a 45% usable response rate. To assess non-response bias, we assigned genders to the non-responders based on the gender typically associated with their first name. To the extent that this method is an appropriate proxy, we estimate that approximately 35% of non-responders were male and 65% were female. Of those who did respond, 80.3% identified as female, 19.7% as male.

In the usable responses (N=59), the final sample was 20% male and 80% female. This gender bias in participation and completion was not unexpected (Curtin, 2000; Moore & Tarnai, 2002; Singer et al., 2000). We have no data regarding the age of non-responders. Overall, our responders were 42.2 years old (SD = 15.6y, range 18y-75y), and there was no difference in age between those who responded and those who completed the surveys.

In our final usable sample, the average cat was 6 years old (SD = 4.3y, range = .75y to 17y), 50.8% female, and 100% altered.

Procedure

Exploratory Analysis

All statistical analysis was performed in R (R Core Team, 2020). The first step in exploring the data was to look at all simple correlations between all of the variables. *p* values for correlations between predictor variables were used as a tool for deciding which correlations would undergo later confirmatory testing but will not be reported here as they are potentially misleading outside of planned hypothesis testing. Four simple correlations were observed that met the criteria for further confirmatory testing: the correlation between cat age and cat Agency, cat age and human Communion, cat Agency and human Agency, and cat Communion and human Communion.

Linear regression models of the linear, quadratic, cubic, and quartic terms of each personality variable, including the deviation between Agency and Communion within cat-owner dyads, regressed on both RAS and LAPS were examined. *p* values for relationships between predictor variables and outcome variables were used to choose which predictor variables would

be included in subsequent exploratory model fitting. As a result, three new variables were created to include in further exploratory testing: the quadratic of human Agency, cat Agency, and human Communion (following mean-centering). A series of linear regression models were then compared using the Akaike information criterion (AIC) and adjusted R^2 , first regressed on satisfaction (RAS) and then on attachment (LAPS). Only one model including a polynomial showed a statistical relationship with one outcome variable (human Agency² and RAS) but as there was no simple correlation between those two variables and additional variance explained was only 0.43%, and given that model fitting should not only be a statistical endeavor but also should include researcher input, this statistical finding was not considered to be meaningful in an applied sense and was not retained in subsequent models. Following the exploration of the data to this point, three models attempting to predict RAS were created using three techniques, and compared using change in AIC and change in adjusted R^2 . The first model included all of the linear predictor variables: years owned (control), cat age, cat Agency, cat Communion, human Agency, human Communion, intradyadic deviation along Agency and intradyadic deviation along Communion. The second model was based on the simple correlations found in the exploration, as well as the findings of Chapter Three of this dissertation and the predictor variables were: years owned, cat age, intradyadic deviation on Communion, cat Agency, cat Communion, and human Communion. The third model was created using the `glmulti` function in R (Calcagno & de Mazancourt, 2010) which performed an exhaustive comparison of all possible models using all eight variables and returned the one with the lowest AIC. The variables selected via this method were: years owned, cat age, intradyadic deviation on Agency, cat Agency, and cat Communion.

Comparison of these three models showed that the same four variables were significant in each model (years owned, cat Agency, cat Communion, and cat age). The AIC change between the first model and the second and between the second and the third was <2 and so not considered meaningful. The change in AIC between the first model and the third model was greater than 2, but the increase in the adjusted R^2 explained only an additional 0.48% of the variance and the intradyadic deviation in Agency was not significant within the model. Given that no evidence thus far had supported the inclusion of intradyadic deviation as a good predictor of RAS, this variable was not retained. The final model created for subsequent confirmatory testing included four variables: years owned, cat Agency, cat Communion, and cat age.

The same exploration of variables was completed with regards to LAPS. No polynomials showed any relationship to LAPS. All eight predictor variables were included in the first comparison model following initial exploration. Six of those variables showed simple correlation with LAPS. Intradyadic deviation on Agency and Communion did not correlate with the outcome variable but were included in the model to see how those two variables performed in the presence of the other six. The second model was created using `glmulti`. Both models converged upon the same final four variables to best explain LAPS: years owned (control), cat Agency, cat Communion, and human Agency.

Once we had our models for RAS and LAPS, we introduced additional variables to see if we could find exploratory support for findings reported in recent literature (Elvers & Lawriw, 2019; Evans et al., 2019). Elvers and Lawriw (2019) reported a (positive) trend towards significance in predicting relationship satisfaction between cats and owners in the interaction between human Agreeableness and cat “demandingness”. Our measure of human Communion

is equivalent to human Agreeableness when the term Agreeableness refers to a personality factor measured with an instrument designed to capture the Big Five, as in Elvers and Lawriw (2019). There is no such established equivalence with the term “demandingness” but when we examined the adjectives used in the survey (taken from Bennett et al., 2017) to measure “demandingness”, they were similar to those used to measure Agency, or at least an aspect of agency (the PA octant; Trapnell & Wiggins, 1990; Figures 2 & 3). We therefore included in our final model predicting RAS an interaction term between human Communion and cat Agency, and compared that to the same model including the interaction term between human Communion and cat PA; AIC comparison between the three models showed a change >2 when the interaction between human Communion and cat Agency was included, and the interaction was significant within the model and therefore added to the final model for confirmatory testing. It should be noted that in Elvers and Lawriw (2019), the trend was for a positive relationship between this interaction term and relationship satisfaction, whereas in our exploratory analysis, the effect was in the opposite direction. Neither interaction term was related to LAPS.

Evans et al. (2019) described an interaction between owner dominance and cat agreeableness that predicted cat satisfaction. Despite using the term “agreeableness”, their survey was not based on the FFM, nor a similar established factorial personality model, and therefore no equivalency to Communion could be assumed (they used a survey from Litchfield et al. (2017), based upon Gartner et al. (2014) to measure cat personality). Dominance is also not part of the Big Five. However, as lack of agreed upon terminology in this area is unfortunately common, we looked more closely at the adjectives used in each case to measure the traits in questions. Again, there was similarity between adjectives used in those studies and in ours (Figures 2 & 3), such that it was reasonable to include interaction terms for human Agency and

cat Communion, as well as terms for the most similar IAS-R octants (PA and LM) in all four possible combinations. However, we found no evidence to support any of those relationships and therefore no variables based on Evans et al. (2019) made it into our final confirmatory model. This applied when tested on LAPS as well.

Confirmatory Analysis

The study was reviewed and approved by the University of Washington Human Subjects Division (STUDY00000517). All participants provided informed consent. At adoption, or shortly thereafter, owners were asked to complete the IAS-R for themselves, the PAS-M, and the CAS. One month after adoption, an email request for continued participation was sent to the adoptive owners who had initially agreed to participate. The email contained a link to electronic surveys on the Qualtrics website that consisted of the IAS-R (for their cat), the FPS, and LAPS, and the RAS. For those participants who did not complete the surveys following first request, a second request was sent out. If there was no response to the second email request, paper copies of the surveys were sent by mail, including a postage-paid return envelope. Upon completion, participants had the option to enter a drawing to win a \$50 gift card for a pet supply store as compensation for their participation. Funding for the gift cards, and for mailing supplies and postage, was obtained via Experiment.com. The funding source had no further involvement with the study.

4.3 Results

Exploratory analysis

For summary statistics, see Table 1. Effect sizes of exploratory findings are reported here (Pearson's r for correlations and Cohen's f^2 for multiple regression; Cohen's f^2 is interpreted as follows: $f^2 \geq 0.02$, $f^2 \geq 0.15$, and $f^2 \geq 0.35$ represent small, medium, and large effect sizes, respectively; Cohen, 1988; Selya et al., 2012). We found four correlations between predictor variables: cat age and cat Agency ($r = .11$); cat age and human Communion ($r = .12$); cat Agency and human Agency ($r = .20$); and cat Communion and human Communion ($r = .34$). The final model created to predict relationship satisfaction included the variables years owned (control), cat age, cat Agency, cat Communion, human Communion and the interaction term of cat Agency and human Communion (Cohen's $f^2 = .29$; table 2). The final model created to predict attachment included the variables years owned (control), cat Communion, cat Agency, and human Agency (Cohen's $f^2 = .10$; table 3).

Confirmatory Analysis

For summary statistics, see Table 4.

Evidence supported the correlation between cat and human Communion, $r = .30$, $p = .02$. As cat Communion scores increased, human Communion scores increased.

Multiple linear regression indicated that cat Agency was predictive of relationship satisfaction, controlling for the owner attitude towards pets, ($F(6,52) = 3.89$, $R^2 = 0.3098$, $R^2_{adjusted} = 0.2301$, $p = .003$, $f^2 = .45$; Table 5). As cat Agency increased, relationship satisfaction increased. Cat age, cat Communion, human Communion and the interaction term of cat Agency and human Communion were not significantly related to relationship satisfaction.

Multiple linear regression indicated that controlling for attitudes towards pets, neither cat or human Agency, nor cat Communion explained attachment to pets, ($F(4,54) = 7.44$, $R^2 = 0.3553$, $R^2_{adjusted} = 0.3075$, $p < .0001$, $f^2 = .55$; Table 6).

4.4 Discussion

Confirmatory analysis provided evidence that cat Agency (or Extraversion) is predictive of relationship satisfaction, when controlling for the adoptive owner's initial attitude towards pets. In contrast, no variable beyond owner attitude was predictive of attachment to cats. The significant correlation between cat and human Communion (Agreeableness) indicates a relationship between these two traits across the two species, though this similarity appears unrelated to relationship satisfaction or attachment.

To our knowledge, this is the first study of cat/human relationship satisfaction and attachment that has controlled for an owner's initial opinion of pets. One other study has explicitly reported that humans prefer cats higher in Agency (Zeigler-Hill & Highfill, 2010). However, as we have mentioned, the terminology used across studies is not consistent. In examining the two studies that found that people prefer cats low in "demandingness" (Elders & Lawriw, 2019) and cats low in "neuroticism" (Evans et al., 2019), we contend that their findings are similar to our own.

In the first case (Elders & Lawriw, 2019), as we described previously, the dimension labeled "demandingness" resembles both the FFM domain of Extraversion and the IPC octant PA (Assured-Dominant). How then to account for the finding that in one study (Elders & Lawriw, 2019), something similar to Agency or at least PA, is negatively associated with

relationship satisfaction, and in our study, Agency is positively associated with relationship satisfaction? The answer lies in a more nuanced discussion of what makes up the overarching domain of Extraversion, how that relates to the domain of Agency, and a deeper consideration of the underlying facets and octants that make up each higher order trait.

Extraversion is actually made up of two parts, surgent and nurturant aspects, that are now commonly referred to as Agentic Extraversion and Affiliative Extraversion (Church & Burke, 1994; Depue & Collins, 1999; Do & Minbashian, 2014). The facets that underly Agentic Extraversion in the FFM are: excitement-seeking, activity, and assertiveness, while the facets that underly Affiliative Extraversion are warmth, gregariousness, and positive emotions (Costa et al., 1991; Costa & McCrae, 1995). Similarly to Extraversion, the domain of Agency in the circumplex model is also made up of surgent and nurturant aspects (Trapnell & Wiggins, 1990). Those scoring higher on Agency will tend to also score higher on the octant PA, as well as NO and BC, and score lower on HI, FG, and JK, with PA and HI scores weighted more heavily than the other octants (see Figure 2 for exact formula used in calculations). It is primarily the difference between PA (Assured-Dominant) and HI (Unassured-Submissive) that drives the overall Agency score and it is also only PA and HI that contain terms that load onto primarily the Extraversion factor (positively) but also secondarily onto the Neuroticism factor (negative loading; Trapnell & Wiggins, 1990). The parts that load onto Extraversion are the more surgent/Agentic aspects of PA and the parts that load onto Neuroticism are the more nurturant/Affiliative aspects of PA, specifically those that are related to social confidence/anxiety (Trapnell & Wiggins, 1990). It is not uncommon that subscales of social confidence/anxiety will correlate with both Extraversion and Neuroticism (e.g., Briggs, 1988). Alternatively, it is possible that Affiliative Extraversion is more pleasing and Agentic Extraversion is displeasing

(McCrae & Costa, 1989). In light of these considerations, it is reasonable to infer that “demandingness” may capture only (the lack of) affiliative Extraversion and/or may correlate with Neuroticism, and that people who prefer cats that score lower on the dimension labeled “demandingness” are in turn indicating a preference for cats that score higher on specifically the affiliative aspects of Extraversion/the nurturant aspects of Agency.

This same line of reasoning applies to the second case, in which Evans et al. (2019) found that owners preferred cats lower on what they labeled as “neuroticism”. The adjectives that made up their measurement of “neuroticism” most closely resemble those used to measure HI (Litchfield et al., 2017; Trapnell & Wiggins, 1990; Figure 2 &3). A cat that scored high on “neuroticism” would also score high on HI, which when subtracted from the Agency equation (Figure 2), would decrease the effect of PA, and lower the overall Agency score. Therefore, their results can be interpreted to indicate that owners prefer cats that are in fact higher in Agency/Extraversion. In both studies, it was also found that people preferred cats that were more “amiable” (Elvers & Lawriw, 2019) and “agreeable” (Evans et al., 2019); a similar excavation of their adjectives (taken from Bennett et al. (2017) and Litchfield et al (2017), respectively) indicates that those labels best resemble Communion (specifically the LM octant of Communion) and Agreeableness (specifically the Altruism facet; Costa et al., 1991; Costa & McCrae, 1995; Trapnell & Wiggins, 1990; Figures 2 & 3).

“A better acquaintance with the individual comes from a consideration of the facets.” (Costa & McCrae, 1995). While it does appear that cat Extraversion and cat Agreeableness are preferred by owners and that cat Agency contributes to relationship satisfaction, categorizing cats and matching them to owners in some way using these broad domains may not be the most

fruitful avenue of pursuit. When the intention is not to characterize the entire personality of a species or individual but rather to identify aspects of that personality that can be used to predict outcomes, focusing on similarities and differences in lower order traits/facets/octants/dimensions might yet prove useful. In point of fact, this is demonstrably true in the human literature, where facets have been shown to predict a variety of behavioral outcomes, ranging from college-drinking behavior, to effective leadership, to obesity, to criminality, and more (e.g., Do & Minbashian, 2014; Feher & Vernon, 2020; McAdams & Donnellan, 2009; Paunonen et al., 2003; Paunonen & Ashton, 2001; Terracciano et al., 2009). From an applied science perspective, we suggest that future work should focus on facets rather than factors.

While we believe that facet analysis is a logical next step in applied animal personality work, it is likely to be stymied by the lack of standardization of terms. The nonstandardization of nomenclature in the field of pet personality is detrimental to the understanding and dissemination of what could be helpful information to the average pet owner or animal welfare worker. Furthermore, when researchers must go through a complicated and subjective process of review in order to discern whether or not they might be measuring the same constructs, the ability for animal personality science to build upon itself as it should is undoubtedly delayed, as evidenced by the reality that we remain unable to come to a consensus on terminology to describe the two most conserved personality domains across all higher mammals thus investigated, and specifically pet animals (Gartner, 2015; Gosling et al., 2010; Gosling & Bonnenburg, 1998; Gosling & John, 1999), despite the fact that we began measuring cat personality at least as early as 1986 (Feaver et al., 1986). Without fail, papers on animal personality point out the lack of standardization of terms and the problems in interpretation that this presents, and ours will not be an exception.

One way to remedy the language problem would be to use surveys originally designed for humans and adopt their nomenclature, as in our work. Personality surveys used in humans have a rich psychometric history and ample published reliability and validity data dating back to the early twentieth century (Wiggins, 1996). We have discussed the Interpersonal Circumplex model and the Five Factor Model here; of the two, the FFM lexicon is perhaps the most familiar to the layperson and therefore might be a better choice, but there are of course other personality models with associated scales and terminology that could be adopted. It is important, however, to not simply adopt the labels from a particular model without verifying that those labels refer to the same constructs. That is to say, simply using a factorial approach to reducing the dimensionality of survey data is not sufficient to allow the use of terms like Extraversion and Agreeableness, if our goal is to speak the same language of personality. In point of fact, we hope that we have adequately described that what we have seen labeled as such more closely resemble various facets of overarching factors, rather than the factors themselves.

An argument against adopting a generally understood nomenclature of personality such as the FFM is a lack of face and content validity when applied to cats. Terms such as “engages in fantasy or daydreams” or “unsparkling” do not lend themselves easily to describing feline personality, diminishing face validity. Content validity, the idea that the survey has items that capture every aspect of cat personality, is also potentially problematic as there may be elements of cat personality we have yet to conceive of (Vitale Shreve & Udell, 2015). However, notwithstanding possible weaknesses in those two subjective validities, objective validities (e.g., criterion, convergent, and discriminant), as well as reliabilities (e.g., inter-rater, test-retest, and internal), in human surveys are well-documented, which stands in stark contrast to the state of reliability and validity testing in surveys designed from scratch to study cat personality.

Reliability is a necessary precursor to validity. As of 2013, 40% of studies on cat personality shared no reliability data; of those that did report reliability data, the most common was interrater reliability (Gartner & Weiss, 2013). In the 12 studies published subsequent to 2013, 50% did not report any reliability data; of those that did report reliability data, the most common was internal reliability (Cronbach's α ; Bennett et al., 2017; Elvers & Lawriw, 2019; Evans et al., 2019; Fukimoto et al., 2019; Gartner, 2015; Ha & Ha, 2017; Kaleta et al., 2016; Litchfield et al., 2017; Martínez-Byer et al., 2020; Weiss et al., 2015). The two factorial personality scales used in the studies of cat-owner compatibility that we have described here (Elvers & Lawriw, 2019; Evans et al., 2019), depended upon measures taken from Bennet et al. (2016) and Litchfield et al. (2017; "The Feline Five"). Bennet et al. (2016) did not report reliability data. Litchfield et al. (2017; using a survey from Gartner et al. (2014), which reported inter-rater reliability), reported Cronbach's α . The Feline Five was cross validated using two independent samples. Face validity was good for both surveys and Bennet et al. (2016) emphasized content validity by requesting survey creation input from people who were formally trained in the area, as well as people with a high degree of experience with cats. Both personality surveys were created using exploratory factor analysis and neither underwent criterion, convergent, or discriminant validity testing. No further reliability or validity testing was reported before each scale was subsequently used in new studies, nor within those subsequent studies (Elvers & Lawriw, 2019; Evans et al., 2019). The lack of reliability and validity testing in the cat personality arena means that construct validity of cat-specific instruments has yet to be documented. Proceeding in our field with instruments that do not have established construct validity threatens our ability to draw any usable conclusions. If we do not want to use established human measures, then we absolutely must be required by journal editors to conduct and report

reliability and validity testing prior to publication. And, unfortunately, the combination of a lack of a standard naming system and a lack of fundamental psychometric data means that there are currently no factors or facets of cat personality that can be relied upon. Without better instruments, it is foolhardy to continue attempting to use such personality measures to improve adoption success.

Our work here supports the idea that people are more satisfied with Extraverted and Agreeable cats. We have found no evidence that human personality trait domains, either on their own or in conjunction with cat personality trait domains, allow us to distinguish between which individual person should adopt which individual cat. From an applied animal welfare perspective, that is not a promising result. However, we did find a correlation between cat Communion and human Communion. This may be evidence of assortative choice in adoption that is unrelated to satisfaction or attachment, and could prove useful in a real-world setting. If people choose which cat to adopt based on a perception of similar warmth (and are satisfied with cats that are Extraverted), then it follows that shelters would be well-advised to provide ample opportunities for cats to display their full behavioral repertoire to the viewing public, such that potential adopters would be able to evaluate their warmth (Sinn, 2016). For those cats that might score lower on Communion (or on some future reliable and valid measure of specifically cat Agreeableness, or facets/dimensions of warmth), those individuals could be diverted into a behavioral modification program designed to increase that aspect of their personality (e.g., Kogan et al., 2017), as has been demonstrated as possible in humans (e.g., Massey-Abernathy & Robinson, 2019; Oades & Caputi, 2014), and thereby perhaps increase their chances of being adopted.

We were unable to replicate some of our other exploratory findings. It is possible that this is due to the artificial inflation of Type I error introduced to a study system with unfettered multiple testing; that is to say, the unconfirmed exploratory results may have been statistical artifacts of searching for significance. It is also possible that though we were able to detect smaller effects in our exploratory dataset due to our larger sample size, we may have missed some small effects in our confirmatory dataset due to lower power (Type II error). However, from an applied perspective, small effects may be less useful and potentially misleading. For example, we found in Chapter Three of this dissertation that there was a statistically significant relationship between intradyadic similarity in cat and human Communion and relationship satisfaction, but the effect size of the models were quite small (accounting for only 1.4% to 2% of the variance in satisfaction), and as we have demonstrated here, that effect is swamped by the much stronger effects of PAS-M and cat Agency, which accounted for 23% of the variance in relationship satisfaction.

It is also possible that there were differences between the two groups of participants that could have affected our findings. While similar in age and similar in gender distribution, it does appear that the SAS group of cats and humans were higher in Agency and Communion than the exploratory group. Are those people who actively choose to adopt a pet from a shelter systematically different from those who do not? Perhaps: only 26% of owned cats originally came from a shelter; other ways of becoming a cat owner can be considerably more passive (e.g., finding and keeping a stray, taking over care for a cat from a friend or relative), and those ways of acquiring cats could be related to personality traits (HSUS, 2020; Salman et al., 1998). Are cats in shelters systematically different from cats not in a shelter? In our sample of 196 cats evaluated for Chapter One of this dissertation, 46% entered the shelter via owner surrender and

48% entered as strays or were otherwise seized from their environment. There is a well-documented risk of potential personality-related sampling bias in wild animal studies, where the animals available (catchable) for study may be more bold than those who are not catchable – this may apply to stray/trapped cats as well, such that it is possible that on average, cats in a shelter may be more bold (a dimension of Extraversion/Agency) than other cats (Biro, 2013; Biro & Dingemanse, 2009).

Perhaps the biggest limitation in situating our work within the cat personality field is that our effort to interpret others' findings in conjunction with our own was by necessity subjective. The comparison of adjectives or phrases used to collect data in other studies to those terms used in our own is a step in the right direction, but it does not replace the objective comparisons that would be possible if our field had reliable and valid instruments and a standardized nomenclature.

4.5 Tables and Figures

Figure 1

The Interpersonal Circumplex personality model (image from Zeigler-Hill, 2010). Agency and Communion are the two overarching dimensions, with eight octants distributed equally around the circumplex.

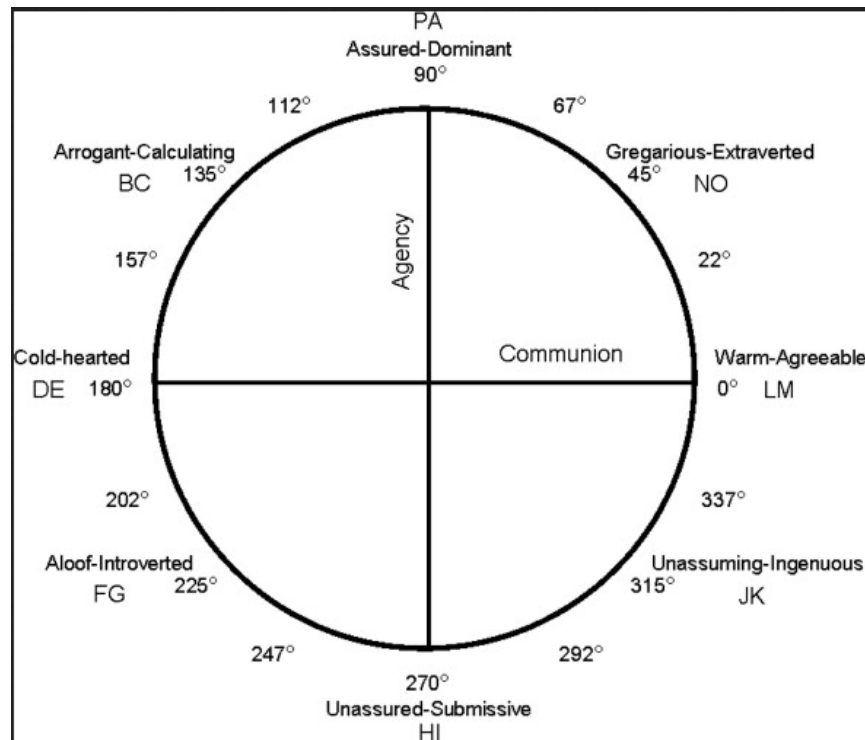


Figure 2

The IAS-R Scoring Key (Research Measures, n.d.). Octant scores are the mean of the responses made to the individual adjectives in each octant scale. Each of the eight octant scales have eight underlying adjectives, as follows:

PA Assertive	BC Boastful	DE Ruthless	FG Unsparkling
PA Dominant	BC Tricky	DE Hardhearted	FG Unneighbourly
PA Forceful	BC Calculating	DE Uncharitable	FG Anti-social
PA Self-assured	BC Cocky	DE Iron-hearted	FG Dissocial
PA Domineering	BC Wily	DE Warmthless	FG Uncheery
PA Firm	BC Sly	DE Unsympathetic	FG Distant
PA Self-confident	BC Cunning	DE Coldhearted	FG Unsociable
PA Persistent	BC Crafty	DE Cruel	FG Introverted
HI Timid	JK Unargumentative	LM Soft-hearted	NO Cheerful
HI Unaggressive	JK Uncunning	LM Kind	NO Extraverted
HI Unbold	JK Undemanding	LM Tender	NO Perky
HI Shy	JK Unwily	LM Tenderhearted	NO Neighbourly
HI Meek	JK Unsly	LM Accommodating	NO Jovial
HI Unauthoritative	JK Uncalculating	LM Charitable	NO Enthusiastic
HI Forceless	JK Uncrafty	LM Gentlehearted	NO Friendly
HI Bashful	JK Boastless	LM Sympathetic	NO Outgoing

Transform the above raw octant scores to Z-Scores, using either the published norms (Wiggins et al., 1988) or sample means and standard deviations and compute as follows.

$$\text{Agency} = .03 [(zPA - zHI) + .707(zNO + zBC - zFG - zJK)]$$

$$\text{Communion} = .03 [(zLM - zDE) + .707(zNO - zBC - zFG + zJK)]$$

Figure 3

The IAS-R Glossary, words listed in the order in which they appear in the survey (Wiggins et al., 1988).

1. Introverted: feels more comfortable by oneself; is less interested in other people
2. Assertive: tends to be aggressive and outspoken with others
3. Timid: tends to be fearful or uncomfortable around others
4. Unargumentative: tends to avoid arguments or fights
5. Boastful: tends to brag
6. Soft-hearted: tends to be easy-going or gentle with others
7. Ruthless: pursues one's own interests regardless of the effect on others
8. Kind: thoughtful and caring for others
9. Cheerful: happy, usually in good spirits
10. Unsparkling: not lively or entertaining with others
11. Tricky: can be deceiving toward others in order to get something; able to fool others
12. Unaggressive: tends to be mild-mannered, not forceful around others
13. Calculating: tends to use or manipulate others to your own advantage
14. Tender: warm and loving with others
15. Hard-hearted: unconcerned and unfeeling toward others
16. Unneighbourly: unfriendly, aloof toward others, avoid contact with others
17. Uncharitable: dislike helping others; tends to judge others harshly
18. Uncunning: not crafty or sly, tends to be straightforward with others
19. Extraverted: like being with others; outgoing and lively around others
20. Cocky: self-centered; conceited; thinks highly of one's own abilities
21. Dominant: tends to lead others, like to command, take charge in a group
22. Antisocial: dislike the company of others; behavior not affected by social rules
23. Perky: lively, energetic around others
24. Forceful: tends to take charge around others
25. Wily: crafty, cagey, or tricky
26. Sly: crafty, secretive, or cunning in dealing with others
27. Iron-hearted: tends to be stern or harsh with others

Figure 3 continued.

28. Unbold: not daring or courageous
29. Neighbourly: friendly; likes to get involved with people around you
30. Shy: lacking in self-confidence; tends to be uncomfortable around others
31. Undemanding: doesn't demand or expect much from others
32. Meek: timid, has trouble being assertive or standing up from others
33. Unwily: not tricky or crafty
34. Self-assured: confident, certain of oneself
35. Dissocial: doesn't care for the company of others
36. Jovial: cheerful; playful around others
37. Domineering: tends to control or manipulate others
38. Tender-hearted: easily feels love, pity, or sorrow for others
39. Warmthless: has no feeling of pleasure or affection for others
40. Unsly: not tricky or cunning; tends to be genuine; sincere; trusting
41. Enthusiastic: enjoys active involvement with others
42. Firm: steadfast; does not give in easily; gets others to do things your way
43. Uncalculating: doesn't try to manipulate others or maximize one's own gain
44. Accommodating: obliging, tends to do favours for others
45. Uncheery: not lively or jolly around others
46. Friendly: open, accepting, warm around others
47. Cunning: crafty, skillful at manipulating others, devious
48. Self-confident: sure of oneself around others, devious
49. Unauthoritative: doesn't try to influence others; goes with others' opinions
50. Uncrafty: not tricky or sly when dealing with others
51. Unsympathetic: not interested or concerned about others' feelings or problems
52. Charitable: generous, like to help others
53. Coldhearted: have little warmth or feelings for others; unfeeling; harsh
54. Distant: tends to be cold toward others; tends to stay away from others
55. Forceless: not forceful with others; timid or weak, find it hard to be assertive
56. Gentle-hearted: warm or kind to others
57. Outgoing: enjoy meeting other people

Figure 3 continued.

58. Sympathetic: feel interested or sensitive to the feelings and problems of others

59. Boastless: don't like to brag

60. Persistent: doesn't give up even when others think you are wrong

61. Crafty: can mislead or manipulate others for one's own purposes

62. Unsociable: doesn't enjoy meeting people or being in the company of others

63. Cruel: able to cause pain and suffering to others; unfeeling

64. Bashful: tends to shy away from public attention

Table 1

Means and standard deviations for all variables in exploratory dataset (N=920). Octants are reported here in unstandardized raw averages for ease in comparison across studies and across species (z-scores are used for calculation of overall Agency and Communion).

Variable	<i>M</i>	<i>SD</i>
Years Owned	6.01	4.59
Cat Age	7.09	4.60
Cat Agency	0.00046	0.10549
Cat Communion	0.00026	0.09854
Human Agency	-0.000088	0.107370
Human Communion	0.00028	0.09804
Agency Deviation	0.1045	0.0850
Communion Deviation	0.0862	0.0734
PA (Cat/Human)	4.748/4.527	1.295/1.239
BC (Cat/Human)	4.054/3.138	1.535/1.370
DE (Cat/Human)	2.733/2.329	1.214/1.098
FG (Cat/Human)	3.086/3.854	1.569/1.502
HI (Cat/Human)	3.878/4.342	1.424/1.444
JK (Cat/Human)	4.396/5.146	1.383/1.275
LM (Cat/Human)	5.458/6.279	1.292/1.088
NO (Cat/Human)	5.507/5.048	1.518/1.376
RAS	31.63	3.76
LAPS	52.91	10.65

Table 2

Unstandardized Beta coefficients with standard error and β (standardized coefficients) for variables in final exploratory model predicting relationship satisfaction ($f^2 = .29$).

Predictor Variable	Beta	SE	β
Years owned	0.22	0.05	0.27
Cat age	-0.15	0.05	-0.18
Cat Agency	2.26	1.05	0.06
Cat communion	16.26	1.18	0.42
Human Communion	1.23	1.20	0.03
Cat Agency x Human Communion	-23.17	10.22	-0.07

Table 3

Unstandardized Beta coefficients and β (standardized coefficients) for variables in final exploratory model predicting attachment to pet cat ($f^2 = .10$).

Predictor Variable	Beta	SE	β
Years owned	.25	0.07	0.11
Cat Agency	12.36	3.27	0.12
Cat communion	26.03	3.41	0.24
Human Agency	-10.80	3.20	-0.11

Table 4

Means and standard deviations for all variables in confirmatory analyses.

Variable	<i>M</i>	<i>SD</i>
PAS-M	108.6	6.3
Cat Age	5.54	4.31
Cat Agency	0.0064	0.1018
Cat Communion	0.0414	0.0751
Human Agency	0.0083	0.0867
Human Communion	0.0538	0.0818
RAS	31.53	3.96
LAPS	50.3	9.9

Table 5

Unstandardized Beta coefficients with standard error and β (standardized coefficients) for confirmatory model predicting relationship satisfaction ($f^2 = .45$).

Predictor Variable	Beta	<i>SE</i>	β	<i>p</i>
Intercept	6.30	8.11	0	.44
PAS-M	0.23	0.08	0.37	.003**
Cat age	-0.09	0.11	-0.10	.40
Cat Agency	13.22	5.77	0.34	.026*
Cat Communion	8.96	7.71	0.17	.25
Human Communion	-2.57	6.30	-0.05	.68
Cat Agency x Human Communion	-57.72	52.22	-0.15	.27

*Significance levels: $p < .001 = ***$; $p < .01 = **$; $p < .05 = *$.*

Table 6

Unstandardized Beta coefficients with standard error and β (standardized coefficients) for confirmatory model predicting attachment to pet cat ($f^2 = .55$).

Predictor Variable	Beta	SE	β	<i>p</i>
Intercept	-49.24	18.79	0	.01*
PAS-M	0.92	0.17	0.58	<.0001***
Cat Agency	4.66	12.56	0.05	.71
Cat Communion	-7.82	16.99	-0.06	.65
Human Agency	13.76	13.12	0.12	.30

*Significance levels: $p < .001 = ***$; $p < .01 = **$; $p < .05 = *$.*

4.6 References

- American Society for the Prevention of Cruelty [ASPCA]. (2007). *Meet Your Match® Feline-ality™ Training Manual*. American Society for the Prevention of Cruelty to Animals.
- Bennett, P. C., Rutter, N. J., Woodhead, J. K., & Howell, T. J. (2017). Assessment of domestic cat personality, as perceived by 416 owners, suggests six dimensions. *Behavioural Processes, 141*, 273–283. <https://doi.org/10.1016/j.beproc.2017.02.020>
- Biro, P. A. (2013). Are most samples of animals systematically biased? Consistent individual trait differences bias samples despite random sampling. *Oecologia, 171*(2), 339–345. <https://doi.org/10.1007/s00442-012-2426-5>
- Biro, P. A., & Dingemanse, N. (2009). Sampling bias resulting from animal personality. *Trends in Ecology and Evolution, 24*(2), 66–67.
- Briggs, S. R. (1988). Shyness: Introversion or neuroticism? *Journal of Research in Personality, 22*(3), 290–307. [https://doi.org/10.1016/0092-6566\(88\)90031-1](https://doi.org/10.1016/0092-6566(88)90031-1)
- Briggs, S. R. (1992). Assessing the five-factor model of personality description. *Journal of Personality, 60*(2), 253–293. <https://doi.org/10.1111/j.1467-6494.1992.tb00974.x>
- Calcagno, V., & de Mazancourt, C. (2010). glmulti: An R package for easy automated model selection with (generalized) linear models. *Journal of Statistical Software, 34*(12), 29. <https://doi.org/10.18637/jss.v034.i12>
- Church, A. T., & Burke, P. J. (1994). Exploratory and confirmatory tests of the big five and Tellegen's three- and four-dimensional models. *Journal of Personality and Social Psychology, 66*(1), 93–114. <https://doi.org/10.1037/0022-3514.66.1.93>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hoboken, NY: Academic.
- Costa, P. T., & McCrae, R. R. (1995). Domains and facets: Hierarchical personality assessment using the revised NEO personality inventory. *Journal of Personality Assessment, 64*(1), 21–50. https://doi.org/10.1207/s15327752jpa6401_2
- Costa, P. T., McCrae, R. R., & Dye, D. A. (1991). Facet scales for agreeableness and conscientiousness: A revision of the NEO personality inventory. *Personality and Individual Differences, 12*(9), 887–898. [https://doi.org/10.1016/0191-8869\(91\)90177-D](https://doi.org/10.1016/0191-8869(91)90177-D)
- Curtin, R. (2000). The effects of response rate changes on the index of consumer sentiment. *Public Opinion Quarterly, 64*(4), 413–428.
- Darwin, C. (1871). *The descent of man, and selection in relation to sex. Volume 1*.
- Depue, R. A., & Collins, P. F. (1999). Neurobiology of the structure of personality: Dopamine, facilitation of incentive motivation, and extraversion. *Behavioral and Brain Sciences, 22*(3), 491–517. <https://doi.org/10.1017/S0140525X99002046>
- Digman, J. M. (1990). Personality structure: Emergence of the five-factor model. *Annual Review*

- of Psychology*, 41(1), 417–440. <https://doi.org/10.1146/annurev.ps.41.020190.002221>
- Do, M. H., & Minbashian, A. (2014). A meta-analytic examination of the effects of the agentic and affiliative aspects of extraversion on leadership outcomes. *Leadership Quarterly*, 25(5), 1040–1053. <https://doi.org/10.1016/j.leaqua.2014.04.004>
- Elvers, G. C., & Lawriw, A. N. (2019). The behavioral style of the cat predicts owner satisfaction. *Anthrozoos*, 32(6), 757–768. <https://doi.org/10.1080/08927936.2019.1673038>
- Evans, R., Lyons, M., Brewer, G., & Tucci, S. (2019). The purrfect match: The influence of personality on owner satisfaction with their domestic cat (*Felis silvestris catus*). *Personality and Individual Differences*, 138, 252–256. <https://doi.org/10.1016/j.paid.2018.10.011>
- Feaver, J., Mendl, M., & Bateson, P. (1986). A method for rating the individual distinctiveness of domestic cats. *Animal Behaviour*, 34(4), 1016–1025. [https://doi.org/10.1016/S0003-3472\(86\)80160-9](https://doi.org/10.1016/S0003-3472(86)80160-9)
- Feher, A., & Vernon, P. A. (2020). Looking beyond the big five: A selective review of alternatives to the big five model of personality. *Personality and Individual Differences*, 110002. <https://doi.org/10.1016/j.paid.2020.110002>
- Freedman, M. B., Leary, T. F., Ossorio, A. G., & Goffey, H. S. (1951). The interpersonal dimension of personality. *Journal of Personality*, 20(2), 143–161. <https://doi.org/10.1111/j.1467-6494.1951.tb01518.x>
- Fukimoto, N., Howat-Rodrigues, A. B., & Mendonça-Furtado, O. (2019). Modified Meet Your Match® Feline-ality™ validity assessment: An exploratory factor analysis of a sample of domestic cats in a Brazilian shelter. *Applied Animal Behaviour Science*, 215, 61–67. <https://doi.org/10.1016/j.applanim.2019.03.013>
- Gartner, M. C. (2015). Pet personality: A review. *Personality and Individual Differences*, 75, 102–113. <https://doi.org/10.1016/j.paid.2014.10.042>
- Gartner, M. C., Powell, D. M., & Weiss, A. (2014). Personality structure in the domestic cat (*Felis silvestris catus*), scottish wildcat (*Felis silvestris grampia*), clouded leopard (*Neofelis nebulosa*), snow leopard (*Panthera uncia*), and African lion (*Panthera leo*): A comparative study. *Journal of Comparative Psychology*, 128(4), 414–426. <https://doi.org/10.1037/a0037104>
- Gartner, M. C., & Weiss, A. (2013). Personality in felids: A review. *Applied Animal Behaviour Science*, 144(1–2), 1–13. <https://doi.org/10.1016/j.applanim.2012.11.010>
- Gosling, S. D. (2001). From mice to men: What can we learn about personality from animal research? *Psychological Bulletin*, 127(1), 45–86. <https://doi.org/10.1037/0033-2909.127.1.45>
- Gosling, S. D. (2008). Personality in non-human animals. *Social and Personality Psychology Compass*, 2(2), 985–1001. <https://doi.org/10.1111/j.1751-9004.2008.00087.x>
- Gosling, S. D., & Bonnenburg, A. V. (1998). An integrative approach to personality research in anthrozoology: Ratings of six species of pets and their owners. *Anthrozoos*, 11(3), 148–155. <https://doi.org/10.2752/089279398787000661>

- Gosling, S. D., & John, O. P. (1999). Personality dimensions in nonhuman animals. *Current Directions in Psychological Science*, 8(3), 69–75. <https://doi.org/10.1111/1467-8721.00017>
- Gosling, S. D., Sandy, C. J., & Potter, J. (2010). Personalities of self-identified “dog people” and “cat people.” *Anthrozoos*, 23(3), 213–222. <https://doi.org/10.2752/175303710X12750451258850>
- Ha, D., & Ha, J. (2017). A subjective domestic cat (*Felis silvestris catus*) temperament assessment results in six independent dimensions. *Behavioural Processes*, 141, 351–356. <https://doi.org/10.1016/j.beproc.2017.03.012>
- Hendrick, S. S., Dicke, A., & Hendrick, C. (1998). The relationship assessment scale. *Journal of Social and Personal Relationships*, 15(1), 137–142. <https://doi.org/10.1177/0265407598151009>
- Humane Society of the United States [HSUS]. (2020). *Pets by the numbers*. Humane Society of the United States. <https://www.animalsheltering.org/page/pets-by-the-numbers>
- Johnson, T. P., Garrity, T. F., & Stallones, L. (1992). Psychometric evaluation of the lexington attachment to pets scale (Laps). *Anthrozoös*, 5(3), 160–175. <https://doi.org/10.2752/089279392787011395>
- Jones, A. C., & Gosling, S. D. (2005). Temperament and personality in dogs (*Canis familiaris*): A review and evaluation of past research. *Applied Animal Behaviour Science*, 95(1–2), 1–53. <https://doi.org/10.1016/j.applanim.2005.04.008>
- Judge, T. A., Rodell, J. B., Klinger, R. L., Simon, L. S., & Crawford, E. R. (2013). Hierarchical representations of the five-factor model of personality in predicting job performance: Integrating three organizing frameworks with two theoretical perspectives. *Journal of Applied Psychology*, 98(6), 875–925. <https://doi.org/10.1037/a0033901>
- Kaleta, T., Borkowska, N., & Goral-Radziszewska, K. (2016). The study of domestic cat (*Felis catus*) personality based on survey in Poland. *Annals of Warsaw University of Life Sciences - SGGW, Animal Science*, 55(1), 39–46.
- Kogan, L., Kulus, C., & Schoenfeld-Tacher, R. (2017). Assessment of clicker training for shelter cats. *Animals*, 7(12), 73. <https://doi.org/10.3390/ani7100073>
- Leary, T. (1957). *Interpersonal diagnosis of personality; A functional theory and methodology for personality evaluation*. Ronald Press.
- Leising, D., & Bleidorn, W. (2011). Which are the basic meaning dimensions of observable interpersonal behavior? *Personality and Individual Differences*, 51(8), 986–990. <https://doi.org/10.1016/j.paid.2011.08.003>
- Litchfield, C. A., Quinton, G., Tindle, H., Chiera, B., Kikillus, K. H., & Roetman, P. (2017). The ‘feline five’: An exploration of personality in pet cats (*Felis catus*). *PLoS ONE*, 12(8). <https://doi.org/10.1371/journal.pone.0183455>
- Locke, K. D. (2006). Interpersonal circumplex measures. In S. Strack (Ed.), *Differentiating normal and abnormal personality* (pp. 383–400). Springer Publishing Company.

- Markey, P. M., & Markey, C. N. (2007). Romantic ideals, romantic obtainment, and relationship experiences. *Journal of Social and Personal Relationships*, *24*(4), 517–533. <https://doi.org/10.1177/0265407507079241>
- Martínez-Byer, S., Urrutia, A., Szenczi, P., Hudson, R., & Bánszegi, O. (2020). Evidence for individual differences in behaviour and for behavioural syndromes in adult shelter cats. *Animals*, *10*(6), 962. <https://doi.org/10.3390/ani10060962>
- Massey-Abernathy, A. R., & Robinson, D. N. (2019). Personality promotion: The impact of coaching and behavioral activation on facet level personality change and health outcomes. *Current Psychology*, 1–12. <https://doi.org/10.1007/s12144-019-00530-4>
- McAdams, K. K., & Donnellan, M. B. (2009). Facets of personality and drinking in first-year college students. *Personality and Individual Differences*, *46*(2), 207–212. <https://doi.org/10.1016/j.paid.2008.09.028>
- McCrae, R. R., & Costa, P. T. (1987). Validation of the five-factor model of personality across instruments and observers. *Journal of Personality and Social Psychology*, *52*(1), 81–90. <https://doi.org/10.1037/0022-3514.52.1.81>
- McCrae, R. R., & Costa, P. T. (1989). The structure of interpersonal traits: Wiggins's circumplex and the five-factor model. *Journal of Personality and Social Psychology*, *56*(4), 586–595. <https://doi.org/10.1037/0022-3514.56.4.586>
- McCrae, R. R., & Costa, P. T. (2008). Empirical and theoretical status of the five-factor model of personality traits. In *The SAGE Handbook of Personality Theory and Assessment: Volume 1 - Personality Theories and Models* (pp. 273–294). SAGE Publications Inc. <https://doi.org/10.4135/9781849200462.n13>
- McCrae, R. R., Costa, P. T., Del Pilar, G. H., Rolland, J.-P., & Parker, W. D. (1998). Cross-cultural assessment of the five-factor model. *Journal of Cross-Cultural Psychology*, *29*(1), 171–188. <https://doi.org/10.1177/0022022198291009>
- McCrae, R. R., & John, O. P. (1992). An Introduction to the five-factor model and its applications. *Journal of Personality*, *60*(2), 175–215. <https://doi.org/10.1111/j.1467-6494.1992.tb00970.x>
- Moore, D., & Tarnai, J. (2002). Evaluating nonresponse error in mail surveys. In R. J. A. Groves, R. M., Dillman, D. A., Eltinge, J. L., and Little (Ed.), *Survey Nonresponse* (pp. 197–211). John Wiley & Sons, New York.
- Munsell, K. L., Canfield, M., Templer, D. I., Tangan, K., & Arikawa, H. (2004). Modification of the pet attitude scale. *Society and Animals*, *12*(2), 137–142. <https://doi.org/10.1163/1568530041446580>
- Oades, L. G., & Caputi, P. (2014). Intentional personality change coaching. A randomised controlled trial of participant selected personality facet change using the five-factor model of personality. In *researchgate.net*.
- Paunonen, S. V., & Ashton, M. C. (2001). Big five factors and facets and the prediction of behavior. *Journal of Personality and Social Psychology*, *81*(3), 524–539. <https://doi.org/10.1037/0022-3514.81.3.524>

- Paunonen, S. V., Haddock, G., Forsterling, F., & Keinonen, M. (2003). Broad versus narrow personality measures and the prediction of behaviour across cultures. *European Journal of Personality*, *17*(6), 413–433. <https://doi.org/10.1002/per.496>
- Qualtrics. (2019). *Qualtrics XM // The Leading Experience Management Software*.
- R Core Team. (2020). R: A Language and Environment for Statistical Computing. In *R Foundation for Statistical Computing* (4.0.0).
- Research measures. (n.d.). Retrieved September 10, 2020, from <http://paultrapnell.com/measures/>
- Salman, M., New, Jr., J. G., Scarlett, J., Kass, P., Ruch-Gallie, R., & Hetts, S. (1998). Human and animal factors related to relinquishment of dogs and cats in 12 selected animal shelters in the United States. *Journal of Applied Animal Welfare Science*, *1*(3), 207–226. https://doi.org/10.1207/s15327604jaws0103_2
- Selya, A. S., Rose, J. S., Dierker, L. C., Hedeker, D., & Mermelstein, R. J. (2012). A practical guide to calculating Cohen's f^2 , a measure of local effect size, from PROC MIXED. *Frontiers in Psychology*, *3*(APR). <https://doi.org/10.3389/fpsyg.2012.00111>
- Singer, E., Van Hoewyk J., & Maher, M. P. (2000). Experiments with incentives in telephone surveys. *Public Opinion Quarterly*, *64*(2), 171–188. <https://doi.org/10.1086/317761>
- Sinn, L. (2016). Factors affecting the selection of cats by adopters. *Journal of Veterinary Behavior: Clinical Applications and Research*, *14*, 5–9. <https://doi.org/10.1016/j.jveb.2016.06.001>
- Terracciano, A., Sutin, A. R., McCrae, R. R., Deiana, B., Ferrucci, L., Schlessinger, D., Uda, M., & Costa, P. T. (2009). Facets of personality linked to underweight and overweight. *Psychosomatic Medicine*, *71*(6), 682–689. <https://doi.org/10.1097/PSY.0b013e3181a2925b>
- Trapnell, P. D., & Wiggins, J. S. (1990). Extension of the interpersonal adjective scales to include the Big Five dimensions of personality. *Journal of Personality and Social Psychology*, *59*(4), 781–790. <https://doi.org/10.1037/0022-3514.59.4.781>
- Vitale Shreve, K. R., & Udell, M. A. R. (2015). What's inside your cat's head? A review of cat (*Felis silvestris catus*) cognition research past, present and future. In *Animal Cognition* (Vol. 18, Issue 6, pp. 1195–1206). Springer Verlag. <https://doi.org/10.1007/s10071-015-0897-6>
- Weiss, E., Gramann, S., Drain, N., Dolan, E., & Slater, M. (2015). Modification of the Feline-ality™ assessment and the ability to predict adopted cats' behaviors in their new homes. *Animals*, *5*(1), 71–88. <https://doi.org/10.3390/ani5010071>
- Wiggins, J. S. (1979). A psychological taxonomy of trait-descriptive terms: The interpersonal domain. *Journal of Personality and Social Psychology*, *37*(3), 395–412. <https://doi.org/10.1037/0022-3514.37.3.395>
- Wiggins, J. S. (1996). *The five-factor model of personality: Theoretical perspectives*. Guilford Press.
- Wiggins, J. S., Trapnell, P., & Phillips, N. (1988). Psychometric and geometric characteristics of

the Revised Interpersonal Adjective Scales (IAS-R). *Multivariate Behavioral Research*, 23(4), 517–530. https://doi.org/10.1207/s15327906mbr2304_8

Woodward, L. E., & Bauer, A. L. (2007). People and their pets: A relational perspective on interpersonal complementarity and attachment in companion animal owners. *Society and Animals*, 15(2), 169–189. <https://doi.org/10.1163/156853007X187117>

Zeigler-Hill, V. (2010). The interpersonal nature of self-esteem: Do different measures of self-esteem possess similar interpersonal content? *Journal of Research in Personality*, 44(1), 22–30. <https://doi.org/10.1016/j.jrp.2009.09.005>

Zeigler-Hill, V., & Highfill, L. (2010). Applying the interpersonal circumplex to the behavioral styles of dogs and cats. *Applied Animal Behaviour Science*, 124(3–4), 104–112. <https://doi.org/10.1016/j.applanim.2010.02.012>