Efficacy of the Feline Temperament Profile in Evaluating Shelter Cats for Adoption into Families of a Child with Autism Spectrum Disorder

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Abstract: This project was part of the Feline Friends Study, which matches shelter cats with families of children with Autism Spectrum Disorder (ASD) to study children's social behaviour and cats' stress. Cats were screened for calm temperament using the Feline Temperament Profile (FTP). The FTP consists of ten phases, with a list of 'acceptable' and 'questionable' behaviours under each phase. Our aim was to answer the following research questions: What items of the FTP best predict temperament in shelter cats? What are similarities and differences in temperament between cats who qualified or did not qualify for placement? Forty-four shelter cats were rejected for placement in a home with a child with ASD and twenty-six cats qualified. There was no difference according to sex; however, there was a significant difference in FTP scores across animal shelters. Principal Component Analysis showed that 'vocalizations' and 'watches with no approach' were most predictive of acceptable temperament. The findings show that the FTP can be shortened with no loss of reliability, facilitating shelter efforts to rehome cats successfully. The implementation of FTP could effectively reduce the amount of time cats spend in the shelter as well as the number returned to the shelter after adoption, resulting in improved welfare both at the shelter (shorter stay) and in their new home (decreased return).

Introduction

The American Society for the Prevention of Cruelty to Animals (ASPCA®) estimates that approximately 3.2 million cats (*Felis silvestris catus)* are relinquished to United States shelters annually and almost 900,000 are euthanized to manage cat overpopulation (ASPCA®). Adoptions may commonly be based on the appearance of the companion nonhuman animal (Weiss 150); however, not knowing a nonhuman animal's temperament is a concern of future guardians (O'Connor et al. 368). Temperament tests can predict problem behaviours in dogs after adoption (Bollen and Horowitz 134). However, a recent systematic review showed that often, such tests may not be reliable and are not adequately tested for inter-rater reliability in particular (Brady et al. 5). Other authors demonstrated inter-rater reliability of a scale amalgamated from two dog behaviour instruments administered by volunteer puppy walkers (Harvey et al. 13).

Additionally, few studies of temperament tests have been conducted with cats. Cat temperament is considered among adoption criteria (Sinn 9). After the adoption, if the cat's behaviour does not meet the expectations of the adopting family, it could affect the success of the adoption (Shore 195). New et al. found that relinquished cats are significantly likely to have been owned for a short period of time, and the risk of relinquishment decreases with increasing length of ownership (188). Cat behaviour influences the human-nonhuman animal relationship (Mertens and Turner 95). Behaviour issues and guardian allergies are two of the most commons reasons for relinquishment of cats to shelters (see Casey et al.; Patronek et al.; DiGiacomo et al; Scarlett et al.; New et al.). For example, cats were most likely to be relinquished due to behaviour issues such as soiling or destruction in the house (New et al. 198; Weiss et al. 439). Such problematic behaviours may be caused by health problems or by the cat's response to something in its environment, which may be stressful or inconvenient for guardians (see Bradshaw). Incorporating the cat into the household may promote these behaviours; for example, if guardians are unknowledgeable about typical cat behaviour, they may not understand the need to provide a litter box in a location that is acceptable to their cat, especially in a multi-cat household (see Bradshaw). If cat temperament can be reliably assessed, then it may

be easier to identify situational causes of problem behaviour, and to match cats and adopting families more effectively.

The ASPCA®'s Meet Your Match Feline-ality™ adoption program is based on cat behaviour assessment to bring compatible companion nonhuman animals and adopters together (ASPCA®). However, this test requires three days to collect cat behaviour data. The delay can be challenging for some shelters in which staff have limited time to assess each cat's temperament, and lead to adoption delays causing a backlog of cats. A quick, standardized, reliable and valid assessment instrument is needed.

The Feline Temperament Profile (FTP) was developed by Lee et al. This tool was designed to assess the suitability of cats for placement in nursing homes. The nursing home environment may be stressful to a cat due to dementia-associated behaviour of older adult residents (for example, pacing, shouting, kicking), continual seeking of attention from the cat by the residents, and the wide range of equipment present (for example, canes, walkers, wheelchairs). The FTP's origin and testing of cats' temperament for the nursing home environment may be an approximation of the home environment of children with ASD. In the latter setting, there may be similar aggressive behaviour, seeking attention of the cat, and further, a wide range of activities, toys, and sporting equipment, which may be stressful to the cat. The FTP measures the cat's general levels of sociability, aggressiveness, and adaptability through a series of ten interactions between the assessor and the cat. It has been validated by Siegford et al. This objective test is simple to perform and does not require extensive knowledge of cat behaviour; therefore, it can be used by shelter staff.

The study reported here is part of the Feline Friends Study, which matches shelter cats and families with children who have Autism Spectrum Disorder (ASD). ASD affects children's social and communication skills, commonly results in child anxiety, and there is no cure (see Jennett et al.).

Nonhuman animal assisted therapy is a possible therapeutic intervention to manage problematic behaviours of children and to reduce their anxiety. Companion nonhuman animals may aid children in having better social skills and cognitive development (Esposito et al. 207).

Studies show that introducing a therapeutic nonhuman animal was associated with differences in the social behaviour of children with autism when compared with a control group of children having no therapeutic nonhuman animal (Kršková et al.148; O'Haire et al. 7). However, no study has examined the role of companion cats in families of children with ASD. Children with special needs include children with ASD and other developmental and emotional disorders. Children with special needs face a number of social and emotional challenges (Wodder 11). Human-animal interaction can help to encourage social interactions. Wodder found that animal-assisted therapy has a positive effect on children with special needs socialization, and overall prosocial behaviours (72). Quiet and non-verbal interactions with cats may be beneficial for children with ASD by promoting positive social contact, which the children may then extend to interactions with humans. A preliminary study found that compatible cats for children with ASD must be socially outgoing, affectionate, and non-aggressive (Hart et al. 2).

Cat temperament assessment is needed for families with special needs who intend to adopt a cat. The FTP is used to screen cats for calm and non-aggressive temperament; therefore, it may be beneficial to predict a suitable match between the cat and the family.

The first aim of the present study was to determine what items of the FTP best predict temperament in shelter cats. The second aim was to identify the similarities and differences in temperament between cats who qualified or did not qualify for placement. This aim is important because despite the fact that we set specific inclusion and exclusion criteria, there is a wide range of cat behaviour within these. We wanted to obtain a more precise indicator of behaviours that influence cat adoption.

Methods

Shelter Cat Selection

The study included 70 domestic cats from two animal shelters located in mid-Missouri, U.S.A. Shelter 1 is a 'traditional' shelter with cats housed in a 'cat room' with separate cages, each with its own litter box. Some cats have access to an area with toys and climbing structures, but cats do not have regular interaction with each other. In Shelter 2, cats are group-housed in large

rooms allowing for cat-cat interaction. There are housing structures that they may choose to enter. The rooms provide toys and climbing structures, and communal litter boxes. When foster homes become available or when cats appear overly stressed, the cats at Shelter 2 are moved into the foster homes and brought to the shelter at weekends to be viewed by prospective guardians.

The cats studied were from 10 months to 4 years of age (approximate due to largely unknown histories of the cats). We selected this age range because cat temperament is believed to remain stable after 10 months (Lowe and Bradshaw 232), and also because younger cats may be more affectionate to children with ASD (Hart et al. 5). Study cats were veterinarian-certified as healthy, free of specific pathogens and up to date with vaccinations. Fifty-two cats were spayed or neutered, five were intact; that information was unavailable for thirteen of the cats.

Study Staff Training

Before the data collection began, the study staff completed an Animal Care and Use Committee training through the University of Missouri. To minimize variations in administration of the FTP, we used an assessor training and testing process to promote inter-rater reliability.

Study staff assessors were trained by watching three videotape recordings of cats being tested using the FTP. A veterinarian practicing in small animal medicine served as the coordinator of the assessors. All assessors scored the cat in each video using the FTP. A Board-Certified Specialist in Veterinary Behavior (Dr Colleen Koch, DVM, DACVB) scored the cats in the videotape recordings and assessors' scores were compared with those of the behaviourist. We calculated percentage of agreement using the difference between the behaviourist's scores and those assigned to cats in the videotape recordings by the study staff assessors. Study staff scores were divided by the behaviourist score to derive a percentage of agreement. The goal was to achieve at least 90% agreement with the behaviourist's ratings. Where testing did not reach this agreement, the assessors discussed their ratings with the coordinator, reviewed the videotape recordings and re-rated the cats. This iterative study staff training process resulted in a 90 percent agreement. Then study staff assessors were eligible to rate cats in the shelters. The staff repeated this training process every six months as a refresher or 'booster' throughout the study.

FTP Test Procedure

Cats were tested individually at the shelters in a room the cats had not entered before. Before the test, the study staff assessor and the study staff observer cleaned the room with a dry Swiffer sweeper to create a neutral environment by dissipating the scent of previous cats, which could result in increased fear and anxiety and alter the test results. The test started 10 minutes after the cat entered the novel room. This delay allowed the cat to explore and become acquainted with the new environment. During the test, the room door was closed so that the cat was alone with the assessor and the observer, and no one else could enter the room. The assessor performed the tasks associated with the FTP test while the observer scored the cat. Both were unfamiliar to the cat.

FTP Scoring Details

The FTP test is comprised of 10 phases during which the assessor interacted with the cat and the observer assigned a score to the cat's behaviour. The phases each include Acceptable behaviours ('approaches', 'meows', 'sniffs hands') and Questionable behaviours ('hiss', 'defensive position', 'watches with no approach'). The first phase consisted of calling the cat from a distance of 5 feet. The following phases had closer interactions with the cat, such as stroking the cat, initiating play, or taking hold of and gently pulling the cat's tail. The phases and corresponding behaviours are described in Table 1.

For each of the phases, the observer scored the occurrence of each behaviour of the phase. The score was 1 if the behaviour was observed at least once during the phase. If a behaviour occurs more than once in the phase, the score was 1. The score was 0 if the behaviour did not occur during the phase. For example, if the cat made several eye contacts in phase 1 the score was 1 for 'makes eye contact' in phase 1. If the cat made eye contact again in phase 2, the score was 1 for 'makes eye contact' in phase 2. If the cat did not rub against legs during phase 4, the score was 0 for 'rubs against legs or hand' in phase 4, even if the cat rubbed against legs during another phase.

At the end of the test, the acceptable behaviour score represented all observed acceptable behaviours. All observed questionable behaviours constituted the questionable behaviour score. There were 73 behaviours in the FTP test (39 acceptable behaviours and 34 questionable behaviours, as can be seen in Table 1). The maximum acceptable behaviour score was 39; the maximum questionable behaviour score was 34.

Table 1. The 10 phases of the FTP,
with a list of acceptable behaviours and questionable behaviours for each phase.
The disqualifying behaviours are identified by asterisks.

Phase 1. The tester should squat down about 5-6 feet away from the cat and call the cat several times. One hand should be extended. The cat:	
Acceptable behaviors	**Questionable behaviors**
Makes eye contact	Avoids eye contact
Meow/Purr/chirrup	Hiss/Growl *
Approaches	Retreats/defensive position
Rolls	Watches with no approach
Comes and sniffs hand	
Phase 2. If the cat does not approach, moves closer to the cat (about 3 feet away) and call again. The cat:	
Acceptable behaviors	**Questionable behaviors**
Makes eye contact	Avoids eye contact
Meow/Purr/chirrup	Hiss/Growl *
Approaches	Retreats/defensive position
Rolls	Watches with no approach
Comes and sniffs hand	
Phase 3. After approaching or getting the cat to come, extend hand to cat while squatting. Hand should be lower than cat's head. The cat:	
Acceptable behaviors	**Questionable behaviors**
Sniffs hand	Hiss/growl *
Licks or rubs body on hand	Retreats/defensive position
Rubs head on hand	Strikes/attempts to strike hand *
Rolls	Bites/attempts to bite hand *
Meow/purr/chirrup	

Phase 4.
While talking to the cat, begin to stroke the cat along the head, back, and sides. The cat:

Acceptable behaviors	Questionable behaviors
Rubs against legs or hand	Hiss/growl *
Meow/purr/chirrup	Retreats/defensive position
Head bump	Strikes/attempts to strike hand *
Circles you attentively	Bites/attempts to bite hand *
Initial fear then relaxes	

Phase 5.
Move away from the cat and move a piece of string along the floor slowly to initiate play (or use other toy as needed). The cat:

Acceptable behaviors	Questionable behaviors
Comes back for stroking	Ignores toy
Watches toy intently	Attends to something else
Chases toy	Avoids eye contact

Phase 6.
Call the cat again until it approaches or approach it slowly yourself. Begin to stroke the cat again and if the cat is calm, pick up the cat gently and cradle it against your chest. The cat:

Acceptable behaviors	Questionable behaviors
Relaxes	Hiss/growl *
Extends paw affectionately to neck/shoulder	Struggles to escape
Meow/purr/chirrup	Strikes/attempts to strike *
	Bites/attempts to bite *

Phase 7.
Sit down and place cat on lap, facing you. Stroke the cat. The cat:

Acceptable behaviors	Questionable behaviors
Purrs or rubs against hand	Sits on lap tensely

Makes eye contact	Jumps off
Rolls submissively	Threatens or becomes aggressive
Stands to sniff face/place paw on neck	

Phase 8.

Place cat on floor next to chair. Call cat and motion with hands. The cat:

Acceptable behaviours	Questionable behaviours
Jumps up	Ignores calls and you
Makes eye contact/stays on floor	Moves away fearfully
Gets up on hind legs/makes contact	

Phase 9.

Place cat on floor. Grab tail firmly at the base and pull up with a steady pressure. The cat:

Acceptable behaviours	Questionable behaviours
Rolls submissively	Struggles/tries to escape
Shows no reaction	Strikes/attempts to strike *
Meow/purr/chirrup	Bites/attempts to bite *
	Hiss/growl *

Phase 10.

Place cat on floor (not in a carpeted room). Drop a metal box or other object on the floor behind the cat when the cat is not looking. If in a carpeted room, make a loud noise by vocalizing, banging together two objects, or using some other object in the environment. The cat:

Acceptable behaviours	Questionable behaviours
Startles but quickly relaxes	Startles, then runs to hide
Ignores the noise	Startles, then defensive/aggressive *
Does not appear to hear the noise	

In order to qualify for possible adoption by families of children with ASD and be included in our study, a cat had to have an acceptable behaviour score of 20 or higher, with no disqualifying behaviours. The disqualifying behaviours were: 'hiss/growl' in phases 1, 2, 3, 4, 6, 9; 'strikes/attempts to strike' in phases 3, 4, 6, 9; 'bites/attempts to bite' in phases 3, 4, 6, 9; 'threatens or becomes aggressive' in phase 7 and 'startles, then defensive/aggressive' in phase 10. The disqualifying behaviours are identified by asterisks in Table 1. We chose 20 or higher as an acceptable behaviour score because Siegford et al. found that cats with an acceptable

behaviour score greater than or equal 20 and a low questionable behaviour score could successfully be placed in a family desiring a sociable pet or a novice cat owner. They found that cats with an acceptable behaviour score lower than 20 required an experienced cat owner (347).

ASD is defined by the DSM as a complex developmental condition that involves persistent challenges in social interaction and speech and nonverbal communication. A study by Grandgeorge et al. showed that in individuals with autism, pet arrival in the family setting may improve some pro-social behaviours and reduce anxiety (8). The adoption of cats with a high acceptable behaviour score and a low questionable behaviour score by families of children with autism may help shed light on the beneficial effect of interaction with high-scoring cats for a child with autism. The FTP can be used by shelter staff to assess the temperament of a cat in order to place the cat in a compatible home and to achieve successful long-term adoption and decreased likelihood of re-relinquishment.

Statistical Analyses

Quantitative data were entered into two separate Microsoft Excel spreadsheets. The two spreadsheets were then compared for errors in data entry. The aims of the statistical analyses were to (1) compare cats who qualified for the Feline Friends Study with cats who were rejected from inclusion in the study, and (2) determine which behaviours in the FTP were the most predictive of this temperament in shelter cats.

Data assumptions of normality and homoscedasticity were checked before analyses. Descriptive statistics and one-way analyses of variances (ANOVA) were used to compare the study groups (accepted for inclusion; rejected from inclusion) in relation to demographic characteristics (gender, shelter site, estimated age). Cronbach alpha coefficients were calculated to determine whether test items were internally consistent. Logistic regression was performed to determine to what extent acceptable behaviour scores and questionable behaviour scores could predict temperament (acceptability for placement) in the cats. Principal component analyses with varimax rotation were used to determine variability of the data in relation to the factors of the FTP. The alpha value for determining statistical significance was set at 0.05 for all

analyses. Results are given as mean ± standard deviation. Data were analysed using the Statistical Package for the Social Sciences (IBM SPSS) and Microsoft Excel software.

Results

FTP Scores

Among the 70 tested cats, 26 qualified for the Feline Friends Study and 44 were rejected. The frequency counts of acceptable and questionable behaviours are reported in Figure 1. 'Approaches' in Phase 1, 'rubs against leg' in Phase 4 and 'rolls submissively' were observed in all qualified cats ($n = 26$). In this study, 38 of the 39 acceptable behaviours were observed in at least one cat. The item of 'Does not appear to hear the noise' in Phase 10 of the FTP did not occur in any cat.

In total, 24 questionable behaviours were observed and 10 questionable behaviours did not occur in any cat. The following list of questionable behaviours did not occur: 'avoids eye contact' in Phases 1 and 2; 'retreats or defensive position' in Phases 1, 2 and 4; 'hiss or growl' in Phases 2 and 4; 'attempts to bite' in Phase 6; 'becomes aggressive' during Phase 7; and 'moves away fearfully' during Phase 8. The following five questionable behaviours occurred in more than 20% of the rejected cats: 'attends to something else,' 'struggles to escape,' 'jumps off,' 'ignores calls and you,' and 'strikes or attempts to strike.' We observed eight questionable behaviours in cats who qualified. The item of 'Jumps off' in Phase 7 was the only item with a frequency over 0.2 in the group of qualified cats.

Figure 1. Frequency of
A) acceptable behaviours with a high frequency,
B) acceptable behaviours with a low frequency and
C) questionable behaviours in qualified cats (n=26) and rejected cats (n=44).
*The number before the behaviour refers to the phase in which the behaviour was observed.*
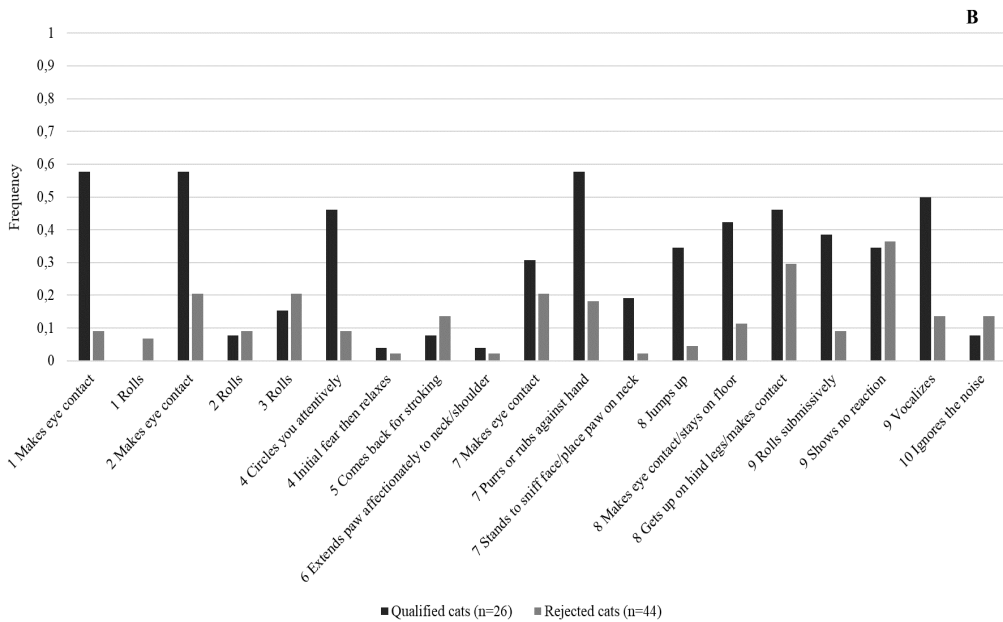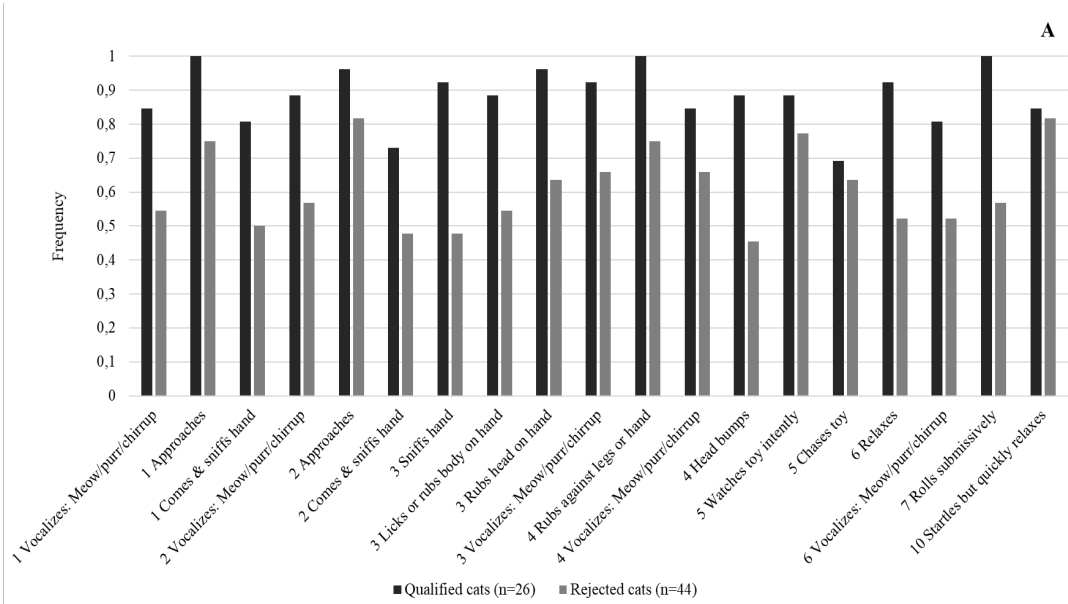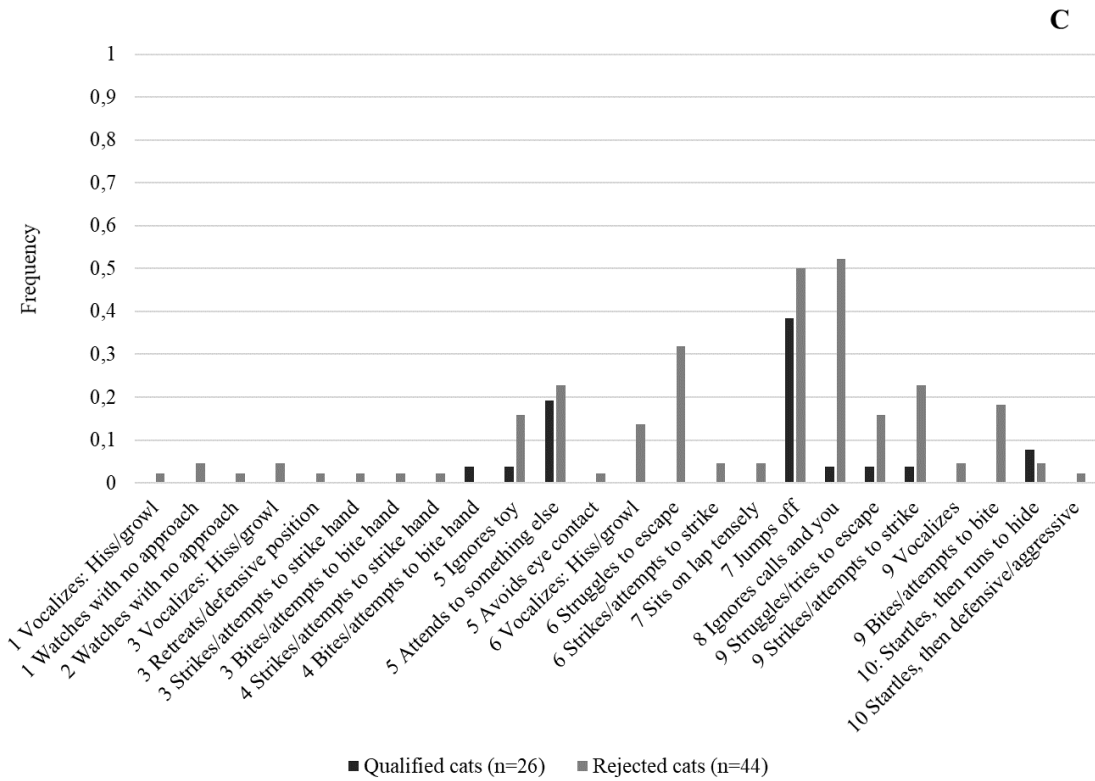
In the group of all tested cats ($N = 70$), 17.3 $\pm$5.7 acceptable behaviours were observed on average, whereas 2.1$\pm$1.9 questionable behaviours were observed. The acceptable behaviour scores across the total sample ranged from 4 to 26. The questionable behaviour scores ranged from 0 to 8. Figure 2 reports the frequency of acceptable behaviour scores in all cats. We found that 46% of cats had an acceptable behaviour score between 20 and 26, while 27% had an acceptable behaviour score between 14 and 19 and that 27% of cats had an acceptable behaviour score between 4 and 13. For 17% of cats, no questionable behaviour was observed. However, 30% had one questionable behaviour (questionable behaviour score = 1), 26% had 2 or 3 questionable behaviours, and 17% had between 4 and 8 questionable behaviours.

Figure 2. Distribution of A) acceptable and B) questionable behaviour scores in cats (N=70).

A

B

C
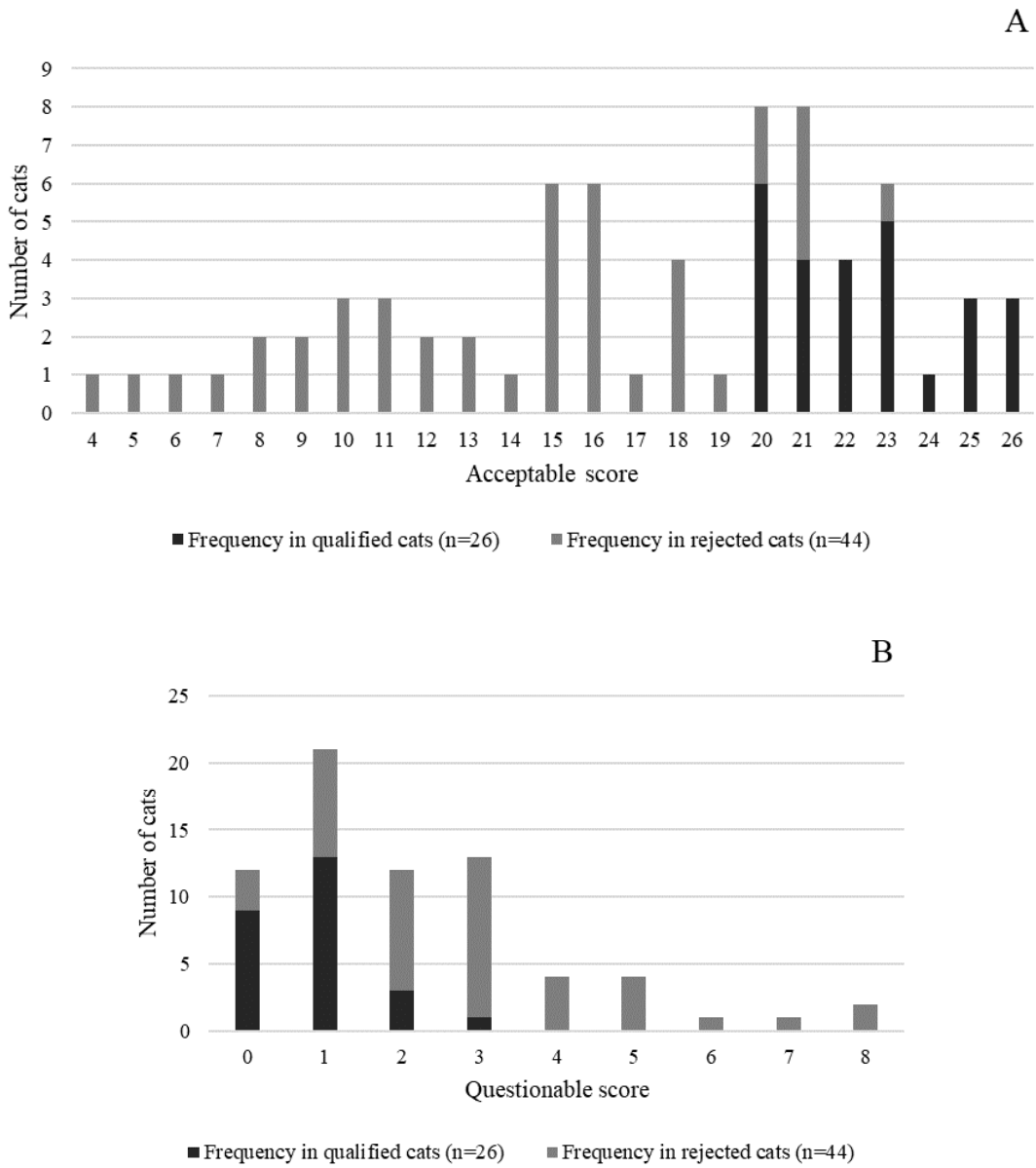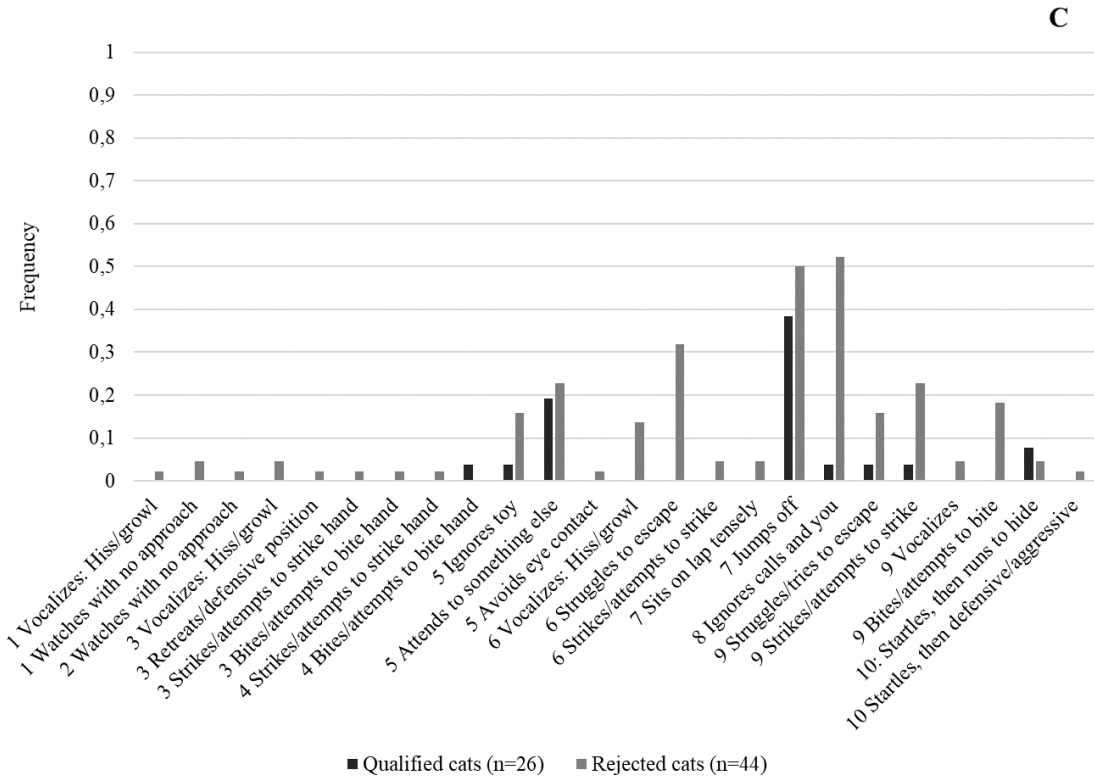
We compared acceptable and questionable behaviour scores between the group of qualified and the group of rejected cats. Descriptive statistics are reported in Table 2. The acceptable behaviour score mean was higher in qualified cats (22.4±2.2) than in rejected cats (14.2±4.8). The acceptable behaviour score range was wider among rejected cats. While seven cats had an acceptable behaviour score over 20, they were rejected from the study due to a disqualifying behaviour ('hiss', 'strikes', 'attempts to strike', 'bites', 'attempts to bite', 'becomes aggressive'). The questionable behaviour score mean was 0.9±0.6 in the group of qualified cats. The questionable behaviour score mean was 3.1±1.8 in the group of rejected cats. Acceptable behaviour scores were significantly different between qualified and rejected cats ($F1,68 = 68.3$, $p = .000$). Questionable behaviour scores were significantly different between qualified and rejected cats ($F1,68 = 26.0$, $p = .000$).

Table 2. Descriptive statistics of acceptable and questionable FTP scores in qualified (n=26) and rejected cats (n=44).

	Acceptable scores		Questionable scores	
	Qualified cats	Rejected cats	Qualified cats	Rejected cats
n	26	44	26	44
Mean	22.1	14.1	1.3	3.1
Median	21	15	1	3
Standard Deviation	2.2	4.9	0.6	1.8
Range	20-26	4-23	0-3	0-8

There was heterogeneity of variance between the two groups. The ratio of the larger to the smaller variance was 5.15 for the acceptable behaviour scores and 5.77 for the questionable behaviour scores. This violated the homogeneity of variance assumption for the ANOVA. There does exist an acceptable alternative, the Welch test, which is available in SPSS. We used the Welch test to adjust the degrees of freedom to correct for the heterogeneity of variance. With df=4 and 47.5, the Welch test statistic was 25.05 (p= 0.000), meaning there was a significant difference in acceptable and questionable behaviour scores between the two groups.

Demographic Characteristics

Factors potentially influencing the FTP scores (sex, shelter sites, and age), were investigated with ANOVA and F tests. We did not have data describing the history of the cats (for example, stray vs. guardian surrender, or declaw status).

Sex

Acceptable behaviour scores were compared as a function of sex (males: n=23, mean=17.6±5.3; females: n=43, mean=17.4±6.0). There was no significant difference in acceptable behaviour score as a function of sex ($F_{1,64}$=.025, p=.874). Distribution of acceptable behaviour scores and questionable behaviour scores among the groups of qualified males, qualified females, rejected males and rejected females are reported in individual value plots (Figure 3A, Figure 3B). Rejected males and females had a wider spread among values than did qualified males and females. However, there was no significant difference in acceptable behaviour score as a function of sex in qualified cats (males=9, mean=21.9±1.8; females=17, mean=22.3±6.2; $F_{1,24}$=.3, p=.589). Acceptable behaviour scores in rejected cats also did not significantly differ as a function of sex (males=14 mean 14.5±5.1; females=26, mean=13.8±5.2; $F_{1,38}$=.2, p=.653).

Figure 3. Individual value plots representing
A) distribution of acceptable behaviour scores in the group of qualified males (n=9), qualified females (n=17), rejected males (n=14), and rejected females (n=26);
B) distribution of questionable behaviour scores in the group of qualified males (n=9), qualified females (n=17), rejected males (n=14), and rejected females (n=26);
C) distribution of acceptable behaviour scores in the group of cats from Shelter 2(n=14), and the group of cats from Shelter 1 (n=12); and
D) distribution of questionable behaviour scores in the group of cats from Shelter 2 (n=14), and the group of cats from Shelter 1 (n=12);
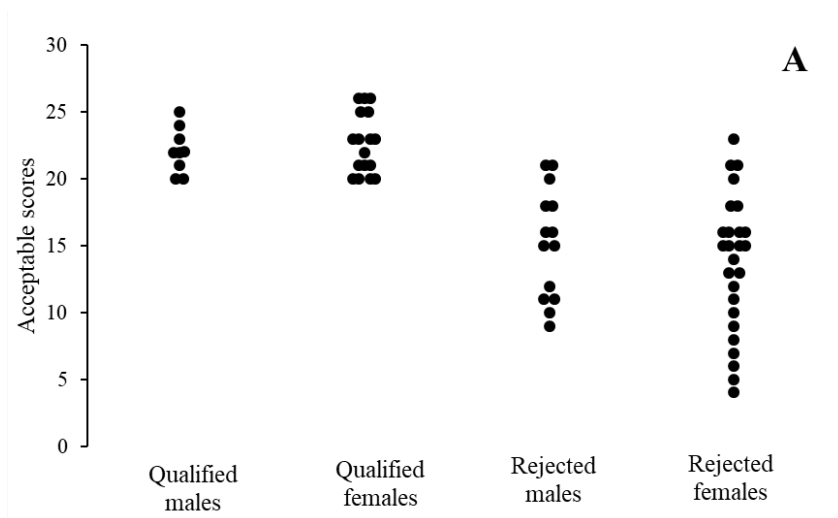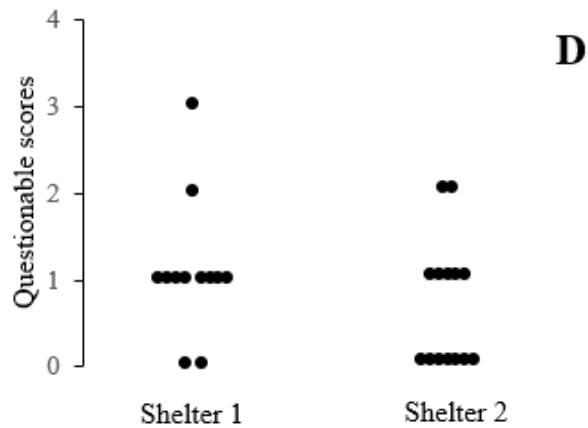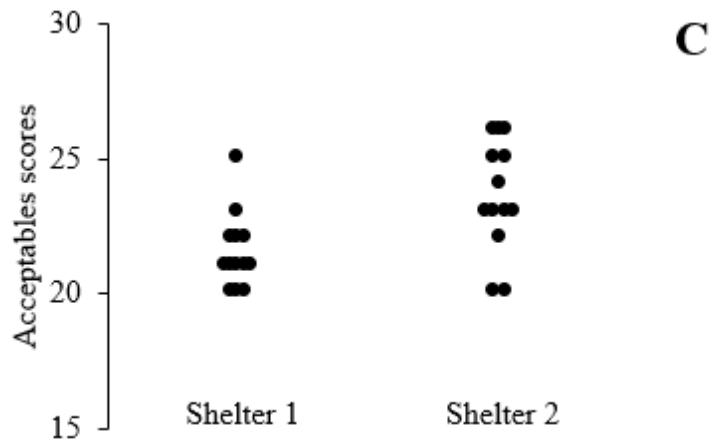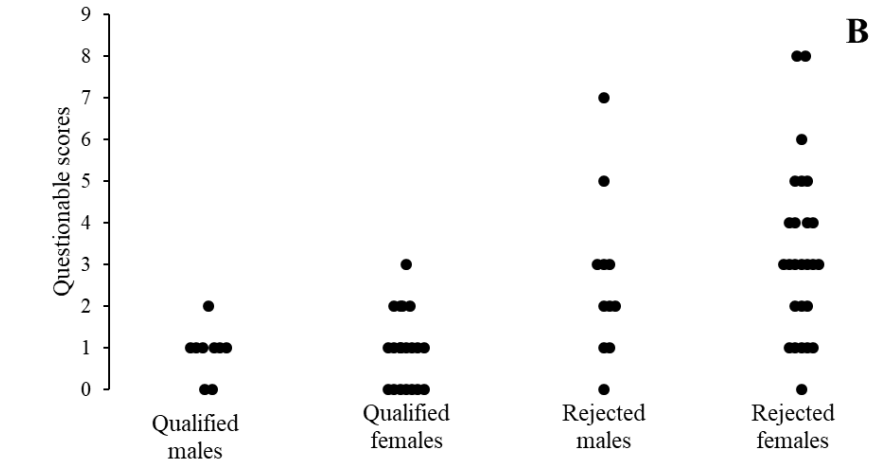
Shelter Sites

Acceptable behaviour scores were compared as a function of shelter site among the group of qualified cats. (Shelter 1: n=12 mean=21.1±1.5; Shelter 2: n=14, mean=23.6±5.0). Distributions of acceptable behaviour scores and questionable behaviour scores according to shelter sites are reported in individual value plots (Figure 3 C, Figure 3 D). The 2 shelters differed significantly from each other with respect to cats' acceptable behaviour scores ($F1,24$=9.5, p=.005).

Age

Age was known for 62 cats. These 62 cats were between 10 months and 4 years old. However, 39% of them were less than 12 months old, while 37% were between 12 and 24 months old, and 24% were between 2 and 4 years old. In the group of qualified cats (n=25), 44% of them were less than a year old. In the group of rejected cats (n=37), 80% of them were less than 2 years old. The ages of the two groups were compared (qualified cats: n=25 mean=22.7±12.4; rejected cats: n=37, mean=20.8±9.0). The groups of qualified and rejected cats did not differ significantly with respect to age. The ages for qualified and rejected cats are reported in Figure 4.

Figure 4. Distribution of age in the group of qualified cats (n=25) and the group of rejected cats (n=37).
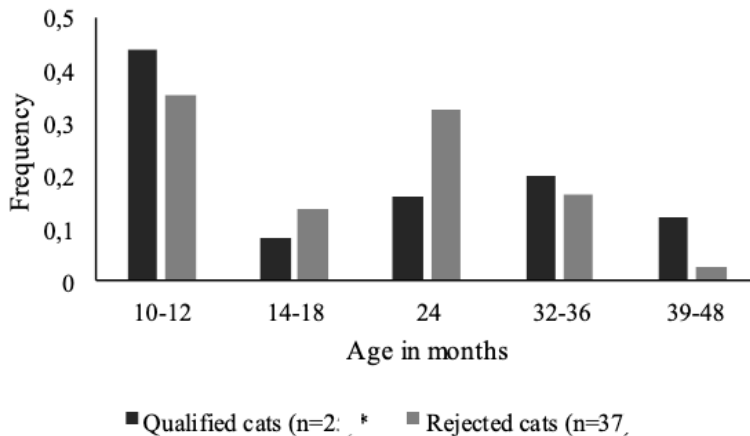
FTP Reliability

The internal consistency of the FTP test was estimated through the Cronbach's alpha coefficient. Considering all FTP behaviours (73 items), the Cronbach's alpha score was 0.654. Considering the acceptable behaviours (39 items), the Cronbach's alpha was 0.816. For questionable behaviours (34 items), the Cronbach's alpha was 0.550. As a Cronbach's alpha over 0.8 equals a good internal consistency, the analysis revealed that acceptable behaviour items were reliable. However, these findings indicate that more work is needed to determine the internal consistency of the questionable behaviour items.

Logistic Regression

Logistic regression analysis was conducted to determine to what extent the acceptable behaviour scores and questionable behaviour scores influenced the cats' qualification for the Feline Friends Study. The dependent variable was qualification. Qualification was scored as 0 and rejection was scored as 1. Logistic regression results are reported in Table 3. Results indicate that the acceptable behaviour score had a significant partial effect. As the acceptable behaviour score increased, the likelihood of being rejected for the study decreased. The odds ratio was 0.410, thus for every point of increase in acceptable behaviour score, the odds of being qualified for the study increased by a factor of 1/0.410=2.439 (Table 3A). This prediction, based on the acceptable behaviour score, correctly classified 84.3% of cats (Table 3B).

      Questionable behaviour scores also had a significant partial effect. As the questionable behaviour score increased, the likelihood of being rejected from inclusion in the Feline Friends study increased. The odds ratio was 4.793, thus for every point of increase in questionable behaviour scores, the odds of a cat being rejected increased by a factor of 4.793 (Table 3C). This prediction based on the questionable behaviour score correctly classified 79.3% of cats (Table 3D).

Table 3. Summary of logistic regression findings.
A) Variables in the equation of the first analysis,
B) Classification table for the first logistic regression,
C) Variables in the second analysis, and
D) Classification table for the second logistic regression

A

Source	B	Standard Error	Wald	p	OR
Acceptable score	-.892	.255	12.237	.000*	.410
Constant	17.992	5.223	11.866	.001*	65161964.251

* p<0.05

B

Observed			Predicted		Percentage correct
			Qualification in the study		
			Qualified	Rejected	
Observed	Qualification in the study	Qualified	20	6	76.9
		Rejected	5	39	88.6
Overall percentage					84.3

* p<0.05

					C
Source	B	Standard Error	Wald	p	OR
Questionable score	1.567	.491	10.181	.001*	4.793
Constant	-2.057	.820	6.296	.012*	.128
* p<0.05					

						D
			Predicted			
			Qualification in the study		Percentage correct	
			Qualified	Rejected		
Observed	Qualification in the study	Qualified	13	4	76.5	
		Rejected	8	33	80.5	
Overall percentage					79.3	
* p<0.05						

Factor Analyses

As described in the statistical analysis section, two principal component analyses (PCA) were performed. The aim was to reduce the set of variables to a smaller set that still contained most of the information tested in the FTP. The first analysis included acceptable behaviours in the FTP. The matrix (70 cats by 39 acceptable items) was subjected to PCA with rotation.

The scree plot shown in Figure 5A displays the variances against the principal components, showing the variation in the data. Twelve components with eigenvalues >1 were

extracted. Two components were retained for inclusion, rejecting all others. The criterion for retention was that at least 10 percent of the total variance explained by each component had an eigenvalue greater than one. This allowed us to determine meaningful interpretations for these two components over replicating similar, duplicated interpretations. Only with congeneric assessments (not the case here) are parallel components recommended for determining the number of components.

Component 1 and 2 together explained 27.6% of the variability in the data (Figure 5B). The first component included 4 items with loadings >0.7. These were labelled as 'meow/purr/chirp' in phases 1,2,3,4 of the test. The second component included 5 items with loadings >0.5. These elements were labelled 'comes and sniffs hands' in phases 1 and 2, 'sniffs hands' in phase 3, 'rubs head on hands' in phase 3, and 'head bumps' in phase 4. Component 1 represented vocalizations in the first phases of the FTP. Component 2 included the cat's first physical contact with the assessor.

The second analysis included questionable behaviours in the FTP. The matrix (70 cats by 34 questionable items) was subjected to PCA with rotation. Ten components with eigenvalues >1 were extracted (Figure 5 C). Components 1 and 2 together explained 25.4% of the variability in the data. The first component included 2 items with loadings >0.9 ('hiss/growl' in phase 1 and 'startles then aggressive reaction' in phase 10). The second component included 3 items with loadings >0.7: 'watches with no approach' in the phases 1 and 2, and 'hiss or growl' in phase 9 (Figure 5 D).

Figure 5. Summary of Principal Components Analyses.
A) Scree plot for the analysis of acceptable items,
B) Loading plot for the analysis of acceptable items,
C) Scree plot for the analysis of questionable items,
D) Loading plot for the analysis of questionable items.

C

D
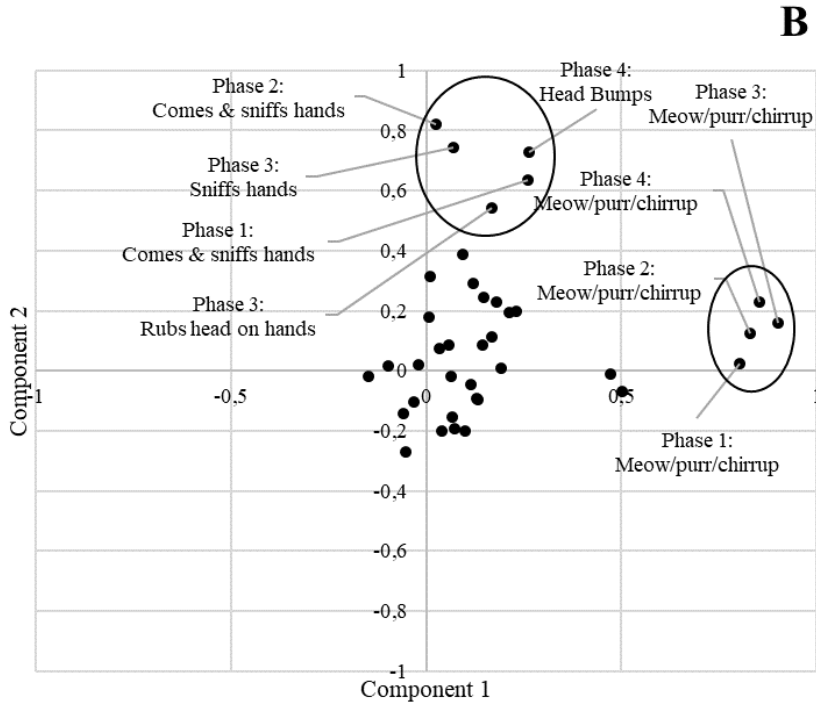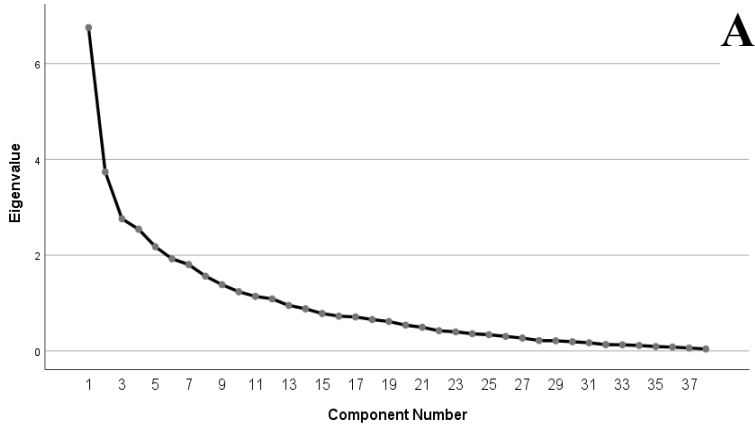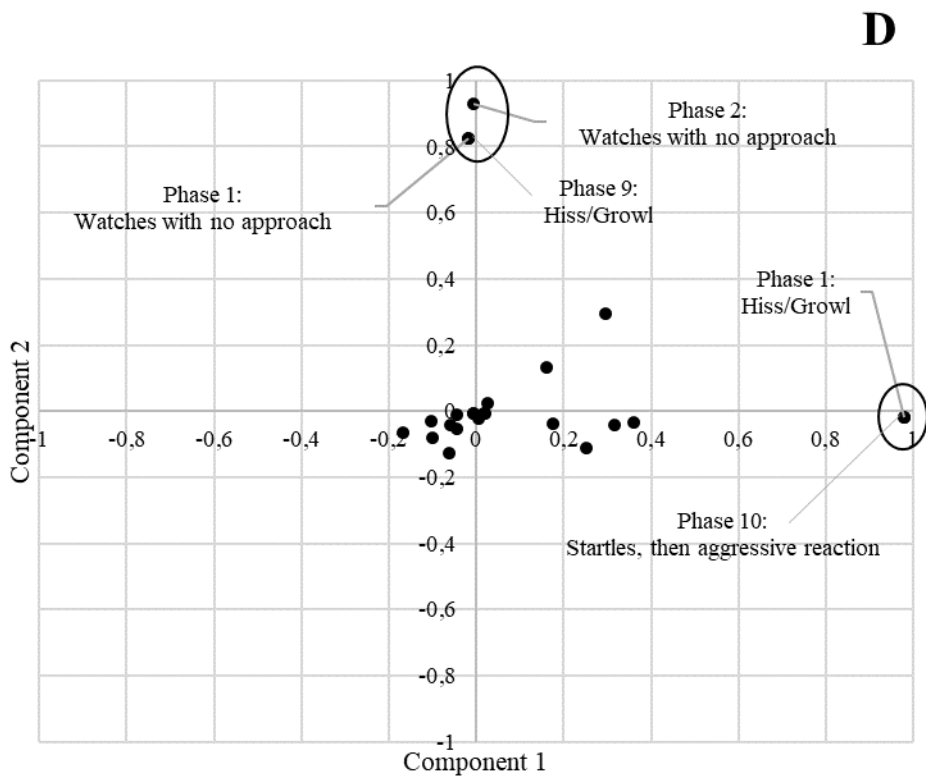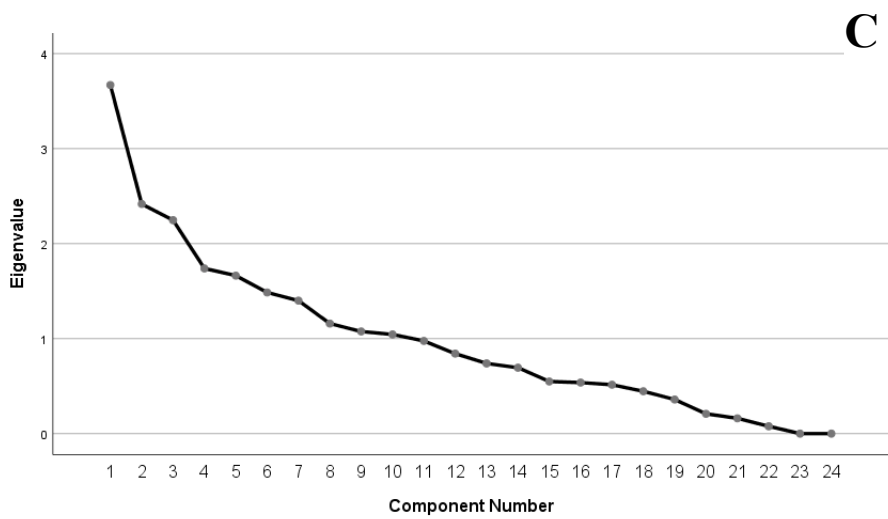
Discussion

Cat Behaviour and Shelter Pre-selection

Principal component analysis demonstrated the presence of behavioural dimensions. Among acceptable behaviours, component 1 contrasted vocalizations and component 2 contrasted the cat's first approach to the evaluator. Among questionable behaviours, component 1 was driven by the 'Hiss/growl' in phase 1 of the test and the 'Startles then aggressive reaction' in phase 10. Component 2 included 'Watches with no approach' and 'hiss/growl' in phase 9 of the test. Statistical analyses revealed that there was no difference in acceptable behaviour scores as a function of sex. However, there was a significant difference between animal shelters. Shelter staff pre-selected cats who they thought could pass the FTP; however, the shelter staff members were not trained to select cats. Shelter 2 has facilities that allow cat-cat and human-cat interaction. These different housing conditions may have led to different behaviour in cats. These differences between shelter sites may have helped shelter staff from Shelter 2 to select cats who were likely to have a high acceptable behaviour score. The difference in our results across shelter sites can be partially explained by the housing conditions and the social interaction of shelter cats.

Shelter Environment

The environment in an animal shelter may also explain the differences in selection of cats between shelters. While cat temperament is known to play a role in a cat's perception of the environment, the environment can also influence cat behaviour. Newly relinquished shelter cats need time to adapt to the environment; therefore, research recommends that behaviour evaluations be done at least 3 days after a cat enters the shelter (Moore and Bain). Shelter environments themselves can lead to stress and fear. A large segment of the shelter cat population may be affected by chronic stress (McCobb et al. 553).

Level of noise and exposure to dogs may contribute directly to stress levels in shelter cats. Furthermore, degrees of human contact may vary widely across shelters. Cats housed in

shelters with greater space per cat were more likely to engage with a study staff member (Miller and Watts 235). In our study, it was not possible to ascertain what degree of human contact the cats had. In Shelter 1, the main human-cat contact was with caregivers of the cats, student volunteers doing service-learning experiences, and potential guardians. However, because Shelter 2 is located several miles away from any community, the main human-cat contact was with volunteers who particularly went there to help care for the cats. Furthermore, cats in this shelter were likely to be moved out of the shelter and into foster homes if the cats showed significant signs of stress and foster homes were available. This variable may have influenced our findings; however, it was not possible for us to ascertain the extent of human-cat contact in the shelters we studied.

In our study, the FTP was used as a behaviour assessment instrument rather than as a representative evaluation of overall cat temperament. As the shelter environment could invoke strong emotional responses, some cats react to stress by aggressive behaviours. There are countless variables in shelters that may influence cat behaviour such as noise, smells, textures of the surfaces to which cats have access, as well as contact with and tolerance of other cats. We do not have data to elucidate the potential effects of these variables on the behaviour of the cats, or corresponding scores on the FTP. This is an area of inquiry that needs to be addressed. Such confounding behaviour variables may have led us to reject cats who may have scored a higher acceptable behaviour score in a different environment.

Cats in Families of Children with ASD

Given the many challenges in households of families with children with ASD, and myriad behaviour issues that the children may have, systematic assessment of the potential for a cat to succeed in such a family is needed. Families with children with ASD need friendly cats identified as least likely to behave aggressively in any situation. These findings are encouraging to our team and other investigators studying child-cat interaction, as families of children with ASD could be offered a cat known to be affectionate, non-aggressive, docile, playful, and social. By way of follow up, of 10 cats placed in families, 8 remained in their family for the full 18-week period of

the main study. 2 cats were relinquished. Of these 2 cats, one cat had an FTP score with 3 questionable behaviours. The owner of this cat reported that the cat did not bond with her child with ASD. More detail findings of the relationship between cat temperament, cat stress, and parental stress are in progress (Carlisle 2020, personal communication).

Reliability of Temperament Testing

Some aspects of temperament have been found to change following adoptions, making a temperament test less useful. For example, Christensen et al. found that dogs who passed a temperament test could exhibit aggressive behaviours after adoption (91). These behaviours were not reliably exhibited during the test. However, in cats, Siegford et al. demonstrated that the FTP could provide an accurate evaluation of the cat's temperament and affinity for humans (349). In that study, FTP scores were consistent over time, even when the cat's situation changed after adoption. Siegford et al. concluded that the FTP provides a consistent measure of a cat's temperament, but the applicability of the FTP for assessing cat stress is unclear, as is the relationship between temperament and stress (349).

In our study, the FTP was used as a screening instrument for inclusion of cats in the Feline Friends Study. In that study, we are assessing cat stress longitudinally over 18 weeks after adoption through the Cat Stress Scale, body weight, and faecal cortisol levels. It will be possible to include the FTP score levels as a covariate in analysis of cat stress. In that instance, we intend to shed further light on the role of temperament in stress.

Reduction of FTP Items

The present study showed that the FTP can be shortened with no loss of reliability. The shorter version could be a quick and practical tool for shelter staff to assess cats' temperament to assist with finding compatible homes. In the wider context of cat adoption, the FTP could be used to achieve successful adoptions by matching cats with adoptive families' expectations. Cats with a high acceptable behaviour score and a low questionable behaviour score could be adopted by

families with special needs. Conversely, cats with a low acceptable behaviour score and a low questionable behaviour score could be compatible with potential guardians who do not desire an attention-seeking companion animal. Placing cats more appropriately by using the FTP has implications for increasing cat adoptions and reducing their return to shelters, as cat behaviour has been linked to retention of adopted cats (Salman et al. 103). Considering the possible implications – increasing adoption and decreasing re-relinquishment to shelters – there is room for further study to monitor adoption rates in shelters using the FTP.

Limitations

A limitation of the study was the dissimilarity of the two animal shelters studied and its effect on cat stress. It also may have been a factor in our testing of the cats. For example, while testing occurred in a private room in each shelter, the environment was still noisy in one of the shelters. While this created variability, knowledge about this variability may assist shelters to adapt the environment in their facilities to reduce cat stress and enhance the behaviour of cats needing to be adopted.

Another limitation is that we did not have knowledge about the cats' pre-shelter life and experiences. These factors could be beneficial for future study; however, in the case of shelter cats they are difficult to obtain.

We had 5 study staff members conducting the FTP testing. While we would have preferred to have only one person doing all the FTP testing, this was not logistically possible. We did however attend to this limitation through training and reassessing of assessors and inter-rater reliability testing.

We did not calculate sensitivity and specificity of the FTP behaviour scores. This needs to be addressed in future studies.

Another limitation of the study was lack of long-term follow up to determine the success of the adoption. We were limited by the 18-week period of the main study. Long term follow-up (for example, 1 year) would be highly beneficial.

Conclusion

Benefits of dogs as therapeutic nonhuman animal companions have been reported for families with special needs (Carlisle 1143), but little attention has been paid to cats for children with ASD. Working with cats in two shelters consisting of two different housing types, the aims of the present study were to compare the group of cats who qualified for the Feline Friends Study and the group of cats who did not qualify, and further, to identify items of the FTP that best predicted cat temperament.

Acceptable behaviour scores in qualified and rejected cats did not significantly differ according to their sex. There was a significant difference in acceptable score between the 2 shelters, with higher acceptable scores in cats from the shelter with cats in large room group housing. The groups of qualified and rejected cats did not differ significantly as a function of age.

The FTP can be a valuable instrument to identify cats who have calm and non-aggressive reactions even in stressful situations. The FTP can be shortened with no loss of reliability. The shorter version could be a useful tool for shelter staff to assess cats' temperament to achieve successful adoptions by placing cats in compatible homes. This may help to increase cat adoptions and decrease relinquishment to shelters.

Works Cited

Bollen, Kelly, and Joseph Horowitz. 'Behavioural Evaluation and Demographic Information in the Assessment of Aggressiveness in Shelter Dogs.' *Applied Animal Behaviour Science,* vol. 112, no. 1, 2008, pp. 120-35, DOI: 10.1016/j.applanim.2007.07.007.

Bradshaw, John W. S. 'Normal Feline Behavior … and Why Problem Behaviors Develop.' *Journal of Feline Medicine and Surgery*, vol. 20, no. 5, 2018, pp. 411-21. DOI: 10.1177/1098612X18771203.

Brady, Karen, et al. 'A Systematic Review of the Reliability and Validity of Behavioural Tests Used to Assess Behavioural Characteristics Important in Working Dogs.' *Frontiers in Veterinary Science,* vol. 5, no. 103, 2018, DOI: 10.3389/fvets.2018.00103.

Carlisle, Gretchen K. 'The Social Skills and Attachment to Dogs of Children with Autism Spectrum Disorder.' *Journal of Autism and Developmental Disorders*, vol. 45, no. 5, 2015, pp. 1137-45, DOI: 10.1007/s10803-014-2267-7.

Casey, Rachel A., et al. 'Reasons for Relinquishment and Return of Domestic Cats (*Felis Silvestris Catus*) to Rescue Shelters in the UK.' *Anthrozoös*, vol. 22, no. 4, 2009, pp.347-58, DOI: 10.2752/089279309X12538695316185.

Christensen, E'Lise, et al. 'Aggressive Behaviour in Adopted Dogs that Passed a Temperament Test.' *Applied Animal Behaviour Science,* vol. 106, no. 1-3, 2007, pp. 85-95, DOI: 10.1016/j.applanim.2006.07.002.

DiGiacomo, Natalie, et al. 'Surrendering Companion Animals to Shelters: The Relinquisher's Perspective.' *Anthrozoös*, vol. 11, no. 1, 1998, pp.41-51, DOI: 10.1080/08927936.1998.11425086.

Esposito, Layla, et al. 'Directions in Human-Animal Interaction Research: Child Development, Health, and Therapeutic Interventions.' *Child Development Perspectives*, vol. 5, no. 3, pp. 205-11, 26 May 2011, DOI: 10.1111/j.1750-8606.2011.00175.x.

Grandgeorge, Marine, et al. 'Does Pet Arrival Trigger Prosocial Behaviors in Individuals with Autism?' *PLoS ONE* vol. 7, no. 8, 2012, DOI: 10.1371/journal.pone.0041739.

Hart, Lynette A., et al. 'Affectionate Interactions of Cats with Children Having Autism Spectrum Disorder.' *Frontiers in Veterinary Science,* vol. 5, no. 39. 2018, DOI: 10.3389/fvets.2018.00039.

Harvey, Naomi D., et al. 'Social Rearing Environment Influences Dog Behavioral Development.' *Journal of Veterinary Behavior*, vol. 16, 2016, pp.13-21. DOI: 10.1016/j.jveb.2016.03.004.

IBM Corp. IBM SPSS Statistics for Windows, Version 25.0. Released 2017, Armonk, NY.

Jennett, Heather, et al. 'Anxiety in Children with Autism Spectrum Disorder.' *Pediatric Anxiety Disorders: A Clinical Guide*, edited by R.A. Vasa & A. K. Roy, Springer, 2013, pp. 345-77.

Kršková, Lucia, et al. 'Guinea Pigs – The "Small Great" Therapist for Autistic Children, or: Do Guinea Pigs Have Positive Effects on Autistic Child Social Behaviour?' *Society and Animals*, vol. 18, 2018, pp. 139-51, DOI: 10.1163/156853010X491999.

Lee, Ronnal L., et al. 'Guidelines: Animals in Nursing Homes.' *California Veterinarian*, vol. 3, 1983, pp. 22a-26a.

Lowe, Sarah E. and John W.S. Bradshaw. 'Ontogeny of Individuality in the Domestic Cat in the Home Environment.' *Animal Behaviour*, vol. 61, no. 1, 2001, pp. 231-7, DOI: 10.1006/anbe.2000.1545.

McCobb, Emily C., et al. 'Assessment of Stress Levels Among Cats in Four Animal Shelters.' *Journal of the American Veterinary Medical Association*, vol. 226, no. 4, 2005, pp. 548-55, DOI: 10.2460/javma.2005.226.548.

'Meet Your Match Feline-ality™ Guide.' *American Society for the Prevention of Cruelty to Animals*, 2013, www.aspcapro.org/sites/default/files/Feline-ality%20Guide_PRO.pdf. Accessed 13 Aug. 2018.

Mertens, Claudia, and Dennis C. Turner. 'Experimental Analysis of Human-Cat Interactions During First Encounters.' *Anthrozoös*, vol. 2, no. 2, 1988, pp. 83-97, DOI: 10.2752/089279389787058109.

Miller, Katherine, and Katie Watts. 'Environment and Behavioural Enrichment for Cats.' *Animal Behavior for Shelter Veterinarians and Staff,* Wiley, 2015, pp 234-49, DOI: 10.1002/9781119421313.ch12.

Moore, Alexandra M., and Melissa Bain. 'Evaluation of the Addition of In-Cage Hiding Structures and Toys and Timing of Administration of Behavioural Assessments with Newly Relinquished Shelter Cats.' *Journal of Veterinary Behaviour: Clinical Applications and Research*, vol. 8, no. 6, 2013, pp. 450-7, DOI: 10.1016/j.veb.2011.10.003.

New, John. C., et al. 'Characteristics of Shelter-Relinquished Animals and Their Owners Compared with Animals and their Guardians in U.S. Companion Animal Owning Households.' *Journal of Applied Animal Welfare Science*. vol. 3, no. 3, 2010, pp. 179-201, DOI: 10.1207/S15327604JAWS0303_1.

O'Connor, Rachel, et al. 'Exploratory Study of Adopters' Concerns Prior to Acquiring Dogs or Cats from Animal Shelters.' *Society & Animals*, vol. 25, no. 4, 2017, pp. 362-83, DOI:10.1163/15685306-12341451.

O'Haire, Marguerite E., et al. 'Social Behaviours Increase in Children with Autism in the Presence of Animals Compared to Toys.' *PLoS ONE*, vol. 8, no. 2, 2013, DOI: 10.1371/journal.pone.0057010.

Patronek, Gary J., et al. 'Risk Factors for Relinquishment of Cats to an Animal Shelter.' *Journal of the American Veterinary Medical Association,* vol. 209, no. 3, 1996, pp. 582-8.

'Pet Statistics.' *American Society for the Prevention of Cruelty to Animals*, 2018, www.aspca.org/animal-homelessness/shelter-intake-and-surrender/pet-statistics. Accessed 5 Aug. 2018.

Salman, Mo D., et al. 'Behavioural Reasons for Relinquishment of Dogs and Cats to 12 Shelters.' *Journal of Applied Animal Welfare Science, 3* vol. 3, no. 2, 2000, DOI: 10.1207/S15327604JAWS0302_2.

Siegford, Jannice M., et al. 'Validation of a Temperament Test for Domestic Cats.' *Anthrozoös*, vol. 16, no. 4, 2003, pp. 332-51, DOI: 10.2752/089279303786991982.

Sinn, Leslie. 'Factors Affecting the Selection of Cats by Adopters.' *Journal of Veterinary Behavior*, vol. 14, 2016, pp 5-9, 2016, DOI: 10.1016/j.jveb.2016.06.001.

Scarlett, Janet M., et al. 'Reasons for Relinquishment of Companion Nonhuman Animals in US Animal Shelters: Selected Health and Personal Issues.' *Journal of Applied Animal Welfare Science*, vol. 2, no. 1, 1999, pp. 41-57, DOI: 10.1207/s15327604jaws0201_4.

Shore, Elsie R. 'Returning a Recently Adopted Companion Animal: Adopters' Reasons for and Reactions to the Failed Adoption Experience.' *Journal of Applied Animal Welfare Science*, vol. 8, no. 3, pp. 187-98, DOI: 10.1207/s15327604jaws0803_3.

Weiss, Emily, et al. 'Goodbye to a Good Friend: An Exploration of the Re-homing of Cats and Dogs in the U.S.' *Open Journal of Animal Sciences,* vol. 5, 2015, pp. 435-56, DOI: 10.4236/ojas.2015.54046.

---. 'Why Did You Choose this Pet? Adopters and Companion Animal Selection Preferences in Five Animal Shelters in the United States.' *Animals*, vol. 2, no. 2, 2002, pp. 144-159, DOI: 10.3390/ani2020144.

Wodder, Sarah. 'Exploring Perceived Benefits of and Barriers to the Use of Pet Therapy Dogs in a Private School for Children with Special Needs.' *PCOM Psychology Dissertations*. Paper 294, 2014.

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