Rotational Preference in the Domestic Cat:

Relationship to Temperament and Behaviors

by

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Acknowledgements

Table of Contents

Tables

iii

Figures

List of Appendices

Abstract

Rotational preference, an animal's preferred turning direction as it moves about with free choice, has been assessed in humans and rodents. Studies have shown that those with a right-turning preference are more susceptible to developing learned helplessness, and less likely to act according to Gray's Behavioral Approach System than those who prefer to turn to the left. In the present study, rotational preference was assessed in twenty-nine adult male cats (*Felis silvestris catus*). Rotational preference was compared to the results of two assessments in a within-subjects design. The first was the Feline Temperament Profile (Lee, Zeglen, Ryan, & Hines, 1983) which was administered by the experimenter. The second was a Cat Behavior Questionnaire which was completed by the cats' owners. The proportion of right turns emitted by the cats was negatively correlated with the number of approach behaviors measured in the temperament test and behavior questionnaire ($r = -.591, p = .001$). This finding supports studies of rotational preference and behavior with other species, as well as the hypothesized neurochemical basis of reward-seeking behavior (Abwender & Pusateri, 2005).

Rotational Preference in the Domestic Cat: Relationship to Temperament and Behaviors

Rotational Preference (RP) is defined as the direction an organism turns when assessed in the absence of environmental constraints (Mead & Hampson, 1997). It has been found in several species that some individuals prefer to rotate in a clockwise (right-turning) direction, and others prefer a counterclockwise (left-turning) direction (Gengerelli, 1930; Glick, Weaver, & Meibach, 1981; Mead & Hampson, 1996). Neurobiological studies have revealed that humans and rats tend to turn in the direction toward the hemisphere with the lower concentration of dopamine (Bracha, Shults, Glick, & Kleinman, 1987; Zimmerberg, Glick, & Jerussi, 1974).

Further study revealed that those individuals demonstrating a right-turning preference are more susceptible to developing learned helplessness (LH) after exposure to uncontrollable events. This has been shown clearly in rats (Carlson & Glick, 1991; Krahe, Filgueiras, & Schmidt, 2002), and recent findings in humans demonstrate the same relationship (Pusateri, 2007).

In another series of studies, learned helplessness has been related to personality characteristics. For instance, extraverted personality types were found to be less susceptible to developing learned helplessness (Tiggemann, Winefield, & Brebner, 1982). Combining this finding (that extraverts are less likely to develop learned helplessness), with those above (that LH is more likely in right-rotators), a reasonable hypothesis would be that extraverts would show a left-turning rotational preference.

In a study by Abwender and Pusateri (2005), this specific hypothesis was tested. With a sample of 25 male and 64 female college students, extraversion scores from the Big Five Inventory (John, Donahue, & Kentle, 1991) did not show a significant relationship with RP. However, another metric was found to be correlated with RP. In the sample of males, those who measured high in Behavioral Approach System sensitivity according to the BIS/BAS scales (Carver & White, 1994), were significantly ($p < .002$) more likely to turn to the left in

a rotational preference assessment (Abwender & Pusateri, 2005). People with a sensitive Behavioral Approach System (BAS) are characterized by approach-related and reward-seeking activities (Carver & White, 1994).

At this point, one could hypothesize that a nonhuman animal with a sensitive BAS (high reward sensitivity) would be more likely to rotate to the left than those with an insensitive BAS. Conversely, these low BAS animals may be more likely to rotate to the right. Feline temperament models and behavior assessments are available for domestic cats and feature traits that are comparable to those of humans (Feaver, Mendl, & Bateson, 1986; Lee, Zeglen, Ryan, & Hines, 1983; Meier & Turner, 1985). These models and assessments can be used to estimate BAS sensitivity in cats.

Based on these measures and findings for rotational preference, learned helplessness, and BAS sensitivity, parallels between human and domestic cat behavior can be drawn. If these parallels are accurate, then through the assessment of rotational preference, the personality of an individual cat (which includes innate temperament as well as experiential history) may be predicted. This knowledge may be useful in the understanding of human personality, learned helplessness, disorders such as depression, as well as for animal-assisted therapy, pet adoption placement, and behavior management in pet cats.

Rotational Preference Research

The concept of rotational preference was first described in rats. To assess olfactory characteristics, male albino rats were run in a T-maze with food or the scent of food at one or both ends (Gengerelli, 1930). For the control group, food was placed at both ends of the T-maze. After 19 control group rats were run 3 times each, Gengerelli observed that 79 percent of the rotations were to the right, rather than 50 percent, as expected. Subsequent runs verified that most rats in this study preferred to turn right.

More recently, Zimmerberg et al. (1974) used a T-maze to assess preferred turning direction as rats escaped shock. After 10 trials, 92 percent of the rats showed a directional

preference. Stability of preference was demonstrated by testing the same rats on a weekly basis for a month. Further, rats tested in both a T-maze and in a spherical rotometer apparatus (a wire was placed around the animal's thorax) maintained their directional biases.

Rotational preference of rats was then considered with respect to brain chemistry. Glick, Jerussi, Waters, and Green (1974) studied the rotational behavior of rats in a rotometer apparatus. Individual rats had different rotational preferences, and the magnitude of rotations (defined as the difference between the number of left and right turns) was found to be directly correlated with the (postmortem) difference in dopamine levels between the left and right hemispheres of the brain. Further, turning was in the direction of the side with *less* dopamine. This finding indicated an "intrinsic and normal bilateral imbalance in dopamine content of left and right nigro-striatal systems" (Glick et al., 1974, p. 3223).

This finding was supported by Zimmerberg et al. (1974). After assessing rats' turning preferences as they escaped a T-maze, these investigators also discovered that the dopamine levels ipsilateral to the preferred turning directions were significantly lower than DA on the contralateral side.

Later, Glick and Cox (1978) monitored spontaneous rotations in female rats under normal conditions, those elicited by amphetamines, and those due to various lesions. Normal circling was increased (in the same direction) after dextroamphetamine injection, and circling was temporarily reversed due to lesions of the contralateral (hemisphere opposite that of the original turning direction) substantia nigra, nigrostriatal bundle, and caudate nucleus. The direction of spontaneous rotation returned to normal for most subjects within a month. These findings suggested that rotational preference is mediated by hemispheric differences in dopamine levels (enhanced by amphetamines) as well as the structure of various dopamine pathways (damaged by lesions).

Human measures of rotational preference were first performed by Bracha, Seitz, Otemaa, and Glick (1987). In this study, 135 male and female participants wore belt-mounted

rotometers to measure turning behavior as they moved freely over 7-8 hours in their normal routines on two separate days. All but 7 (95%) showed a preference to turn in one direction over the other (more turns in one direction than the other). Fifty three participants (39%) demonstrated significantly more turns in one direction than the other according to paired t tests.

Bracha, Shults, et al. (1987) assessed the rotational preferences of ambulatory participants with hemi-Parkinsonism. In this disorder, like Parkinson's, it is believed that reduced dopaminergic activity is responsible, at least in part, for symptoms. In hemi-Parkinson's, it is held that only one side of the brain is affected. Therefore, in this rotational preference study, it was expected that the four participants with deficits in the left hemisphere would turn left, and the one participant with deficits in the right hemisphere would turn right. Participants wore belt-mounted rotometers for 8-12 hours during a normal day. As expected, the number of rotations in the direction of the hemisphere purportedly containing less dopamine significantly outnumbered those in the opposite direction.

Another method of assessing turning behavior in humans was developed by Mead and Hampson (1996). In this paradigm, participants moved about in a room equipped with tape recorders in each of the four corners. In a pseudorandom pattern, tape recorders alternately emitted 1-s tones. Participants were instructed to approach the tape recorder from which they heard a tone. In 80 of 160 trials, participants turned from one corner of the room to the opposite (diagonal) corner, and these 180 degree rotations were recorded. Of 75 male and female participants, 81% demonstrated significant rotational preferences, with 15 preferring the left, and 46 preferring the right. Further study showed that women had weaker rotational biases when in the midluteal phase than when in the menstrual phase, indicating a role of ovarian hormones in turning behavior (Mead & Hampson, 1997).

Finally, the rotational characteristics of the domestic cat were assessed in a study by Glick et al. (1981) in which subjects were placed in a cylindrical chamber with a harness-

mounted rotometer. On days 1, 3, and 5, cats received amphetamine injections, while on days 2 and 4, they were drug-free. It was found that of 9 cats, 6 cats demonstrated a natural right-turning bias, while 3 cats demonstrated a left-turning bias. (The magnitudes of these biases cannot be determined from the publication.) In all cases, the effect of the amphetamines increased the turning behavior in the naturally preferred direction. This further supports the dopamine explanation of rotation and indicates similarities in dopamine-induced action among cats, rats, and humans.

Learned Helplessness and Personality

Learned helplessness (LH) can be defined as "when events are uncontrollable the organism learns that its behavior and outcomes are independent, and that this learning produces the motivational, cognitive, and emotional effects of uncontrollability" (Maier & Seligman, 1976, p. 3). Originally demonstrated with dogs by Seligman and Maier (1967), several paradigms have been created to measure this phenomenon in other species. In all cases, subjects are exposed to conditions in which they learn to obtain reinforcers or to escape an aversive event. This conditioning phase is followed by an uncontrollable phase in which the subject's responses no longer result in reward or escape. In the final phase, the subject again is given control over the consequences, and performance is measured. Some individuals fail to respond or show deficits in responding in this final phase. These *learned helpless* subjects operate according to the contingencies learned during the uncontrollable phase.

Several studies investigating learned helplessness in rats have been performed. First, after some rats had received tail shocks while restrained to a plastic tube, all subjects were placed in a two chamber shuttle box (Maier, Albin, & Testa, 1973). Rats required a more complicated escape response (double shuttle, or wheel turn) than dogs (one shuttle) in order to elicit learned helplessness. In both tests, rats in the group that was first subjected to uncontrollable shock had significantly longer latencies in responding than controls ($p < .01$ for double shuttle, and $p < .05$ for wheel turn responding). In the double shuttle trials, 5 of 8

6

rats consistently failed to escape and showed no improvement over trials, and in the wheel turn paradigm, 7 of 10 failed to learn to escape. Therefore, rats demonstrated learned helplessness after uncontrollable conditions as do dogs, and they also show individual differences in the severity of the phenomenon.

Other measures of learned helplessness with rats have shown similar results. These involve choosing an arm of a Y-maze to escape shock after a tail shocked (Jackson, Alexander, & Maier, 1980), pressing a bar to escape shock (Carlson & Glick, 1991), shuttling twice across a barrier to escape shock (Maier, 2001), and forced swimming tests (Krahe et al., 2002; Taghzouti, Lamarque, Kharouby, & Simon, 1999).

Seward and Humphrey (1967) assessed escape responding after inescapable shock in the domestic cat. In all cases, learning was impaired for those groups exposed to an *uncontrollable* phase. In another study with cats, "experimental neurosis" was demonstrated (Thomas & DeWald, 1977). Two discrimination tasks were presented, one to receive food and the other to avoid shock, and in each case, the task became increasingly difficult by making the discriminating stimuli more similar. Some of the cats demonstrated what the authors referred to as "experimental neurosis," suddenly becoming aggressive toward objects, and urinating and defecating in the test area. They also demonstrated agitation, and then remained immobile, in crouching positions, rigid, lethargic, and some refused food. Other cats did not display such behaviors.

Together, these and other studies of learned helplessness prompt the question of whether such behavior can be predicted for individuals without actual LH testing. It has been shown that temperament measures may be used to predict behavior during LH testing. For instance, mice from an aggressive line were found to be less affected by inescapable shock than those from a nonaggressive genetic line (Benus, Bohus, Koolhaas, & Van Oortmerssen, 1990).

Individual differences in personality can account for human susceptibility to the development of learned helplessness as well. In a common paradigm, participants are

exposed to unsolvable problems prior to a set of solvable problems. In one study, a sequence of key presses necessary to turn off a buzzer was learned by participants. A subset of the sample was then exposed to a phase of uncontrollable buzzing, and final controllable performance was compared between groups (Tiggemann et al., 1982). Participants also completed the Eysenck Personality Questionnaire (Eysenck & Eysenck, 1975), and were classified as extraverts or introverts. With both introverts and extraverts in controllable and uncontrollable training groups, introverts were significantly more likely to demonstrate LH in escape tests than extraverts (Tiggemann et al., 1982).

Building upon Eysenck's personality traits of extraversion and neuroticism (Eysenck & Eysenck, 1975), Jeffrey Gray developed a neuropsychological theory that features two independent sets of structures that form the neural bases for processing specific types of stimuli. The first is called the Behavioral Approach System (BAS), which responds to stimuli perceived as rewarding, or nonpunishing, leads to emotions such as happiness or hope, and results in the individual's motion toward (approaching) the stimulus (Gray, 1991). Gray's BAS sensitivity is positively correlated with Eysenck's personality trait extraversion (Carver & White, 1994). Gray also proposes the Behavioral Inhibition System (BIS) which reacts to stimuli perceived as punishing, nonrewarding, or novel, generates the emotion of anxiety, and causes inhibition of behavior. The individual may then avoid or escape the stimulus.

To further illustrate this concept, consider two individuals, each presented with a plate of brownies. One, with a sensitive BIS, has learned from repeated experience that eating desserts causes weight gain and guilt (punishers). This individual will inhibit his behavior and withdraw from the brownies to avoid punishment. The other, with the more sensitive BAS, will act according to the rewards he will receive, focusing on the pleasure experienced or the reduction of hunger, and will approach the plate of brownies for consumption. According to Gray, the BAS and the BIS are orthogonal variables, meaning that a person's nervous system can be characterized by any combination of BAS and BIS sensitivity levels (Gray, 1991).

Incorporating the BAS with previous research, one can tentatively classify individuals along a continuum varying from those who are more likely to develop learned helplessness when faced with uncontrollable conditions, more likely to have low extraversion, and having low BAS sensitivity to those who are less likely to become learned helpless, more extraverted, and more reward-seeking (high BAS).

Rotational Preference, Learned Helplessness, and Personality

Knowledge of the rotational preference of an individual may allow the prediction of susceptibility to learned helplessness as well as other aspects of personality. By combining findings from several studies, a theory has evolved that indicates that learned helpless, low BAS individuals are more likely to rotate to the right while their behaviorally activated counterparts are more likely rotate to the left.

A relationship between rotational preference and susceptibility to learned helplessness was first demonstrated by Carlson and Glick (1991). In this study, rats were harnessed in a Plexiglas® rotometer, and assessed for rotational preference. Subjects were then matched for RP across experimental and control groups and yoked in a floor shock test. In the training phase, the experimental group was unable to escape floor shock, while the control group learned to press a lever to escape shock. (At this time, the matched experimental group rat was also relieved of shock.) In the test phase, all rats were assessed in a shuttle test, in which one shuttle jump (FR1) was required to escape the first several shocks, and FR2 was required thereafter. It was discovered that the right-rotating rats exposed to uncontrollable shock in the training phase performed poorly in the test phase, and in fact, failed to learn to escape, while all other groups improved. Carlson and Glick (1991) refer to this as the first reliable method of *predicting* learned helplessness (i.e., the measurement of RP alone could indicate susceptibility to learned helplessness).

Building on the finding that rats classified as reward-seeking spent significantly less time immobile in forced swimming tests than their passive, less reward-seeking counterparts

(Taghzouti et al., 1999), Krahe et al. (2002) assessed turning preference in mice in the same paradigm. They showed consistently right-turning swimmers spent significantly more time in a state of immobility, a behavior emitted by learned helpless animals.

Pusateri (2007) found the same relationship with humans using the RP measurement procedure used by Mead and Hampson (1996). To test for learned helplessness, a procedure using solvable and unsolvable anagrams (first demonstrated by Schmeck & Dunckley, 1973) was implemented. Pusateri (2007) showed that right-turning rotational preference was positively (though not significantly) correlated with the susceptibility to develop learned helplessness in males.

In considering this established correlation between RP and LH, it is reasonable to assume that, rather than one of these phenomena causing the other, left-right hemispheric dopamine balance, or its underlying mechanism, influences both phenomena.

Through EEGs, several studies have shown that activation in the left side of the frontal cortex is associated with reward sensitivity and approach emotions. For example, Coan, Allen, and Harmon-Jones (2001) asked participants to create facial expressions that are associated with approach emotions (such as joy and anger), and also facial expressions that are associated with withdrawal or avoidance (such as fear and disgust). Approach emotions elicited activity in the left frontal hemisphere while withdrawal emotions elicited activity in the right. Later, Coan and Allen (2003) found significantly higher levels of activity in the left frontal cortex than the right for participants who scored higher in BAS on the Carver and White (1994) BIS/BAS scale. Using the same self-report measure, another study reported that participants who reported higher levels of BAS strength showed greater relative left prefrontal baseline activation as measured by EEG (Sutton & Davidson, 1997). These three studies indicate that those who score high in BAS (those who are more reward sensitive) may have a lower baseline (tonic) level of dopamine on the left side, which includes reward sensitive pathways mediated by dopamine. It is speculated by Abwender and Pusateri (2005)

that this lower level makes this group more susceptible to activation upon reward since the magnitude of the phasic burst (temporary increase in dopamine level) can be much larger than for individuals who consistently have a high baseline level of dopamine in the left hemisphere.

This explanation follows from earlier findings of dopamine lateralization, and may account for the relationship between BAS sensitivity and rotational preference. That is, reward-sensitive individuals turn to the left, which is toward the hemisphere with the lower tonic DA level. This is supported by the Abwender and Pusateri (2005) study in which men who scored high in Behavioral Approach System sensitivity were in fact significantly more likely to turn to the left in rotational preference testing.

The relationship between rotational preference and behavior has not been studied in nonhuman animals. For the present study, rather than measuring the relationship between RP and LH, a related construct is investigated. This involves measuring a series of behaviors in domestic cats to determine the BAS sensitivity for each individual.

Extending the concept of the Behavioral Approach System to domestic pets is reasonable in that as early as Pavlov's time, domestic animals have been known to possess varying temperaments. In particular, Pavlov noticed that some of his dogs tended to be "bold and lively," while others were "timid and cowardly" (Corr & Perkins, 2006, p. 369). According to Gray's model, these dogs would have high and low BAS sensitivity, respectively.

Domestic Cat Personality

In order to locate cats along the proposed continuum (from learned helpless and low BAS to non-LH and high BAS), typical methods for assessing humans (self-report measures of Extraversion or the Behavior Approach System) are obviously unobtainable. However, validated measures of temperament and behavior specifically created for the domestic cat are available and can be related to the BAS.

Like human personality, domestic cat personality has been shown to remain stable over time (Lowe & Bradshaw, 2001; Siegford, Walshaw, Brunner, & Zanella, 2003). Researchers studying resident cats' acceptance of a new cat to the household reported that their findings "suggest that the original cat may be fearful (e.g. flee, hiss, scratch) or dominant (e.g. stare, ignore) to the new cat and that individual personality differences will influence how the original cat responds to a new cat. Genetics and previous social experience with cats are likely to play a role in the original cats' behaviors (Landberg, Hunthausen, and Ackerman, 2003)" (Levine, Perry, Scarlett, & Houpt, 2005, p. 335).

The most simple domestic cat personality model features two types. Meier and Turner (1985) performed a study in which they sought out pet cats living in suburban neighborhoods and rated cats' reactions to the experimenter's advances. Cats were classified along a scale from *shy* to *trusting*, and finding a bimodal distribution, they concluded that there is "evidence for two personality types" (Meier & Turner, 1985, p. 45).

Feaver et al. (1986) assessed 14 female cats along 18 separate characteristics over a period of three months. High interrater reliability between two experimenters (both strangers to the cats) was found for the following characteristics: active, curious, equable with cats, fearful of people, hostile to people, sociable with people, and tense. Through factor analysis, the authors combined them into three personality traits: alert, sociable (with people), and equable (with cats).

Another measure, the Feline Temperament Profile (FTP; Lee et al., 1983), was developed to assess cats' reactions to strangers to rate them for eligibility in animal-assisted therapy programs. This temperament test is administered by a stranger, who leads the cat through 10 stages, which include attempts to pet the cat, trying to interest the cat in play, and an assessment of reactivity to a sudden noise. The FTP includes a checklist for the tester to record behaviors observed for each of the 10 tests. Some of the items on the checklist contribute to an overall Acceptable behaviors score, and others contribute to an overall

Questionable behaviors score. Scores for this measure place cats along a single scale from socially comfortable (appropriate for animal-assisted therapy) to shy or fearful (inappropriate for animal-assisted therapy). A validation of the FTP revealed high interobserver reliability, significant correlations with alternate methods of assessing social comfort, and significant test-retest reliability (Siegford et al., 2003).

Of the 38 potential checkmarks that contribute to the Acceptable score, at least 32 (84%) are clear indicators of reward-seeking, or the Behavioral Approach System. These behaviors include, among others, making eye contact, approaching the experimenter, jumping into the experimenter's lap, and tolerating petting. At least 14 (47%) items of the 30 in the Questionable category represent inhibited or avoidance behaviors characteristic of the BIS. Examples are maintaining distance, hissing, and intolerance of petting. Therefore, the FTP (shown in Appendix I with BIS and BAS labels added) was used as a BIS/BAS measure for cats.

The studies by Siegford et al. (2003) and Feaver et al. (1986) were both performed with cats raised and housed in a laboratory. Other cat behavior studies have been conducted in the cats' homes (Adamelli, Marinelli, Normando, & Bono, 2005; Bradshaw & Cook, 1996; Turner & Stammbach-Geering, 1990; Wells & Millsopp, 2009). The study by Adamelli et al. (2005) also included an owner-report questionnaire, which was validated by Marinelli et al., (2001).

Application of Findings to the Present Study

In the present study, rotational preference in domestic house cats was compared to results from a temperament test and an owner-report questionnaire. Although the use of house cats does not provide control as in laboratory conditions, there are several advantages. First, pet owners who have lived with a pet for at least one year can provide detailed information about their cats' behaviors. Second, variability in both genetic makeup and environmental conditions contributes to the generalizability of findings from this study (in fact, Siegford et

al., 2003, listed the lack of variability in their laboratory-housed cat sample as a limitation). Variation in conditions during early socialization and to a lesser extent, into adulthood, certainly have an impact on cats' comfort with strangers and other cats, but it is the relationship between the current personality and the rotational behavior that is of interest in the present study.

Only predominantly indoor cats participated. First, this ensured that the subject would actually be available for assessment, which occurred in one room of the residence. Also, if cats are kept indoors, the owners are likely to be more aware of their cats' behaviors. Finally, an outdoor cat may not be comfortable in rotational and behavioral assessment simply due to confinement to one room.

Subjects were adult neutered males. Though domestic cats reach sexual maturity at 12 months, they do not reach social maturity until roughly 3 years (Beaver, 2003), so subjects were required to be at least 4 years old. Males were used in order to avoid any rotational effects caused by ovarian hormones (Mead & Hampson, 1997), and to match the Abwender and Pusateri (2005) study in which a relationship between BAS and rotational preference was found for males only. Cats were required to be neutered, partially because responding owners were expected to be more likely to possess neutered pets, but also because it is uncertain what the effect would be if the sample incorporated both neutered and intact subjects.

The study consisted of three evaluations, as follows: (1) a cat behavior questionnaire, completed by owners, (2) a feline temperament test, administered by the experimenter, and (3) a rotational preference assessment, administered jointly by the experimenter and the owner.

The Cat Behavior Questionnaire (CBQ) was created specifically for the present study (Michels, 2008a). For each of 16 items, participants responded by selecting a number from 1 to 7 that best describes their cat's behavior. CBQ items were chosen based on questions from previous cat behavior studies (Adamelli et al., 2005; Feaver et al., 1986; Meier & Turner,

1985; Turner & Stammbach-Geering, 1990), adapting items from the BIS/BAS scales (Carver & White, 1994) for cats, and choosing typical cat behaviors that indicate approach or avoidance. Each item represents a range from BIS to BAS or from neutral to BIS or BAS, as indicated in the right-hand column on the questionnaire shown in Appendix F.

The Feline Temperament Profile (Lee et al., 1983) was chosen for its simplicity, demonstrated validity and reliability, and inherent semblance to a BIS/BAS scale. It was administered with additional instructions to enhance objectivity for the present study (these are shown in italics in the FTP in Appendix I). Also, rather than calculating Acceptable and Questionable scores, as originally intended, a BAS score and a BIS score were calculated.

Rotational preference was assessed by allowing the cat to roam freely in a one room in the cat's own home. Two wooden boxes were set on the floor with the openings facing one another and with room for the cat to roam in between. Dry food morsels or toys were placed alternately by the experimenter and owner through holes in the backs of the boxes to draw the cat in and keep the subject positioned in the center of the box before turning to leave the box. Cats were free to turn left or right when leaving the box. This method is drawn from the previous research in which subjects were placed in situations in which they could freely choose between left and right to accomplish some goal, such as escaping shock (Zimmerberg et al., 1974), obtaining food (Gengerelli, 1930), and following instructions (in the case of humans asked to walk toward the speaker that emits a tone as in Mead and Hampson, 1996). In the present study, subjects were not restrained, punished, or reinforced for turning. Two sets of turning trials were observed, with sets on two separate days to generate at least 16 measurable turns.

For each subject, the right-hand turn ratio (number of right turns divided by the total number of turns) was calculated, and thus results run on a continuum from 0 to 1.0, with 0 indicating all turns to the left, 1 indicating all turns to the right, and .5 indicating an equal number of turns to the left and right. As a separate calculation, each cat's results were

analyzed to determine if the number of turns in the preferred direction was significantly greater than that which would occur by chance.

Aims of the Present Study

This study aims were to:

1. Demonstrate a portable, noninvasive, and reliable method for assessing the rotational preference of the domestic cat. This method could be extended to other domestic animals, such as rodents, rabbits, dogs. The apparatus design would be the same, but may be scaled in size.

2. Replicate the finding in other species that rotational preference would vary within the sample, and that some subjects would demonstrate a rotational bias (number of turns in the preferred direction is significantly greater than the number of turns in the non-preferred direction, compared to a chance distribution, using a chi-square test).

3. Determine whether there is a relationship between rotational preference ratio and cat behavior as assessed by the experimenter and/or reported by owners. RP were compared to BAS scores calculated from the FTP and from the CBQ. These results could be compared to those from studies with humans.

4. Create an additional tool for the assessment of animal personality for placement into adoptive homes, likelihood to endure temporary boarding with low stress, use in pet assisted therapy situations, or for care and handling procedures in shelters and clinics.

5. Add to the literature on domestic cat personality and assessment, considering both BAS and BIS behaviors. Cats' actual reactions to strangers (the experimenter in the FTP) can be compared to behavioral reports filled out by owners (CBQ). This may reveal that a portion of owners report their cats' behavior with strange people accurately reflect the FTP results, while some may not. Also, this study may serve to demonstrate interrater reliability and validity for the CBQ.

Hypotheses

For the present study, it was hypothesized that:

1.   Rotational preference assessments would reveal a range of rotational preference ratios (proportion of right turns to total turns) across subjects. Studies with humans have demonstrated ranges up to 85% (Pusateri, 2007) and 90% (Abwender & Pusateri, 2005).

2.   There would be a subset of the sample demonstrating a left-turning bias, and another subset demonstrating a right-turning bias, as defined by chi-square tests between the number of turns in the preferred direction and the number of turns in the non-preferred direction. In Bracha, Seitz, et al. (1987), the number of turns in one direction exceeded the other by a statistically significant number for 39% of 135 participants. A similar result was expected in the current study.

3.   There would be a positive correlation between CBQ-derived BAS scores and FTP-derived BAS scores. There would also be a positive correlation between CBQ-derived BIS scores and FTP-derived BIS scores.

4.   Lower rotational preference ratios would be associated with higher FTP-derived BAS scores and higher CBQ-derived BAS scores (low turning ratios indicate a left-turning preference).

5.   Rotational preference ratios would be unrelated to both the FTP-derived BIS scores and the CBQ-derived BIS scores.

Method

Subjects and Participants

A total of 62 subject cats (*Felis silvestris catus)* took part in the study. Forty-two subjects were temperament tested and were rated by their owners on the Cat Behavior Questionnaire. These cats were referred to as primary subjects. Of the 42 primary subjects, 29 successfully completed two rotational preference sessions. The remaining (n=13) did not show interest in entering the boxes. Primary subjects were neutered, male, at least four years old, and had

lived with the owner for at least one year in the current home. Primary subjects were in good health and nonmedicated for at least three months. This ensured that disease would not be transmitted through the apparatus to other cats, and that medication would not alter rotational preference. All primary subjects were housed predominantly indoors. Those with a history of unprovoked aggression were ineligible.

In addition to the 42 primary cats, 20 secondary subjects were involved only in that an additional participant filled out Cat Behavior Questionnaires for them. Secondary subjects had lived with their CBQ raters for at least a year.

Of the 42 primary subjects, 30 were domestic shorthairs, 7 were domestic longhairs, 2 were known mixes, and 3 were full breeds. Primary subjects were an average of 7.1 years old (SD=3.3 years), neutered at age 5.9 years (SD=3.6 years), and weighed an average of 12.8 pounds (SD=2.8 pounds). Fourteen primary subjects were front declawed, and none were rear declawed. Primary subjects had lived with the current family for an average of 5.6 years (SD=3.5 years) and, including the current home, had lived in an average of 1.85 homes (SD=0.94 homes). Secondary subjects varied in age, sex, and neuter status.

Participants were cat owners who were at least 18 years old. Those who participated in the CBQ and the RP assessment are referred to as primary participants. Other adults who had lived in the home with the cat for at least one year were also invited to complete the Cat Behavior Questionnaire, and were referred to as secondary participants. In addition, if there was any other cat in the home with which two adults had lived for more than one year, both adults were asked to complete a Cat Behavior Questionnaire for this cat as well. Data on secondary subjects was collected only to be used in investigating the reliability of the Cat Behavior Questionnaire. All cats and humans were experimentally naïve.

Participants were solicited through convenience sampling. Flyers were posted around The College at Brockport campus, as well as at veterinary clinics, restaurants, and various stores

in the town of Brockport. The flyer briefly lists the activities involved, the compensation amount, and the subject requirements (see Appendix A).

Phone screening was performed according to a protocol to determine eligibility for those who responded to solicitation. The phone screen protocol and phone log are given in Appendices B1 and B2. After scheduling the first session, participants were sent reminder letters (see Appendix C).

The primary participant was compensated $20 at the end of each of two sessions. By signing the Consent Form for Primary Participants (see Appendix D), they indicated that they understood that they could stop the study at any time during either session. Participants were compensated for any session which was begun. Secondary participants (who only filled out the CBQ) signed the Consent Form for Secondary Participants (see Appendix E) and were not compensated.

After the debriefing at the end of Session 2, all participants were asked if they had any concerns about their cat's behavior. If so, they were advised to see their veterinarian, or to contact the local Humane Society. Due to several requests, a letter summarizing the study results was sent to all participants after data analysis was complete (see Appendix P).

Materials

Primary and secondary participants completed the Cat Behavior Questionnaire (CBQ, Michels, 2008a, see Appendix F), a new measure created for this study. Questions relate to the cat's typical behavior around the home, including with owners, strangers, and other cats. Note that the questionnaire in the appendix also includes a right hand column which denotes BAS and BIS; these were not included on the questionnaire that participants received. Although many items in this questionnaire are rooted in validated questionnaires (Adamelli et al., 2005; Feaver et al., 1986; Lee et al., 1983), the CBQ in its current form has not been validated.

All participants were interviewed and the experimenter recorded responses on a Background Questionnaire created for this study (Michels, 2008b, see Appendix G). The Background Questionnaire was used to gather supplemental information about the cat, other pets, people, and the physical household. Primary and secondary participants were asked to rate how familiar they were with each cat's day to day behaviors on a scale from 1 to 5, with 5 indicating they know their cat's daily routine well and can predict how he would react to most situations, and 1 indicating that they are not familiar with the cats routine and reactions at all. Cat Behavior Questionnaires were only collected from participants who chose a 4 or 5 for this question.

The Feline Temperament Profile (Lee et al., 1983) was used, with permission from the Delta Society. This assessment is comprised of 10 tests of the cat's reactivity to stimuli such as attempts to pet the cat, trying to interest the cat in play, and a sudden noise created by the experimenter. In addition to the original FTP, italicized supporting instructions were added for the current study to enhance objectivity (see Appendix I). Also, labels for BAS and BIS were added to the form. Items labeled *BAS* in the profile are worth 1 BAS point, and items denoted *BIS* are worth 1 BIS point. If items labeled *lowBAS* and *lowBIS* are checked, 1 point is subtracted from the BAS and BIS totals, respectively. Test 10 was administered with a slight variation. Rather than dropping a metal box on the floor (and possibly damaging the participant's property), a plastic box of coins was shaken to test the cat's noise reactivity. The original FTP instructions remained, but were marked with a strikethrough.

The FTP was validated by Siegford et al. (2003). In this study, 20 female domestic shorthair laboratory cats were rated using the FTP, and these results were compared to the results from three other tests. Interrater reliability of FTP scores was over 80%. There was a strong negative correlation between Acceptable (A) totals and Questionable (Q) totals ($r = -0.85$), indicating that the FTP can predict that a cat that displays many acceptable behaviors is likely to display few questionable behaviors, and vice versa. Each cat's four Acceptable

scores over a 20-month time frame remained statistically unchanged. A positive and significant correlation was found between the FTP scores and an alternate test in which interaction with caretakers was assessed. Also, positive and significant correlations were found between FTP scores and the proximity to both a strange man and a strange woman in an alternate test of behavior. In this same test, there was a positive correlation between the FTP Q scores and the amount of time spend in the corner of the room, and the number of cell crossings (designating amount of movement in room during the strange person test) was positively correlated with FTP A scores.

For the present study, only those FTP items designated BAS or BIS were considered. Items which are not labeled cannot be clearly attributed to either system. For example, under Test 3 is a Questionable item called "strikes hand, with paw or claws." This, and several other items throughout the profile, may represent defensive or offensive aggression. Defensive aggression would result from the Behavioral Inhibition System, a state of anxiety in which the animal chooses fight over flight. On the other hand, offensive aggression is associated with the Behavioral Approach System, through which the animal attempts to gain the reward of driving off the victim. Rather than attempting to discern between defensive and offensive behaviors, these items were recorded, but not used for scoring in the present study. Other items, such as "watches you but does not approach," are considered neutral, and therefore did not count toward BIS or BAS. For the remaining 51 labeled items, each BAS behavior was worth 1 BAS point, and each BIS behavior resulted in 1 BIS point. After all points were added, each cat had a BAS score and a BIS score from this assessment.

Other materials used during the FTP included a towel (requested from the participant, to be placed in experimenter's lap when cat is coaxed to jump in lap), 3 feet of curling ribbon, a half sheet of paper crumpled into a ball, and a small plastic box half filled with coins (to be shaken as a noisemaker). New curling ribbon and paper were used for each cat. All other

items brought into the home for the FTP were sanitized and kept free of animal scents before use in the next home.

Dry food, small dishes, and toys (without catnip) were provided by the participants for the RP assessment. A normal meal's amount was divided into two Ziploc® bags. A SONY Handycam® DCR-SR80 digital video recorder and a Sunpack 6200DX tripod was used to record both the FTP and RP assessments. This allowed the assessments to be scored by an independent rater at a later time. A Radio Shack® timer (model 63-878) was used for timing in both the RP and FTP assessments.

Apparatus

The turning apparatus consisted of two identical boxes, labeled Box A and Box B. The boxes, built for the purposes of this study, were 46 cm wide, 46 cm deep, 30 cm tall, and open in the front (see Figure 1). The construction was 3/8 inch plywood, painted with acrylic latex gloss paint; white on the outer surfaces and brown on the inner surfaces. The inner bottom surface of the box was lined with disposable brown paper, and a center line was drawn on the paper. In the center of the back of each box were two holes. A rectangular hole at the bottom was 7 cm wide by 3.5 cm high, and a circular hole had a 3 cm diameter, centered and 19 cm from the bottom of the box.

On the top of each turning box was a 30 cm by 18 cm Plexiglas® window centered and displaced 11 cm from the back of the box. This window let in light to allow the cat to see the food drawer and may have helped the cat to feel more comfortable entering. Windows also allowed the experimenter and video camera to see cats' behaviors in the box.

The apparatus was cleaned at a neutral site after each session. All surfaces of the boxes and windows were sprayed and wiped with a bleach solution (1 part bleach, 32 parts water), cleaned inside and out with soap and water, dried, and finally sprayed with one pump of Feliway®. Feliway® is a synthetic feline pheromone (by Ceva Santé Animale) which is

interpreted by cats as their own unique facial scent. This has been shown to have a calming effect on cats (Griffith, Steigerwald, & Buffington, 2000).

For rotational preference testing, Boxes A and B were positioned facing each other with their front edges 122 cm apart. The video camera was placed on a tripod at a height of 148 cm. The camera was positioned approximately 100 cm behind one of the boxes and aimed such that one box was at the bottom of the field of view and the other was at the top of the field of view.

Procedure

The Study Protocol is attached in Appendix J. At the end of the Study Protocol are Humane Endpoints that were developed to determine whether a session needed to be terminated due to subject distress.

Participants were asked to ensure that their cat had not eaten for 8-10 hours prior to the scheduled visit, for both Sessions 1 and 2. They were asked to place the cat alone in a room with a door and close the door prior to the experimenter's arrival. The experimenter called from outside the house upon arrival to ensure that the cat was confined. The experimenter wore clothing that had been laundered in a cat-free environment. She removed her shoes to avoid transmitting microorganisms from home to home, and to be sure that scents of other animals would not alter subjects' behavior.

All adults from the household who agreed to participate were provided Informed Consent (see Appendices D and E). Afterward, the experimenter briefly reiterated the three parts of the study (the CBQ and background questionnaires, a temperament test administered by the experimenter, and the rotational preference procedure). Participants were also reminded verbally that they could stop the study at any time without penalty.

Instructions for completing the CBQ were read from the study protocol and participants then completed the CBQ(s). If there was more than one participant filling out CBQs, they were instructed to not talk until after they had completed the questionnaire, and to not change

their responses after discussion. After participants completed the CBQ, the experimenter asked the participant(s) questions and filled out the Background Questionnaire (see Appendix G). Afterward, any secondary participants were told that they were done with their portion of the study.

Next, the primary participant filled out the Recent Food Consumption Questionnaire (see Appendix H) to be sure that the subject had not eaten in 8-10 hours before proceeding. If the cat had eaten within 8 hours, the session was rescheduled. If the cat had not eaten for at least 8 hours, the experimenter washed her hands and entered the room with the cat. The Feline Temperament Profile was performed according to the instructions in Appendix I. FTPs required approximately 20 minutes. If participants asked for the results of the Feline Temperament Profile, they were given a general description of their cat's behavior, such as "he was very friendly with me," or "he seemed pretty hesitant about approaching me." However, they were told that the final results cannot be shared with them because they have not yet been calculated. They were also told that a cat's behavior varies by situation and that this temperament test could not be used to predict future behavior.

Due to ethical and safety considerations, some of the FTP tests were skipped. For instance, if the cat forcefully struggled to escape when being picked up in Test 6, the experimenter did not attempt to handle the cat for Test 7. Also, if the cat demonstrated fearful behaviors to stimuli in Tests 1 through 9, Test 10 (sudden noise) was not performed. For each skipped test, one point was added to the cat's total BIS score.

The experimenter then exited the cat's room and read the rotational preference testing instructions to the participant. Both the experimenter and the primary participant then entered the room with the cat. After the boxes and video camera had been positioned, the owner and the experimenter each sat behind a box and alternated placing food or toys in the holes in the backs of the boxes. Food was dropped into a small bowl that was placed on the centerline in the box, or food was placed directly on the line. Toys, such as mice or curling ribbon, were

inserted into the holes and pulled back. The experimenter and the owner were allowed to speak to one another in a normal conversational tone, but did not speak to the cat. The experimenter stressed that the cat must be allowed to move freely, according to his own choices, and that patience might be required to wait for the cat to enter the boxes. Participants were made aware that the direction of their cat's turns was of interest, so that the importance of symmetry in the participants' actions could be stressed. However, the hypothesis about direction of turning was not shared until the debriefing.

The RP Data Collection Sheet, used by the experimenter during the RP assessment, is shown in Appendix K, along with a similar form for an independent rater to re-score from the video at a later time. Raters circled *L* for left turns, *R* for right turns, and *N* for any turn that was not clearly left or right. For instance, if a cat approached the box from a sharp angle, did not straighten out after entering the box, and turned in the biased (expected) direction, this was not counted as an acceptable turn (additional guidelines are given in the Rotational Preference Scoring Protocol, Appendix N). A timer was set for 30 minutes, designating the longest amount of time the cat would be confined to the room for rotational preference testing.

The primary participant was paid $20 for Session 1, asked to sign a receipt (see Appendix K), and then Session 2 was scheduled. Session 2 was scheduled for approximately one week later, a time frame used in previous RP studies (Bracha, Seitz, et al., 1987; Mead & Hampson, 1996; Zimmerberg et al., 1974).

In Session 2, after the participant completed the Recent Food Consumption Questionnaire (see Appendix H), a second rotational preference assessment was completed by the same experimenter and participant, using the same procedure. The only difference was that the experimenter and participant switched positions. Testing continued until a total of at least 12 acceptable turns had been made (including both sessions), or if 30 minutes had expired.

At the end of Session 2, primary participants were again compensated with $20, asked to sign a receipt, and the debriefing was read aloud to all participants. A copy of the debriefing (see Appendix O) was left with participants.

Results

Fifty-one primary subjects were assigned subject numbers and scheduled for Session 1. Eight subjects were dropped from the study. Two subjects (S27 and S50) were cancelled by participants after changing their minds about their cat's participation. Four subjects (S06, S29, S49, and S63) were dropped due to scheduling difficulties. Two were dropped due to procedural errors; lost data (S39) and subject not able to be confined (S06 and S52). None of the sessions were terminated due to subject distress (i.e., the Humane Endpoints were not reached).

Raw scores from the Cat Behavior Questionnaire, the Feline Temperament Profile, and the Rotational Preference assessment are given in Table 1 for all primary subjects.

Cat Behavior Questionnaire

The results from the Cat Behavior Questionnaire (CBQ) were analyzed first. Data from all cases in which primary or secondary subjects were rated by two participants were used in calculating interrater reliability for each of the questionnaire's items. Fourteen of the 16 items had large or medium correlations (according to Cohen, 1988) and were therefore retained for further analysis (the correlations are given in Table 2). A single set of CBQ scores was created for each primary subject by taking the average of the two raters' scores.

After removing the data from questions 6 and 8, the possible range of BAS scores was 0 to 39, and the possible range of BIS scores was 0 to 45. Missing responses were accounted for by multiplying each subject's BAS total by the ratio of the total number of BAS points to the addressed number of BAS points. For the CBQ, the mean raw BAS score was 20.3 (SD=5.91) and the mean raw BIS score was 7.63 (SD=4.55).

Feline Temperament Profile

Sixty-two percent of the primary subjects completed all 10 FTP tests. The average number of tests skipped was 1.62 (SD=2.48).

The digital video files for the Feline Temperament Profiles (FTP) were viewed and scored independently by a trained undergraduate research assistant. The scoring sheet was identical to that used by the experimenter (Appendix I). The FTP scoring protocol given in Appendix M was used as a guide by the research assistant.

Of the 51 possible cat behaviors, 47 were observed by the experimenter or the research assistant. The 4 behaviors never observed were in Test 7 ("rolls over [in lap]" and "sits tensely on lap") and Test 10 ("does not appear to hear noise," and "startles, then runs to hide"). Additional behaviors in the FTP (which were coded but not used in this study for BAS and BIS calculations) were in Test 3 ("threatens to strike hand, bites or attempts to bite hand," and "strikes hand, with paw or claws"), Test 4 ("assumes a threatening or defensive position," and "attempts to strike or strikes with paw"), in Test 9 ("attempts to strike hand" and "growls or hisses"), and in Test 10 ("startles, then adopts a defensive or aggressive posture"). This list of 10 behaviors not observed in the current study is similar to the list of 9 behaviors that did not occur in the FTP study by Seigford et al., 2003, including the fact that all but one of the nonoccurring behaviors was considered an acceptable behavior ("jumps up into lap" in the prior study, and "rolls over [in lap]" in the present study).

Interrater reliability (IRR) for the FTP was calculated for each subject by dividing the number of behaviors agreed upon by the experimenter and the research assistant by the 47 total BAS/BIS behaviors which were observed in the primary cats. The average IRR for the FTP was 91% with a range from 77-100%, indicating high interrater reliability.

For cases in which the two raters disagreed on the item (one scored a 1 and the other scored a 0), the value used was 0.5. After removing the 4 unobserved behaviors, the range of

possible BAS scores from the FTP was -6 to 29, and the range of possible BIS scores from the FTP was -1 to 11.

The mean raw BAS score was 10.5 (SD=6.82) and the mean raw BIS score was 3.33 (SD=3.03).

Rotational Preference Assessments

Next, the video files for the Rotational Preference (RP) Assessments were viewed and scored independently by a trained research assistant. The recording form and scoring protocol used are given in Appendices K and N, respectively.

Interrater reliability (IRR) for the RP assessment was then calculated. For this procedure, just over 50% (n=15) of the 29 subjects were selected at random, which is typical in behavioral observations with animals (Hillyer & Joynes, 2009). Both the experimenter and research assistant listed the video times when the cat broke the invisible plane of the front of the box. The video times for these cats were entered into SPSS, including both the experimenter's and the research assistant's data in case any turns were missed. Both the experimenter and research assistant then independently entered L for left turns, R for right turns, or N for no turn/disqualified. Cohen's Kappa was used as a measure of interrater reliability for this categorical data (Landis & Koch, 1977). For the 414 observations, Kappa was .604, falling on the transition from *moderate* to *substantial* reliability (Landis & Koch, 1977).

In addition, the correlation between RP ratios (number of right turns divided by total number of turns) for the 15 subjects in the interrater reliability exercise was calculated. RP ratios were strongly correlated between the experimenter and the research assistant, r = .91, p < .001.

For all 29 subjects that completed two RP assessments, the mean number of acceptable turns emitted was 23 (SD=8.95). The lowest RP was .12, indicating mostly left turns, and the highest was 1.0, indicating all right turns. This range of rotational preference ratios supports

Hypothesis 1, covering 88% of the possible range. According to chi-square goodness of fit tests ($p < .05$), 6 subjects (21%) had a significant left-turning bias, and 2 subjects (7%) had a significant right-turning bias, supporting Hypothesis 2. The remaining 21 subjects demonstrated left- or right-turning preferences, but the number of turns in the preferred direction was not significantly greater than the number of turns in the nonpreferred direction.

Relationships Between BAS, BIS, and RP

Bivariate Pearson correlations were calculated between the BAS scores derived from the FTP (BAS_{FTP}), and the BAS scores derived from the CBQ (BAS_{CBQ}) for all 42 primary cats, and similarly for BIS scores derived from the FTP and the CBQ (BIS_{FTP} and BIS_{CBQ}, respectively). As expected (supporting Hypothesis 3), in both cases, there were significant correlations between the two measures ($r = .586$, $p < .001$ for BAS, and $r = .470$, $p = .002$ for BIS). Therefore, the two measures of BAS were collapsed into one by converting all BAS scores to z scores, and then taking the average of the two z scores. For instance, if a subject's BAS z score was -1.1 from the FTP and -1.3 from the CBQ, then the total BAS score (BAS_{TOT}) would be -1.2. BIS scores from the two measures were similarly collapsed into one BIS_{TOT} value reflecting the average z score from the two measures.

The relationship between BAS and RP (Hypothesis 4) was found to be significant, the bivariate correlation between BAS_{TOT} and RP being $r = -.591$, $p = .001$. [Feline Temperament profile BAS scores were somewhat better predictors of RP ($r = -.645$, $p < .001$) than the CBQ scores ($r = -.410$, $p = .008$)]. For Hypothesis 5, it was predicted that BIS scores would be unrelated to RP, but a strong positive correlation was found between BIS_{TOT} and RP ($r = .697$, $p < .001$). [FTP and CBQ BIS scores were roughly equal predictors of RP ($r = .550$, $p < .001$, and $r = .529$, $p < .001$), respectively].

We looked at the BAS and BIS scores for the 8 cats who demonstrated biased rotational preferences (6 cats to the left, and 2 cats to the right). The data in Table 3 show that on average, left-turning cats had roughly twice the BAS scores of right-turning cats (19.2 versus

10.7), while left-turning cats had half the BIS scores of right-turning cats (3.2 versus 6.7). The difference in BIS scores is statistically significant (t = 4.400, p = .007). Because of the small numbers of subjects and uneven number of subjects in this comparison, a statistical analysis could not be performed for the BAS scores. We also looked at scores on the specific items in the CBQ and the FTP. In the CBQ, cats with a left-turning bias were more likely to score high in Question 2 (length of time petting is tolerated) than other primary cats. Cats with a right-turning bias were more likely to score low in CBQ Questions 14 and 16 (poor adjustment to move, and low level of "pushing to get what he wants") than other primary cats. In the FTP, behaviors that most distinguished left- from right-turners were as follows:

Test 1, approaches experimenter (left-turners),

Test 2, watches, but does not approach experimenter (left-turners),

Test 4, bumps head against experimenter while being petted (left-turners),

Test 4, circles around experimenter attentively while being petted (left-turners),

Test 4, withdraws from experimenter when attempts to pet (right-turners),

Test 6, relaxes when picked up by experimenter (left-turners), and

Test 7, purrs or rubs hand when in experimenter's lap (left-turners).

Since BAS was found to be negatively related to RP and BIS was found to be positively correlated with RP, the correlation between BAS_{TOT} and BIS_{TOT} was determined, and the result was strong (r = -.755, p < .001). See Table 4 for the relationships between BAS and BIS for various subsets of subjects and from the CBQ and FTP separately.

Discussion

All but one of the five hypotheses for this study were supported.

Rotational Preference. Rotational preference assessments revealed a large range of rotational preference ratios across subjects (Hypothesis 1). Additionally, a subset of the sample demonstrated a left-turning bias, and another demonstrated a right-turning bias (Hypothesis 2). These results were expected based on previous rotational preference

performed with humans, rodents, and cats, particularly those by Abwender and Pusateri (2005), Bracha, Seitz, et al. (1987), and Glick et al. (1981).

In planning the current study, there was a question about whether reinforcement received by the cats (food or toys) would affect dopamine activity and thus the direction of rotation. For example, consider a left-turning cat that becomes aware of the opportunity for reward. Given the dopamine theory (Abwender & Pusateri, 2005), this cat will have a low tonic level of dopamine activity in the left hemisphere, but it will surge in the left frontal cortex upon becoming aware of the reward opportunity. If dopamine were also to surge in the basal ganglia area, the cat may temporarily turn to the right. The current results indicate that this phasic burst of dopamine activity does not interfere with rotational movement, although it is not clear whether this is because the burst is shortlived, or because the basal ganglia are not affected by this phasic burst.

Cat Behavior Questionnaire. Analyses for Hypothesis 3 demonstrated that BAS and BIS scores from the owner-report Cat Behavior Questionnaire were well correlated with the experimenter-administered Feline Temperament Profile BAS and BIS scores, respectively. This implies that either the CBQ or the FTP assessment may be used to measure a cat's BAS and BIS sensitivities. Good correlation between the un-validated CBQ and the validated FTP indicates concurrent validity for the CBQ. For those who use the FTP for assessing cats for animal-assisted therapy, the CBQ may be requested from the owner as an initial screen before scheduling a temperament test with a trained administrator.

Given the consistency of the current and previous results, a comparison of the types of behaviors featured in the CBQ and FTP with those in measures of human BAS, such as the BIS/BAS scales (Carver & White, 1994), may be useful in further understanding of the human BAS. For example, cats received BAS points for chasing toys, initiating contact with the experimenter, and showing interest in exploring the outdoors. Analogous behaviors in

humans, such as playing sports, initiating contact with other humans, and travel, may be considered indicative of the behavioral activation system.

These results may also be of benefit to the understanding of cat behavior, which could potentially lead to better methods of addressing behavior problems experienced by owners. A new understanding of cat behavior may be of help in reducing the alarming rates of pet relinquishment and euthanasia. Though 3-4 million cats and dogs are adopted from shelters each year, 3-4 million more are euthanized (Humane Society of the United States, 2008). Among the top ten reasons for relinquishment of cats to shelters are *too many*, *housesoiling*, and *doesn't get along with other pets*, which all relate to a misunderstanding about the territorial nature of certain cats (National Council on Pet Population Study and Policy, 2008). In a study of cat to cat aggression, authors conclude that "a reliable temperament test might allow veterinarians to assess an individual kitten's degree of defensiveness and its suitability for living within a multi-cat household" (Lindell, Erb, & Houpt, 1997, p. 160).

Rotational Preference and BAS. The strong negative relationship between RP and BAS (Hypothesis 4) directly supports the human study by Abwender and Pusateri (2005), in which $r = -.60$, $p = .002$. It can be hypothesized that the same neural structures and neurotransmitters are responsible for this phenomenon in cats as in humans. That is, structures in the basal ganglia are responsible for rotational activity, the prefrontal cortex is responsible for registering signals of opportunity for reward, and dopamine is an active neurotransmitter in both processes. Asymmetric dopamine activity accounts for differences in turning preferences and reward sensitivity. If this explanation is accurate, then the current finding also supports the behaviors selected for measuring BAS in the cats.

This relationship between turning behavior and approach and avoidance behaviors could lead to additional methods of assessing temperament type, which could be useful for animal-assisted therapy, matching pets for adoption, or determining the level of care needed for animals in shelters and clinics. Candidates for animal-assisted therapy are tolerant of

environmental changes, sociable with people, and calm when handled. According to the present study, these cats would score high in BAS and would rotate to the left. Many prospective adopters would prefer these same temperament characteristics in a pet. However, those interested in a more independent cat (for instance, one that would not constantly demand their attention), or those interested in adopting a cat that may be less attractive to other adopters, may prefer to adopt a low BAS, right-turning cat.

BIS Relationships. The final hypothesis for this study (Hypothesis 5) was not supported. A strong correlation was found between RP and BIS, while there is no corresponding proposed neurological explanation. Likewise, the strong negative relationship between BAS and BIS measured in cats was unexpected, inasmuch as Gray's theory deems these systems as orthogonal (Gray, 1991). Four possible explanations for these findings are proposed.

First, there may be a relationship between RP and BIS that has not been detected or hypothesized in previous studies. For example, approach emotions elicited EEG activity in the left frontal hemisphere while withdrawal emotions elicited activity in the right frontal hemisphere in the human study by Coan et al. (2001). If this was *dopamine* activity, then one might suspect that those prone to negative/anxious affect would turn to the right in the same way it is suspected that those prone to positive affect turn to the left. However, this is most likely serotonin or noradrenaline activity (Gray, 1991). Supporting this is the weak ($r = -.057$) and insignificant relationship between BIS and RP found in 89 college-aged participants by Abwender and Pusateri (2005).

Second, the unexpected findings may be due to limitations in the present study. BAS and BIS scores may not fully reflect the concepts defined by Gray's theory. Although several items in the CBQ were strongly influenced by the BIS/BAS scales (Carver & White, 1994), it was not possible to adapt all items for cats. For instance, BAS items in the subcategory Reward Responsiveness, such as "It would excite me to win a contest," and "When I get something I want, I feel excited and energized" are not readily accessible from behavioral

observations. The other assessment of BAS and BIS in the present study (the FTP, Lee et al., 1983) was created to be unidimensional, rating cats on a scale of appropriateness for use in animal-assisted therapy. This may have contributed to the unidimensional results in the current study. Finally, the way in which animal behavior is perceived by the humans (including those who created and administered the FTP assessment, and the owners who responded in the CBQ) may be simplified, placing cat behavior on a single variable scale. For instance, cats may be thought of as on a continuum from friendly to fearful, while other dimensions are unrecognized or ignored.

Third, Gray's theory of BIS/BAS orthogonality may be called into question. Many studies support the four-factor model (created by all combinations of high and low BAS and BIS), including Carver and White (1994), and Jorm et al. (1998). Further, Abwender and Pusateri (2005) found a weak (r = .17) and insignificant relationship between BAS and BIS in their 89 college-aged participants. However, all of these studies used the self-report BIS/BAS scales (Carver & White, 1994) to measure BAS and BIS sensitivity.

Other studies, which have used measures other than the BIS/BAS scales (Carver & White, 1994), have not supported the orthogonality of the BAS and the BIS. The Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ, Torrubia, Ávila, Moltó, & Caseras, 2001), a longer self-report questionnaire which has also been accepted as a measure of BAS and BIS, was evaluated by O'Connor, Colder, and Hawk (2004). Several factor analytic methods suggested only mixed support for two orthogonal scales. Further, in contrast to Gray's separable subsystems hypothesis, Corr (2002) posits a *joint subsystems hypothesis*, in which an individual's BIS sensitivity affects reactions to rewarding stimuli, and their BAS sensitivity affects reactions to potential punishers. The existence of these "cross terms" was demonstrated by Corr (2002) through behavioral measurements (startle response to slides depicting pleasant, neutral, and unpleasant scenes in one experiment, and number of errors in

a computer task in which positive or negative feedback for performance was given in a second experiment).

Despite the fact that these studies do not support orthogonality of BAS and BIS, they certainly do not suggest the nearly unidimensional findings of the present study. A final interpretation is that, although Gray's theory addresses the "mammalian CNS" (Gray, 1991), the current study suggests that the BAS and BIS processes may not function in the same way for cats as they do for humans. Our study may be the first to attempt to comprehensively measure BAS and BIS in a large number of nonhuman animals. There is little dispute that "older" brain structures (such as the substantia nigra and the hypothalamus) function similarly in cats and humans (Beaver, 2003; Bekoff, 2007). Due to rodent studies, it is clear that asymmetric dopamine activity in these areas is associated with directional rotation (Glick et al., 1994; Zimmerberg et al., 1974). However, due to differences in the frontal and other cortical structures, the way in which BAS and BIS are expressed in behaviors may differ between humans and nonhumans. For instance, executive planning in humans may serve to inhibit BAS behaviors ("I'd love to go do that, but I may not have enough in my bank account"), or BIS behaviors ("I feel afraid, but this will be a good opportunity for me"). Further we simply may be unable to detect complex specific emotions in nonhuman animals (Bekoff, 2007), it is likely that humans experience a wider range of emotions and this may account for more complex array of approach and avoidance behaviors. For example, cats may lack emotions such as guilt, shame, and embarrassment, which may play a large part in humans' responses to stimuli that evoke these emotions.

An additional difference between cats and humans is their social nature. Although after thousands of years of domestication, the domestic cat does demonstrate bonding with other cats and also human family members, their wild ancestors (*Felis silvestris silvestris* and *Felis silvestris libyca*) are strictly solitary animals (Beaver, 2003), leaving pet cats in a gray area between social and asocial. In a study of intercat aggression, researchers suggested that "this

increasingly social domestic cat may not have had sufficient time to develop a complex means of communication through subtle gestures" (Lindell et al., 1997, p. 160). Many BAS and BIS questionnaire items, such as those that relate to criticism and praise, can only be interpreted with a social perspective. Therefore, the notions of the BAS and the BIS may be less complex when considered in less than fully social animals.

The current unidimensional finding does support the study by zoologists Meier and Turner (1985) in which they found "evidence of two personality types" in the domestic cat. They termed the limits of this scale *shy* and *trusting*. It may be that these terms are synonymous with the high BIS/low BAS and high BAS/Low BIS categories, respectively.

Further study may involve a closer look at the structures and functioning of the dopamine pathways that make up the BAS, and the serotonin/noradrenaline pathways that make up the BIS, as described by Gray (1991), comparing those of the domestic cat to those of the human. Of particular importance would be those structures that are directly involved in emotion, such as the hippocampus, the hypothalamus, and the cingulate cortex (Gray, 1991). This interspecies comparison may explain the unidimensional personality range found in the present study. Another extension of this study of pets would be to examine BAS, BIS, and RP in the domestic dog (*canis familiaris*). Owners of pet dogs as well as temperament testing can provide BAS and BIS information, as in the current study. The rotational preference testing procedure could be modified to take advantage of many dogs' willingness to respond to commands. Further, the social nature of the domestic dog may provide additional behaviors (not found in the domestic cat) that lend insight into the relationship between BAS and BIS. Finally, given that the BAS has been closely linked to rotational preference in the current and previous studies (Abwender & Pusateri, 2005), and that dopamine levels within the rat brain change upon forced rotation (Yamamoto & Freed, 1982), further study may investigate the effect of forced rotation on humans. It is possible that rotation to the left may increase BAS sensitivity and/or decrease learned helplessness, at least in the short term.

The evaluation of rotational preference may provide a noninvasive and objective method of assessing brain activity as well as personality. In the present study, several similarities and differences were found between humans and cats in both rotational preference and in their BAS and BIS levels. As a comparative study, insight into both RP and Gray's BIS/BAS model is provided. In particular, given that depression features anhedonia, which is similar to low BAS, and anxiety is associated with high BIS, these findings may be of use in the understanding of both mood and anxiety disorders.

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Table 1

Raw Data

	Cat Behavior Questionnaire		Feline Temperament Profile		
Subject	BAS score	BIS score	BAS score	BIS score	RP Ratio[a]
1	23.3	1.9	16.0	1.0	0.4
3	11.7	7.6	6.5	6.0	
5	15.0	11.0	-1.0	7.0	
7	14.5	13.1	2.0	9.0	
9	24.8	4.0	19.5	0.0	0.18
11	29.1	0.6	19.0	0.5	0.33
13	14.0	17.4	2.5	8.5	
14	26.4	2.1	15.5	2.0	
16	26.0	6.7	22.5	0.0	0.21
18	21.0	12.0	4.5	4.5	0.83
19	22.0	8.0	12.0	0.5	0.63
20	16.2	5.0	17.0	0.5	
21	19.5	8.0	-1.5	9.5	
23	16.0	12.3	-0.5	1.5	
24	18.9	7.6	6.0	2.5	0.35
25	33.4	5.0	17.5	0.0	0.27
30	17.6	5.4	17.0	0.0	0.28
31	17.4	12.7	13.0	2.5	0.71
32	11.5	0.2	14.0	3.5	0.5
34	18.3	4.3	8.5	1.0	0.44
35	21.0	14.0	11.3	1.5	
36	14.0	6.5	6.5	9.0	1
38	21.0	3.5	6.0	4.0	
40	30.0	2.0	13.0	3.0	0.24
42	19.4	17.0	13.8	3.5	
44	12.3	17.3	-2.0	10.5	
46	21.0	4.7	16.5	2.0	0.21
48	13.0	13.0	3.0	5.5	
54	24.0	10.5	10.5	4.0	0.58
56	32.0	8.2	17.0	2.5	0.32
58	20.2	5.2	2.0	10.0	0.41
60	19.4	13.1	3.5	5.5	0.74
61	18.0	7.0	13.0	2.5	0.19
65	19.5	7.3	18.5	0.0	0.12

Table 1. (Continued)

Raw Data

66	12.5	8.5	10.5	3.0	0.63
68	14.5	8.1	10.5	3.0	0.58
70	17.9	9.8	4.0	1.5	0.76
72	25.5	3.5	17.5	2.0	0.48
74	33.0	2.0	18.5	1.0	0.38
75	28.5	5.5	15.0	2.0	0.5
77	21.5	5.5	18.5	2.5	0.5
79	19.0	3.6	14.5	1.5	0.25

[a]Rotational Preference Ratio = number of right turns divided by total number of turns

Table 2.

Interrater Reliability for the 16 Questions in the Cat Behavior Questionnaire

Question Number and Topic	Number of Rating Pairs	Correlation Coefficient (r)
14. Adjustment to move	n = 11	.90 (large)**
7. Approach visitor for petting	n = 49	.77 (large)**
13. Movement: tense or free	n = 48	.73 (large)**
4. Behavior at veterinary clinic	n = 27	.71 (large)**
09. Time spent around people	n = 49	.65 (large)**
15. Behavior when picked up	n = 49	.63 (large)**
02. How long cat accepts petting	n = 49	.56 (large)**
05. Reactivity to sudden noise	n = 49	.54 (large)**
03. Petting locations	n = 49	.51 (large)**
12. Cat's proximity to rater	n = 48	.51 (large)**
11. Dominates other cats	n = 46	.51 (large)**
10. Fearful of other cats	n = 46	.49 (medium)**
01. Reaction to open door to outside	n = 33	.45 (medium)*
16. Bossy behaviors toward owners	n = 48	.38 (medium)*
06. Frequency of piloerection[a]	n = 46	.23 (small)
08. Approach visitor aggressively[b]	n = 49	-.03 (insubstantial)

[a]This question did not generate sufficient range (78% of responders chose a rating of 1 or 2).

[b]This question did not generate sufficient range (98% of responders chose the lowest rating of 1).

* $p < .01$. ** $p < .001$.

Table 3.

BAS and BIS Score Summary for Cats with Significant Turning Biases

Subject	RP bias	CBQ		FTP			Avg BAS	Avg BIS
		BAS	BIS	BAS	BIS			
S9	left	24.8	4.0	19.5	0.0		22.2	2.0
S16	left	26.0	6.7	22.5	0.0		24.2	3.4
S30	left	17.6	5.4	17.0	0.0		17.3	2.7
S61	left	18.0	7.0	13.0	2.5		15.5	4.8
S65	left	19.5	7.3	18.5	0.0		19.0	3.6
S79	left	19.0	3.6	14.5	1.5		16.8	2.6
						Avg	**19.2**	**3.2**
S36	right	14.0	6.5	7.0	9.0		10.5	7.7
S70	right	17.9	9.8	4.0	1.5		11.0	5.6
						Avg	**10.7**	**6.7**

Table 4.

Summary of BIS and BAS Correlations

Subjects	Source	Correlation Coefficient	Level of Significance
Primary Cats			
29 Turners	CBQ	r = -.283	*p* = .13
	FTP	r = -.704	*p* < .001
13 Non-Turners	CBQ	r = -.502	*p* <<.0005
	FTP	r = -.741	*p* < .02
Total (N=42)	CBQ	r = -.590	*p* < .0005
	FTP	r = -.804	*p* <<.0005
	Avg CBQ/FTP	r = -.755	*p* < .001
Secondary Cats			
14 females	CBQ	r = -.702	*p* < .005
6 males	CBQ	r = -.894	*p* < .002
Total (N=20)	CBQ	r = -.705	*p* < .001
All Subjects			
(N=62)	CBQ	r = -.749	*p* < .0001
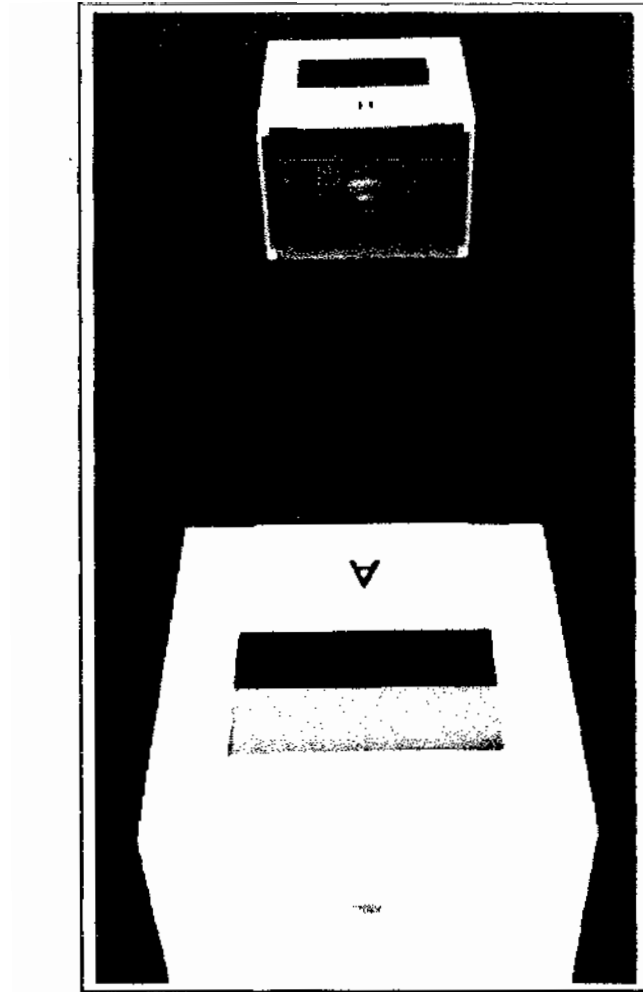
Figure 1. Rotational preference apparatus. The two boxes are shown set 122 cm apart. The circular hole can be seen in the back of Box A, and the rectangular hole can be seen in the back of Box B. A cat dish is shown on the centerline in Box B. Dishes were repositioned to the back of the box as soon as cats showed interest in eating from the dish.

Got a Cat?
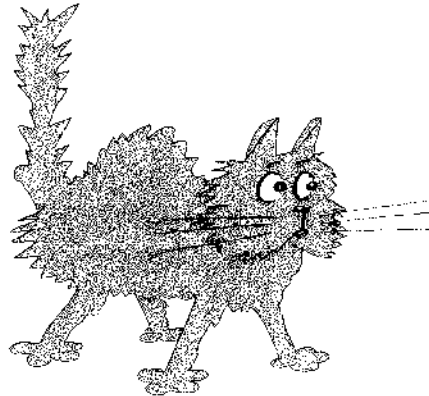
You can help us study cat behavior, and
earn $40 for participating!

You will be asked to fill out a questionnaire about your
cat's behavior, your cat will be temperament tested,
and we will play a game with your cat.

Cats must be neutered and healthy males,
ages 4 and up. Participants must be 18 and over.

Outgoing, shy, and moody cats all welcome!

The College at
BROCKPORT
State University of New York

**For more information, contact
Dr. Forzano's lab
In the Department of Psychology
at the number below**

| Cat Study 395-5428 | Cat Study 395-5428 | Cat Study 395-5428 | Cat Study 395-5428 | Cat Study 395-5428 | Cat Study 395-5428 | Cat Study 395-5428 | Cat Study 395-5428 | Cat Study 395-5428 | Cat Study 395-5428 | Cat Study 395-5428 | Cat Study 395-5428 |

Phone Screening Protocol
Rotational Preference and Personality in the Domestic Cat

Items to be entered on the Phone Log are underlined.

1. First, enter the caller's <u>name</u> and <u>phone number</u> on the phone log.

   "Hi, may I speak with _____?"
   If not able to take call: "I'm returning her/his call about our Cat Study." Ask when would be a good time to call back.

   "My name is ___ _____ and I'm a research assistant in the Psychology Department at the College at Brockport. I'm returning your call about our Cat Study. If you are still interested, I can ask you some questions and then give you some more information. OK?"
   If No- "OK, thanks anyway. Have a good day."

2. "Have you ever participated in a research study with animals?" Write answer by <u>Naïve</u>
   If Yes- "OK, thanks anyway. Have a good day."

3. If No, "Are you at least <u>18 years old</u>?"
   If no- "I'm sorry, this study is for adults only. Thanks for calling and have a good day." Note- okay if they will be 18 summer 2009!

   If Yes, "OK, Do you have a male cat who is 4 years or older?"
   If No- "I'm sorry, we are only looking for adult males right now. Thanks for calling and have a good day."

4. "What is his <u>Name</u>?"
   "OK, and <u>how old</u> is he? (best approximate age is fine)

5. Is he <u>neutered</u>/fixed? (If they don't know, ask if he has noticeable testicles)
   If No, "We are only looking for neutered males. Thanks for calling and have a good day."

6. If Yes, "Has he lived with you for at least <u>one year</u>?"
   If No, "I'm sorry, we are looking for cats who have been with the same owner for at least a year. Thanks for calling and have a good day."

7. If Yes, "Do you keep his <u>Indoors</u> predominantly?"
   If No, ask about how often he goes out. If it is supervised, that's okay. If he wanders freely, that's NOT okay. No more than 2 hours a day.

   If No- "I'm sorry, we are only looking for indoor cats. Thanks for calling, and have a good day."

8. If Yes, "Does he eat <u>dry food</u>?"
   If no, "I'm sorry, part of the study involves cats eating dry food, so this study is not right for him. Thanks for calling, and have a good day."

   If Yes, "OK, great. Now I need to ask some questions about his health. Does he have any chronic conditions? Let me list some of the commons ones: FIV, Feline leukemia, diabetes, hyper- or hypothyroidism, kidney/renal failure, seizures, or cognitive dysfunction."

9A. If Yes, write down the condition under <u>Healthy</u> and ask a little more. For most cases, "I'm sorry, but we need to be sure cats are healthy for this study. Thanks for calling, and have a good day/night."

9B. Would you be able to show proof of <u>rabies</u> vaccination? You can do this by showing us any record from your veterinarian in the last 3 years.

If No, ask if they can call their veterinarian and have a rabies record sent to them, or ask the vet to release information to Jennifer Michels. (Get vet name and address if so).

If still No, say, "I'm sorry, it's important that we know your cat has been vaccinated for rabies just in case we get bit during the study. Thanks for calling, and have a good day/night."

If Yes, say "We'd appreciate it if you could have that information available when we arrive. This is because in the unlikely even that an experimenter is bit, we can avoid the involvement of the Public Health Department. Do you have any questions about that?"

If so, tell them that "the health department may be called by a medical professional if the experimenter seeks medical attention. The health department would require that the cat is quarantined (kept separate from people and animals) for 10 days. At the end of the 10 days, the health department visits to make sure that he is healthy. OK?"

10. "Has _____ been on any <u>medications</u> for in the last 3 months?"
If yes, "Okay, what medication?" write down the name, and say, "I'm sorry, but it is important that the cats we assess are not on medication. Thanks for calling, and have a good day/night."

11. If No, "Okay. Has ___(a)=cat's name____ every bitten or scratched a person to the point of bleeding without being provoked? Let me give you a few examples- if a cat was cornered by a child, or a stranger approached the cat quickly, or the cat was agitated due to a fight with another cat, he or she might bite or scratch, and these would be considered provoked incidents. If aggression is unprovoked, it happens for no known reason...., such as attacking a person who did nothing to the cat and is walking away from the cat. Has something like this every happened?"

Write answer by <u>SAFE</u>.

If yes, "We need to be sure that all people and cats stay safe. This study isn't right for your cat. Thank you for calling and have a nice day."

If no, "Okay. Do you think you would have any trouble withholding food from ___(a)__ for 8-10 hours before we arrive?"
If yes, explain that the Cornell Feline Health Center recommend feeding healthy adult cats once or twice a day, so 8-10 hours without food is not unhealthy. It is very important for our study that the cat is hungry so we can use food to interest him. He will eat a full meal soon after we arrive.

If no, "Okay. We still need you to place ___(a)___ in a room with the door closed a few minutes before we arrive. This will ensure that he will be available for the assessments. Does this sound okay?"

"How large is the room? We will need about a space about 14 feet of open floor space to do the assessments. Will that work?"

If no…discuss other options. It must be a place that a door can be closed and no other animals and people can get to.

"OK, let me tell you a little about the study. First, we will ask you to fill out a questionnaire about your cat's behavior, and then we will ask some other questions about your cat (like when you adopted him and what breed he is) and then we will do two simple, non-invasive assessments on your cat. One you will be involved in and it will be no more than 30 minutes. The other is a temperament test that the researcher will perform with your cat alone (this will take 20 minutes). We will give you more detail about exactly what we need to do when we arrive. You have the right to ask us to stop at any time, with no penalty."

"Does this sound okay?" *(If they have more questions, you may explain the FTP and/or the rotational assessment in more detail. Just do not reveal that we will be comparing CBQ results.)*

"We will need to meet for about an hour on two different days about a week apart. Does this sound possible?"

12. "Is there another adult who has lived with ____(a)___ for at least a year and may want to participate by filling out a questionnaire? They should be familiar with his day to day behavior." Write down first names of <u>Participants B</u>, <u>C</u>…

If yes, "What about other cats? We may ask you both to fill out a questionnaire for them, too. Would that be okay?" (Write down names under <u>cat (b),</u> <u>cat (c)</u>). They need not meet primary cat requirements (4 yo NM, etc.).

13. "Will you be able to confine other pets and children while we work with ___(a)____?

If no-- discuss the particular cats, dogs, children involved. It is important that cat (a) is not disturbed during the assessments. For example, loud noises, other animals scratching at the door, etc. Determine if this will be possible. Be creative.

"Okay, great. Let me explain how the compensation will work:

You will receive $20 for each of the two sessions. So, for example, at the end of Session 1, we will pay you $20. If you do not agree to proceed with Session 2, or we decide it is not appropriate to continue (say your cat is afraid of our experimenter), then you will not receive the additional $20 for Session 2. But you can keep the money for the first session. Does that sound okay?"

If OK,

"We will need about 90 minutes for the first session, and 30 minutes for Session 2. Would you like to go ahead and schedule the first session?"

Set schedule- keep in mind Participant B's availability. Write <u>Date & time</u> on phone log.
Figure out when food must be put away: 8 to 10 hours before session starts. Adjust session date and time as needed.

So, on (day), (date), you can put all food away at _____ am/pm?
Water is okay.

"Okay. A couple more things. We will need you to have a meal's worth of dry food separated into 2 containers when we arrive. Also, we will need a towel handy. Okay?"

"Great. You will receive a reminder letter in a few days. It will have the instructions and has our phone number if you need to reach us for any reason."

14. Can I have your <u>address</u> please?

"Thanks so much, and we'll see you then."

---

15. Assign cat (a) the next available subject number, and any other cats (b,c) the next consecutive subject numbers. Assign participants A, B, etc. the next available participant numbers. Write all numbers on phone log next to names like this: S12, P8, etc..

16. Notify the experimenter of the Session 1 date and time.

17. Fill out and mail a Reminder Letter to the participant.

- If owner has two cats who meet the requirements, ask them which one they would like to participate. If they cannot decide, tell them you are going to flip a coin, designate who is heads, who is tails, and write down the name of the cat who wins. Do not take into account any behavioral descriptions.

- If there are behavioral concerns (such as unprovoked aggression), suggest that they call the Humane Society at Lollypop Farm free Behavior Helpline, at 295-2999. They may be able to help you keep everyone safe.

- If there are medical concerns, suggest that they contact a veterinarian.

Phone Log for Cat Study

1. Name (Participant A)	*Jennifer Michels (P1)*			
Phone Number				
2. Naïve?	*yes*			
3. 18 yo?	*yes*			
4. Cat (a) name	*Jonah (S1)*			
Cat's Age	*8 yo*			
5. Neutered male?	*yes*			
6. Lived together 1 yr	*yes*			
7. Indoor	*yes*			
8. Dry Food	*yes*			
9A. Healthy? 9B. Rabies Vax?	*yes* *yes*			
10. Meds?	*no*			
11. Safe?	*yes*			
12. Other Partic's (B, C)	*Greg (P2)*			
other cat names (b,c)	*Tabitha (S2)*			
13. Date & time Session 1	*6/11/2009, 6 pm*			
Time to remove food	*10:00 AM*			
14. Address & zip code				
Cat (a) Subject Number	*99*			

Appendix C
Participant Reminder Letter

Cat Study Reminder

Participant Name(s): _____

Thank you for your interest in our cat study!

We have you scheduled for:

Date: _____

Time: _____

Cat's name: _____

Remove food by: _____

Please remember:

- Remove all food for 8-10 hours before your scheduled appointment, as indicated above. This includes dog food, people food, and any other food your cat can get to. Please be very careful about this. Provide water as usual.

- Have ready a large towel, and one meal's worth of dry food separated into 2 plastic bags.

- Plan to confine your cat to one room with a door a few minutes before we arrive. We will call from outside to be sure your cat is confined.

- Plan to confine other animals or children who might disturb your cat during our visit.

- Allow up to 90 minutes for Session 1 (Session 2 will be shorter).

If you cannot make the above necessary arrangements for our scheduled times, please call us at the number below. We understand that scheduling may be difficult. We would be happy to reschedule to a better time, or cancel if you change your mind about participating.

Thanks again,

Jennifer Michels
The College at Brockport

JLEB0425@brockport.edu

The College at
BROCKPORT
STATE UNIVERSITY OF NEW YORK

Appendix D

STATEMENT OF INFORMED CONSENT

Primary Participant

The purpose of this research project is to collect information about your cat's behavior, through questionnaires, a temperament test, and a rotational preference test. This research project is also being conducted in order for the Primary Researcher, Jennifer Michels, to complete a master's thesis for the Department of Psychology at the College at Brockport, State University of New York.

In order to participate in this study, your informed consent is required. You are being asked to make a decision whether or not you and your cat will participate in the project. If you want to participate in the project, and agree with the statements below, please sign your name in the space provided at the end. You may change your mind at any time and leave the study without penalty, even after the study has begun.

By signing this consent form, you understand that:

1. Your participation is voluntary. You have the right to refuse to answer any questions, and the right to stop the study at any time.

2. Your confidentiality is guaranteed. Your name will not be written on questionnaires. If any publication results from this research, you would not be identified by name.

3. Your direct participation involves three (3) parts:

    a. Completing a written questionnaire with 16 questions. It is estimated that it will take 10 minutes to complete this questionnaire.

    b. Answer questions about your pets and household in a background interview. This is estimated to take 5 minutes.

    c. Participate in a rotational preference assessment. In this assessment, you and the experimenter will place food alternately in two boxes that your cat can choose to enter. We will record the direction your cat turns when he comes out. This may take up to 30 minutes, depending on your cat's behavior.

4. In addition, the experimenter will spend 20 minutes alone in a room with your cat assessing his temperament. This assessment is a standard, non-invasive test used by the Delta Society to determine whether a cat is a candidate for pet assisted therapy. In this test, your cat may be picked up and held, but only if he demonstrates comfort with the experimenter. The experimenter will create one loud noise to assess your cat's reaction.

5. You may experience some stress as your cat undergoes assessment. For example, you may be concerned about his comfort with a stranger or his hunger level. You may stop the study at any time. Benefits of your participation may be a better understanding of your cat and your knowledge of contributing to cat behavior research.

6. Both the rotational preference assessment and the temperament test will be video-taped. These video files will be viewed by a trained research assistant only to generate independent scores to ensure the accuracy of scoring.

7. You will receive $20 for each session that we begin. So, for example, at the end of Session 1, you will be paid $20. If you do not agree to proceed with Session 2, or if we decide it is not appropriate to continue (say your cat is afraid of the experimenter), then you will not receive compensation for Session 2. But you will keep the money for the first session.

8. Approximately 30 people and 50 cats will take part in this study. The results will be used for the completion of a master's thesis by the primary researcher.

9. Data and video files will only be used for the purposes of this study and will be kept on a portable hard drive in a locked safe by the primary researcher. Consent forms will be destroyed by shredding when the research has been accepted and approved.

10. In the unlikely event that the experimenter is severely bitten by your cat, the involvement of the Monroe County Public Health Department can be avoided by you showing that he has been vaccinated for rabies.

I am 18 years of age or older. I have read and understand the above statements. All my questions about my participation in this study have been answered to my satisfaction. I agree to participate in the study realizing I may withdraw without penalty at any time during the study. Participating by filling out questionnaires, answering interview questions, verbally consenting to temperament testing, and participating in the rotational preference assessment indicates my consent to participate.

If you have any questions you may contact:

Primary Researcher   Faculty Advisor
Jennifer L. Michels   Dr. Lori Forzano

Graduate Student   Department of Psychology

JLEB@brockport.edu   lforzano@brockport.edu

_____   _____

Participant Signature   Date

_____   _____

Experimenter Signature   Date

Appendix E
STATEMENT OF INFORMED CONSENT
Secondary Participant

The purpose of this research project is to collect information about your cat's behavior, through questionnaires, a temperament test, and a rotational preference test. This research project is also being conducted in order for the Primary Researcher, Jennifer Michels, to complete a master's thesis for the Department of Psychology at the College at Brockport, State University of New York.

In order to participate in this study, your informed consent is required. You are being asked to make a decision whether or not you will participate in the project. If you want to participate in the project, and agree with the statements below, please sign your name in the space provided at the end. You may change your mind at any time and leave the study without penalty, even after the study has begun.

By signing this consent form, you understand that:

1. Your participation is voluntary. You have the right to refuse to answer any questions.

2. Your confidentiality is guaranteed. Your name will not be written on the questionnaire. If any publication results from this research, you would not be identified by name.

3. There are no anticipated personal risks because of your participation in this project. Benefits of your participation may be a better understanding of your cat and your knowledge of contributing to cat behavior research.

4. Your direct participation involves completing a written questionnaire with 16 questions. It is estimated that it will take 10 minutes to complete this questionnaire. You will also be asked, along with the primary participant, to answer questions about your pets and household in a background interview. This is estimated to take 5 minutes.

5. You will not be compensated for your time in completing the questionnaire.

6. Approximately 30 people and 50 cats will take part in this study. The results will be used for the completion of a master's thesis by the primary researcher.

7. Data will be kept on a portable hard drive in a locked safe by the primary researcher. Consent forms will be destroyed by shredding when the research has been accepted and approved.

I am 18 years of age or older. I have read and understand the above statements. All my questions about my participation in this study have been answered to my satisfaction. I agree to participate in the study realizing I may withdraw without penalty at any time during the study. Participating by filling out the questionnaire indicates my consent to participate.

If you have any questions you may contact Jennifer L. Michels, Primary Researcher, Graduate Student,   JLEB0425@brockport.edu, or Dr. Lori Forzano, Faculty Advisor, Department of Psychology,   , lforzano@brockport.edu.

_____   _____
Participant Signature   Date

_____   _____
Experimenter Signature   Date

CBQ16 with BIS/BAS scoring added in right hand column.

Cat Behavior Questionnaire

In answering the following questions, consider your cat's behavior on average for the entire
time you have lived with together (do not include kittenhood).
For each question, circle ONE NUMBER from 1 to 7 that best describes your cat.

Q1	The first several times your indoor cat had the opportunity to sneak outside, how did he/she behave?	BIS/BAS	
	1 - Nervous, suspicious about what was out there. Ran back inside.	BIS	3
	2 -		2
	3 -		1
	4 - Stayed at the door. Cautiously curious.		0
	5 -		1
	6 -		2
	7 - Walked right outside and began exploring with confidence.	BAS	3
	0 - Not applicable/don't know		

Q2	For how long does your cat like to be petted? My cat:		
	1 - does not like to be pet at all, moves away.	BIS	3
	2 -		2
	3 -		1
	4 - likes to be pet for a while, but not too long.		0
	5 -		1
	6 -		2
	7 - will accept petting for as long as you keep petting.	BAS	3
	0 - Not applicable/don't know		

Q3	How much of your cat's body does he or she like you to pet?		
	1 - None of it. He/she moves away.	Neutral	0
	2 -		1
	3 -		2
	4 - About half of his or her body.		3
	5 -		4
	6 -		5
	7 - All of his or her body.	BAS	6
	0 - Not applicable/don't know		

Q4	How does your cat behave at the veterinary clinic?		
	1 - Sociable, purring, friendly to staff.	BAS	3
	2 -		2
	3 -		1
	4 - Neutral.		0
	5 -		1
	6 -		2
	7 - He/she hides, attempts to run away, hisses when handled.	BIS	3
	0 - Not applicable/don't know		

Q5 How does your cat react to sudden noises? (For example, a dropped pot or pan, the doorbell rings, you run a coffee grinder or power tool, or thunder.)

1 - He/she reacts strongly, darting from the room and hiding.   BIS   6

2 -   5

3 -   4

4 - He/she reacts moderately, becoming startled, but recovering quickly.   **3**

5 -   **2**

6 -   **1**

7 - He/she doesn't react at all.   Neutral   **0**

0 - Not applicable/don't know

Q6 How often does your cat's fur stand up on end? This is most noticable on the tail (it becomes larger, like a bottle brush), or along the back/spine.

1 - I've never seen this on my cat.   Neutral   **0**

2 -   1

3 -   2

4 - Every 1-2 weeks.   3

5 -   4

6 -   5

7 - This happens on a daily basis.   BIS   6

0 - Not applicable/don't know

Q7 Suppose a stranger enters your house (for example, an electrician or the meter reader). In the first few minutes, my cat would most likely:

1 - run and hide.   BIS   3

2 -   2

3 -   1

4 - remains in view of the stranger, but stays across the room.   **0**

5 -   1

6 -   2

7 - move toward the visitor for petting.   3

0 - Not applicable/don't know

Q8 Suppose a stranger enters your house (for example, an electrician or the meter reader). In the first few minutes, my cat would most likely:

1 - run and hide.   BIS   3

2 -   2

3 -   1

4 - remains in view of the stranger, but stays across the room.   **0**

5 -   1

6 -   2

7 - move toward the visitor and threaten him/her with a hiss, growl, or swat.   3

0 - Not applicable/don't know

Q9   When my cat has access to people who live in the home, he/she:

1 - spends his/her time alone, avoiding company.   BIS   3
2 -   2
3 -   1
4 - interacts with people about 50% of the time.   **0**
5 -   1
6 -   2
7 - constantly wants to be around me (or other people) in the house.
0 - Not applicable/don't know

Q10   Does your cat fear other cats who live in the same house? He/she:

1 - is calm around the other cats.   Neutral **0**
2 -   1
3 -   2
4 - acts a little nervous, avoids other cats.   3
5 -   4
6 -   5
7 - regularly gets chased or attacked.   BIS   6
0 - Not applicable/don't know

Q11   Does your cat dominate other cats who live in the same house? He/she:

1 - is calm around the other cats.   neutral **0**
2 -   1
3 -   2
4 - acts a little bossy, trying to steal resting spots, or hitting others on the head.   3
5 -   4
6 -   5
7 - regularly chases or attacks other cats.   6
0 - Not applicable/don't know

Q12   How does your cat generally behave in your presence?

1 - Runs and hides.   BIS   3
2 -   2
3 - Stays in the same room, but keeps distance   1
4 -   **0**
5 - Rubs against you   1
6 -   2
7 - Wants to be held or in your lap.
0 - Not applicable/don't know

Q13 Some cats move around freely with a tall posture, and head and tail held up.
Other cats are tense when they move, they have a crouched posture and head
and tail lowered. On average, my cat:

1 - moves freely with ease.	Neutral	0
2 -		1
3 -		2
4 - moves with some of both of these styles.		3
5 -		4
6 -		5
7 - moves tensely.	SIS	6
0 - Not applicable/don't know		

Q14 If you have moved with your cat, how long did it take for your cat to adjust?
He/she:

1 - hid for weeks.	SIS	6
2 -		5
3 -		4
4 - was nervous or apprehensive for 3-4 days.		3
5 -		2
6 -		1
7 - adjusted immediately, like nothing happened.	Neutral	0
0 - Not applicable/don't know		

Q15 My cat:

1 - enjoys being picked and held, seeks it out, can be handled in various positions.		3
2 -		2
3 -		1
4 - tolerates when I pick up or hold him/her, but only in specific ways, and would rather be put down.		0
5 -		1
6 -		2
7 - bites and scratches if I try to handle him/her.	SIS	3
0 - Not applicable/don't know		

Q16 My cat paws at people or vocalizes to get what he/she wants, such as treats,
meals, toys, attention, or access to a location.

1 - Very true, he/she pushes to get what he/she wants.		6
2 -		5
3 -		4
4 - Somewhat true, he/she pushes to get some of these things.		3
5 -		2
6 -		1
7 - False. My cat never asks for anything.	Neutral	0
0 - Not applicable/don't know		

Background Questionnaire   S#_____

Current Household

Type and size of home _____

No. adults _____

No. children, gender, and ages _____

Other cats- age, sex, neuter status, date obtained

List dogs:

Other pets?

<u>Primary</u>
How familiar are you with cat (a)'s day to day behaviors?   1   2   3   4   5
How familiar are you with cat (b)'s day to day behaviors?   1   2   3   4   5

<u>Secondary</u>
How familiar are you with cat (a)'s day to day behaviors?   1   2   3   4   5
How familiar are you with cat (b)'s day to day behaviors?   1   2   3   4   5

Primary Participant (A)-
How many cats have you lived with for more than one year, for whom you were primary or co-caretaker?
_____
How many cats have you lived with for more than one year, for whom you were NOT primary or co-caretaker? _____

Secondary Participant (B)-
How many cats have you lived with for more than one year, for whom you were primary or co-caretaker?
_____
How many cats have you lived with for more than one year, for whom you were NOT primary or co-caretaker? _____

Cat (a)

Cat birthdate (best estimate): _____

Obtained from _____

Adopted at age:

Time with queen and littermates

Number of littermates

How many homes has this cat lived in?

How many other cats has this cat lived with?

Neuter date (best estimate):

Breed: SH or LH?

Size (small/medium/large)

Weight

Coat color

Eye color

Declawed? When?

Indoor only? (requirement)

Assess the environment

    Scratching opportunities: _____

    Perching/sleeping opportunities: _____

    Eating opportunities: _____

    Play opportunities: _____

How much time do you spend with your cat, in the same room, per day?

Less than one hour   Several hours   All day long

Recent Food Consumption

Subject # _____

Session # _____

Date _____

Please write the date and time of your cat's last meal:

Please write the type, and amount of food your cat had:

Feline Temperament Profile

Subject No. _____

Text in italics has been added to the original profile instructions Date & Time: _____
by J. Michels, 2009. The cat should be taken from its cage or carrier and placed in an average-sized room for several minutes *prior to the tester entering.* The tester should wear ordinary clothes and enter the room in a calm manner.

Test 1: Squat down, about 5-6 feet away, and call the cat several times. Extend one hand. *Say "Test 1". Try for 30 seconds. If cat does not approach, set timer for 15 minutes.*

Acceptable:
_____Makes eye contact (*BAS*)
_____Vocalizes
_____Approaches slowly(*BAS*)
_____Looks at you and rolls over(*BAS*)
_____Approaches and sniffs hand(*BAS*)

Questionable:
_____Avoids eye contact(*BIS*)
_____Retreats or assumes defensive position(*BIS*)
_____Watches you but does not approach(*lowBAS*)

Other observations: _____

Test 2: If the cat does not approach, move closer to the cat (3 feet away) and call again. Check off the cat's response(s): *Say "Test 2". Try for 30 seconds. If skipping, say "Skipping Test 2".*

Acceptable:
_____Makes eye contact(*BAS*)
_____Vocalizes
_____Approaches slowly(*BAS*)
_____Comes and sniffs hand(*BAS*)
_____Looks at you and rolls over(*BAS*)

Questionable:
_____Avoids eye contact(*BIS*)
_____Retreats or assumes defensive position(*BIS*)
_____Watches you but does not approach(*lowBAS*)
_____Arches back and/or hisses(*BIS*)

Other observations: _____

Test 3: After approaching the cat or getting it to approach, extend hand to cat (squat so that hand is at lower level than cat's head). Check off the cat's response(s): *Say "Test 3". Try for 30 seconds.*

Acceptable:
_____Sniffs hand(*BAS*)
_____Licks or rubs body against hand(*BAS*)
_____Rubs head against hand(*BAS*)
_____Rolls submissively(*BAS*)
_____Vocalizes

Questionable:
_____Retreats or assumes defensive position(*BIS*)
_____Strikes hand, with paw or claws
_____Threatens to strike hand
_____Bites or attempts to bite hand

Other observations: _____

(Lee, Zeglen, Ryan, & Hines, 1983). Used courtesy of Delta Society, www.deltasociety.org

If the cat has been approached and has shown no aggressive or defensive postures, proceed. Otherwise, try the approach procedure patiently and slowly again. It may be necessary to stay in the room and wait until the cat initiates interaction. In any case, if interaction cannot be initiated within 10 to 15 minutes, the cat is probably too shy, fearful, or unhealthy to be successfully placed in a facility.

Test 4: While talking to the cat, begin to stroke the cat along the head, back, and sides. Check off the cat's response(s): *Say "Test 4". Pet for at least 30 seconds, if he/she tolerates. If skipping, say, "Skipping Test 4".*

Acceptable:
_____Rubs against your legs or hand(*BAS*)
_____Begins to purr, meow or chirp(*BAS*)
_____Bumps head against you(*BAS*)
_____Circles around you attentively(*BAS*)
_____Shows initial fear but quickly relaxes(*BAS*)

Questionable:
_____Assumes a threatening or defensive position
_____Attempts to strike or strikes with paw
_____Attempts to bite or bites
_____Withdraws(*BIS*)

Other observations: _____

Test 5: Move away from cat and drag a piece of string along the floor slowly to initiate play (or toss a "ball" consisting of a crumpled piece of paper). *Say, "Test 5." Try each toy for at least 30 seconds.*

Acceptable:
_____Returns for more stroking(*BAS*)
_____Watches the string or ball of paper intently(*BAS*)
_____Chases the string or ball of paper(*BAS*)

Questionable:
_____Ignores the string or ball of paper (*low/BAS*)
_____Attends something else in the room and avoids eye contact (*low/BAS*)

Other observations: _____

Test 6: Call the cat again until it approaches, or approach it slowly yourself. Begin to stroke again and if the cat is calm, pick it up gently (*first to a side hold, then if that goes well.....*) and cradle it against your chest. *Say, "Test 6." If skipping, say, "Skipping Test 6"*

Acceptable:
_____Relaxes(*BAS*)
_____Makes eye contact(*BAS*)
_____Extends its paw affectionately to your neck and shoulder(*BAS*)

Questionable:
_____Struggles to escape(*BIS*)
_____Attempts to strike or strikes with paw
_____Attempts to bite or bites

Other observations: _____

If he/she likes it, continue to hold and pet for 30 seconds.

Test 7: Sit down, *place a towel in lap,* and place cat on your lap, facing you. Stroke the cat. *Say, "Test 7." If skipping, say, "Skipping Test 7"*

Acceptable:

_____Purrs or rubs against hand(*BAS*)

_____Makes eye contact(*BAS*)

_____Rolls over(*BAS*)

_____Stands up to smell your face or to place paw on your neck(*BAS*)

Questionable:

_____Sits tensely on lap(*BIS*)

_____Jumps off(*BIS*)

_____Threatens or becomes aggressive (bites or scratches)

Other observations: _____

If he/she likes it, continue to hold and pet for 30 seconds

Test 8: Place cat on floor next to chair. Call and beckon with hands. *Towel in lap. Try for 30 seconds. Say, "Test 8"*

Acceptable:

_____Jumps up(*BAS*)

_____Makes eye contact but remains on the floor(*BAS*)

_____Gets up on hind legs and makes contact(*BAS*)

Questionable:

_____Ignores calls, ignores you (*lowBAS*)

_____Moves away (*BIS*)

Other observations: _____

Test 9: Place cat on floor. *Wear a leather glove.* Grab tail firmly and pull with a steady pressure *for 2 seconds. Say, "Test 9" or "Skipping Test 9".*

Acceptable:

_____Tries to escape or struggle

_____Rolls submissively(*BIS*)

_____Shows no reaction(*lowBAS*)

Questionable:

_____Attempts to strike hand

_____Growls or hisses

Other observations: _____

Test 10: Place cat on floor (in a non-carpeted room). *Make noise by shaking plastic box of coins out of the view of the cat.* ~~Drop a metal box or other object on floor~~ behind cat when cat is not looking. ~~If in a carpeted room, make a loud vocal noise or bang together two objects such as pots.~~ *Say, "Test 10"*

Acceptable:

_____Startles but quickly relaxes(*neutr*)

_____Ignores the noise(*lowBIS*)

Questionable:

_____Does not appear to hear the noise (ask vet to check hearing)

_____Startles, then runs to hide(*BIS*)

_____Startles, then adopts a defensive or aggressive posture (*BIS*)

Other observations: _____

70

Study Protocol
Rotational Preference in the Domestic Cat: Relationship to Temperament and Behaviors
7/20/09

Preparation for Session 1

check messages for cancellation

1. Prepare video camera: Be sure that both video camera batteries are completely charged. Be sure that the video camera hard drive is empty.
2. Be sure the apparatus is sanitized and sprayed with Feliway. The boxes should be lined on the bottom with brown paper, and a line drawn down the center.

3. Prepare materials and put in **Box A**:
   Place on clipboard, in this order:
   participant map and phone number
   Study Protocol
   2 Consent Forms for Primary Participant
       2 Consent Forms for Secondary Participants if needed
       Background Questionnaire
   Recent Food Consumption Questionnaire
   CBQ16s – labeled
   instructions and envelope if 2ndary p not there
   FTP form labeled with cat a subject number
   RP Data Collection sheet, labeled with cat a subject number
   Money Receipt form
   Cat Study Reminder (for second visit)
   Debrief
   Calendar

   Place clean food dishes and plexiglas window in Box A
   Put $20 bill in scrubs pocket

4. Prepare remaining materials in **Box B**:

   Put in Plastic Box---
   leather glove in ziploc
   Box with coins, ribbon, crumpled paper ball
   Timer, extra battery for timer
   stopwatch, extra battery for stopwatch
   tape measure (122 cm = 48 inch)
   extra pencils, 2 ziplocs
   laser, extra ribbon and string

   Place clean plexiglas window in Box B
   Place video camera, tripod, piece of brown paper, and extra battery in Box B
   Put Cell phone and glasses in Box B or carry
   Clean towel for car seat

5. Load Boxes A and B in car trunk. Put a clean towel on the driver's seat. Get map.
6. Wear clothing that has been laundered in a cat-free environment

Upon Arriving at Home

7. Call from cell and ask "Hi, this is Jennifer calling about the cat study. Is your cat in a room with the door closed like we talked about?" If they say "no", ask them to do this now, and come to the door to let you in when they are ready. If they are having trouble, give them some ideas (towel, use room cat is in now, coax with toy…). If they cannot do this comfortably, ask if they would like to reschedule or withdraw.

8. When they open the door, "Hi, I'm Jennifer. Thanks for having me. I'll need to bring these two boxes inside."

9. Enter, remove shoes.

10. Then say, "OK, we can set the boxes anywhere for now. First we need to go through some paperwork. Is it okay if we sit here?" Motion to a kitchen or dining room table, or a couch with coffee table. Get clipboards. Sit down with all participants at table.

11. Hand an Informed Consent form to each person who will be participating. "I need you to read these carefully and sign."

12. Iterate, "It's important that you understand you can stop the study at any time and I will leave." (They'll be paid if we start an *assessment*.)

13. Collect Consent Forms, "Thank you", and place on clipboard underneath other materials. "Here is a copy you can keep." Hand them a blank form(s).

"Please fill out these questionnaire(s) to the best of your knowledge. [IF 2 people: *It is very important that you do not discuss the questions until you are done. Please do not change your answers.]* Please understand that we are not studying people, we are studying cats. Since genetics and early environmental conditions are the most important factors in establishing cat behavior, we understand that you do not have full control of your cat's behavior. So, please think about *how your cat behaves* when you answer the questions, and not what you think he should do, or how you may have contributed to this behavior. Again, we are not evaluating you, we want to get to know your cat. There are no right or wrong answers."

14. Also, when you answer the questions, please think about your cat overall for the entire time he has lived with you, *as an adult*. For example, if he used enjoy petting, but does not anymore, put down something in the middle. Do you have any questions? *I'll meet you back here."*

I'll be here if you have any questions.

15. Collect CBQs. "Thank you. Now, I'd like to ask you both a few questions about your pets and your home." Fill out Background Questionnaire. "thank you."

16. Say to Participants B, C…"Okay, your part of the study is done. Thank you. You can stay if you would like."

17. To Participant A, "Now I need you to fill out this form," and hand them the Recent Food Consumption Questionnaire.

18. "Thank you." Check over to be sure that cat has not eaten in 8-10 hours. If not, "I'm sorry, but I'm afraid your cat will not be hungry enough for the assessments today. Can we reschedule?"

FTP Assessment

19. Explain, "I will now go into the other room and do a Temperament test with your cat. It will take about 20 minutes. Like it says on the Consent Form, the (worst) thing I will do is make a loud noise, and that will only be if the cat seems to be comfortable. Also, if he is comfortable with me touching him, I will hold his tail for 2 seconds to see how he reacts to that. I will not proceed if he seems uncomfortable. Do you have any questions about that?" (*if still hesitant, show them the FTP and answer questions*).

20. I will need a large towel. "Thank you."

21. "Where can I wash my hands?" Wash hands and arms.

22. Take Box B into the room, set up the video camera on tripod. **Turn on the camera**.

23. Set timer for 20 minutes.

24. Perform the FTP. Comment aloud on events that may not be noticeable in the video tape. Use the Humane Endpoints given in the Appendix at that end of this protocol to determine whether the cat is distressed and the assessment should be stopped.

25. When complete, stop the video camera, exit the room. Leave stuff there.

26. Rejoin Participant A, and say "OK, the temperament test is done."

What to say if participants ask about the results: Give a general description of the cat's behavior, such as "he was very friendly with me," or "he seemed pretty hesitant about approaching me." However, they will be told that the final results cannot be shared with them because they have not yet been calculated. Also, they will be told that cat's behavior varies by situation and that this temperament test cannot be used to predict future behavior.

RP Assessment

27. "For the next task, we will both go into the room with your cat and use the two boxes I brought (motion to Box A). Both boxes have been sanitized with a solution that veterinarians use to sterilize cages. We then wash everything with soap and water. The boxes are sprayed with Feliway, a pheromone scent that helps cats feel calm. Does that sound okay?"

28. Ask the owner for the dry food, and separate into 2 ziplocs. "We will each need some of his food."

29. "I will place the two boxes on the floor, about 4 feet apart, with the openings facing each other (mimic this where we are). You and I will each sit behind one box, and face each other. At the back of the box is a hole to a food tube that we will alternately drop 2 pieces of food into." Get behind **BOX A** and Point out the food tube and the food drawer). "When (cat's name) eats and comes out of one box, the other person will drop food into their box. We'll count how many times he goes back and forth. Specifically, we will be looking at **which way he turns each time** he comes out of a box."

30. "It is very important that we both stay squarely behind the boxes so we don't encourage him to turn either left or right."

31. "Does this sound okay?" If they say "no, or maybe…." Say, "some cats are nervous about the boxes, but usually they warm up. We will not force him to go in, just provide the food and then see what he chooses to do. We don't want to encourage or discourage him from entering the boxes, we'll just let him do what he wants to do."

32. While we are in there, we can talk to each other about what we are doing, or what we observe. For instance, we can say "Wow, I can't believe he went in so fast. Or, boy does he seem bored." But it is very important that we **do not talk** to the cat, do not talk in **kitty talk**, don't try to encourage him in any way, don't say his name, and do not make eye contact. This can be difficult, we are so used to

talking to our cats. We will stay very neutral, let him wander, lay down, let him do what he wants to do."

33. "We will stay for 30 minutes, or when the cat has gone in and out of the boxes 16 times. Or, whenever you say to stop. Then you can give him the rest of his food. Are you ready to go in?"

34. Enter the room, set up the boxes. Ask the participant to sit behind the Far box. Change FTP to RP on the white board, hold up to camera and turn it on.

35. Set **timer** for 30 minutes. Set **stopwatch** to countdown from 10 minutes.

36. "Okay, we are ready to start. I'll sit behind this box (**BOX B**) but first, I'm going to place some food on the floor so he knows we have it. If he goes between the boxes, go ahead and drop two pieces in the hole. Then, I'll go next. Drop *after* the cat turns from the other box.

37. Comment aloud on events that may not be noticeable in the video tape. After 10 minutes, ask the participant, "Are you still comfortable?" Use the Humane Endpoints given in the Appendix at that end of this protocol to determine whether the cat is distressed and the assessment should be stopped.

38. When the cat has completed at least 16 turns, or the 30 minutes are up, say, "Okay, we are done here. Here is the rest of his food, you can open the door and feed him." **Turn off camera**.

39. Here is your $20 for today. Please sign this receipt. After they sign, I sign.

40. "For the Second session, we will repeat the turning task only. Then I will give you some more information about the study and pay you another $20."

If cat did not turn at least 5 times, debrief now and do not schedule Session 2.

41. Would you like to schedule Session 2? [Make it approximately one week. Fill out the Cat Study Reminder].

42. "Please remember that cat (a) cannot eat anything for 8-10 hours, so that's no food after XX o'clock. Again, if this is not possible, be sure to let me know. Re-scheduling is no problem. Also remember to confine the other pets."

43. "Thank you!"

44. Collect all items, put them back into Boxes A and B, and put the boxes in the back seat of the car.

45. When arriving back at lab, put car seat towel in one of the boxes.

46. Place all paperwork for Session 1 in hanging file folder labeled Subject a in lab.

47. In a well-ventilated area, clean apparatus and window surfaces with bleach solution. Use one spray on each surface. Wipe down well with a cloth. Then, wash all again with warm water and soap. Wipe down leather glove and place bag in its ziploc.

48. After cleaning and drying the boxes, set so the openings face up and pump one spray of Feliway over each box.

49. Place clean boxes and items back in the lab (ONLY WHEN THEY ARE CLEAN). Replace plastic strips. Replace green pads on bottom of boxes if needed.

Session 2

Prepare Materials and put in **Box A**

    Place on clipboard, in this order:
    participant map and phone number
    Study Protocol
    Recent Food Consumption Questionnaire
    RP Data Collection sheet (same as Session 1)
    Money Receipt form
    Debrief

    Place clean food drawer, food tube, and plexiglas window in Box A
    Put $20 bill in scrubs pocket

    Put in Plastic Box---
    Timer, extra battery for timer
    stopwatch, extra battery for stopwatch
    tape measure (122 cm = 48 inch)
    extra pencils, 2 ziplocs
    extra ribbon and string

    Prepare Materials and put in **Box B**

    Place plexiglas window in Box B
    Place video camera, tripod, extra battery, and power cord in Box B
    Put Cell phone and glasses in Box B or carry
    Clean towel for car seat

50. Upon arriving, call to be sure cat is ready. Enter.

51. Ask participant to fill out the Recent Food Consumption Questionnaire *(and any CBQ omission*s). "Thank you."

52. Enter. Set up boxes (A and B in *same* location) and video camera (behind Box A). T**urn on camera**.

53. "Okay, let's go in and start. Everything will be the same except that you and I will switch places. Remember not to talk to ____(a)____ . We don't want to affect his behavior. Are you comfortable with going ahead with this?" If not, go to 56.

54. Set **timer** for 30 minutes. Set **stopwatch** to countdown from 10 minutes

55. Use the Humane Endpoints given in the Appendix at that end of this protocol to determine whether the cat is distressed and the assessment should be stopped.

56. If the subject did not reach 16 turns in Session 1, say "We will wait until we have 16 total turns, including Session 1, or until the 30 minute timer runs out."

If the cat already had 16 from the Session 1, say, "We will wait until he turns 6 times, or until the 30 minute timer runs out."

57. When the criteria are met, say, "Okay, we are done here. Here's the rest of the food, you can feed him and open the door."

58. "Here is your $20 for today. Please sign this receipt." They sign, I sign. Thank you.

59. "The last thing I'll do is read to you more information about the study. I'll also leave a copy with you, too." Read it to them, and hand them a copy to keep.

60. Ask if they have any concerns about their cat's behavior. If so, direct them to the Humane Society's free Behavior Helpline at the bottom of the Debriefing. Also, there are many good books about cat behavior. You can find them at bookstores and libraries."

61. "Thank you for your participation in this study! You may contact the Department of Psychology (on your Consent Form) if you have questions in the future, or if you are interested in the results."

After Session 2

Complete paperwork **as soon as possible after Session 2**

a. Label all forms with subject number, participant number, and dates. Be sure that no names (people, cats) are on any forms.

b. Place signed Consent Forms in Complete Consent Form folder

c. Place all forms inside in Subject folder, in this order:

- All Cat Behavior Questionnaires, in the order Aa, Ab, Ba, Bb, etc.
- Background Questionnaire
- Recent Food Consumption Questionnaire for Session 1
- Feline Temperament Profile
- Rotational Preference Data Collection Sheet
- Money Receipt 1
- Recent Food Consumption Questionnaire for Session 2
- Money Receipt 2
- Checker's FTP
- Checker's RP

d. Download videos to computer X, and to backup hard drive Y.

e. Label the mpegs files as follows:
- FTP_S.mpg for FTP video for Subject S
- RP_S_1.mpg for Rotational preference video for Subject S for Session 1
- RP_S_2.mpg for Rotational preference video for Subject S for Session 2

f. Once you are certain that you have the videos properly labeled and backed up, empty the video recorder hard drive.

g. Recharge video camera battery.

h. Clean the apparatus (see steps 46-49 above).

Study Protocol Appendix: Humane Endpoints

During FTP and RP assessments, the following guidelines will be used to prevent unnecessary distress to the subject cats. Assessments should be stopped if any of the following occurs:

1. The cat remains in hiding or backed into a corner for more than 10 minutes.

2. The cat swipes at or bites and breaks the skin of the experimenter or participant, or attempts to scratch or bite in a manner that would be likely to cause damage to bare skin.

3. The cat hisses, growls, or shrieks continuously for 1 minute, or occasionally for more than 10 minutes.

4. The cat's physical appearance indicates fear or defensive behavior, such as a sideways stance, piloerection, or dilated pupils for more than 10 minutes.

5. The experimenter otherwise feels that the cat is distressed or that injury may occur.

6. The participant indicates, for any reason, that they are not comfortable with proceeding with the assessment.

Rotational Preference Data Collection Sheet- Experimenter   S#_____

Start Time: _____   Session 1 date: _____
Near Box= _____   Session 2 date: _____
Far Box= _____

Session	Near or Far	Result	Notes
		L / R / N	
		L / R / N	
		L / R / N	
		L / R / N	
		L / R / N	
		L / R / N	
		L / R / N	
		L / R / N	
		L / R / N	
		L / R / N	
		L / R / N	
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		L / R / N	
		L / R / N	
		L / R / N	

Rotational Preference Data Collection Sheet- Checker

S#_____

RA Name: _____

Session 1 date: _____

Today's Date: _____

Session 2 date: _____

Near Box= _____

Far Box= _____

Filename	Video Time	Near/Far	Result	Notes
			L / R / N	
			L / R / N	
			L / R / N	
			L / R / N	
			L / R / N	
			L / R / N	
			L / R / N	
			L / R / N	
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			L / R / N	
			L / R / N	

Money Receipt and Financial Agreement

Study: Cat Behavior Study

I was offered _____ for Session _____ of the Cat Behavior Study.

I understand that any compensation I receive in connection with the above referenced study is given in return for my activities as a research participant.

Participant Signature: _____   Date: _____

Experimenter Signature: _____   Date: _____

Feline Temperament Profile Scoring Protocol
5/25/09

1. On an FTP Score Sheet, write subject number, date of assessment, and location in the upper right hand corner of first page.

2. Write *your* name and *today's* date at the top of the page in the center.

3. Play the FTP video and score as indicated. Use check marks for all behaviors you see in the video, and leave blank behaviors you did not see.

4. Make any notes that you think are applicable in the "other observations" area. Please note any uncertainties (for example, "*can't see if cat made eye contact- was out of the camera field of view*"), anything you think was off protocol ("*the assessor did not use a towel when placing cat in lap*", or "*she attempted to play with the cat for more than 30 seconds for the string*"), possible other explanations for behaviors ("*it sounded like a train went by- maybe that's why cat was startled*"), etc. Note the time in the video of any observations you write.

5. If the experimenter notes something that you could not see or hear (she says, "he just nipped at me," or "he is purring"), check the appropriate box. **Do** second guess the experimenter if there is something you can see or hear.

6. Here are some details about specific tests:

Test 1

- If the experimenter did not say "eye contact," check "avoids eye contact"

- For "approaches slowly," ignore the *slowly*, and check if the cat approaches the experimenter at any speed.

- For "looks at you and rolls over," ignore the *looks at you*, and check if the cat lays down such that none of his paw pads (the pink or black fleshy part on the bottom) are in contact with the floor. The significance is that the cat cannot easily spring up to run away.

- For "approaches and sniffs hand," ignore the *approaches*, and check if the cat sniffs any part of the experimenter or her clothes.

- See the Definitions section below for descriptions of "defensive position."

Test 2

- Use the same instructions as for Test 1

- For "comes and sniffs hand," again check if the cat sniffs any part of the experimenter or her clothes.

- For "arches back," see the Definitions section below

- For "hisses," the experimenter should tell you if this happens. If she missed it and you hear it, go ahead and check "arches back and or hisses."

Test 3

- For "sniffs hand," it can be any part of the experimenter or her clothing.

- For "rubs body", this would be from the neck down the side of the body and including the tail.

- For "Rubs head," this would be the cheeks and top of the cat's head.

- "Rolls submissively" has the same definition as "rolls over" in Test 1. Also see Definitions below.

- For "threatens to strike," see the Definitions section below.

*** If the cat progresses through Tests 1-3 quickly (i.e., readily approaches experimenter for interaction), check off everything in Tests 1-3 that the cat did. For example, if he sniffed the experimenter, put a check mark in all three places. This differentiates the cat who immediately interacts from the cat who does not approach and sniff until Test 3.***

Test 4

- A rub is any moving contact the cat makes with the experimenter from the cat's cheek down to his tail.

- The experimenter will tell you if the cat is purring.

- A bump is an abrupt head butt the cat makes with the experimenter using his forehead/top of his head.

- For "circles around you attentively," the cat does not need to literally circle, but remains in motion with a tall posture and attending to the experimenter for at least 30 seconds.

- For "shows initial fear but quickly relaxes," check this if the cat relaxes within 30 seconds. So, if he initially flinches or jumps back, for example, check off "withdraws" or "defensive position," but if he quickly relaxes, and the experimenter is able to pet him, and says "He is relaxed," also check off "shows initial fear but quickly relaxes." To be quick, cat must be relaxed within 30s of the experimenter's first attempt to pet the cat.

Test 5

- If the cat chases the string or ball, check of BOTH "watches" and "chases."

Test 6

- Much of this test may be off camera.

- If the cat's body is relaxed when the experimenter picks him up, the experimenter should say this. If you do not hear anything, but you can see it, use your best guess- does the cat seem awkward- flailing legs and paws, or does he just hang?

- Do not check anything unless you heard or saw it. If there is not enough information to go by, talk to the experimenter before entering your data.

Test 7

- The experimenter should note if the cat's body is relaxed or tense, and if he makes eye contact.

- If the cat stays for at least 30 seconds, and then jumps off, do not check "Jumps off." Only check "jumps off" if he jumps off in less than 30 seconds.

Test 8

- If the cat does both "gets up on hind legs and makes contact" and "jumps up," check both.

Test 9

- "Rolls submissively" here has the same physical definition, but the reason for it would be that the cat is extremely frightened and surrenders.

- "Attempts to strike hand" can be with the paws or mouth.

- Listen to hear what the experimenter says: "he pulled away" would mean "tries to escape or struggle," or "he didn't do anything" would mean "shows no reaction"

- If the cat only struggles a bit, you can check both "tries to escape or struggle" and "shows no reaction," it's a little of both.

Test 10

- If the cat does not appear to hear the noise, check "ignores the noise," and do not check "Does not appear to hear the noise"

- If the cat flinches, but does not run away from the coin box, check "startles but quickly relaxes"

- If the cat does not flinch at all, check "ignores the noise"

- If the cat startles and runs away from the coin box, but re-approaches the experimenter within 10 seconds, then check both "runs to hide" and "quickly relaxes"

- For "defensive or aggressive posture," use the "assumes defensive position" definition below.

If the cat does not get through the entire FTP, score as many as you can. Then see the "Rules for Incomplete Assessments" below.

7. When you have completed all check marks and "Other observations", enter this information into the appropriate excel worksheet. The file will be labeled "Cat Study_SXX.xls", where XX is the cat subject number. Along the tabs across the bottom of the file, you will see FTP_exp and FTP_check. The experimenter will fill out FTP_exp, and you will fill out FTP_check.

8. Enter a "1" for every checkmark, and enter a "0" for every item you did not check.

9. When done entering data, go to File, then Save.

10. Check the inter-rater reliability number in cell N120. If it is less than 70%, notify the experimenter. Do not make any changes until the experimenter and checker have a chance to talk.

11. File your FTP Score Sheet in the hanging file folder for Subject XX right behind the FTP that the experimenter filled out.

Rules for Incomplete FTP Assessments

- Write SKIPPED in capital letters in the "Other observations" area for any Test that was not attempted.

- If the there was no interaction for the entire first 15 minutes, he gets a BIS score of 10, and a BAS score of 0. He gets an additional 1 BIS point for each of the following: he hides, hisses, strikes a defensive position, or rolls submissively.

- If the cat gets part of the way through the FTP, score as usual, then add 1 BIS point for every skipped test. Enter the BIS correction number in the orange box in the lower right hand corner. (If experimenter skipped two tests, enter a 2 in the orange box).

Definitions

Makes eye contact = this may be difficult to ascertain from the video. The experimenter should say when the cat makes eye contact. If she does not say "he made eye contact," do not check this one off. Ask the experimenter if you are quite certain that the cat did make eye contact.

Rolls over = lays down and lifts all four paw pads off the floor for any amount of time

Rolls submissively = same as Rolls Over

 Vocalizes = This refers to any favorable vocalization, such as a "meow" or "chirp". If the cat "hisses", or "growls", do not put down a check for vocalizes. Instead, indicate this in the "Other observations" area. Ask if you are not familiar with these sounds.

Assumes defensive position = a defensive cat may piloerect (hair puffs up on back and/or tail), position body sideways with respect to the threat (the assessor), arch back (as shown below), position the head lower than the back (as shown below), pull ears backward, or crouch and walk with belly close to the ground.

Arches back =
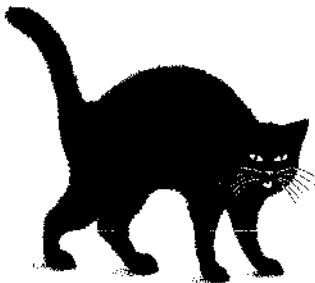
Threatens to strike hand = the cat may hold up a fore leg without striking, but his indicates a threat to strike.

Rotational Preference Scoring Protocol
7/31/09

1. On a Rotational Preference Data Collection Sheet for *Checkers*, fill in the data in the header.

2. Play the RP video and score as indicated. Write down the video time when the cat ENTERs the box, and enter F or N for Far or Near box (with respect to the video camera). If the cat is already in the box and does another turn, write down the time for the TURN.

3. Also enter T, F, or N for toy, food, or neither as the reason the cat went into the box.

4. We define ENTER as any time any part of the cat crosses the imaginary plane that makes up the front of the box.

5. Enter L or R for acceptable turns, and an N for unacceptable turns.

6. Make any notes that you think are applicable in the Notes area. For example, "he backed out halfway, then turned," or "she looked up through the window at her owner, but then went back to eating."

7. The following invalidate the turn and you should choose "N" on the score sheet.

   • The cat dropped food, attended to it, and did not attend to the food box again before leaving the box. [The cat must attend to the food box, but doesn't necessarily have to eat.]

   • The experimenter said that there was a noise that may have distracted the cat, and the cat did not attend to the food box again before leaving the box.

   • The experimenter or the participant did anything that was non-symmetric that influenced the cat.

   • Anything else you see or hear that obviously influenced the way the cat turned.

   • If the cat looks outside of the box before turning. Sometimes they back up, and lift head out before deciding which way to turn.

   • If the cat came out of the box and then went behind the box after having previously been reinforced for coming around that side of the box to get pet or treats, etc.

   • If the cat is biased to turn one way, but turns the other, COUNT the turn.

   • If the cat looks up through the window (or window is absent) and appears to see food or toy in the participant or experimenter's hand, and then turns that way to go around the back of the box, do not count the turn.

   • NOTE that the cat may appear to be biased at times when it was actually his choice- if it's his choice, it's okay.

   • If the bowl is left in the box and the cat goes to a toy, do not count the turn because he will bias his body based on paw preference (i.e., not his choice).

   • If the cat makes a good approach, but moves to the left or right before entering the box for a toy, count as a good entrance- he chose to "hide" in that way.

   • If a treat or toy was thrown from one box to the other, assume it did NOT land on the center line, unless there is information that it did.

- What about if they <u>lay down/roll</u> around? I say disqualify b/c could fall down to use dominant paw to play- which has nothing to do with RP. The cat must get back on his feet and be aligned in order for turn to count.

- if the cat is already in the box when the video starts, do not count the turn- there's no way to know how the cat approached the box.

8. Add up the number of L's and R's and write at the bottom of the score sheet. Our goal is to have 8 acceptable turns per session.

9. Now enter this information into the appropriate excel worksheet. The file will be labeled "Cat Study_SXX.xls", where XX is the subject number. Along the tabs across the bottom of the file, you will see RP1, RP2, etc. The assessor will fill out RP1, you will fill out RP2.

10. Enter an L, R, or N as appropriate in the spreadsheet. Double check that the total lefts and total rights results match what you wrote on the RP Data Collection Sheet.

11. When done entering data, go to File, then Save.

Cat Study Debriefing

Thank you for participating in our study.

When we tested _____ in the Boxes, we were looking at which way he turned. This is called *rotational preference*. People, rats, and other species have been found to demonstrate a left or right-turning bias when put in situations where they have free choice to turn either way. Past research has shown that these biases are linked to brain chemistry, hormone levels, aspects of learning, and temperament (or personality) traits.

There are several purposes of this study.

1. The first is to see if the findings from the temperament test are associated with what you wrote on the questionnaires we gave you. For instance, if you said that your cat was nervous around strangers, did we find the same thing in the temperament test?

2. Next, if more than one person filled out questionnaires for the same cat, we will look at the association between the answers. For instance, if one adult in the house rated the cat likes to be pet, did the other adult report the same thing?

3. Next, we would like to know if our two-box method for assessing rotational preference is a good one for cats. This has not been done before with this species.

4. We will then look at the answers on the questionnaires you filled out and see if there is a relationship between the cat's traits and the direction he/she turned. For instance, one of our hypotheses is that cats who cope well in multi-cat households will be more likely to turn left when they leave the boxes.

5. In the same way, we will look at the temperament test scores and see if they are associated with the preferred rotational direction. For instance, one of our hypotheses is that cats who showed a high level of comfort with me would be more likely to turn left, and vice versa.

All of these findings will be of benefit to the understanding of cat behavior. It could lead to additional methods of assessing temperament type, which could be useful for pet assisted therapy, matching pets for adoption, or determining the level of care needed for cats in shelters and clinics. Also, results for rotational preference can contribute to the study of brain chemistry, aspects of learning, hormonal balances, and personality types that are important to humans in the study of depression and other disorders.

Do you have any questions?

If you are concerned about your cat's behavior, you can call the Humane Society at Lollypop Farm's free Behavior Helpline at 295-2999.

Rotational Preference in the Domestic Cat: Relationship to Temperament and Behaviors
A research summary by Jennifer Michels

Hello participants,

First, I can't thank you enough for your help in this project! It has been a dream of mine to investigate and understand cats better. Hopefully, we will publish, which will contribute to the literature on cat behavior, and support the understanding of the human brain, too. You and your furry ones have made that possible. Even for those of you whose cats were not interested in entering the turning boxes, we have collected valuable information...

The Cat Behavior Questionnaire (CBQ)

On the CBQ, you answered 16 questions about your cat's typical behavior. The first thing we did with this was look at CBQ's for cats who had two raters (there were 49 cats rated twice). We looked at correlations between what the primary participant said and what the secondary participant said. Of the 16 questions, 14 were found to be well correlated. This means that these questions were sufficiently clear, and the behaviors in question are ones that typical (or super!) cat owners would recognize.

The remaining two questions were dropped from the study as they are not considered reliable. One was the question about piloerection (when a cat puffs up); there was a small correlation, but there was not enough variability in the data (most of your cats rarely puff up) that we can't prove it is a good question. The other question was about aggression toward visitors. Here we had the same problem because almost everybody chose "very unlikely to approach and attack" which is lucky for me, but maybe not so smart that I put it on the questionnaire in the first place!

From your questionnaires, each cat ended up with a BAS score and a BIS score. BAS points mean that the cat showed signs of having a strong Behavioral *Activation* System, which can be thought of as being reward-seeking. Examples are enjoying being held and pet, being friendly with veterinary staff, and "pushing" to get what he wants. BIS points mean the cat showed signs of a strong Behavioral *Inhibition* System, which can be thought of as nervousness. Examples are hiding from visitors, struggling when picked up, and strong reactions to sudden noises. Every cat has a mix of BAS and BIS scores, there is no right or wrong. It's like humans, some of us are activated to go bungee jumping, and some of us (me) would rather stay home and avoid disaster.

The Feline Temperament Profile (FTP)

This is the temperament test I did with your cat alone. First, thank you for allowing me to do this! I so enjoyed meeting a wonderful variety of cats. Again, each cat got a BAS score and a BIS score. BAS examples are coming to me for petting, jumping in my lap, and chasing toys. BIS examples are hiding from me, hissing, or running away when they heard me shake the coin box.

We compared the BAS and BIS scores that came from your questionnaires (the average if there were 2 raters) to the BAS and BIS scores I got from the FTP. They were very well correlated!

The Rotational Preference (RP) Testing

Thanks for your help with this, too! For some cats, it was a breeze, as if they knew what the study was about. Others were hesitant, and it was a lot of work to convince kitty it would be fun. You

know who you are! Others wanted nothing to do with the silly game. That's fine, there is no guarantee that animals will do what you want, especially when they are free to roam.

There were 29 cats who turned enough times that we could use their data. Of these, many cats made predominantly left turns, many made predominantly right turns, and there were many mixed results, too.

Our main hypothesis for this study is that the higher the BAS score, the more left turns the cat would make. This is exactly what we found.

So, what does it all mean? We know from studies on rodents a long time ago that if you have more dopamine on the right side of your brain than on the left, you will turn left. Dopamine is a neurotransmitter that, among other things, works in the basal ganglia (deep in the brain) to trigger movement. Dopamine also appears to surge on the left side of the frontal cortex of the brain in the "reward center" when we are faced with a potentially rewarding opportunity (like "hey, you want $100?"). If you have a low base level of dopamine on the left side, the more of a surge (an electrical signal) can take place. So, low on the left side means you are reward-sensitive and high on the right side means you turn left.

Others have a higher level of dopamine on the left. They tend to turn right, and are less reward-seeking. They are less likely to try to jump in your lap, meow for their favorite toy, and figure out how to open the cupboard to get their own dinner.

There are advantages and disadvantages of both kinds of turners in both cats and humans. For one thing, the lack of reward-seeking behavior is associated with depression in humans. For cats, that may mean that they would have a harder time adjusting to loss. However, too much reward-seeking can get out of hand and lead to selfish or criminal behavior in humans. For cats, that may mean being overly bossy and destructive. I don't think that any of your cats has a personality disorder, so don't worry about that! Even so, there are ways to help cats at extreme ends of the spectrum, so if you are concerned, please give me a call.