A Study on the Factors Related to Human-cat Relationship and Owner's Self-Perception

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Abstract. The prevalence of loneliness and social anxiety in modern society is increasing. This has led to growing attention being paid to the human-pet relationship as a means to alleviate psychological issues. This study aims to explore the factors influencing owners' perceived human-cat relationships and provide recommendations for improving the quality of life for both pet owners and their cats. We adapted the CAT-Tri+ questionnaire and made various improvements for assessing domestic cats' personalities and the human-cat relationship, tailored for the Chinese cat owner population. Through data validation, the questionnaire was found to objectively measure the human-pet relationship, providing a basis for enhancing the quality of life for both parties involved. We conducted a survey and correlation analysis based on this questionnaire, four significant factors that influence cat owners' subjective perception of the human-cat relationship were identified: "owner's gender", "cat's sex", "cat's age", and "time spent together". Based on the results, we briefly summarized their implications, providing reference indicators for optimizing the human-cat lifestyle for cat owners and offering suggestions for researchers studying the human-cat relationship.

Keywords: Human-Animal Relationship, Human-Cat Relationship, Domestic Cat, Well-Being.

1   Introduction

1.1   Background

Due to the fast pace of modern life, many individuals living alone experience varying degrees of loneliness or social anxiety [1]. Owning a pet is one way of alleviating the growing psychological issues in modern society. However, due to work and other life commitments, the time spent together between humans and pets is limited, leaving the pets to spend a significant amount of time alone at home. This can lead to psychological stress for the pets and, in severe cases, result in symptoms such as depression and separation anxiety [2].

While pets can serve as a source of relief for human loneliness, their own mental well-being also requires attention. From the perspective of cats, their inability to clearly communicate their needs or desires in a timely manner can lead to abnormal behavior.

This subsequently affect the harmony and interaction patterns between humans and cats, resulting in negative impacts for both parties involved. In today's society where pet ownership is widespread, the psychological well-being of pets and the coexistence between humans and pets have gradually become topics of societal concern.

1.2   Physical and psychological characteristics of domestic cats

Most pets lack the ability to clearly express their needs and emotions, which makes it difficult for owners to perceive any abnormalities in their pets or understand their needs [3]. This communication barrier is particularly pronounced among cat owners. One reason for this is that cats are far less domesticated than dogs and still retain characteristics like their wild counterparts (e.g., hunting and feeding) [4]. Additionally, cats do not have many social needs, as they can fulfill their survival requirements, including food sources, without relying on humans [5]. Furthermore, there are still many gaps in the study of cat psychology and behavior, making certain behaviors and habits of cats incomprehensible to us. These factors contribute to a more complex relationship between humans and cats compared to humans and dogs, thus more challenging to meet the emotional needs of cats.

The lifestyle of most domestic cats is to live indoors, which leads to more alone time and a greater need of attention to their psychological well-being. Cats primarily rely on vision to perceive their environment, and moving objects can greatly stimulate their curiosity [2, 6]. Due to restrictions on cats' habits, age, and living environments, there is a significant occurrence of overweight and obesity among cats [7]. This, in turn, leads to increased health problems, abnormal behavior, and a decrease in their willingness to interact with their owners.

In conclusion, daily activities, diet, living conditions, and interaction between humans and pets have varying degrees of impact on the physiological and psychological well-being of domestic cats. These challenges further contribute to the perception of cats' behavior as "unpredictable", making it difficult to accurately assess the human-cat relationship. Therefore, the purpose of this study is to understand the human-cat relationship and assist cat owners in establishing a positive relationship that benefits them and their cats.

1.3   Impact of social development on human-animal relationship and well-being

The human-animal relationship refers to the bond that develops between a pet owner and their pet through symbiosis, which exists independently of human social interactions [8]. Previous research on the human-animal relationship and human-animal interaction has mainly focused on three aspects: (1) animal-assisted intervention; (2) the effects of pet ownership on human health; and (3) the benefits of human-animal interaction for the well-being and welfare of pets.

The intimacy between humans and pets in social development can bring physiological and psychological benefits to individuals. As a result, animal-assisted interventions were developed. Medical research has shown that the interaction between humans and

pets helps reduce the risk of diseases caused by psychological factors. Moreover, the presence of pets can alleviate negative emotions such as fear, despair, and loneliness for many patients [9]. For example, by simply engaging in prolonged eye contact with one's pet dog, the concentration of oxytocin in both the owner and the dog increases [10], which has potential positive effects such as regulating stress, coping with anxiety, and enhancing psychological resilience on individuals [11]. Owning a cat also has similar effects. Experimental studies have shown that the presence of cats significantly lowers the heart rate and blood pressure of their owners, and this effect is positively correlated with the degree of attachment the owner has to the cat [12].

Pet ownership proved beneficial to both youth and older adults. For adolescents, pet ownership is associated with the development of a sense of responsibility, empathy, and prosocial behavior [13]. For older adults, owning a dog increases their willingness and opportunity to engage in outdoor walking activities [14], thus helping to maintain their overall physical functioning. Additionally, the sense of responsibility leads to a greater investment in caring for their pets, which derive emotional value from the companionship and interaction. This could serve as a supplement to their social support [15]. These reasons make pet ownership a supportive factor for both youth and older adults in maintaining well-being.

Human-animal relationships not only benefit humans but also pets, for the oxytocin concentration effect also applies. Being in a familiar environment and establishing a good relationship with humans, physical contact such as stroking and brushing can generally increase the secretion of oxytocin in pets. This may result in pets displaying more positive behaviors [16]. A good human-animal relationship allows pets to live in a more relaxed and secure manner, enhances their ability to cope with anxiety, and helps reduce their risk of illness and injury. As a result, the costs associated with caring for them are indirectly alleviated.

In summary, a good human-animal relationship is mutually beneficial. However, a few questions arise. How can pet owners accurately perceive the nature of their relationship with their pets? How can we establish a good relationship with pets that is beneficial for both? To answer these questions, research focusing on personality and behaviors of cats is needed.

1.4   Domestic cat personality and behavior assessment

Due to the current inability to objectively measure the relationship between cat behavior and personality traits, there is a lack of assessments to obtain human-cat relationship. Currently, the assessment of cat personality is primarily achieved through owner ratings [17, 18, 19, 20]. These studies typically involve asking owners questions related to their cat's daily activities and using Likert scales to quantify the cat's tendencies in different behavior categories. By analyzing the data, connections between the observed behaviors and personality traits have been established.

Several scales have been developed to assess domestic cat personalities. However, some questions left untouched. The most prominent one is the lack of consensus in the factor structure and naming convention of personality traits. Gartner et al. suggest that friendliness, dominance, and curiosity are the most valid personality factors for cats

[21]. The Feline Five suggests five factors: neuroticism, extraversion, dominance, impulsiveness, and agreeableness [17]. In the Domestic Cat Personality Inventory (DCPI-e1), six factors were extracted, namely playfulness, nervousness, amiability, dominance, demandingness, and gullibility [18]. CAT-Tri+ has extracted boldness, disinhibition, meanness, pet-unfriendliness, and human-unfriendliness as the main factors [19]. Lastly, in the cat-owner relationship scale (CORS), three factors related to human-cat relationships were discovered: human-cat interaction, perceived emotional closeness, and perceived costs [20]. The inconsistency in the number of factors arises not only from the different focuses of researchers but also from the complexity of factors involved in cat personalities, resulting in multifaceted interpretations of each factor across different scales (e.g., "extraversion" on the Feline Five scale encompasses not only the level of activity but also traits like boldness and curiosity). The diverse naming of factors is influenced by the usage of synonyms in animal personality research [21, 22] (e.g., agreeableness and sociability, both referring to the friendliness of pets). The complexity of factors involved leads to variations in encoding methods taken by researchers, resulting in interrelated and somewhat distinct factor divisions.

Therefore, when conducting research on human-cat relationships, the scale used should meet the following criteria: (1) The dimensions should cover typical personality traits in cat personalities that are meaningful to owners, and the naming of these dimensions should be clear and easy to understand; (2) the results generated by the scale should be associated with the owner-perceived human-cat relationship to further investigate the link between cat personality and the human-cat relationship. Among the mentioned scales, the first four factors of CAT-Tri+, boldness, inhibition, meanness, and pet-unfriendliness, are highly correlated with owners' perceptions of cat personality and behavior. The last factor, human-unfriendliness, is negatively correlated with owners' self-rated human-cat relationships. The items on this scale can comprehensively cover scenarios of in-home environment. After completing and scoring the scale, human-cat relationship is revealed to some extent. For the purpose of this study, CAT-Tri+ can meet the basic requirements for exploring cat personality and the human-cat relationship, making it a suitable starting point for this research.

2   Methods and materials

This study is based on the theoretical foundation of the CAT-Tri+ scale. We focus on the understanding and perception of the daily behaviors of their pets among cat owners to explore the correlation between factors related to humans and cats and the relationship perceived by the owners.

2.1   Questionnaire development

Before designing the survey questionnaire, we conducted a scoping review to gather relevant literatures as the fundamental framework for questionnaire development. The initial draft of the questionnaire was based on the CAT-Tri+ scale. We translated all items in the questionnaire and added detailed operational definitions to the items based

on the Chinese residential context. We also optimized the presentation format of some items for online questionnaire administration. Subsequently, we sought suggestions from scholars and experts regarding the content items of the questionnaire and revised them to enhance face validity and content validity. Finally, based on this initial questionnaire, we invited seven participants for a pilot test to evaluate the clarity and coherence of the items' statements. In addition, we asked the participants to provide feedback on the items and any difficulties (if presented) encountered during the response process. After revising and optimizing the questionnaire, it was reviewed again by scholars and experts to form the questionnaire used in this study.

The final questionnaire consists of five dimensions, namely boldness, disinhibition, meanness, pet-unfriendliness, and human-unfriendliness, for a total of 46 items. A 5-point Likert scale was used for these items. Additionally, the questionnaire includes a basic demographic survey of both the pet and the owner, including gender, age, time spent together, and self-rated human-cat relationship, comprising a total of 8 items. Refer to *Table 1* for details of the questionnaire items.

2.2 Subjects basic profile

Chinese cat owners were our main subjects of interest. Therefore, our inclusion criteria for survey recruitment are individuals who own at least one cat as their pet, while exclusion criteria are individuals who do not have any pets or own only dogs or other types of non-cat pets. A total of 406 valid responses were collected (152 males, 254 females) after screening and excluding invalid questionnaires with short response times (less than 1 minute) and repeated responses. The distribution of cat sex was 198 males and 208 females. The distribution of cat breeds was: Chinese Lihua ($n = 45$), Chinese Sanhua ($n = 76$), Shizi ($n = 64$), Jianshou ($n = 35$), British Shorthair ($n = 59$), American Shorthair ($n = 37$), Ragdoll ($n = 48$), Siamese ($n = 25$), and others ($n = 17$). Informed consent was provided to all participants, and the data was anonymized before analysis.

2.3 Data analysis

We analyzed the data collected through SPSSAU data tools (source: https://spssau.com) [23]. The reliability and validity of the questionnaire were examined using Cronbach's α and exploratory factor analysis (EFA). One-way ANOVA and chi-square tests were conducted to explore the factors influencing perceived human-cat relationship.

3 Results

3.1 Questionnaire and data validation

First, we conducted Cronbach's α test and exploratory factor analysis. See *Table 1* and *Table 2*.

Table 1. Results of Cronbach's alpha test.

Items	CITC	Cronbach's α if item deleted	Cronbach's α
1-1. My cat likes to explore unfamiliar places	0.679	0.890	
1-2. My cat likes to explore dangerous places	0.653	0.891	
1-3. My cat fails to perceive danger	0.561	0.896	
1-4. My cat likes to sit on high places	0.566	0.896	
1-5. My cat likes to climb	0.595	0.894	
1-6. My cat is comfortable outdoors	0.613	0.894	
1-7. My cat ventures far from home	0.610	0.894	0.901
1-8. My cat is very territorial, it chases unknown cat out if show up	0.623	0.893	
1-9. My cat preys on smaller animals	0.636	0.892	
1-10. My cat tortures its prey before killing them	0.632	0.893	
1-11. Among other cats, my cat is dominent	0.645	0.892	
1-12. My cat is hostile towards cats in the neiborhood	0.641	0.892	
2-1. My cat turns into "hype mode" from time to time	0.700	0.880	
2.2. My cat is energetic all the time	0.641	0.884	
2-3. My cat is friendly / has an affinity to human	0.614	0.886	
2-4. My cat needs company	0.633	0.885	
2-5. My cat needs constant stimulation	0.608	0.886	
2-6. My cat meows loudly	0.562	0.889	0.895
2-7. My cat sits on (or steps on) things I'm using purposely	0.608	0.886	
2-8. My cat is afraid of being alone	0.579	0.888	
2-9. My cat pesters people when it needs something	0.679	0.882	
2-10. My cat is easily distracted	0.574	0.888	
2-11. My cat is very curious	0.634	0.885	
3-1. My cat is disobedient	0.695	0.876	
3-2. My cat never learns lessons	0.623	0.882	
3-3. My cat is not afraid of punishments	0.623	0.882	
3-4. My cat likes to wreak havoc	0.717	0.874	
3-5. My cat steals food and water from people or other pets	0.637	0.881	0.892
3-6. My cat likes to ambush and scare people or other pets	0.653	0.879	
3-7. My cat disturbs people or other pets when they are resting	0.644	0.880	

3-8. When my cat plays with people, they quickly move for real (e.g., bites people suddenly)	0.617	0.882
3-9. My cat doesn't look vain at all after doing something bad	0.627	0.881

4-2. As opposed to the other pets and people in the house, my cat has control over common areas	0.976	0.609	
4-3. My cat occupies positions other cats like	0.513	0.733	
4-4. My cat is dominant among other cats in my house	0.514	0.733	
4-5. My cat is hostile towards other cats in my house	0.518	0.732	0.767
4-6. My cat is dominant among other non-cat pets in my house	0.303	0.772	
4-7. My cat occupies positions other pets (include non-cat pets) like	0.296	0.773	
4-8. My cat is hostile towards other pets (includes non-cat pets) in my house	0.299	0.772	

5-1. Between me and my cat, my cat is dominant	0.611	0.843	
5-2. My cat does not like to be touched or get close	0.653	0.836	
5-3. My cat seems to have a changeable temperament	0.718	0.824	0.860
5-4. My cat is hostile towards children / I fear that my cat will do harm to children	0.661	0.834	
5-5. My cat behaves aggressively towards strangers	0.661	0.834	
5-6. My cat purrs while attacking people	0.600	0.846	

Source: authors.

Through Cronbach's α reliability test in Table 1, dimension 1 (α = 0.901), dimension 2 (α = 0.895), dimension 3 (α = 0.892), and dimension 5 (α = 0.860), the α coefficients for four dimensions exceeded 0.8, indicating high reliability for these dimensions. The α coefficient for Dimension 4 was 0.767, which falls between 0.7 and 0.8, indicating good overall reliability.

The expected number of factors in this study was 5, namely boldness, disinhibition, meanness, pet-unfriendliness, and human-unfriendliness.

Table 2. Factor loading and communality.

Items	Factor loading						commu-nality
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	
1-1	**0.757**	0.017	-0.002	-0.096	0.041	-0.010	0.585
1-2	**0.701**	0.127	0.113	-0.015	0.015	-0.085	0.527
1-3	**0.614**	0.057	0.100	0.093	0.134	0.049	0.419

1-4	**0.661**	0.083	-0.071	-0.186	-0.105	-0.096	0.504
1-5	**0.674**	0.160	-0.101	-0.166	-0.103	-0.064	0.533
1-6	**0.691**	0.008	0.018	0.008	-0.050	-0.050	0.483
1-7	**0.657**	0.065	0.118	0.207	-0.001	0.076	0.498
1-8	**0.670**	0.132	0.128	0.070	-0.015	0.020	0.488
1-9	**0.685**	0.090	0.151	0.088	-0.001	0.068	0.513
1-10	**0.696**	0.090	0.079	0.065	-0.006	0.062	0.507
1-11	**0.703**	0.119	0.031	0.011	0.133	-0.056	0.530
1-12	**0.684**	0.123	0.127	0.186	0.009	0.048	0.536
2-1	0.046	0.124	**0.572**	**-0.485**	0.036	-0.006	0.581
2-2	0.192	0.196	**0.464**	**-0.473**	-0.013	0.020	0.515
2-3	0.059	-0.007	**0.522**	**-0.451**	0.054	-0.007	0.482
2-4	0.053	0.134	**0.564**	-0.375	-0.027	-0.028	0.481
2-5	0.153	0.124	**0.663**	-0.181	0.078	0.011	0.518
2-6	0.058	0.124	**0.680**	-0.111	0.009	-0.057	0.496
2-7	0.122	0.106	**0.694**	-0.129	-0.047	-0.093	0.536
2-8	0.041	0.066	**0.694**	-0.121	-0.024	0.045	0.505
2-9	0.055	0.126	**0.655**	-0.298	0.011	-0.030	0.538
2-10	0.041	0.018	**0.688**	-0.151	0.067	-0.026	0.504
2-11	0.155	0.197	**0.491**	**-0.441**	-0.047	0.010	0.501
3-1	0.044	**0.784**	0.043	-0.053	-0.002	-0.064	0.625
3-2	0.031	**0.717**	0.054	-0.045	0.002	0.011	0.520
3-3	0.037	**0.731**	0.011	-0.181	0.026	-0.004	0.570
3-4	0.126	**0.776**	0.099	0.060	0.019	-0.080	0.639
3-5	0.101	**0.727**	0.022	0.003	0.021	0.094	0.549
3-6	0.170	**0.705**	0.110	0.004	0.068	0.006	0.543
3-7	0.098	**0.676**	0.204	0.193	0.063	-0.057	0.553
3-8	0.194	**0.637**	0.225	0.147	0.022	0.020	0.517
3-9	0.181	**0.674**	0.095	0.087	-0.016	-0.006	0.505
4-2	-0.013	0.022	-0.014	0.065	**0.808**	**0.561**	0.973
4-3	0.014	0.068	0.043	-0.004	**0.965**	-0.190	0.974
4-4	0.018	0.051	0.014	-0.013	**0.967**	-0.192	0.975
4-5	0.028	0.052	0.024	0.026	**0.966**	-0.192	0.975
4-6	-0.006	-0.014	-0.044	0.114	-0.125	**0.974**	0.979
4-7	-0.015	-0.014	-0.075	0.118	-0.129	**0.968**	0.973
4-8	-0.008	-0.036	-0.034	0.093	-0.126	**0.974**	0.976
5-1	0.030	0.030	-0.202	**0.667**	0.033	0.058	0.492
5-2	0.081	0.036	-0.387	**0.622**	0.026	0.142	0.565

5-3	0.076	0.028	-0.241	**0.728**	-0.014	0.046	0.597
5-4	0.085	0.073	-0.209	**0.700**	0.029	0.104	0.558
5-5	0.058	0.086	-0.170	**0.746**	0.014	-0.012	0.596
5-6	0.116	0.077	-0.235	**0.639**	-0.025	0.092	0.492

Source: authors.

Based on *Table 2*, the items under Dimensions 1, 2, 3, and 5 exhibit strong correlations with their respective factors, which aligns with the initial expectations and indicates good construct validity for these four dimensions. However, the items under Dimension 2 show not only a high correlation with Factor 3 but also a certain degree of negative correlation with Factor 4. Factor 4 represents human unfriendliness, which is negatively associated with the quality of the human-cat relationship. On the other hand, Factor 3 represents disinhibition in cats, which reflects the inability to resist impulses, high activity levels, and difficulty controlling emotions. These characteristics may be perceived by owners as positive traits, such as being affectionate and lively. Hence, this kind of result is reflected in the data analysis.

The items under Dimension 4 exhibit correlations with both Factor 5 and Factor 6, indicating that the items intended to belong to one dimension now occupy two factors. In this study, Dimension 4 represents "pet-unfriendliness" and aims to measure the degree of unfriendliness exhibited by cats towards other pets in the household. The situation of pet ownership can be categorized into "only one cat," "multiple cats," and "one cat and other non-cat pets." The original study employed an additional "not applicable" option on top of the 5-point Likert scale [19]. Conversely, during the pilot testing of the initial questionnaire, some participants had difficulty understanding the intent of the "not applicable" option, leading to increased cognitive load during the response process. To address this issue, the current study utilized the advantages of online questionnaire and implemented the skip command to redirect respondents based on their pet ownership situation, thereby increasing the ease of use. Specifically, items 4-3, 4-4, and 4-5, targeting individuals who own multiple cats, exhibit strong correlations with Factor 5. Items 4-6, 4-7, and 4-8, targeting individuals who own both cats and non-cat pets, exhibit strong associations with Factor 6. Item 4-2, which applies to both groups, shows high correlations with both factors.

3.2   Extraction of factors related to perceived human-cat relationship

To further investigate the factors influencing the owner-perceived human-cat relationship, one-way ANOVA was conducted with a cut-off value of $p < 0.05$. See Table 3-6.

Table 3. ANOVA test results (x=owner gender).

| Items | Owner gender | | F | p |
	Male(n=152)	Female(n=254)		
1-1	3.16±1.23	**3.48±1.19**	6.82	0.009**
1-4	3.25±1.20	**3.50±1.13**	4.276	0.039*

1-7	**3.19±1.27**	2.93±1.24	4.042	0.045*
2-6	**3.55±1.10**	3.31±1.16	4.441	0.036*
4-6	**3.47±1.41**	2.76±1.32	5.131	0.026*
4-8	**3.50±1.20**	2.74±1.22	7.522	0.008**

Note. **$p < .01$ *** $p < .001$. Source: authors.

From *Table 3*, "owner's gender" has a significant influence on items 1–1, 1-4, 1–7, 2–6, 4-6, and 4–8. Specifically, female owners are more inclined to agree with items 1–1 and 1-4 compared to male owners, while male owners are more inclined to agree with items 1–7, 2–6, 4-6, and 4–8.

Table 4. ANOVA test results (x=cat sex).

Items	Cat sex		F	p
	Male(n=152)	Female(n=254)		
1-2	**3.35±1.13**	3.08±1.29	4.905	0.027*
1-4	**3.53±1.10**	3.28±1.21	4.586	0.033*
5-1	2.26±1.07	**2.63±1.18**	10.793	0.001**
5-2	2.18±1.13	**2.45±1.12**	5.668	0.018*
5-5	2.34±1.15	**2.64±1.22**	6.292	0.013*

Note. **$p < .01$ *** $p < .001$. Source: authors.

From *Table 4*, "cat's sex" has a significant influence on items 1-2, 1-4, 5-1, 5-2, and 5-5. Overall, regarding the items that inquire about the "boldness" trait of the cat (items 1-2 and 1-4), the owners' perception tends to be positively evaluated. However, for the three items (5-1, 5-2, and 5-5) that inquire about "human-unfriendliness," the perception leans towards the negative. Specifically, the owners who have male cats tend to agree more with items 1-2 and 1-4 compared to the owners who have female cats. Conversely, owners of female cats tend to express a more neutral attitude in items 5-1, 5-2, and 5-5.

Table 5. ANOVA test results (x=cat's age).

Items	Cat age			F	p
	<10 weeks(n=79)	10 weeks-7years(n=285)	> 7 years(n=42)		
3-7	3.23±1.30	2.92±1.23	**3.40±1.21**	3.984	0.019*
4-6	**3.94±1.20**	2.90±1.37	2.78±1.48	4.099	0.021*
4-7	**4.00±0.79**	3.02±1.22	2.78±1.56	5.018	0.009**
5-3	**2.76±1.28**	2.39±1.13	2.67±1.20	3.689	0.026*
5-4	2.58±1.10	2.28±1.16	**2.79±1.22**	4.903	0.008**

Note. **$p < .01$ *** $p < .001$. Source: authors.

From *Table 5*, "cat's age" has a significant influence on items 3–7, 4-6, 4–7, 5–3, and 5–4. Owners who have cats aged less than 10 weeks tend to express agreement on items

4-6, 4-7, and 5-3. On the other hand, owners of cats aged between 10 weeks and 7 years tend to give negative opinions on items 3–7 and 5–3 compared to other age groups.

Table 6. ANOVA test results (x=time spent together).

Items	Time spent together		F	p
	Few(n=309)	Much(n=97)		
1-5	**3.59±1.11**	3.31±1.18	4.527	0.034*
1-7	**3.11±1.24**	2.76±1.26	5.825	0.016*
2-7	3.23±1.12	**3.54±1.23**	5.272	0.022*
4-5	**3.20±1.20**	2.69±1.41	4.294	0.040*

Note. **p< .01   *** p< .001. Source: authors.

From *Table 6*, "time spent together" has a significant influence on items 1–5, 1–7, 2–7, and 4-5. Specifically, owners who spend less time interacting with their cats tend to express agreement in items 1–5, 1–7, and 4-5 and tend to hold a neutral attitude in items 2–7. On the other hand, individuals who spend more time with their cats are more likely to express a neutral or positive attitude in items 1–5, 1–7, and 4-5, while holding agreement in items 2–7.

In addition, we conducted a chi-square test with the independent variable "time spent together" and the dependent variable "self-rated human-cat relationship". The results are presented in *Table 7*.

Table 7. Results of Chi-Squared Test.

Items	Select-ion	Time spent together		Sum	χ^2	p
		Few（n=309）	Much（n=97）			
Self-rated human-cat relationship	Good	134(44.08%)	**55(58.51%)**	189(47.49)	6.245	0.044*
	Normal	**125(41.12%)**	27(28.72%)	152(38.19)		
	Bad	**45(14.80%)**	12(12.77%)	57(14.32)		
Sum		304	94	398		

Source: authors.

It can be concluded from *Table 7* that owners who spend more time with their cats tend to be more positive in their self-rated relationship, and the proportion of ambiguous (selecting "normal") or negative feedback is lower as well. This result aligns with the common understanding that spending more time with pets helps owners develop a better understanding of their relationship.

4   Discussion

The human-pet relationship is an important factor that influences the quality of life for both humans and pets. However, previous research has primarily focused on medical

studies and pet personality research, with limited research examining the owner-perceived human-pet relationship. This study employed a questionnaire in which cat behaviors were measured through owners rating, aiming to investigate the factors that influence the owner's perception of human-cat relationship. Through quantitative analysis of the collected data, four factors related to the human-cat relationship were identified: "owner's gender", "cat's sex", "cat's age", and "time spent together", along with their associations with cat behaviors.

(1) **"Cat's sex" has a significant influence on various items in the "boldness" and "pet-unfriendliness" dimensions.** The results of our study indicate that owners of male cats are more likely to perceive their cats as "bold" (items 1-2 and 1-4) and have a stronger belief that their relationships are positive (items 5-1, 5-2, and 5-5). In contrast, owners of female cats tend to have more conservative attitudes across all items. Generally, male cats have a higher activity level than female cats, tend to display a higher level of friendliness, and are more attached to the family [24]. From these characteristics, we speculate that the observed differences in the results may be attributed to the behavioral patterns associated with cats' sex.

(2) **"Cat's age" significantly influences the perception of "pet-unfriendliness" and "human-unfriendliness" dimensions of cat behavior.** The development of domestic cats can be roughly divided into three stages: 2–10 weeks as the kitten learning period; 9–16 weeks when their eating, social, and daily activity behaviors gradually establish; and after 7 years, their eating habits may change, accompanied by a decrease in daily activity levels [25, 26]. Based on this pattern and our finding, 10 weeks - 7 years is a stage where cats are relatively stable in terms of their behaviors, which result in lower scores in the dimensions of boldness and pet-unfriendliness, and thus are more likely to receive positive evaluations from their owners compared to the other two age groups. Meanwhile, kittens younger than 10 weeks have behaviors that are not fully developed and are less familiar with their living environment, owners, and other pets (if presented). Therefore, their owners are more likely to perceive them as having a "changeable temperament" (item 5-3) and exhibiting more dominance towards other pets or people in the household (items 4-6, 4-7).

(3) **"Time spent together" has a direct impact on the owner's perception of the human-cat relationship.** Spending more time with the cat clearly increases the frequency of interaction, making it more likely to meet the cat's daily activity needs. Conversely, less interaction results in more alone time indoors for the cat, which reduces the owner's opportunities to observe the cat's behavior. Item 4-5 ("My cat is hostile towards other cats in my house") reflects the social behavior between cats and their conspecifics. Our result indicates that people who have less interaction with their pets tend to suspect that their cats have hostile feelings towards other cats. However, based on previous research, the social behavior of cats towards conspecifics is primarily influenced by their early environment (0–12 weeks) and their experiences with other cats [27]. The impact of human-pet interaction on the behavior of cats (especially hostile behavior) is still not well established.

(4) **"Owner's gender" has a significant influence on certain items related to the "boldness" and "pet-unfriendliness" dimensions.** However, the specific mechanisms through which the owner's gender affects their perception of the human-cat

relationship are not yet clear, and further research is needed to confirm this finding. Additionally, "time spent together" has a direct connection to owners' self-rated human-cat relationships. Owners who spend more time interacting with their cats tend to perceive their relationship as positive. Conversely, less interaction leads to ambiguous responses. This result aligns with the general understanding of the human-pet relationship.

In summary, the conclusion drawn from this study is that pet owners' subjective perception of the human-cat relationship is influenced by four factors: "owner's gender", "cat's sex", "cat's age", and "time spent together". We believe that the discovery of these factors may help cat owners further understand the relationship between cat behavior and human-cat relationships, which may also serve as a guide for improving their well-being.

5   Conclusion

This study is based on the CAT-Tri+ questionnaire to investigate the correlation between the behavior of domestic cats and the human-cat relationship. The identified significant factors are: "owner's gender", "cat's sex", "cat's age", and "time spent together" The underlying implications and meanings of the findings were discussed.

For cat owners, the questionnaire used in this study helps them gain more insights into the human-cat relationship. In real-life situations, owner-perceived human-cat relationships often come from observations and experiences. Through this questionnaire, cat owners can learn about their cats' behavior in different contexts, which grants more detailed interpretations of their cats' personalities. This enables them to improve the human-cat relationship more objectively. For example, if their cat receives a high score in the dimension of "inhibition," it indicates that the cat has a high level of activity and needs more opportunities for interaction. To foster a harmonious relationship, owners can spend more time playing with their cats, provide cat supplies or toys, and diversify activities to meet the cat's needs for exercise.

For future research on the human-cat relationship, factors such as "owner's gender", "cat's sex", "cat's age," and "time spent together" are important factors that influence owners' interpretation of cat behavior and perceived human-cat relationship. For cat owner selection, having sufficient time to interact with their cats should be considered a criterion to ensure a basic understanding of the pet's daily behavioral habits. For cat selection, it is recommended to choose cats that are between 10 weeks and 7 years old to reduce the possible interference.

The quality of the human-cat relationship is not only influenced by the factors mentioned in this study but also related to many other factors such as cat breed, diseases, neuter status, etc. The complexity of the variables and conditions involved made it impossible to cover them in this study. Therefore, we suggest that future research explore other related factors to enhance the research framework for domestic cat behavior and the human-cat relationship.

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