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Tailoring The C-BARQ To Shelter Dogs: Identification Of Five Reliable Factors

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Abstract – Despite the multitude of studies on dog behavior using the Canine Behavioral Assessment and Research Questionnaire (C-BARQ), little is known about its utility in a shelter population. This study aimed to identify and validate a subset of items adapted from the C-BARQ to assess behavior in sheltered dog populations. All questionnaires were administered while the dogs were still in the shelter and were completed by shelter staff, volunteers, or members of the research team who had the most frequent interactions with the study dogs. Analysis included 445 questionnaire responses, one per dog, from 11 shelters. Exploratory (n = 222) and confirmatory (n = 223) factor analyses revealed a five-factor structure (Fear, Arousal, Human Excitability, Dog Aggression, and Human Aggression) comprising 24 items henceforth referred to as the Shelter C-BARQ. These factors exhibited above-threshold internal consistency reliability (M = .78) and meaningful inter-factor correlations, affirming their suitability for assessing the behavior of sheltered dogs. Furthermore, item response theory analysis underscored the reliability and validity of these items in measuring the underlying constructs. These findings can be particularly valuable for shelters facing resource constraints, offering both efficiency and validated data collection methods to collect behavioral information.

Keywords – Shelter dogs, C-BARQ, Factor structure, Behavior assessment, Psychometric analysis

Behavioral problems are among the primary causes of euthanasia and relinquishment of dogs in the United States and Europe (Hsu & Serpell, 2003). Duffy et al. (2014) reported that nearly half of relinquishing owners cited behavioral issues as contributing factors in surrendering dogs to animal shelters and they were the primary reason for relinquishment in approximately 25% of cases. In Northern Ireland, Wells and Hepper (2000) reported that 68% of dogs showed behavioral problems after adoption, with 90% of those returned within four weeks also exhibiting such issues. To address these concerns, many dogs undergo behavioral evaluations in the shelter, assessing traits like fearfulness, aggression, and friendliness to determine adoption eligibility (Clay et al., 2020b; Dowling-Guyer et al., 2011). Dogs with problematic behavior may not only be returned post-adoption but also present safety risks to shelter staff, foster care volunteers, adopting owners, and the general public, including their pets (Christensen et al., 2007; Mondelli et al., 2004; Powdrill-Wells et al., 2021; Powell et al., 2022; Shore, 2005; Stephen & Ledger, 2007; Wells & Hepper, 2000). Growing public pressure to improve animal welfare and save the lives of shelter-housed animals has fueled the urgent need for reliable and accurate screening methods to identify major behavioral problems within this population of dogs (Duffy & Serpell, 2012).

Acquisition of behavioral information for shelter-housed dogs has been acknowledged as valuable; however these evaluations typically require a dedicated testing environment and specialized staff for an extended period of time per dog (Netto & Planta, 1997; Palma et al., 2005; Sternberg, 2002; van der Borg et al., 1991; Weiss, 2002). Taylor and Mills (2006) highlighted the importance of assessments that measure aspects pertinent to common reasons for surrender or return. They emphasized the value of targeting specific characteristics about dogs in order to aid adopters in finding an ideally matched dog. However, they also voiced concern about resource-intensive comprehensive assessments with numerous subtests, suggesting that attempting to capture a broad range of general information might yield lower sensitivity compared to more specific tests. Furthermore, shelters frequently face staffing and resource challenges (Daly, 2021), further underscoring the need for a more efficient behavioral assessment tool.

An alternative to formal behavior assessments are questionnaires. In-home behavior questionnaires, designed primarily for dog owners (Hsu & Serpell, 2003; Ley et al., 2008; Mirko et al., 2012), ask owners to rate their dog's behavior in various scenarios based on everyday observations rather than formal evaluations. Although shelter staff may not know individual dogs as intimately as their owners, their extensive experience with many dogs enables them to assess behavior accurately (Griffin et al., 2024). By combining elements of formal behavioral tests and owner-centric questionnaires, a resource-efficient method of assessing behavior can be developed for shelters. This approach would allow expert individuals with varying degrees of familiarity with the dogs to report their observations in natural settings. It provides a more holistic view of the dog's behavior compared to formal tests and does not require more resources than routine daily interactions and husbandry practices.

The Canine Behavioral Assessment and Research Questionnaire (C-BARQ) is a widely used scale for evaluating the presence and severity of behavioral problems in pet dogs (Duffy & Serpell, 2008; Hsu & Serpell, 2003; Serpell & Hsu, 2005). Originally developed by Hsu and Serpell (2003) with 68 items grouped by factor analysis into 11 factors, the most widely used version today, C-BARQ, comprises 78 items distributed among 14 factors alongside 22 standalone behavioral measures. Click or tap here to enter text.The factor structure of the C-BARQ has demonstrated some consistency across both breed (Duffy et al., 2008; Hsu & Serpell, 2003; van den Berg et al., 2006, 2010) and geographic location (Canejo-Teixeira et al., 2018; González-Ramírez et al., 2017; Hsu & Sun, 2010; Nagasawa et al., 2011) for owned dogs, but validation work on shelter-housed dogs is absent from the literature. Duffy et al. (2014) evaluated a shortened 42-item version of the C-BARQ (referred to as the "C-BARQ(S)" or "mini-C-BARQ") which was administered to owners as they relinquished dogs to a shelter and to new adopters two months post-adoption. Although this version showed promise as a shelter intake survey, it was not given to dogs living in the shelter. However, Thielke and Udell (2019) utilized the C-BARQ(S) to understand the role of attachment styles on the well-being of both sheltered and fostered dogs. They found that fostered dogs scored significantly higher than sheltered dogs on C-BARQ(S) items assessing attachment and separation-related problem behaviors, while no significant differences were found regarding stranger-directed fear items (Thielke & Udell, 2019).

Given the absence of validation studies conducted with the C-BARQ on sheltered dogs and the need for short yet accurate behavioral assessments in animal shelters, this study aims to identify, evaluate, and provide validity evidence for the factor structure of a subset of items taken from the original 100-item C-BARQ questionnaire using a sample of sheltered dogs.

Method

Ethic Statement

The study was waived for approval by the Arizona State University IRB as it was determined that the research activities did not constitute human subjects research.

Study Design and Participants

Data collection for the current study occurred concurrently with a series of three studies on dog fostering by Gunter et al. (2019, 2021, 2023). Only dogs participating in these fostering studies were eligible for questionnaire completion. Shelter staff determined the selection criteria for the Gunter et al. (2019, 2021, 2023) studies, ensuring dogs were eligible for fostering experiences (e.g., not on hold or quarantine). To adhere as closely as possible to the instructions for completing the original 100-item C-BARQ, we sought responses from the person most familiar with each dog. We provided a list of study dogs to animal care, behavior, and foster staff at each shelter, and asked the staff member with the most interactions with each dog to complete the questionnaire. Respondents were given the option to complete either a paper version of the questionnaire or an online version via Qualtrics (https://www.qualtrics.com), an online survey platform. Respondents who used Qualtrics provided consent through an online form, while those using the paper version provided verbal consent. All questionnaires were completed while the dogs were still in the shelter. Sample size by shelter, as well as intake type and average length of stay, age, weight, and sex can be found in the supplementary materials (Table S1). A total of 445 dogs participated in the study.

Measures

Because the current study aims to identify a subset of items from the original C-BARQ that can be used in both a shelter and home environment, the 100-item C-BARQ was carefully reviewed by an expert panel (LG and EF). Any questions that could not be answered about a dog in both a shelter and home environment were removed, resulting in the retention of 37 items (see Tables 1.1-1.4). Following the guidelines of Hsu and Serpell (2003), respondents were instructed to answer all questions using a 5-point ordinal response scale to assesses either the severity (e.g., dog-directed aggression, nonsocial fear, excitability, etc.) or frequency (e.g., attachment and attention-seeking, chasing, energy, trainability, all miscellaneous items) of the dog's behavior in various situations. Generally, higher scores indicate less desirable responses, except in the case of trainability items, where higher scores are favorable (Duffy & Serpell, 2012; Serpell & Duffy, 2014). However, if the dog's response to the particular situation was not known or if the question was not applicable for any other reason, the respondent could select "NA." These non-answered responses were treated as missing values.

Table 1.1

Fear Items Subject Matter Experts Selected From 100-Item C-BARQ

Instructions to Respondents	Item ID	Item Content		Factor Derived From	Questionnaire Section
		Shelter	Original		
Dogs often show signs of anxiety or fear when exposed to particular sounds, objects, persons or situations—e.g. crouching or cringing with tail tucked between the legs; whimpering or whining, freezing, trembling, or attempting to escape or hide. Using the following 5-point scale (1=No fear, 5=Extreme fear), please indicate the dog's tendency to display fearful behavior in the following circumstances	Fear_1	When seeing an unfamiliar adult while away from their kennel	N/A	Stranger-directed fear	Fear & Anxiety
	Fear_2	When approached by an unfamiliar adult while away from their kennel	When approached directly by an unfamiliar adult while away from your home	Stranger-directed fear	Fear & Anxiety
	Fear_3	When an unfamiliar person (to the dog) visits their kennel	When unfamiliar persons visit your home	Stranger-directed fear	Fear & Anxiety
	Fear_4	When an unfamiliar person (to the dog) tries to touch or pet the dog		Touch sensitivity	Touch Sensitivity
	Fear_5	In response to sudden or loud noises (e.g. vacuum cleaner, hair dryer, car backfire, objects being dropped, etc.)		Nonsocial fear	Fear & Anxiety
	Fear_6	When a familiar person returns to their kennel	N/A	Stranger-directed fear	Fear & Anxiety
	Fear_7	In response to strange or unfamiliar objects while on-leash (e.g. plastic trash bags, leaves, litter, flags flapping, etc.)	In response to strange or unfamiliar objects on or near the sidewalk (e.g. plastic trash bags, leaves, litter, flags flapping, etc.)	Nonsocial fear	Fear & Anxiety
	Fear_8	When seeing an unfamiliar dog on-leash	N/A	Dog-directed fear	Fear & Anxiety
	Fear_9	When entering their kennel for the first time	When first exposed to unfamiliar situations (e.g. first car trip, first time in elevator, first visit to veterinarian, etc.)	Nonsocial fear	Fear & Anxiety
	Fear_9x	When approached by an unfamiliar dog on-leash	When approached directly by an unfamiliar dog of the same or larger size	Dog-directed fear	Fear & Anxiety
	Fear_10	When barked, growled or lunged at by an unfamiliar dog when being walked on-leash	When barked, growled, or lunged at by an unfamiliar dog	Dog-directed fear	Fear & Anxiety

Note. Factor and questionnaire section names are taken from Serpell, J. A., & Duffy, D. L. (2014). The "Item Content" column presents the wording used in this study alongside the original wording from the 100-item C-BARQ when applicable. Blank entries in the "Original Item Content" column indicate that the item content remained unchanged for this study, while "N/A" denotes that there is no corresponding item in the original questionnaire.

Table 1.2

Miscellaneous Items Subject Matter Experts Selected From 100-Item C-BARQ

Instructions to Respondents	Item ID	Item Content		Factor Derived From	Questionnaire Section
		Shelter	Original		
Some dogs show little reaction to exciting events, while others become highly excited at the slightest novelty. By using the following 5-point scale (1=Calm, 5=Extremely excitable), please indicate the dog's tendency to become excitable in the following circumstances.	Misc._1	Easily distracted by interesting sights, sounds, or smells		Trainability	Training and obedience
	Misc._2	Tends to sit close to, or in contact with, you (or others) when sitting down		Attachment/attention-seeking	Attachment and attention-seeking
	Misc._3	Barks or whines when you leave or are about to leave their kennel (even momentarily)	How often has your dog barked or whined when left, or about to be left, on its own	Separation-related behavior	Fear and anxiety
	Misc._4	Chases or wants to chase squirrels, rabbits or other small animals given the opportunity		Chasing	Chasing
	Misc._5	Chews or attempts to chew inappropriate objects	Chews inappropriate objects	Miscellaneous	Miscellaneous
	Misc._6	Mounts objects, furniture or people		Miscellaneous	Miscellaneous
	Misc._7	Pulls on the leash (when walking equipment IS used, such as a harness)	Pulls excessively hard when on the leash	Miscellaneous	Miscellaneous
	Misc._8	Attempts to escape or would escape from their kennel or enclosure if given the chance	Escapes or would escape from home or yard given the chance	Miscellaneous	Miscellaneous
	Misc._9	Urinates against objects/furnishings in their kennel	Urinates against objects/furnishings in your home	Miscellaneous	Miscellaneous
	Misc._10	Urinates when approached, petted, handled or picked up		Touch sensitivity	Touch sensitivity
	Misc._11	Chases own tail/hind end		Miscellaneous	Miscellaneous
	Misc._12	Barks persistently when alarmed or excited		Miscellaneous	Miscellaneous

Note. Details as for Table 1.1

Table 1.3

Excitability Items Subject Matter Experts Selected From 100-Item C-BARQ

Instructions to Respondents	Item ID	Item Content		Factor Derived From	Questionnaire Section
		Shelter	Original		
Some dogs show little reaction to exciting events, while others become highly excited at the slightest novelty. By using the following 5-point scale (1=Calm, 5=Extremely excitable), please indicate the dog's tendency to become excitable in the following circumstances.	Excite_1	When you or others return after a brief absence (including inside the building but away from the dog)	When you or other members of the household come home after a brief absence	Excitability	Excitability
	Excite_2	Playing with you or someone else	When playing with you or other members of your household	Excitability	Excitability
	Excite_3	Just before being taken for a walk		Excitability	Excitability
	Excite_4	When visitors arrive at their kennel	When visitors arrive at your home	Excitability	Excitability

Note. Details as for Table 1.1

Table 1.4

Aggression Items Subject Matter Experts Selected From 100-Item C-BARQ

Instructions to Respondents	Item ID	Item Content		Factor Derived From	Questionnaire Section
		Shelter	Original		
Most dogs display stressed behavior from time to time—e.g. barking, growling, baring teeth, snapping, etc. By using the following 5-point scale (1= No stress, 5= Serious stress), please indicate the dog's tendency to display stressed behavior in each of the following circumstances..	Aggress_1	When approached by a new person while being walked on-leash	When approached directly by an unfamiliar adult while being walked/exercised on a leash	Stranger-directed aggression	Aggression
	Aggress_2	When seeing an unfamiliar person while on-leash	N/A	Stranger-directed aggression	Aggression
	Aggress_3	When approached by an unfamiliar dog while being walked on-leash	When approached directly by an unfamiliar dog while being walked/exercised on a leash	Unfamiliar dog-directed aggression	Aggression
	Aggress_4	When seeing another dog on-leash	N/A	Unfamiliar dog-directed aggression	Aggression
	Aggress_5	When barked, growled, or lunged at by another (unfamiliar) dog while being walked on-leash	When barked, growled, or lunged at by another (unfamiliar) dog	Unfamiliar dog-directed aggression	Aggression
	Aggress_6	Towards unfamiliar people (to the dog) while entering their kennel	Toward unfamiliar persons visiting your home	Stranger-directed aggression	Aggression
	Aggress_7	When an unfamiliar person (to the dog) tries to touch or pet the dog while in their kennel	When an unfamiliar person tries to touch or pet the dog	Stranger-directed aggression	Aggression
	Aggress_8	When dogs walk past their kennel	Toward unfamiliar dogs visiting your home	Unfamiliar dog-directed aggression	Aggression
	Aggress_9	Towards familiar people returning to their kennel	N/A	Owner-directed aggression	Aggression
	Aggress_10	When toys, bones or other objects are taken away	When toys, bones or other objects are taken away by a household member	Owner-directed aggression	Aggression

Note. Details as for Table 1.1

Analysis

The full sample of 445 dogs was randomly divided into an exploratory sample (n = 222) and validation sample (n = 223) using R statistical software (Version 4.1.3). That is, 50% of the full sample was randomly selected to be in the exploratory sample and the remaining 50% was designated as the validation sample. Each item was examined for low response rates in each of the three datasets (full, exploratory, and validation). While the data originated from 11 different shelters, our primary focus was on identifying the number of factors and their structure in the abbreviated C-BARQ for sheltered dogs in general, rather than differences between individual shelters. As such, we did not use multilevel modeling techniques with shelter as a factor (Stapleton et al., 2016). Although we recognize the possibility of a shelter effect, this was not the objective of this paper. The relatively small sample size at each shelter (range: 34-45), would also make it challenging to determine whether the shelter effect had a substantial impact on the metrics of primary interest (e.g., factor loadings). Response categories for each item with fewer than five responses were collapsed into the preceding response category. For example, if category five for an item only had three responses, then those three entries were coded as category four responses. This is done to ensure that each category had a minimum number of responses for stable and meaningful analyses (Toland, 2014).

Polychoric correlations, which are appropriate for calculating correlations between ordered categorical variables, were used in both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA; Wirth & Edwards, 2007). Polychoric correlations were calculated in all three samples using Mplus statistical software (Version 8.4; Muthén & Muthén, 2019). Highly correlated items were assessed for redundancy and marked for possible removal if the magnitude of the correlation was greater than or equal to .90. To reduce the number of items in the abbreviated C-BARQ while retaining as much information as possible, one item from each highly correlated pair was removed. This approach helps simplify the model by eliminating redundancy and ensuring that each item contributes unique information to the factor structure. Seven items (Fear 1, Fear 2, Fear 3, Fear 8, Agg 2, Agg 4, and Agg 6) were dropped due to high polychoric correlations (see Tables S2.1-S2.3), and five items (Misc 2, Misc 6, Misc 9, Misc 10, and Misc 11) were dropped due to very low variability in responses (i.e., floor effects). Next, we describe the EFA, CFA, and item response theory (IRT) analyses in more detail.

EFA

An iterative approach was used to reduce the number of items and understand the structure underlying them. EFAs, parallel analysis, and visual examination of scree plots were used in determining an appropriate number of factors to estimate (Horn, 1965). EFAs on the randomly selected exploratory sample were conducted in Mplus (Version 8.4). Diagonally weighted least squares estimation with robust standard errors and polychoric correlations were used for ordinal categorical data at the item level (Wirth & Edwards, 2007). Oblique CF-Quartimax rotation was used to allow the factors to correlate, which is a recommended rotation method in the psychometric literature (e.g., Browne, 2001; and Fabrigar et al., 1999). An oblique rotation was chosen over orthogonal rotation due to the expected correlations between factors, reflecting the interrelated nature of behavioral traits in sheltered dogs. Thurstone (1935, 1947) advocated for the use of oblique rotation for its alignment with real-world scenarios, where correlated factors are common. This choice ensures a more accurate representation of the data by accommodating potential correlations between factors.

CFA

Following EFA, initial CFAs were conducted on the exploratory sample (n = 222) using Mplus (Version 8.4). We analyzed polychoric correlations using the robust diagonally weighted least squares (WLSMV) estimator. We used the theta parametrization and factor variances were set to one for model identification purposes. Using polychoric correlations in combination with the WLSMV estimator corrects for the categorical nature of the data and produces trustworthy fit indices (Edwards, 2009). Model fit was evaluated with the commonly used indices for non-nested models: root mean square error of approximation (RMSEA; Steiger, 2016), comparative fit index (CFI; Bentler & Chou, 1987), Tucker-Lewis fit index (TLI; Tucker & Lewis, 1973), and standardized root mean square residual (SRMR; Bentler, 1995). To evaluate whether a model provided a good approximation to the data, the following guidelines from Hu and Bentler (1999) were used: RMSEA and SRMR less than .1; and CFI and TLI greater than .9. Additionally, modification indices and the residual correlation matrix from each model were inspected. After initial CFAs and model comparison, a subsequent CFA was estimated to test the preferred model in the validation sample (n = 223). A final CFA was then estimated using the full sample (N = 445) to obtain parameter estimates for the preferred model.

Coefficient alpha (Cronbach, 1951) and coefficient omega (McDonald, 1970) were calculated using the 'psych' package in R (Revelle, 2022). Coefficient alpha, unless stringent and often unrealistic test assumptions are satisfied, serves as a lower bound of reliability (Sijtsma, 2009). Therefore, coefficient omega is presented as an alternative, offering a more accurate reliability estimate under more realistic test conditions (McNeish, 2018).

IRT

Following the factor analyses, we used IRT, which offers an in-depth understanding of how individual items contribute information and relate to the construct of interest. While IRT models can be viewed as reparameterizations of item factor analysis models (e.g., Takane & de Leeuw, 1987), the IRT parameterization provides useful information for evaluating item performance, including slope and intercept parameters, as well as item-level fit statistics. Moreover, IRT parameterization provides visual aids for evaluating both item-level performance (e.g., trace line plots) and scale-level performance (e.g., test information function [TIF] plots). Through this approach, IRT enables the identification of where items are most informative for dogs at specific construct levels. For example, an item about a dog entering a kennel for the first time may yield more information for dogs with higher fear levels (who will likely have more varied responses) compared to dogs with lower levels of fear (who are more prone to consistently exhibit no fear when entering a kennel). In this way, IRT analysis can identify the range of construct levels where the scale works best.

The graded response model (GRM; Samejima, 1969) is appropriate when analyzing ordered categorical item responses, such as those on the C-BARQ. We used the GRM and the marginal maximum likelihood expectation-maximization estimator (Bock & Aitkin, 1981) in flexMIRT software (Cai, 2022; Version 3.6.5) with default settings. Priors were not used initially but were used in two cases to stabilize parameter estimation. All IRT analyses were conducted with the full sample (N = 445).

Results

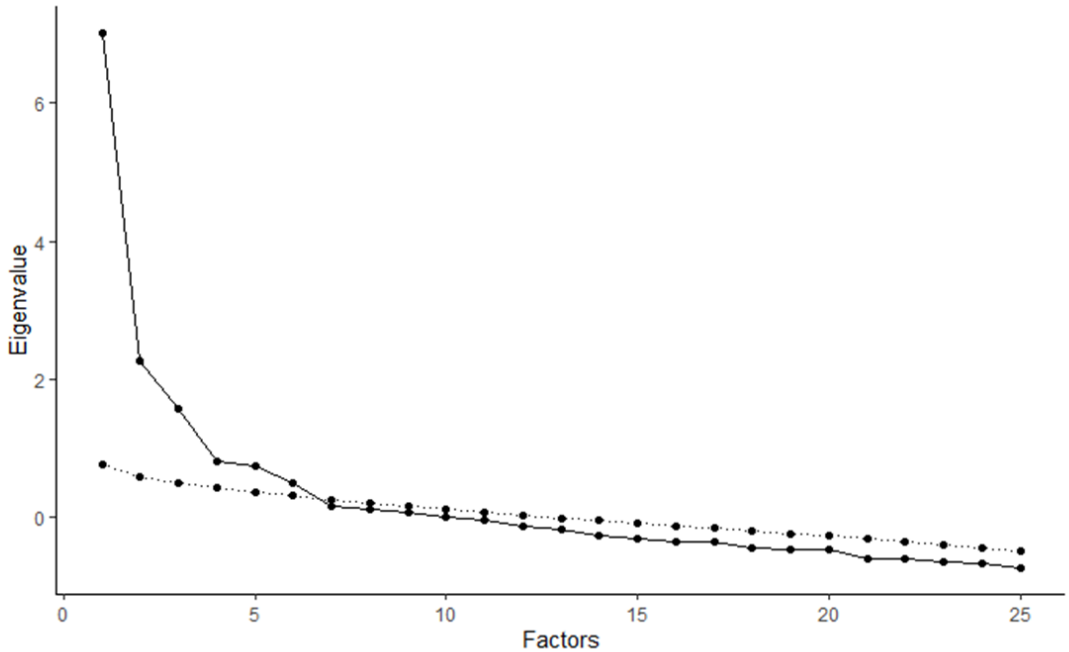
The individuals in our sample were predominantly mature adult male dogs of medium to large size (Table S1). This corresponds to the typical demographic trends seen in shelter dog populations (Cain et al., 2020).

EFA

Determining the most plausible factor structure was first guided by parallel analysis and examination of scree plots (Figure 1), followed by a set of EFAs. The scree plot and the parallel analysis suggested between four and six factors which were examined in subsequent EFAs.

Figure 1

Scree Plot and Parallel Analysis Based on Exploratory Sample (n = 222) With 24 Items



Note. Scree plots based on exploratory sample (n = 222) suggest four, five, or six factors. Solid line represents eigenvalues of exploratory sample factors. Dashed line represents average eigenvalues from simulated datasets derived from parallel analysis involving randomly generated datasets of the same size and variable structure as the exploratory sample. Factors with eigenvalues above the average eigenvalues of random data and located before the leveling-off point in the solid line should be retained, supporting the retention of four, five, or six factors.

After evaluating the four-, five-, and six-factor solutions (see Tables S4 through S6), the four- and five-factor models were deemed most plausible. Item Misc 12's factor loading became weaker across factors when moving from four to five and six factors and thus was removed. The plausibility of the four- and five-factor models was supported by the fact that the six-factor model contained a weak factor composed of only two items. For these reasons, only the four- and five-factor models were considered further.

CFA

Factor loadings and model fit indices for the remaining 24 items were evaluated in correlated four- and five-factor models. In the exploratory sample (n = 222), both models exhibited good fit to the data except for the SRMR which was slightly over the cutoff in both models. The four-factor model had RMSEA = .04, 90% confidence interval (CI) [.03, .05]; CFI = .96; TLI = .96; and SRMR = .14, whereas the five-factor model had RMSEA = .04, 90% CI [.03, .05]; CFI = .97; TLI = .97; and SRMR = .13. Fit statistics for the correlated four- and five-factor models in the exploratory, validation, and full sample are presented in Table S3. Given these results, the five-factor model represented a more plausible structure underlying the 24-item measure compared to the four-factor model and therefore only the five-factor model was retained for subsequent analyses.

Based on the pattern of factor loadings and item content (Duffy & Serpell, 2014), the five factors were composed and labeled as follows: Fear (seven items), Arousal (six items), Human Excitability (four items), Dog Aggression (four items), and Human Aggression (three items). The factor loadings and correlations for the five-factor solution in the full sample (N = 445) are presented in Table 2 and Table 3 respectively.

Table 2

Standardized Factor Loadings and Standard Errors for the Final Five-Factor Model of the 24-Item C-BARQ in the Full Sample (N = 445)

Item ID	Item Content	Factor				
		Fear	Arousal	Human Excitability	Dog Aggression	Human Aggression
Fear_4	When an unfamiliar person (to the dog) tries to touch or pet the dog	.85 (.03)				
Fear_5	In response to sudden or loud noises (e.g. vacuum cleaner, hair dryer, car backfire, objects being dropped, etc.)	.84 (.03)				
Fear_6	When a familiar person returns to their kennel	.89 (.05)				
Fear_7	In response to strange or unfamiliar objects while on-leash (e.g. plastic trash bags, leaves, litter, flags flapping, etc.)	.83 (.03)				
Fear_9	When entering their kennel for the first time	.86 (.03)				
Fear_9x	When approached by an unfamiliar dog on-leash	.79 (.06)				
Fear_10	When barked, growled or lunged at by an unfamiliar dog when being walked on-leash	.84 (.04)				
Misc_1	Easily distracted by interesting sights, sounds, smells		.72 (.03)			
Misc_3	Barks or whines when you leave or are about to leave their kennel (even momentarily)		.66 (.04)			
Misc_4	Chases or wants to chase squirrels, rabbits or other small animals given the opportunity		.84 (.04)			
Misc_5	Chews or attempts to chew inappropriate objects		.64 (.05)			
Misc_7	Pulls on the leash (when walking equipment IS used, such as a harness)		.68 (.03)			
Misc_8	Attempts to escape or would escape from their kennel or enclosure if given the chance		.51 (.05)			
Excite_1	When you or others return after a brief absence (including inside the building but away from the dog)			.84 (.02)		
Excite_2	Playing with you or someone else			.80 (.02)		
Excite_3	Just before being taken for a walk			.88 (.02)		
Excite_4	When visitors arrive at their kennel			.89 (.02)		
Agg_3	When approached by an unfamiliar dog while being walked on-leash				.86 (.03)	
Agg_5	When barked, growled, or lunged at by another (unfamiliar) dog while being walked on-leash				.91 (.04)	
Agg_8	When dogs walk past their kennel				.82 (.03)	
Agg_10	When toys, bones or other objects are taken away				.45 (.09)	
Agg_1	When approached by a new person while being walked on-leash					.95 (.04)
Agg_7	When an unfamiliar person (to the dog) tries to touch or pet the dog while in their kennel					.92 (.04)
Agg_9	Towards familiar people returning to their kennel					.74 (.07)

Note. Confirmatory Factor Analysis was conducted on the full sample (*N* = 445).

Table 3

Factor Correlations for the Final Five-Factor Model

Factor	Fear	Arousal	Excitability	Dog Aggression	Human Aggression
Fear	1				
Arousal	-.06	1			
Excitability	**-.23**	**.65**	1		
Dog Aggression	**.31**	**.55**	**.24**	1	
Human Aggression	**.71**	.11	-.01	**.57**	1

Note. Correlations in bold are statistically significant (p <.001).

To investigate whether the inclusion of correlated residuals affected the discrepancy between SRMR and RMSEA, we analyzed the residual correlation matrix for potential misfit between the model-implied and observed correlations for each item pair. The range of residual correlations was -.71 to .34, where negative values indicated higher model-implied correlation compared to observed correlation, and positive values indicated the opposite. We examined two additional models (one with a single pair and the other with five pairs of correlated residuals) in the exploratory sample. However, including correlated residuals had minimal impact on the discrepancy. In models without any correlated residuals and those with one pair, the difference between SRMR and RMSEA was .09. In the model with five pairs of correlated residuals, the difference was .08. Therefore, a five-factor model with no correlated residuals was selected for final testing with the validation sample. The validation sample had RMSEA = .05, 90% CI [.04, .06]; CFI = .96; TLI = .96; and SRMR = .12. The full sample had RMSEA = .04, 90% CI [.04, .05]; CFI = .97; TLI = .97; and SRMR = .10. Across factors, the factor loadings ranged from .45 to .95 (*Mdn* = .84, *M* = .79), with an average factor correlation of .29.

Measures of internal consistency were computed for the five unidimensional factors. For Fear, coefficient alpha was .85 and coefficient omega was .92. For Arousal, coefficient alpha was .74 and coefficient omega was .85. For Human Excitability, coefficient alpha was .87 and coefficient omega was .89. For Dog Aggression, coefficient alpha was .72 and coefficient omega was .78. For Human Aggression, both coefficient alpha and coefficient omega were .74. All estimated values are above the minimum value of .7 for acceptable internal consistency reliability (Nunnally & Bernstein, 1994).

IRT

In the IRT analyses, two factors (Dog Aggression and Human Aggression) required a more complex modeling approach due to instability in slope parameter estimates for two items in Dog Aggression (5 & 7) and one item in Human Aggression (7). To stabilize these estimates, we used a lognormal prior distribution with a mean of 0 and standard deviation of 0.5 on the slope parameters for all Dog Aggression and Human Aggression items. This is a mild prior and a common practice – for example, it was included by default in all estimates as the default slope prior in the BILOG software program (Zimowski et al., 2020). The item parameters and standard errors for all five factors can be found in Table 4, and the TIFs are displayed in Figure 2.

The TIFs and standard error curves (SEC) for each of the five IRT models indicate where on the latent trait continuum the scale was most precise in measuring an individual's trait. The TIF and SEC are inversely related such that smaller standard errors indicate greater precision and higher test information levels indicate more information is present to estimate the score. The TIFs and SECs in Figure 2 suggest that Fear and Human Aggression items are most precise for dogs who are one to two standard deviations above the mean trait level, indicating that these items work well at identifying dogs with generally high levels of these traits. In comparison, the Arousal scale provides relatively uniform precision across the range of the trait, with less precision at extreme levels of Arousal. The Dog Aggression items are most precise when dogs are either at the average trait level or around two standard deviations above the mean. The Human Excitability scale is most precise when dogs are either above or below the average trait level by one half to two standard deviations in either direction. Taken together, the IRT and factor analytic results provide evidence that each item is a strong indicator of its respective behavioral construct, and the point at which the five scales shown in Figure 2 offer the greatest amount of precision varies based on the trait being measured.

Table 4

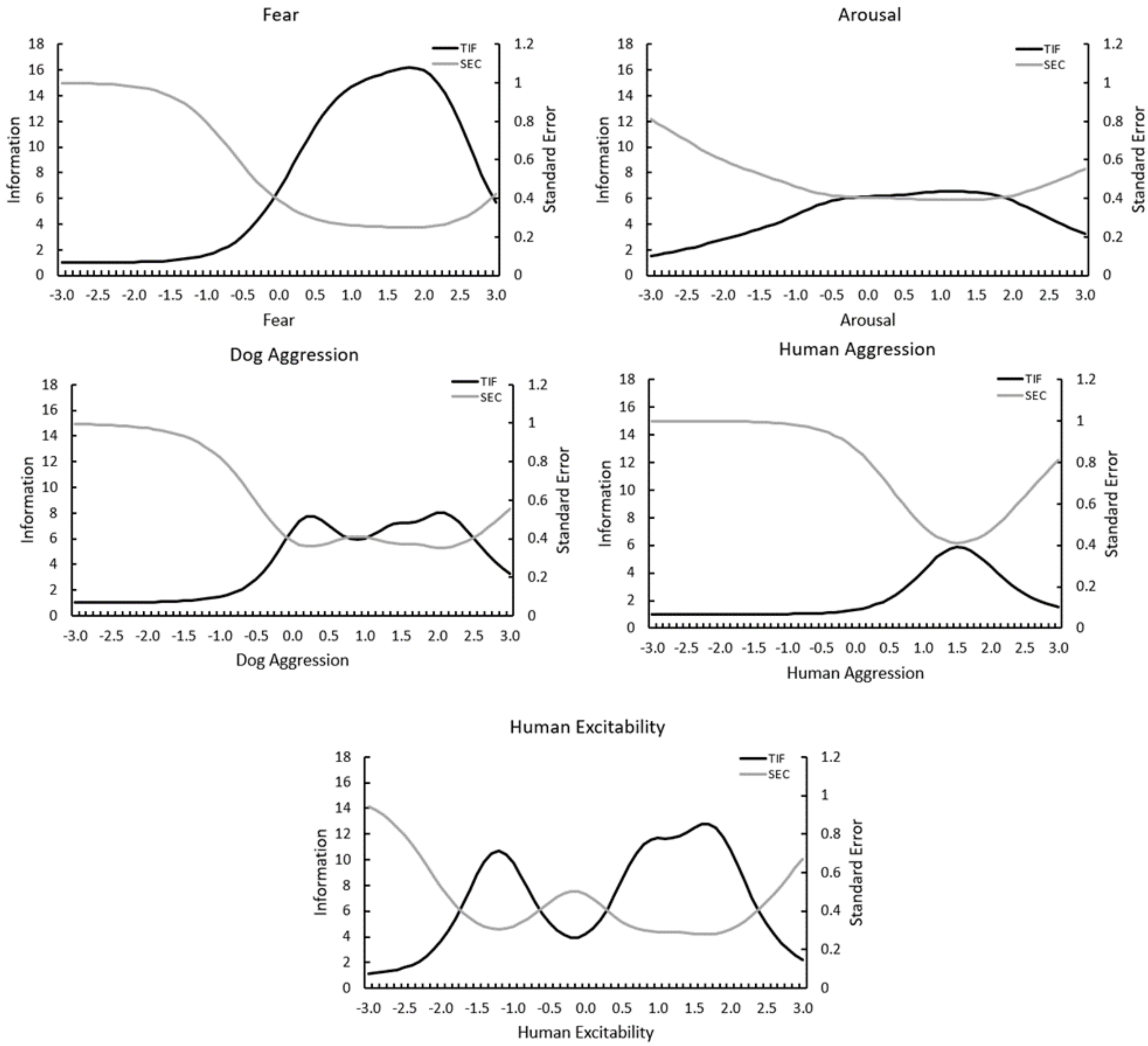
Item Response Theory Parameter Estimates and Standard Errors

Factor		a	b1	b2	b3	b4
Fear	Fear_4	2.30 (0.39)	1.10 (0.12)	1.87 (0.20)		
	Fear_5	2.93 (0.42)	0.17 (0.08)	0.98 (0.11)	1.89 (0.21)	
	Fear_6	2.29 (0.59)	1.82 (0.22)	2.74 (0.41)		
	Fear_7	3.22 (0.52)	1.00 (0.10)	1.76 (0.17)	2.26 (0.24)	
	Fear_9	3.45 (0.52)	0.63 (0.08)	1.39 (0.12)	2.11 (0.22)	2.37 (0.27)
	Fear_9x	2.47 (0.63)	1.03 (0.15)	1.87 (0.32)		
	Fear_10	2.54 (0.39)	0.41 (0.09)	1.47 (0.16)	2.10 (0.25)	
Arousal	Misc_1	2.04 (0.22)	-1.75 (0.15)	-0.7 (0.09)	0.86 (0.10)	2.05 (0.18)
	Misc_3	0.90 (0.13)	-0.48 (0.15)	0.96 (0.17)	2.70 (0.37)	4.22 (0.63)
	Misc_4	2.72 (0.42)	-0.43 (0.10)	0.13 (0.09)	0.91 (0.11)	1.65 (0.16)
	Misc_5	1.57 (0.25)	0.64 (0.12)	1.42 (0.19)	2.18 (0.28)	2.79 (0.37)
	Misc_7	1.67 (0.20)	-0.93 (0.12)	0.05 (0.09)	1.32 (0.14)	2.04 (0.20)
	Misc_8	1.09 (0.15)	-0.67 (0.14)	0.23 (0.12)	1.74 (0.23)	3.24 (0.40)
Human Exchitability	Excite_1	2.82 (0.27)	-1.03 (0.09)	0.87 (0.08)	1.78 (0.15)	1.97 (0.16)
	Excite_2	2.38 (0.23)	-0.95 (0.10)	1.16 (0.10)	2.11 (0.18)	
	Excite_3	3.49 (0.36)	-1.40 (0.10)	0.69 (0.07)	1.57 (0.13)	1.77 (0.14)
	Excite_4	3.91 (0.41)	-1.18 (0.10)	0.92 (0.08)	1.6 (0.12)	1.78 (0.13)
Dog Aggression	Agg_1	2.71 (0.93)	1.56 (0.18)			
	Agg_7	2.92 (1.13)	1.43 (0.17)			
	Agg_9	2.03 (0.48)	1.78 (0.21)			
	Agg_3	2.99 (0.65)	0.56 (0.08)	2.40 (0.24)		
	Agg_5	4.06 (1.55)	0.16 (0.09)	1.40 (0.14)	2.02 (0.24)	
	Agg_8	1.87 (0.30)	0.34 (0.09)	2.49 (0.26)		
	Agg_10	0.87 (0.27)	3.52 (0.91)			

Note. Standard errors are in ( ) following the parameter estimate. a = IRT slope parameter, b = IRT severity/threshold parameter. Dog Aggression and Human Aggression a-parameters were estimated using a lognormal prior distribution with a mean of 0.0 and standard deviation of 0.5.

Figure 2

Test Information Functions and Standard Error Curves for the Five IRT Models.



Note. Black line (TIF) quantifies the amount of information provided by a test at different trait levels (Theta), with higher values indicating more information. Grey line (SEC) quantifies the measurement precision of a test at different trait levels, with lower values indicating more precision and reliability.

Discussion

Psychometric Analyses of Shelter C-BARQ

We began the development of the Shelter C-BARQ by selecting 37 items from the original 100-item CBARQ. Iterative computations using exploratory and confirmatory factor analyses and item response analysis reduced the content to a 24-item, five-factor model. The range (.45-.95) and median (.84) of our factor loadings are consistent with previous research that adapted and conducted factor analyses on the C-BARQ in different populations (Canejo-Teixeira et al., 2018; González-Ramírez et al., 2017; Hsu & Serpell, 2003; Hsu and Sun, 2010; Nagasawa et al., 2011; Tamimi et al., 2015; van den Berg et al., 2006).

Within our questionnaire, four items had exceptionally lower or higher factor loadings than the other items within their factors. The items "Attempts to escape or would escape from their kennel or enclosure if given the chance," "When toys, bones or other objects are taken away," and "Towards familiar people returning to their kennel" had the lowest loadings among the Arousal (.51), Dog Aggression (.45), and Human Aggression (.74) items respectively. One explanation for these loadings is that these situations seldom occur in a shelter setting, which is supported by the fact that the vast majority of respondents selected "never" or "no reaction" to these scenarios. It is also possible that response frequencies are a function of the rater-dog interactions. That is, if the rater worked with the dog once and in that time the dog displayed the behavior (e.g., tried to escape the kennel), then that rater's perception would be that the dog always displayed the behavior. The frequency with which a rater worked with a dog would likely also have an influence on their responses.

Of specific interest is the item "When toys, bones or other objects are taken away." When reported by relinquishing owners, this item did not reliably predict the same behavior toward adopting owners (McGuire et al., 2020). In our study, this item did not load onto a human aggression factor as it did in the original C-BARQ but was instead a moderate indicator of dog aggression. This suggests that the function of this item may be highly sensitive to the environment (e.g., former adoptive home, newly adoptive home, or shelter) or the respondent (e.g., a former owner with extensive knowledge of the dog, a new owner with limited knowledge, or shelter staff with limited knowledge of the dog but extensive experience with human and dog aggression). Given that 94% of respondents reported never seeing this behavior, we would expect the item to load more strongly in situations where the behavior has more opportunity to present itself.

The item "Chases or wants to chase squirrels, rabbits or other small animals given the opportunity" had the highest loading (.84) among the Arousal items. Although this factor loading may seem high at face value, it is reasonable given that inhibiting the chasing component of the predatory motor pattern can be difficult for certain dogs (Udell et al., 2014). Therefore, when a dog finds itself in such a situation, it is likely to seize the opportunity to exhibit this behavior. The item response frequencies highlight this point, with 64% responding that the dog displayed the behavior.

New Scale for Shelter Population

The intention of this study was to identify, evaluate, and provide validity evidence for a plausible factor structure using a modified subset of items extracted from the original 100-item C-BARQ. While the C-BARQ has undergone validation in various contexts and with different samples, including both pet dogs (Barnard et al., 2012; Bennett et al., 2012; De Meester et al., 2008; Hsu & Serpell, 2003; Svartberg, 2005; Vermeire et al., 2011, 2012) and working dogs (Bray et al., 2019; Duffy & Serpell, 2008, 2012; Foyer et al., 2014), this is the first attempt to validate the use of the C-BARQ for shelter-housed dogs.

The only other published version of a validated and significantly shortened version of the C-BARQ is Duffy et al. (2014). They created and evaluated the C-BARQ(S) as a behavioral screening tool for dogs relinquished to animal shelters. The differences in Duffy et al.'s selected items as compared to the items from the current study are likely due to differences in our item reduction techniques and populations of interest. Duffy et al. used a quantitative item reduction approach derived from a non-shelter population whereas we used a qualitative approach intentionally designed to retain items answerable for a shelter population. Many items retained in the C-BARQ(S) posed scenarios that most shelter dogs would not encounter or would not be feasible for respondents to know in the shelter. Though the C-BARQ(S) was shown to be a promising shelter intake survey to predict both shelter outcomes and shelter-assessed aggression, it is not a validated assessment for understanding the constructs of shelter dog behavior. Our modified version assessed the behavior of dogs exclusively within the shelter environment, and as such provides unique insights to the application of the C-BARQ for shelter-housed dogs.

Most of the factors identified in our questionnaire (Fear, Human Excitability, Dog Aggression, and Human Aggression) align with several of the questionnaire sections identified in Serpell and Duffy (2014) (Fear and Anxiety, Excitability, Aggression), indicating some congruence in the constructs retained when shortening the 100-item C-BARQ in the current study. However, our Arousal factor does not have a clear counterpart in the full C-BARQ questionnaire. Most items in the Arousal factor failed to load on any factor in the original C-BARQ (Tables 1.1-1.4), suggesting that this new factor may be unique to the shelter context. This discrepancy might be due to dogs exhibiting different levels of arousal-related behaviors in shelters compared to at home. Studies have shown that dogs have higher cortisol levels in shelters than in home environments (Gunter et al. 2019, 2021, 2023), and cortisol is often associated with arousal. The overstimulating nature of shelters likely causes increased arousal, making it more detectable in shelter dogs than in owned dogs, which could explain the presence of an arousal factor in the shelter context but not in home-based questionnaires.

Additionally, shelter staff may evaluate dogs differently than owners, interpreting and responding to similar items in ways that reflect different behavioral constructs. Rater effects are a known issue in animal behavior assessments, where varying interpretations can influence test scores (Bohland et al., 2023; Kerswell et al., 2009; Mariti et al., 2012; Shore et al., 2008; Tami & Gallagher, 2009). Griffin et al. (2024) found that the type of person conducting the assessment (owner, shelter worker, or researcher) influenced their scores, highlighting the need to account for rater differences in multi-rater studies. Future research should explore the nuances of the differences in how owners and shelter staff use behavior questionnaires.

Implications for Shelter Assessments

More than three million dogs enter shelters in the United States annually (ASPCA, 2020) with many of these dogs undergoing behavior assessments during their shelter stay (Clay et al., 2020b; D'Arpino et al., 2012; Dowling-Guyer et al., 2011). Some experts argue that shelter assessments are not a worthwhile use of shelter resources due to their limited ability to predict the behavior of the dog in the home (Haverbeke et al., 2015; Patronek & Bradley 2016). While no assessment can perfectly predict all post-adoption behaviors, a few studies have indicated that behaviors such as sociability (Clay et al., 2020a, 2020b), fear (Clay et al., 2020a, 2020b; Mornement et al., 2015), and anxiety (Clay et al., 2020a, 2020b; Mornement et al., 2015; van der Borg et al., 1991) can be predicted from in-shelter behavioral information. The assessment of aggression is a major concern in shelter evaluations, as shelters have a legitimate need to gauge a dog's potential for aggression to ensure public safety (Kogan et al., 2019; Patronek & Bradley, 2016; Reid, 2022); unfortunately, predicting post-adoption aggression based on shelter assessments has been inconsistent (Bennett et al., 2012; Christensen et al., 2007; Clay et al., 2020a, 2020b; Mornement et al., 2015; Patronek & Bradley, 2016; van der Borg et al., 1991). This is possibly due to variation between clinical testing environments and real-world situations (Loyer & Foster, 2019; Marder et al., 2013; Patronek & Bradley, 2016; Shabelansky et al., 2015), or that dogs displaying aggressive behaviors in the shelter may not be put up for adoption (Bollen & Horowitz, 2008).

However, it is important not to wholly dismiss the value of collecting in-shelter behavioral information due to the imperfect measurement of one behavior. Some insight into a dog's behavior within the shelter environment is better than none, particularly when assessing aggression. Shelters have a responsibility to the public to assess their dogs' behaviors to the best of their ability to prevent dangerous dogs from entering the community. Until more consistently accurate and reliable shelter assessments are developed to predict post-adoption behavior from in-shelter behavior, gathering in-shelter behavioral information remains necessary to make informed placement decisions for dogs. If shelters choose to use our questionnaire, they can use the scores to help provide an informed assessment of the dog's behavior based on the five defined constructs, and inform their placement decisions in accordance with shelter protocols.

Taylor and Mills (2006) outlined the need for good behavior tests to establish reliability, validity, and feasibility. While some standardized and validated evaluations exist for shelter use (Mornement et al., 2015; Sternberg, 2002; Weiss, 2007), substantial resources are required to conduct them, including dedicated testing environments and specialized staff over an extended duration per dog (De Palma et al., 2005; Netto & Planta, 1997; Sternberg, 2002; van der Borg et al., 1991; Weiss, 2002). Better-resourced shelters might be able to carry out validated assessments that could shed light on behavioral constructs above and beyond what our questionnaire identified, such as separation anxiety (Mornement et al., 2015; Reid, 2022; van der Borg et al., 1991), but the resource strain associated with these assessments make them infeasible options for the majority of shelters (Reid, 2022). Many shelters choose to modify existing assessments or create their own (D'Arpino et al., 2012; Diederich & Giffroy, 2006), which is unfortunate as they often trade feasibility for the validation necessary to accurately reflect the behavioral constructs of shelter dogs (Taylor and Mills, 2006).

Further validity concerns arise for shelters that move away from formal assessments altogether, and adopt a more informal approach. This entails gathering behavioral data during naturally occurring situations when staff and volunteers interact with the dogs, such as observing their behavior during walks, interactions with unfamiliar individuals and dogs, and participation in adoption events. The literature is sparse regarding informal assessments such as these, but Goold & Newberry (2017a, 2017b) recorded behavioral observations for shelter dogs during spontaneous interactions with people and other dogs and saw individual differences in personality, plasticity and predictability in reported behaviors. Although this method of gathering data over multiple interactions with the dog is feasible, they also reported poor inter-rater reliability and validity when identifying both type and severity of behavior. This is unsurprising, as the lack of structure and explicit behavioral criteria in informal assessments provides opportunities for variability across respondents given the subjective nature of collecting the behavioral information (Halm, 2021). Tests that are neither reliable nor validated cannot provide information about the behavioral constructs that shelters use to make placement decisions (Halm, 2021; Taylor and Mills, 2006), and despite the convenience of this approach, to rely on informal assessments for behavioral information would be impractical at best and unethical at worst.

Our questionnaire provides an alternative method to both formal and informal assessments that meets the criteria set out in Taylor and Mills (2006) for a good behavior test. In our study, respondents typically didn't expend additional effort to gather behavioral information. Rather, the person who knew the dog best in the shelter relied on their experiences with the dog in various everyday situations where behaviors can be observed to inform their survey responses, making the test feasible for implementation at all resource levels. The summed scores of the five factors had an average coefficient alpha of .78, indicating internal consistency reliability (Nunnally & Bernstein, 1994). Factor correlations ranged from -.01 to.71, with the weakest correlation between Excitability and Human Aggression (-.01) and the strongest correlation between Fear and Human Aggression (.71). We did not establish correlations with external measures and as such cannot measure criterion validity; however, these associations provide evidence for construct validity. For example, it is reasonable to expect that expressions of human excitability differ from expressions of human-related aggression; and conversely, we would expect fear behavior and human-related aggression to present similarly. For shelters with the ability to carry out formal validated assessments, our approach may not offer insights above and beyond their current approach. However, with many shelters opting for unvalidated but less resource-intensive approaches (D'Arpino et al., 2012; Diederich & Giffroy, 2006; Reid, 2022), our questionnaire offers them a validated method by which five behavioral constructs can be measured in shelter dogs.

Using the Questionnaire

Shelters interested in using the Shelter C-BARQ can access a printable version (Appendix A). We want to emphasize that altering item content, such as selectively choosing items from different factors or changing item wording, would require new validation procedures. Therefore, we strongly recommend using the scales in their current, unmodified forms.

Each item within a specific factor should be answered to the best of the respondent's ability. If a particular behavior is never observed, a "N/A" response is appropriate. Since each factor can function as an independent scale, shelters have the flexibility to choose one, multiple, or all five scales, depending on their specific interests in behavioral constructs.

It is important to highlight that sub-scores can be calculated by summing the scores of all items within a given factor. This allows for a quantitative representation of a dog's behavioral trait level. However, it is essential to avoid creating a "total" score by summing sub-scores across factors, as this does not yield an interpretable measure of a behavioral construct.

Finally, keep in mind that the five scales measure different traits with varying degrees of accuracy depending on the trait being assessed. This does not mean that other parts of the scales are inaccurate; rather, it highlights where the scales provide the most useful information for each trait. If a dog scores in the less precise areas of a scale, shelters may want to use additional behavioral assessments to get a more accurate picture of the dog's behavior, depending on how they plan to use the information from the questionnaire. Below, we have provided specific guidance for interpreting each scale:

Fear

This scale is most precise for identifying dogs with high levels of fear. If a dog scores high on this scale, it means the dog is likely very fearful. Scores are most precise for dogs that show fearfulness well above the average level.

Arousal

This scale is reliable across a range of arousal levels, but is most informative for dogs with average arousal levels. For a dog that scores high or low on this scale, the reliability of this scale to reflect the dog’s arousal behavior is lower than a dog with average arousal levels.

Human Excitability

This scale is most precise for dogs that show excitement slightly above or below average, up to moderately higher or lower levels. Average, extremely low, and extremely high levels of excitement are less precise.

Dog Aggression

This scale is most precise for dogs that show average to high levels of aggression. If a dog scores less than average here, the scale is less accurate.

Human Aggression

This scale effectively identifies dogs with high levels of aggression towards humans. If a dog scores high, it indicates significant aggressive behavior towards humans, whereas it is less precise for dogs that score around or below average.

Overall, these scales are most informative for dogs showing average to extreme levels of each trait. Extreme behaviors (e.g., very high levels of fear, aggression, or excitability) are often the ones that lead to dogs being returned to the shelter, and the majority of these scales are highly reliable in identifying those behaviors. We hope that by providing access to this questionnaire, shelters will feel confident in accurately identifying dogs for whom behavioral intervention or extra adopter counselling may be needed.

Limitations

One limitation of this study is that the sample size is relatively small, especially when using the split-sample approach for validation purposes. Nunally and Bernstein (1984) suggest a minimum sample size of 300 to obtain stable parameter estimates, and although the full sample was 445, when it was split in half the resulting samples were just over 200 each. As a result, not all response options had equal response rates and several items were collapsed to as few as two response categories. It is possible that the effects of low response rates for a particular response option may be overcome or mitigated by increasing the sample size. It should be noted that there is no hard and fast rule regarding sample size requirements for a stable factor analytic solution; the requirements vary as a function of the number of items, number of factors, and the proportion of variance in each item that is explained by the underlying factor (MacCallum et al., 1999). However, a simulation study conducted by MacCallum et al. (2001) demonstrated that sample sizes as low as 60 yielded accurate parameter estimates when the communalities were high (ranging from 0.6 to 0.8, corresponding to factor loadings between 0.77 and 0.89). Our median factor loading was 0.84, corresponding to a communality of 0.71, which further bolsters the robustness of our findings.

Another limitation is that the item responses lacked variability such that a floor effect was observed for some items. Respondents often used the lowest response option (e.g., “never”) for most scenarios. This limits variability in the data set and is likely, at least partially, responsible for the difficulties encountered estimating IRT parameters for several items. One possible explanation for this could be that most of these dogs were up for adoption at the time of survey and all of these dogs later experienced a fostering experience at their shelter, and any dog exhibiting extreme behaviors that could pose a danger to people likely were not in this group and/or were removed from the shelter population before they could reach this point. Another explanation is the number of encounters with the dog may have varied by respondent such that a rater that worked with the dog more or less frequently may have observed more or less variability in their behavior.

Finally, one last limitation is that these data do not permit assessment of inter-rater reliability. Given resource constraints, shelter dogs are usually assessed by a single person, and consequently this study was designed to reflect that constraint. Inter-rater reliability is an important and useful avenue for future research on the Shelter C-BARQ items.

Conclusions

This study identified and validated a subset of items from the Canine Behavioral Assessment and Research Questionnaire (C-BARQ) for assessing behavior in sheltered dog populations. EFA and CFA supported a five-factor structure for the selected 24 items (Shelter C-BARQ), with above-threshold internal consistency reliability and cogent factor correlations demonstrating their suitability for assessing sheltered dogs' behavior. IRT further confirmed the reliability and validity of these items in measuring the underlying constructs. The five identified factors (Fear, Arousal, Human Excitability, Dog Aggression, and Human Aggression) represent robust indicators of shelter dog behavior that can be gathered efficiently without burdening shelter resources.

The study offers shelters a concise method for assessment of sheltered dogs' behavior, which can aid in decision-making processes related to adoption and placement. This streamlined assessment can be especially beneficial for resource-strapped shelters that need both efficient and validated ways to gather behavioral data.

These findings are specific to this sample and different constructs may emerge in diverse samples or populations, warranting further investigation. Future research should also explore whether these identified constructs remain consistent in a home environment after a dog has been adopted. This would enhance shelters' ability to collect reliable matchmaking information, potentially reducing adopter expectations mismatches and decreasing return rates due to behavioral discrepancies.

In summary, this research contributes to the field of animal welfare by providing a validated behavioral assessment tool tailored for sheltered dogs, addressing the unique challenges faced by shelter environments and contributing to the overall goal of improving the well-being and outcomes of sheltered dogs.

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Data Availability: Data from individual questionnaire responses are available upon request.

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Supplementary Materials

Appendix A

SHELTER C-BARQ

SCALE 1: FEAR

SCALE SCORE: /35

INSTRUCTIONS:

The following questions are designed to allow you to describe this dog's current behavior at your shelter. Please do not modify the content (no cherry-picking items from different factors or changing item wording) but feel free to choose one, multiple, or all five scales depending on which behavioral constructs you are interested in.

Each item should be answered to the best of your ability. If a particular situation/behavior is never observed, a "N/A" response is appropriate.

Scores for each scale can be calculated by summing the items within a given scale. It is not meaningful to add together scores from individual scales (i.e. create a "total" score).

Dogs often show signs of anxiety or fear when exposed to particular sounds, objects, persons or situations—e.g. crouching or cringing with tail tucked between the legs; whimpering or whining, freezing, trembling, or attempting to escape or hide.

Using the following 5-point scale (1 = No fear, 5 = Extreme fear), please indicate this dog's recent tendency to display fearful behavior in the following circumstances:

QUESTIONS:	RATING SCALE:					
	No visible signs of fear	Avoiding eye contact, avoidance of the feared object	Crouching or cringing with tail lowered or tucked between the legs	Whimpering and whining, freezing, shaking or trembling	Vigorous attempts to escape, retreat or hide from the feared object	Not observed/ Not applicable
	1	2	3	4	5	0
When an unfamiliar person (to the dog) tries to touch or pet this dog	○	○	○	○	○	○
In response to sudden or loud noises (e.g. car backfire, road drills, objects being dropped, etc.)	○	○	○	○	○	○
When a familiar person returns to the kennel	○	○	○	○	○	○
In response to strange or unfamiliar objects while on-leash (e.g. plastic trash bags, leaves, litter, flags flapping, etc.)	○	○	○	○	○	○
When entering their kennel for the first time	○	○	○	○	○	○
When approached by an unfamiliar dog on-leash	○	○	○	○	○	○
When barked, growled or lunged at by an unfamiliar dog when being walked on leash	○	○	○	○	○	○

SHELTER C-BARQ

SCALE 2: AROUSAL

SCALE SCORE: /30

INSTRUCTIONS:

The following questions are designed to allow you to describe this dog's current behavior at your shelter. Please do not modify the content (no cherry-picking items from different factors or changing item wording) but feel free to choose one, multiple, or all five scales depending on which behavioral constructs you are interested in.

Each item should be answered to the best of your ability. If a particular situation/behavior is never observed, a "N/A" response is appropriate.

Scores for each scale can be calculated by summing the items within a given scale. It is not meaningful to add together scores from individual scales (i.e. create a “total” score).

Dogs display a wide range of behaviors in a variety of situations.

Using the following 5-point scale (1 = Never, 5 = Always), please indicate how often this dog in the recent past has shown any of the following behaviors:

QUESTIONS:	RATING SCALE:					
	Never	Seldom	Sometimes	Usually	Always	Not observed/ Not applicable
	1	2	3	4	5	0
Easily distracted by interesting sights, sounds, smells						
Barks or whines when you leave or are about to leave the kennel (even momentarily)						
Chases or wants to chase squirrels, rabbits or other small animals given the opportunity						
Chews or attempts to chew inappropriate objects						
Pulls on the leash (when walking equipment IS used, such as a harness)						
Attempts to escape or would escape from their kennel or enclosure if given the chance						

SHELTER C-BARQ

SCALE 3: HUMAN EXCITABILITY

SCALE SCORE: /20

INSTRUCTIONS:

The following questions are designed to allow you to describe this dog's current behavior at your shelter. Please do not modify the content (no cherry-picking items from different factors or changing item wording) but feel free to choose one, multiple, or all five scales depending on which behavioral constructs you are interested in.

Each item should be answered to the best of your ability. If a particular situation/behavior is never observed, a "N/A" response is appropriate.

Scores for each scale can be calculated by summing the items within a given scale. It is not meaningful to add together scores from individual scales (i.e. create a "total" score).

Some dogs show little reaction to exciting events, while others become highly excited at the slightest novelty.

Using the following 5-point scale (1 = Calm, 5 = Extremely excitable), please indicate this dog's recent tendency to become excitable in the following circumstances:

QUESTIONS:	RATING SCALE:					
	Little or no special reaction 1	Increased alertness, movement toward the source of novelty 2	Brief episodes of barking 3	Barking or yelping hysterically at the slightest disturbance 4	Barking, rushes toward source of excitement, difficult to calm down 5	Not observed/ Not applicable 0
When you or others return after a brief absence (including inside the building but away from the dog)						
Playing with you or someone else						
Just before being taken for a walk						
When visitors arrive at their kennel						

SHELTER C-BARQ

SCALE 4: DOG AGGRESSION

SCALE SCORE: /20

INSTRUCTIONS:

The following questions are designed to allow you to describe this dog's current behavior at your shelter. Please do not modify the content (no cherry-picking items from different factors or changing item wording) but feel free to choose one, multiple, or all five scales depending on which behavioral constructs you are interested in.

Each item should be answered to the best of your ability. If a particular situation/behavior is never observed, a "N/A" response is appropriate.

Scores for each scale can be calculated by summing the items within a given scale. It is not meaningful to add together scores from individual scales (i.e. create a "total" score).

Most dogs display stressed behavior from time to time—e.g. barking, growling, baring teeth, snapping, etc.

Using the following 5-point scale (1 = No stress, 5 = Serious stress), please indicate this dog's recent tendency to display stressed behavior in each of the following circumstances:

QUESTIONS:	RATING SCALE:					
	No visible signs of stress	Barking or growling, staring at dog	Baring teeth, hackling, stiff or rigid body	Snapping or attempting to bite	Biting	Not observed/ Not applicable
	1	2	3	4	5	0
When approached by an unfamiliar dog while being walked on-leash	○	○	○	○	○	○
When barked, growled, or lunged at by another (unfamiliar) dog while being walked on-leash	○	○	○	○	○	○
When dogs walk past their kennel	○	○	○	○	○	○
When toys, bones or other objects are taken away	○	○	○	○	○	○

SHELTER C-BARQ

SCALE 5: HUMAN AGGRESSION

SCALE SCORE: /15

INSTRUCTIONS:

The following questions are designed to allow you to describe this dog's current behavior at your shelter. Please do not modify the content (no cherry-picking items from different factors or changing item wording) but feel free to choose one, multiple, or all five scales depending on which behavioral constructs you are interested in.

Each item should be answered to the best of your ability. If a particular situation/behavior is never observed, a "N/A" response is appropriate.

Scores for each scale can be calculated by summing the items within a given scale. It is not meaningful to add together scores from individual scales (i.e. create a "total" score).

Most dogs display stressed behavior from time to time—e.g. barking, growling, baring teeth, snapping, etc.

Using the following 5-point scale (1 = No stress, 5 = Serious stress), please indicate this dog's recent tendency to display stressed behavior in each of the following circumstances:

QUESTIONS:	RATING SCALE:					
	No visible signs of stress 1	Barking or growling, staring at person of interest 2	Baring teeth, hackling, stiff or rigid body 3	Snapping or attempting to bite 4	Biting 5	Not observed/ Not applicable 0
When approached by a new person while being walked on-leash						
When an unfamiliar person (to the dog) tries to touch or pet the dog while in their kennel						
Towards familiar people returning to their kennel						

Table S1

Dog Demographics by Shelter

Shelter	N	Intake Type					Average LOS (days)	Average Age (months)	Average Weight (kgs)	Sex (as % female)
		Stray	Owner Surrender	Transfer	Confiscate	Return				
Best Friends Animal Shelter	44	-	-	-	-	-	433.6	60.4	24.2	36.4
Arizona Humane Society	34	15	11	2	6	0	11.2	42	9	23.5
Humane Society of Western Montana	39	2	11	26	0	0	6.5	33.3	16.8	46.2
Lifeline Animal Services Dekalb	41	31	5	2	2	1	63.4	31.9	21.2	61
SPCA Texas	43	1	22	9	5	6	38.2	55.5	21.6	53.5
Spokane County Regional Animal Protection Services	41	33	5	1	0	2	10.5	43.9	22.6	51.2
Detroit Animal Care and Control	41	39	0	0	2	0	35.8	35	24.2	46.3
Lifeline Animal Services Fulton	33	24	2	1	3	3	58.9	34.1	25.3	33.3
Regional Center for Animal Care and Protection	43	21	22	0	0	0	42.5	37.6	22.5	46.5
Pima Animal Care and Control	41	26	11	0	2	2	24.5	52.6	27	41.4
Charlottesville Albemarle SPCA	45	3	0	42	0	0	7.8	24	19.2	51.1

Table S2.1

Polychoric Correlations for the Collapsed Responses in the Training Sample

	Fear_1	Fear_2	Fear_3	Fear_4	Fear_5	Fear_6	Fear_7	Fear_8	Fear_9	Fear_9x	Fear_10
Fear_2	**0.96**										
Fear_3	**0.90**	**0.92**									
Fear_4	0.84	**0.91**	**0.94**								
Fear_5	0.59	0.63	0.64	0.57							
Fear_6	0.87	**0.90**	0.89	0.87	0.55						
Fear_7	0.69	0.71	0.67	0.64	0.82	0.59					
Fear_8	0.46	0.50	0.49	0.54	0.47	0.49	0.51				
Fear_9	0.67	0.72	0.71	0.71	0.79	0.42	0.80	0.59			
Fear_9x	0.51	0.61	0.57	0.74	0.45	0.68	0.62	**0.90**	0.59		
Fear_10	0.53	0.60	0.68	0.72	0.72	0.56	0.71	0.82	0.66	0.86	
Misc_1	0.11	0.08	0.03	0.01	0.27	0.09	0.16	-0.06	0.18	0.00	0.12
Misc_2	-0.04	0.03	0.04	0.06	0.05	-0.13	0.03	0.00	0.15	0.40	0.12
Misc_3	-0.04	0.01	-0.10	-0.10	0.21	-0.03	0.10	-0.14	0.04	-0.23	0.07
Misc_4	-0.18	-0.18	-0.30	-0.09	0.06	-0.63	0.01	-0.37	0.08	-0.13	-0.08
Misc_5	0.05	-0.05	-0.26	-0.25	0.08	0.05	0.21	-0.02	-0.06	0.19	-0.26
Misc_6	0.05	-0.31	-0.08	-0.14	0.13	-0.30	-0.01	-0.07	0.04	-0.05	0.10
Misc_7	0.01	-0.05	0.03	0.00	0.14	0.06	0.16	-0.32	0.09	-0.25	-0.06
Misc_8	0.00	-0.02	0.06	0.14	0.06	0.01	0.08	0.06	0.18	0.20	0.11
Misc_9	0.08	0.08	0.26	0.23	0.31	-0.05	0.08	-0.05	0.17	0.31	0.28
Misc_10	0.58	0.56	0.64	0.54	0.51	0.48	0.57	0.20	0.45	0.21	0.52
Misc_11	0.05	-0.04	-0.06	-0.10	0.19	0.22	0.21	-0.14	0.00	-0.23	-0.33
Misc_12	-0.09	-0.01	0.00	0.01	0.26	-0.10	0.19	-0.08	0.11	-0.29	0.02
Agg_1	0.79	0.78	0.76	0.76	0.55	0.65	0.44	0.23	0.48	0.33	0.56
Agg_2	0.77	0.73	0.76	0.71	0.46	0.71	0.52	0.30	0.48	0.49	0.54
Agg_3	0.32	0.35	0.33	0.38	0.35	0.37	0.29	0.21	0.44	0.32	0.31
Agg_4	0.23	0.30	0.26	0.40	0.16	0.38	0.16	0.21	0.28	0.19	0.24
Agg_5	0.08	0.17	0.42	0.41	0.44	-0.09	0.27	0.34	0.38	0.61	0.43
Agg_6	0.71	0.60	0.79	0.73	0.45	0.62	0.48	0.20	0.50	0.32	0.63
Agg_7	0.71	0.66	0.72	0.70	0.45	0.61	0.50	0.21	0.58	0.30	0.55
Agg_8	-0.12	0.02	0.02	0.14	0.37	-0.10	0.37	0.16	0.33	0.35	0.18
Agg_9	0.35	0.41	0.45	0.44	0.15	0.46	0.03	0.19	0.16	0.11	0.28
Agg_10	-0.17	0.19	-0.03	0.13	0.31	0.29	0.36	0.44	0.12	0.22	0.17
Excite_1	-0.22	-0.15	-0.16	-0.34	0.04	-0.31	0.02	-0.21	-0.16	-0.30	-0.16
Excite_2	-0.22	-0.10	-0.14	-0.15	0.18	-0.27	0.09	-0.27	-0.10	-0.26	-0.27
Excite_3	-0.42	-0.24	-0.30	-0.38	0.20	-0.55	0.01	-0.13	-0.13	-0.12	-0.07
Excite_4	-0.44	-0.32	-0.17	-0.20	0.14	-0.52	0.02	0.08	-0.27	0.06	-0.03

Note. Polychoric correlations that have a magnitude greater than or equal to 0.90 are bolded.

Table S2.2

Polychoric Correlations for the Collapsed Responses in the Training Sample

	Misc_1	Misc_2	Misc_3	Misc_4	Misc_5	Misc_6	Misc_7	Misc_8	Misc_9	Misc_10	Misc_11	Misc_12
Misc_2	0.05											
Misc_3	0.48	0.06										
Misc_4	0.61	0.03	0.52									
Misc_5	0.64	0.14	0.30	0.47								
Misc_6	0.36	0.17	0.30	0.21	0.60							
Misc_7	0.40	-0.01	0.21	0.58	0.42	0.21						
Misc_8	0.41	-0.06	0.41	0.49	0.20	0.23	0.30					
Misc_9	0.35	0.17	0.34	-0.06	0.41	0.59	0.33	0.26				
Misc_10	0.33	0.15	0.24	0.08	0.23	0.39	0.31	0.14	0.29			
Misc_11	0.79	-0.16	0.41	0.41	0.42	0.55	0.43	0.28	0.44	0.31		
Misc_12	0.50	-0.04	0.53	0.49	0.56	0.26	0.42	0.20	0.32	0.23	0.30	
Agg_1	0.27	0.02	0.23	0.14	0.03	-0.15	0.13	0.17	0.41	0.54	0.07	0.34
Agg_2	0.22	-0.09	0.14	-0.01	0.11	-0.07	0.14	0.18	0.19	0.52	0.39	0.31
Agg_3	0.46	0.15	0.19	0.24	0.36	0.17	0.19	0.22	0.16	0.48	0.30	0.39
Agg_4	0.28	-0.04	0.26	0.25	0.30	0.16	0.13	0.21	-0.05	0.44	0.32	0.40
Agg_5	0.34	0.09	0.23	0.28	0.24	0.36	0.21	0.26	0.35	0.46	0.16	0.37
Agg_6	0.10	-0.04	0.20	0.03	-0.30	0.20	0.13	0.24	0.51	0.55	0.10	0.38
Agg_7	0.02	-0.20	0.21	-0.14	-0.26	0.28	0.16	0.14	0.27	0.62	0.35	0.35
Agg_8	0.32	-0.04	0.29	0.42	0.34	0.16	0.14	0.22	0.29	0.21	0.15	0.61
Agg_9	0.14	-0.08	0.38	0.14	-0.40	0.06	-0.15	0.21	0.10	0.19	-0.02	0.50
Agg_10	0.38	-0.06	0.26	0.07	0.49	0.31	0.30	0.09	0.37	-0.09	0.66	0.47
Excite_1	0.41	0.17	0.51	0.38	0.23	0.14	0.36	0.21	0.29	0.14	0.30	0.45
Excite_2	0.32	0.19	0.44	0.23	0.31	0.04	0.32	0.18	0.26	0.23	0.31	0.54
Excite_3	0.45	0.01	0.39	0.35	0.26	0.21	0.44	0.35	0.29	0.18	0.19	0.58
Excite_4	0.34	0.11	0.44	0.24	0.12	0.20	0.33	0.37	0.26	0.16	0.25	0.48

Table 2.3

Polychoric Correlations for the Collapsed Responses in the Training Sample

	Agg_1	Agg_2	Agg_3	Agg_4	Agg_5	Agg_6	Agg_7	Agg_8	Agg_9	Agg_10	Excite_1	Excite_2	Excite_3
Agg_2	**0.96**												
Agg_3	0.65	0.55											
Agg_4	0.58	0.61	**0.95**										
Agg_5	0.53	0.36	0.82	0.77									
Agg_6	0.89	0.86	0.48	0.54	0.61								
Agg_7	0.77	0.85	0.45	0.65	0.58	**0.95**							
Agg_8	0.32	0.12	0.66	0.69	0.68	0.34	0.34						
Agg_9	0.68	0.60	0.30	0.43	0.07	0.77	0.70	0.56					
Agg_10	0.02	-0.10	-0.02	0.13	0.45	-0.04	0.21	0.35	0.08				
Excite_1	0.07	-0.07	0.12	0.15	0.14	-0.06	-0.16	0.29	0.22	0.15			
Excite_2	0.15	0.08	0.17	0.14	0.08	0.04	-0.14	0.21	0.17	0.06	0.77		
Excite_3	0.03	-0.08	0.19	0.19	0.20	0.00	-0.06	0.36	0.10	0.19	0.78	0.68	
Excite_4	0.15	0.04	-0.04	0.08	0.07	0.16	-0.03	0.25	0.28	0.08	0.80	0.75	0.86

Note. Polychoric correlations that have a magnitude greater than or equal to 0.90 are bolded.

Table S3

Fit Statistics for Factor Analysis in the Exploratory Sample, Validation Sample, and Full Sample

Sample/Model	RMSEA	CFI	TLI	SRMR
Exploratory (n = 222)				
4-factor	0.04	0.96	0.96	0.14
5-factor	0.04	0.97	0.97	0.13
Validation (n = 223)				
4-factor	0.07	0.93	0.92	0.16
5-factor	0.05	0.96	0.96	0.12
Full (n = 445)				
4-factor	0.06	0.94	0.94	0.12
5-factor	0.04	0.97	0.97	0.10

Note. RMSEA = Root mean square of approximation. CFI = Comparative fit index. TLI = Tucker-Lewis Index. SRMR = Standardized root mean square residual.

Table S4

4-Factor EFA with 25 items and Oblique CF-Quartimax Rotation in the Exploratory Sample (n = 222)

Item	Factor 1	Factor 2	Factor 3	Factor 4
Fear_4	0.67	-0.15	0.35	-0.21
Fear_5	0.91	0.06	-0.06	0.22
Fear_6	0.60	-0.11	0.28	-0.36
Fear_7	0.97	0.09	-0.18	0.11
Fear_9	0.85	0.13	-0.03	-0.11
Fear_9x	0.69	-0.11	0.23	-0.16
Fear_10	0.81	-0.13	0.12	-0.04
Misc_1	0.13	0.67	-0.01	0.21
Misc_3	0.01	0.34	0.17	0.39
Misc_4	-0.05	0.76	-0.03	0.13
Misc_5	-0.06	0.81	-0.10	-0.01
Misc_7	0.12	0.48	-0.12	0.25
Misc_8	0.13	0.31	0.06	0.23
Misc_12	-0.04	0.45	0.35	0.39
Agg_1	0.39	-0.02	0.64	0.09
Agg_3	0.07	0.51	0.65	-0.17
Agg_5	0.13	0.43	0.67	-0.12
Agg_7	0.36	-0.10	0.65	-0.05
Agg_8	0.03	0.38	0.58	0.12
Agg_9	-0.09	-0.24	0.90	0.25
Agg_10	0.20	0.46	0.05	0.01
Excite_1	-0.08	0.10	0.06	0.84
Excite_2	-0.03	0.06	0.06	0.79
Excite_3	0.03	0.14	0.01	0.85
Excite_4	0.08	-0.11	0.03	1.00
		Factor Correlations		
	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1	1.00			
Factor 2	0.09	1.00		
Factor 3	0.40	0.13	1.00	
Factor 4	-0.12	0.30	0.05	1.00

Note. *n* = Sample size. EFA = Exploratory factor analysis. CF = Crawford-Ferguson.

Table S5

5-Factor EFA with 25 items and Oblique CF-Quartimax Rotation in the Exploratory Sample (n = 222)

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Fear_4	0.67	-0.09	0.09	-0.26	0.36
Fear_5	0.90	0.04	0.04	0.23	-0.04
Fear_6	0.66	0.12	-0.19	-0.48	0.38
Fear_7	0.96	0.08	-0.02	0.12	-0.13
Fear_9	0.83	0.12	0.07	-0.12	-0.02
Fear_9x	0.58	-0.48	0.51	-0.01	-0.12
Fear_10	0.74	-0.24	0.18	0.01	0.04
Misc_1	0.17	0.63	0.17	0.17	-0.05
Misc_3	0.08	0.46	-0.07	0.32	0.32
Misc_4	0.01	0.79	0.07	0.06	0.00
Misc_5	-0.05	0.69	0.32	-0.02	-0.31
Misc_7	0.17	0.51	0.00	0.21	-0.11
Misc_8	0.16	0.34	0.03	0.20	0.09
Misc_12	-0.04	0.42	0.30	0.35	0.26
Agg_1	0.40	0.08	0.22	-0.01	0.57
Agg_3	0.02	0.22	0.78	-0.12	0.17
Agg_5	0.04	0.04	0.91	-0.01	0.04
Agg_7	0.35	-0.02	0.23	-0.13	0.57
Agg_8	-0.05	0.13	0.66	0.16	0.23
Agg_9	-0.11	-0.06	0.08	0.14	1.08
Agg_10	0.19	0.34	0.27	0.02	-0.10
Excite_1	-0.02	0.14	-0.07	0.83	0.11
Excite_2	0.04	0.12	-0.09	0.78	0.13
Excite_3	0.01	0.07	0.15	0.88	-0.09
Excite_4	0.09	-0.08	-0.06	0.99	0.09
Factor Correlations					
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1	1.00				
Factor 2	-0.04	1.00			
Factor 3	0.39	0.17	1.00		
Factor 4	-0.14	0.33	0.12	1.00	
Factor 5	0.25	0.05	0.19	0.02	1.00

Note. *n* = Sample size. EFA = Exploratory factor analysis. CF = Crawford-Ferguson.

Table S6

6-Factor EFA with 25 items and Oblique CF-Quartimax Rotation in the Exploratory Sample (n = 222)

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Fear_4	0.57	0.29	0.08	0.02	-0.28	0.38
Fear_5	0.90	0.02	-0.07	0.09	0.23	-0.04
Fear_6	0.69	-0.06	0.11	-0.22	-0.48	0.37
Fear_7	0.96	0.02	-0.04	0.03	0.12	-0.14
Fear_9	0.79	0.08	0.06	0.10	-0.12	-0.02
Fear_9x	0.33	0.83	-0.03	0.33	-0.03	-0.09
Fear_10	0.62	0.44	-0.01	0.09	0.00	0.06
Misc_1	0.16	-0.13	0.58	0.16	0.15	-0.09
Misc_3	0.06	-0.13	0.45	-0.05	0.30	0.27
Misc_4	-0.14	-0.03	0.86	0.06	0.01	-0.03
Misc_5	0.13	-0.51	0.40	0.35	-0.04	-0.41
Misc_7	0.15	-0.12	0.47	0.00	0.19	-0.13
Misc_8	-0.07	0.37	0.68	-0.08	0.14	0.10
Misc_12	0.12	-0.47	0.17	0.37	0.34	0.25
Agg_1	0.39	0.03	0.09	0.23	-0.02	0.56
Agg_3	0.05	-0.02	0.11	0.78	-0.12	0.15
Agg_5	-0.03	0.22	0.06	0.91	-0.03	0.04
Agg_7	0.35	0.02	-0.04	0.26	-0.14	0.58
Agg_8	0.01	-0.09	0.00	0.71	0.15	0.22
Agg_9	-0.11	-0.04	0.00	0.10	0.12	1.09
Agg_10	0.29	-0.28	0.12	0.32	0.02	-0.12
Excite_1	0.03	-0.14	0.10	-0.03	0.82	0.06
Excite_2	0.17	-0.26	-0.02	-0.05	0.80	0.08
Excite_3	-0.02	0.04	0.11	0.15	0.85	-0.07
Excite_4	0.01	0.18	0.09	-0.09	0.98	0.11
			Factor Correlations			
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Factor 1	1.00					
Factor 2	0.23	1.00				
Factor 3	0.13	-0.19	1.00			
Factor 4	0.35	0.06	0.37	1.00		
Factor 5	-0.13	-0.19	0.31	0.16	1.00	
Factor 6	0.25	0.10	0.07	0.15	0.00	1.00

Note. *n* = Sample size. EFA = Exploratory factor analysis. CF = Crawford-Ferguson.