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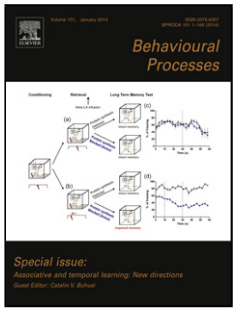

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Development of the cat-owner relationship scale (CORS)

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Abstract

Characteristics of the human-animal bond can be influenced by both owner-related and pet-related factors, which likely differ between species. Three studies adapted the Monash Dog-Owner Relationship Scale (MDORS) to permit assessment of human-cat interactions as perceived by the cat's owner. In Study 1,293 female cat owners completed a modified version of the MDORS, where 'dog' was replaced with 'cat' for all items. Responses were compared with a matched sample of female dog owners. A partial least squares discriminant analysis revealed systematic differences between cat and dog owners in the Dog (Cat)-Owner Interaction subscale (MDORS subscale 1), but not for Perceived Emotional Closeness or Perceived Costs (Subscales 2 and 3). Study 2 involved analysis of free-text descriptions of cat-owner interactions provided by 61 female cat owners. Text mining identified key words which were used to create additional questions for a new Cat-Owner Interaction subscale. In Study 3, the resulting cat-owner relationship scale (CORS) was tested in a group of 570 cat owners. The main psychometric properties of the scale, including internal consistency and factor structure, were evaluated. We propose that this scale can be used to accurately assess owner perceptions of their relationship with their cat. A modified scale, combining items from the CORS and MDORS (a C/DORS), is also provided for when researchers would find it desirable to compare human-cat and human-dog interactions.

Highlights

We conducted 3 studies to develop a cat-owner relationship scale.

We adapted a validated dog-owner relationship scale, the MDORS, for cat owners.

We had to modify the MDORS pet-owner interaction subscale to be relevant for cats.

The scale we developed appears to have adequate psychometric properties.

Key words:

Cat; CORS; dog; human-animal bond; MDORS; owner

1. Introduction

Pet cats are ubiquitous in contemporary Western societies, being present in up to 29% of households in Australia (Animal Health Alliance 2013), 34% of households in the United States of America (USA; American Veterinary Medical Association 2012), and 25% of households in Europe (European Pet Food Industry Federation 2014). Because cats are seen to be well suited to small or busy households, it has been suggested that they may become even more popular as pets in future, reflecting societal pressures associated with increased urbanisation (Downey & Ellis 2008; Zasloff & Kidd 1994). While cats have historically performed a variety of functions, at present they are predominantly kept for the purpose of providing companionship for their human owner (Bradshaw et al. 2012). This is potentially an important function, as companion animal ownership has been associated with various positive health and well-being outcomes. Unfortunately, these outcomes are not guaranteed by the simple purchase of a companion animal of any species, with many studies failing to report significant effects (Herzog 2011). This may be because outcomes depend critically on the quality of the relationship that forms between an animal and his or her owner. While evidence supporting this conjecture is weak (Winefield et al. 2008), it seems reasonable to assume that a good relationship, as perceived by the human owner, is likely to benefit the owner and result in the owner being motivated to ensure that the animal has a good quality of life. Conversely, a poor relationship may mean that the owner fails to benefit and, in some circumstances, that the animal will be neglected, mistreated, abandoned or relinquished to an animal shelter.

Cat relinquishment rates in Australia and elsewhere are unacceptably high, making it imperative that researchers establish exactly what factors make a cat-owner relationship successful or otherwise. Of course, cats and their owners may differ in their view of whether a relationship is good or poor. Consistent with this possibility, a recent publication

demonstrated that some owners have a poor understanding of their cat's welfare needs (Howell et al. 2016). Nonetheless, it remains that owner perceptions of relationship quality are most likely to determine outcomes for cats, making it critical, in the first instance, to identify factors which influence these perceptions. To investigate this issue effectively requires instruments with which to measure the quality of existing cat-owner relationships, as well as to discern which of various components of the relationship contribute most to the overall perception of its quality.

While several scales exist (reviewed in Anderson 2007; Wilson & Netting 2015) to measure the quality of pet-owner relationships, these are typically not specific to one type of pet (Templer et al. 1981; Wilson et al. 1987; Lago et al. 1988; Johnson et al. 1992; Staats et al. 1996). This is problematic since some questions may privilege some species over others (Zasloff 1996), making it impossible to draw valid comparisons. Available scales often include components of how emotionally close one feels to their pet. For instance, one item of the Lexington Attachment to Pets Scale (LAPS) is 'I consider my pet to be a friend' (Johnson et al. 1992), and one item on the Pet Attitude Scale (PAS) is 'My pet means more to me than any of my friends' (Templer et al. 1981). Items related to perceived closeness are conceptually appropriate for owners of most pet types. However, some scales also include items related to the types of interactions that the pet and owner may have together, such as the LAPS item 'I play with my pet quite often'. In some cases, the activity-based items may be more relevant for one type of animal than for others. For example, although cats can be trained to walk on a harness and leash, many cat owners do not choose to walk their cats, so an item such as 'I take my pet along when I go jogging or walking', as on the Pet Relationship Scale (Lago et al. 1988) would be an inappropriate measure of shared cat-owner activities, although it would be perfectly relevant for many dog owners.

While most existing pet-owner relationship scales are not species-specific, there are exceptions. For instance, the Monash Dog-Owner Relationship Scale (MDORS) measures the quality of the dog-owner relationship on three components or subscales: Dog-Owner Interactions, Perceived Emotional Closeness, and Perceived Costs (Dwyer et al. 2006). Since this scale focuses specifically on dog-owner relationships, rather than pet-owner relationships in general, it permits the incorporation of more nuanced scale items that relate to the activities that dog owners, in particular, may engage in. For instance, the Dog-Owner Interaction subscale includes items related to how often the owner takes their dog to visit people or for rides in the car, items that may not be appropriate for other species (e.g., rats and mice).

Another advantage of the MDORS is that it was theoretically well-informed and includes a negative component of dog-owner relationships, similar to the Miller Rada Commitment to Pets Scale (Staats et al. 1996) and the Pet Attitude Inventory (Wilson et al. 1987). The perceived costs of pet ownership to the owner are missing in some other pet-owner relationship scales (e.g. Lago et al. 1988; Johnson et al. 1992), although the financial and time costs of pet ownership are considerable, regardless of species. It is estimated that, in the UK, the total cost of owning a pet dog over the course of its lifespan is approximately £31,000, and the cost for a cat is £17,000 (People's Dispensary for Sick Animals 2014).

The MDORS is a useful addition to the pantheon of pet-owner relationship scales, but more species-specific scales are needed. Because cats are such popular pet animals, the quality of the cat-owner relationship merits investigation. It is reasonable to assume that cat owners likely engage in different types of activities with their cats than dog owners do with their dogs (e.g. cat owners are unlikely to walk their pet cats as a matter of course, to take them for rides in the car, or to visit friends and family). However, it is unclear whether cat-owner relationships are qualitatively different from dog-owner relationships in terms of the emotional closeness that owners feel for their cat or the perceived costs of ownership. The

aim of this study was to examine whether the MDORS could be modified to create a cat owner relationship scale (CORS), as a means of measuring owner perceptions of the quality of the cat-owner relationship.

2. Methods

A flow chart of the methods for all three studies is provided in Figure 1.

--- FIGURE 1 ABOUT HERE ---

2.1 Study 1

2.1.1 Participants

Participants were recruited through social media and a magazine for cat owners. A total of 396 complete responses were collected, and these were filtered to meet the inclusion criteria of the study: adult owners at least 18 years of age with a cat aged at least one year, based in the United Kingdom. The number of male respondents was very small, so only female owners were included in the study, resulting in 293 responses that were included in the analysis. Pre-existing data from a matching population of 293 female dog owners who had completed the MDORS was selected, based on matching for owner age, and for cat/dog age and sex. The mean age of respondents was 43 years (*SD* = 11.35). Recruitment for that population was also through social media and a magazine for dog owners.

2.1.2 Materials

Dog and cat owners were asked to complete an adapted version of the MDORS. The MDORS was adapted for use in cats by exchanging the word ‘dog’ for ‘cat’ throughout the existing scale, but otherwise leaving it identical to the original version. Additional questions were included to collect demographic information about the cat/dog (age, sex) and owner (age, sex).

2.1.3 Analysis

MDORS subscale scores were calculated and compared between the groups. Data were not normally distributed, based on the results of a D'Agostino & Pearson omnibus test, so for univariate comparisons the Mann-Whitney test was used with Graphpad Prism 6 (Graphpad Software Inc, La Jolla, CA, USA). To examine systematic differences between groups, multivariate projection to latent structures discriminant analysis (partial least squares discriminant analysis or PLS-DA) was used with SIMCA P+ 12.0 (MKS Data Analytics Solutions, Umea, Sweden). The discriminant variable (Y) was group membership (dog or cat owner), and the set of X variables was MDORS item values for each individual. Where necessary, orthogonal signal correction was also applied to improve interpretation of the loadings results (orthogonal projections to latent structures discriminant analysis or OPLS-DA). A loading is a measure of the strength of influence of an individual variable within a multivariate model, and in multivariate discriminant analysis the strength of loading indicates a variable's contribution to a model's ability to discriminate between two classes of observations. All data were unit-variance scaled prior to inclusion in the multivariate analysis. Models were cross-validated and significance was tested using analysis of variance of the cross-validated residuals (cross-validated analysis of variance or CV-ANOVA).

2.2 Study 2

2.2.1 Participants

Sixty-one female participants were invited to participate in a qualitative study, in which they were asked to describe their relationship with their pet cat. Participants were recruited by email invitation from the population that had previously completed Study 1 and had agreed to take part in future studies.

2.2.2 Materials

Participants were asked to give text responses to a series of open questions presented in an online survey. Responses to these open-ended questions were recorded and used to develop a more appropriate measure of shared activities between cats and owners.

2.2.3 Procedure

Owners were asked to describe in detail their response to a series of open questions. Responses to two questions were analysed for the study: 'In what ways do you interact with your cat (for example, the games you play, giving food, grooming or physical contact)?', and 'What activities do you involve your cat in (for example: cleaning, gardening, meals, watching TV)?'

2.2.4 Analysis

Text was imported into RapidMiner v. 6 (RapidMiner Inc, Boston, MA, USA), and the text was automatically tokenised, filtered for stop words (such as "the", "is", "at", "which", and "on"), stemmed using the Porter-algorithm, and n-grams of up to five consecutive tokens were generated. Stemming of tokens enables the occurrence frequency of related words such as 'play', 'playing' and 'played' to be summarised with the single stem 'plai'. The resulting list of stemmed tokens and n-grams was sorted by total frequency within the set of owner-statements, in order to identify those which most commonly appeared in owners' descriptions of their interactions and activities with their cats.

2.3 Study 3

2.3.1. Participants

A total of 570 participants completed a survey in English about perceived cat-owner relationships. Of these 88.8% (n = 506) were female and 9.6% (n = 55) were male. The remaining 1.6% selected 'other or prefer not to say'. The most commonly selected age groups were 26 to 35 years old (32.2%) and 18 to 25 years old (32.0%). Most participants (73.7%) were from Australia or New Zealand. Another 17.5% were from the USA/Canada, and 3.9%

were from the UK. The remainder came from elsewhere. A large majority of respondents (83.6%) indicated that there were no children under 12 years of age in their household, and 87.0% reported that there were no children between 12 and 17 years old in their home.

The sample was highly educated, with over one-third (37.2%) of participants reporting that they had a university undergraduate degree, and another 25.4% indicating that they had a postgraduate degree. When asked to indicate their annual household income, nearly one-quarter (24.5%) reported that it was between $50,000 and $100,000 (currency was not specified). Another 22.9% indicated that it was between $100,000 and $200,000, and 18.4% reported that they did not know. Most participants (72.1%) heard about the survey through Facebook.

When asked to indicate how many cats the participant owned or cared for at the time of completing the survey, nearly half (48.4%) reported that they cared for one cat, while 42.1% reported that they cared for two or three cats. A smaller percentage indicated that they cared for four to five cats (5.8%), five to 10 cats (1.9%) or more than 10 cats (1.8%). Owners were also asked to report how many cats they had owned or cared for in their entire life, and the most popular response, at 50.3%, was two to five cats. Another 24.4% reported that they had cared for six to 10 cats, while 9.8% had cared for 11 to 20 cats, and 7.0% had cared for more than 20. Only 8.4% of respondents indicated that they had only cared for one cat over the course of their lifetime. The mean cat age at acquisition was 10 months (*SD* = 1 year 10 months) and owners had owned their cat for an average of 5 years 2 months (*SD* = 3 years 11 months).

Owners were asked to report whether they owned or cared for any animals other than cats at the time of the survey. Just over half (51.4%) reported that they were caring for another animal, including 42.1% of the total sample who indicated that they had at least one dog. Of these participants, 46.3% reported caring for one dog, with 22.5% indicating that

they cared for two. Some respondents (15.8%) indicated that they had dogs, but did not specify how many.

2.3.2 Materials

The existing Monash Dog-Owner Relationship scale (MDORS) was adapted based on the information gained in Study 2, to generate the Cat Owner Relationship Scale (CORS). Much of the MDORS was retained unaltered; however, Item 9 (How often do you take your dog to visit people?) was replaced with 'How often do you spend time enjoying watching your cat?', and Item 17 (How often do you take your dog in the car?) was replaced with 'How often do you talk to your cat?'. The word 'hug' in Item 24 was also replaced with 'cuddle'. A new Item 25 'I like when my cat decides to sleep next to me, on the sofa or on my bed.' was added, and Items 25 through 28 on the MDORS were shifted down to become Items 26 through 29 respectively. Four additional items (30-33 on Table 1) were also added to the scale, as well as a final open-ended question for participants to add any relevant detail that we missed. The version of the CORS administered in Study 3 is presented as Table 1.

=== TABLE 1 ABOUT HERE ===

2.3.3 Procedure

We recruited participants to take part in a survey which was completed online, as part of a research project undertaken by third-year psychology students for course credit. The survey included items related to participant demographics, the CORS, personality items for the participant and the cat, and a series of brief health and well-being scales. Data on personality and health/well-being will be presented in a future report.

Respondents were recruited through social media using the snowball method, beginning with personal contacts of the research team and the third-year student researchers, and with an advertisement on the university website. It was expected to take between 30 and 40 minutes to complete the entire survey.

2.3.4 Analysis

Frequency data were used to explore participant demographics. Responses for 26 out of the 32 items on the CORS were reverse scored, such that a higher score indicated a more positive relationship. A Principal Components Analysis (PCA) with oblimin rotation was conducted on Items 1-32, suppressing correlation coefficients of less than 0.4. Reliability analyses using Cronbach's α were conducted on the final components generated in the PCA. All statistical analyses were conducted using IBM SPSS version 22 (IBM, Armonk, New York).

3. Results

Full descriptive results for Studies 1 and 3 are reported as supplementary material.

3.1 Study 1

3.1.1 Univariate tests

There was a significant difference between cat and dog owners for Pet-Owner Interactions (Subscale 1); two-tailed Mann-Whitney, U=7984, p<0.0001. There was no significant difference between the groups with respect to Perceived Emotional Closeness (Subscales 2) and Perceived Costs (Subscale 3); two-tailed Mann-Whitney U=40320, p=0.204 and U=39886, p=0.134 respectively.

3.1.2 Multivariate models

3.1.2.1 Subscale 1 (Pet-Owner Interaction)

A PLS-DA model with two predictive components was generated (R^2=0.421, R^2Y=0.724, Q^2=0.715, p<1 x 10^{-25}). This is a very strong model in which >72% of variance in the discriminant variable (cat versus dog) was explained by a linear combination of the Subscale 1 variables (R^2Y=0.724). A high Q^2 that is similar to R^2Y indicates that the model is robust to missing data and is not unduly influenced by the presence of a few individuals. This

indicates that there is a strong systematic difference between the two groups. An orthogonal signal correction was applied, to remove systematic variance that was not related to group membership, to produce a model with a single predictive component (R^2=0.421, R^2Y=0.724, Q^2=0.716, $p<1 \times 10^{-25}$). This had a minimal effect on model quality, as there was hardly any change in values for R^2, R^2Y, Q^2 or significance.

The most influential items in the model (those items with the strongest loadings) were 'How often do you take your dog/cat in the car?' and 'How often do you take your dog/cat to visit people?' These were identified as items that ought to be removed from a future cat-adapted version of the MDORS. For the item related to taking the animal in the car, nearly all dog owners (92.8%) reported that they had ever taken their dog in the car, compared to just over one-quarter (27.0%) of cat owners. Similarly, only 15.7% of cat owners indicated that they had ever taken their cat to visit people, as opposed to 93.9% of dog owners. Figure 2 presents a plot of the loadings for this model.

--- FIGURE 2 ABOUT HERE ---

3.1.2.2 Subscale 2 (Perceived Emotional Closeness)

A PLS-DA model with a single predictive component was generated (R^2=0.321, R^2Y=0.023, Q^2=0.005, p=0.26). The model was not significant and Q^2 was extremely low, so there was no systematic difference between the two groups.

3.1.2.3 Subscale 3 (Perceived Costs)

A PLS-DA model with two predictive components was generated (R^2=0.472, R^2Y=0.051, Q^2=0.021, p=0.019). Although significant, in this model only 5% of variance in the discriminant variable (cat versus dog) was explained by a linear combination of the Subscale

3 variables (R^2Y=0.051). This, combined with the very low Q^2, indicates that the model is very weak and does not indicate a systematic difference between groups on Subscale 3 item values.

3.2 Study 2

The results of Study 1 suggested that two of the three MDORS subscales, Perceived Emotional Closeness and Perceived Costs, were relevant to cat owners without the need for change. However, items comprising the Dog-Owner Interaction subscale were not appropriate for use in measuring cat-owner activities. This indicated a need to exclude certain items, such as those relating to travel, and to modify others.

No n-grams were represented in the list of top interactions and shared activities; the list included only single-stemmed tokens. The most frequently mentioned meaningful stemmed tokens included 'plai', 'cuddl', 'groom', 'strok(e)', 'talk' and 'watch'. Lower frequency stemmed tokens such as 'ball' and 'game' were often related to these. The highest frequency stemmed tokens were used to guide the development of additional questions for Subscale 1. They were also used to modify existing items. For example, 'hugging' appeared not to be a common physical interaction between owners and their cats, the results of the analysis suggesting that the word 'cuddle' would be more appropriate for cat owners.

3.3 Study 3

Adjustments were made to the MDORs in line with the findings of Studies 1 and 2, and this adapted version of the MDORS (the CORS) was presented to English-speaking respondents worldwide, as a measure of the cat-owner's perceived relationship quality. This study was approved by the La Trobe University Ethics Committee (S15-190).

Results of the PCA on CORS items indicated that seven components had an eigenvalue of greater than 1.0, accounting for 56.5% of the total variance. Visual examination

of the scree plot revealed that three components should be retained, which accounted for 40.7% of the total variance. When a forced three-factor PCA was conducted, six items (13, 14, 20, 25, 31, and 32) did not load onto any of the three components, and were excluded from further analysis. With these variables removed, the three components explained 45.9% of the total variance, and all three components exceeded Cronbach's α of 0.70. The components included 'Perceived Emotional Closeness' containing 11 items, 'Perceived Costs' containing 9 items, and 'Cat-Owner Interaction' containing 6 items (see Table 2).

--- TABLE 2 ABOUT HERE ---

Table 3 shows a comparison of items included in the Dog-Owner Interaction subscale in the original MDORS and those in the Cat-Owner Interaction subscale in the CORS that resulted from the analysis described above. It can be seen that many of the items are different for cats than for dogs. In fact, only two items, one related to playing with the pet, and another related to having the pet with the owner while watching TV, actually applied to both species. A third item is virtually identical, with the word 'hug' being changed to 'cuddle'.

--- TABLE 3 ABOUT HERE ---

Table 4 shows the same comparison for the 'Perceived Emotional Closeness' subscales for dogs and cats. This table shows that most of the items are the same for both species, but there is no item for cats related to the pet's level of attention to the owner. In addition, two items 'How often do you kiss your cat?' and 'How often do you buy your cat presents?' load onto the Perceived Emotional Closeness subscale for cats, while the corresponding items for dogs load onto the Dog-Owner Interactions subscale.

--- TABLE 4 ABOUT HERE ---

The subscales for 'Perceived Costs' are identical in the CORS and MDORS. The items are not presented in a Table as the subscale can be used in its current form for both species.

4. Discussion

The aim of this study was to create a scale for measuring the quality of individual cat-owner relationships, as perceived by the cat's owner. We particularly sought to devise a scale that could be used to measure these relationships accurately and with regard to the types of relationship factors that are specific to cats and their owners. However, the results indicated that the scale could also be used to conduct comparisons with results for the dog-owner relationship, collected using the existing Monash Dog-Owner Relationship Scale (MDORS). The theoretical basis of the MDORS lies in social exchange theory (Emerson, 1976), and we were able to retain this focus as the basis for the new cat-owner relationship scale (CORS).

Study 1 demonstrated that modifying the existing MDORS (Dwyer et al. 2006), by replacing the word 'dog' with 'cat', was appropriate for two subscales, relating to perceived emotional closeness with the cat and perceived costs of cat ownership respectively. These appear to function similarly in the two species, although there were slight differences in which items loaded on the Perceived Emotional Closeness subscale in Study 3. Conversely, the 'Dog-Owner Interaction' subscale of the MDORS did not translate readily as a measure of the cat-owner relationship, as perceived by cat owners. This was therefore adapted using information collected in Study 2 to better reflect the activities that cat owners share with their pet cats, before the draft version was tested in Study 3. The results revealed that, while this subscale consists of nine items in the MDORS, it comprises just six items in the CORS; only two items are common to both subscales. Physical interaction between owner and cat included cuddling and petting, rather than hugging. There was also a shift in emphasis in the style of interaction, with talking to and watching the cat being important.

Consequently, the resultant Cat Owner Interaction subscale of the CORS excluded interactions that related to travel with the pet (taking the pet to visit people and taking it in the car), and also captured a different style of general interaction. This was consistent with data

captured in Study 1, in which only 15.7% of owners reported taking their cat to visit people. While, for these people, taking their cats travelling with them may be an indication of relationship quality, the low frequency of these behaviours precludes inclusion of them in a scale developed for general use. A higher proportion of the sample ((27.0%) had taken their cat in the car. This result may relate to shared activities engaged in voluntarily by the owner and, therefore, reflective of relationship quality. However, it could equally apply to practical issues of cat management, such as taking the cat on trips when the owner could not find a suitable cattery or live-in cat nanny, or perhaps even taking it to a veterinarian.

In another study (unpublished data) we identified that some items on the MDORS may be culturally biased, in that it is unusual in some places for dog owners to own cars, let alone take their dog on visits using this means of transportation. The same may be true of cats, in that some items that formed the interaction subscale for cat owners in our study may be culturally biased. In other countries or populations, travel with a cat, grooming, and buying presents may reveal aspects of the owner-cat relationship. This should be explored with further study, as should potential reasons for why owners report differences in the relationships they share with different animal species. Are these due to intrinsic differences in the biology of animal species, to differences in owner perceptions and/or expectations, to human factors that influence which animal individual humans choose to keep as a companion, or to some other, so far undetected, variable? Further research, facilitated by the scale developed in this study, is needed to investigate many potential explanations.

One strength of the CORS is that it focuses on three different aspects of the cat-owner relationship. Other pet-owner relationship scales do not have a large number of items related to specific interactions between pet and owner. For instance, the Lexington Attachment to Pets Scale (LAPS) is a 23-item scale with three subscales, including ‘General Attachment’, ‘People Substituting’, and ‘Animal Rights/Animal Welfare’ (Johnson et al. 1992). The only

item related specifically to interactions is 'I play with my pet quite often'. Similarly, the Pet Attitude Scale (PAS) is an 18-item scale with three subscales: 'Love and Interaction', 'Pets in Home', and 'Joy of Pet Ownership' (Templer et al. 1981). Like the LAPS, only two items relate to specific interactions, 'I like to feed animals out of my hand', and 'I frequently talk to my pet'. Since interactions correlate with relationship quality (Miller and Lago 1990), exploring these types and quality of interactions is instructive.

Another strength of the CORS is that it does specifically focus on human-cat relationships. Some existing pet-owner relationship scales tend to be biased towards dogs, because the items about shared activities relate primarily to interactions that would be most applicable to dog-owner relationships (e.g. Lago et al. 1988). For instance, in one study, cat owners initially scored lower than dog owners on the Comfort from Companion Animals Scale, but when two items related to specific interactions were removed, these differences were no longer observed (Zasloff 1996). The benefit of the CORS, a species-specific scale, is that it enables an analysis of cat-owner perceived relationships that is based on the types of interactions that cats and owners have, as opposed to owners of pets in general.

While this specificity is a strength, it is also a potential limitation, since, as with species-specific relationship quality scales in general, it is not possible to compare owners of different animal types on the same scale. In much the same way that the MDORS was not entirely suitable for measuring cat-owner relationship quality, the CORS may not be ideal for measuring the owner-rated quality of relationships between other pets and their owners. Given the lack of systematic difference in responses between cat and dog owners with respect to the Perceived Emotional Closeness subscale in Study 1, and the good level of factor structure similarity found in Study 3, it seems reasonable to conclude that this subscale does measure some core aspects of the emotional bond between owners and their pets, regardless of whether the pet is a dog or a cat. Nonetheless, the inclusion of 'kissing' and 'buying

presents' in the factor structure for this subscale in cats suggests that there may be minor differences between species. These items could be understood to be expressions of an emotional bond and therefore subject to different interpretation in different cultures or groups. 'Kissing' had a relatively high loading on both the Perceived Emotional Closeness and Cat Owner Interaction subscales. In a representative sample, perhaps the factor structure might be more consistent between dog and cat owners. Whether this subscale has any relevance to other companion animal species, however, is yet to be determined.

Similarly, while perceived costs are likely to be similar for species that live freely in the home, such as cats, dogs and house-rabbits, they may be very different for companion species whose husbandry commonly consists of caging, living outdoors or away from the owner's home (e.g. horses). Future research is required to determine the extent to which perceived costs vary across animal species and housing arrangements.

As was found in Studies 2 and 3, pet-owner interaction is the aspect of the relationship that is most variable between companion species, and which may also be most affected by owner knowledge and cultural aspects of pet ownership. While future research should aim to develop a scale that is equally valid for several animal types, this must be balanced against the need to accurately assess aspects of the relationship that are genuinely species specific. We feel that, because the overall structure of the CORS is broadly similar to the MDORS, it is appropriate, at least for now, to combine these two measures into a new scale, called the Cat/Dog-Owner's Perceived Relationship Scale (C/DORS). This is provided as Appendix A.

This new scale includes all current items in the MDORS, together with the small number of additional items created during development of the CORS. We suggest that, when the aim is to exclusively measure owner's perceived relationship quality in either dogs or cats, only those items most suited to the species in question be administered. Conversely, if

cross-species comparisons are desired, all questions should be administered to owners of both cats and dogs, with two of the subscales subsequently being scored slightly differently for each species. This will allow researchers to take into account the statistical findings of Study 3, whilst collecting information about the widest range of interactions in a consistent manner for the two species. This will facilitate further refinements of the scale, as well as cross-species and cross-cultural comparisons. The scoring scheme for the combined C/DORS is broadly the same as for MDORS, with all items being scored 1 to 5, and the highest value being allocated to the response that indicates the most positive relationship. Subscale scores should be calculated (as per Appendix A) as the mean of the item scores for that subscale in that species, to take into account the differing number of items in each subscale.

While we believe that the C/DORS is an important addition to existing owner-pet relationship scales, a significant limitation in this study and, indeed, in all owner-report measures, is that perceptions of relationship quality between animal and owner are one-sided; they focus only on owner perceptions, with no consideration of whether the animal perceives a high quality relationship or the contrary. We therefore recommend that future research incorporate measures of cat or dog behaviour and cognition alongside the C/DORS, in order to develop a more holistic understanding of the companion animal-owner relationship.

A second limitation of the present study is that for all of the studies we used a convenience sample of cat owners. The participants were overwhelmingly female (indeed, only female owners were used in Studies 1 and 2), and in Study 3 they were also generally well-educated. Being self-selected, it is also likely that the samples were biased towards cat owners who cared enough about their cat to engage in the study. This may explain why the response options for some items did not show a large degree of variability, although it is also possible that virtually all companion animal owners are very positively disposed towards their animals. Social exchange theory, on which the MDORS, and now the C/DORS, was

based, holds that social relationships only persist if they benefit the parties involved (Emerson, 1976). While, in the case of companion animals, the choice of whether to remain in the relationship or not is often one-sided, future research should aim to recruit a representative sample of owners, so as to establish whether the types of relationships reported by owners in the current study are truly applicable to the larger community of cat owners.

Since cats are one of the most commonly owned pets throughout western societies, understanding the qualities of cat-owner interactions, perceived emotional closeness and perceived costs that correspond to a positive cat-owner relationship could improve outcomes for both cat and owner. A high quality relationship may reduce the likelihood that the cat will be relinquished to a shelter, a process that can be distressing to owners and potentially fatal to the cat. If perceived costs of cat ownership result in a reduced perception of emotional closeness, educational campaigns could aim to help potential owners better understand the true costs of cat ownership, bringing expectations more in line with reality.

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Figure 1. Schematic of the methods used in CORS development. Study 1 involved a modification of the existing MDORS, replacing the word 'dog' with the word 'cat' for all items. Data using the modified MDORS from 293 females were matched with existing MDORS data to determine whether the existing MDORS subscales were applicable to the cat-owner relationship. Only 'cat-owner interactions' significantly differed from the original 'dog-owner interactions' subscale. In study 2, 61 female cat owners provided free-text descriptions of their relationship with their cat, and these data were used to create new items for the CORS which may better reflect the cat-owner relationship. In study 3, 570 participants completed the new CPRS, and a principal components analysis was used to create the final version. Numbers in parentheses indicate the corresponding subsection in the text.

Figure 2. Loadings plot from the OPLS-DA model of owner-pet interaction. Bar height indicates strength of loading, with whiskers indicating 95% confidence interval for the loading. Bars with a positive sign (upward pointing) indicate items that were associated with the pet being a dog. Bars with a negative sign (downward pointing) indicate items that were associated with the pet being a cat. The strongest loadings are for items related to taking the pet in the car or to visit friends, and to giving the pet food treats; all of these activities were positively associated with dogs and negatively associated with cats.

Appendix A CDORS

Cat/Dog Owner Relationship Scale (C/DORS-2016)

Tiffani J. Howell, Jonathan Bowen, Jaume Fatjó, Paula Calvo, Anna Holloway, Pauleen C. Bennett. Development of the cat owner relationship scale (CORS). *Behavioural Processes (final reference to be updated once published).*

Instructions: Please consider each of the following statements and indicate which option most describes how you feel or act. We are interested in your opinions. There are no correct or incorrect responses.

1.	How hard is it to look after your pet?	Very hard ☐	Hard ☐	Neither hard nor easy ☐	Easy ☐	Very easy ☐
2.	My pet gives me a reason to get up in the morning.	Strongly agree ☐	Agree ☐	Neither agree nor disagree ☐	Disagree ☐	Strongly disagree ☐
3.	There are major aspects of owning a pet I don't like.	Strongly agree ☐	Agree ☐	Neither agree nor disagree ☐	Disagree ☐	Strongly disagree ☐
4.	How often do you kiss your pet?	At least once a day ☐	Once every few days ☐	Once a week ☐	Once a month ☐	Never ☐
5.	I wish my pet and I _____	Strongly	Agree	Neither agree	Disagree	Strongly

	never had to be apart.	agree □	□	nor disagree □	□	disagree □
6.	My pet makes too much mess.	Strongly agree □	Agree □	Neither agree nor disagree □	Disagree □	Strongly disagree □
7.	How often do you play games with your pet?	At least once a day □	Once every few days □	Once a week □	Once a month □	Never □
8.	It bothers me that my pet stops me doing things I enjoyed before I owned it.	Strongly agree □	Agree □	Neither agree nor disagree □	Disagree □	Strongly disagree □
9.	How often do you spend time enjoying watching your pet?	At least once a day □	Once a week □	Once a month □	A couple of times a year □	Never □
10.	It is annoying that sometimes I have to change my plans because of my pet.	Strongly agree □	Agree □	Neither agree nor disagree □	Disagree □	Strongly disagree □
11.	My pet costs too much money.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

	□	□	□	□	□

12.	How often do you buy your pet presents?	Once a week ☐	Once a fortnight ☐	Once a month ☐	A couple of times a year ☐	Never ☐
13.	How often do you tell your pet things you don't tell anyone else?	Once a day ☐	Once a week ☐	Once a month ☐	Once a year ☐	Never ☐
14.	How often do you feel that looking after your pet is a chore?	Once a day ☐	Once a week ☐	Once a month ☐	Once a year ☐	Never ☐
15.	How often do you talk to your pet?	At least once a day ☐	Once every few days ☐	Once a week ☐	Once a month ☐	Never ☐
16.	How often do your pet stop you doing things you want to?	Once a day ☐	Once a week ☐	Once a month ☐	Once a year ☐	Never ☐
17.	I would like to have my pet near me all the time.	Strongly agree ☐	Agree ☐	Neither agree nor disagree ☐	Disagree ☐	Strongly disagree ☐
18.	If everyone else left me, my pet would	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

	still be there for me.	□	□	□	□	□
19.	How often do you feel that having a pet is more trouble than it's worth?	Once a day □	Once a week □	Once a month □	Once a year □	Never □
20.	My pet helps me get through tough times.	Strongly agree □	Agree □	Neither agree nor disagree □	Disagree □	Strongly disagree □
21.	How often do you cuddle your pet?	At least once a day □	Once every few days □	Once a week □	Once a month □	Never □
22.	My pet provides me with constant companionship.	Strongly agree □	Agree □	Neither agree nor disagree □	Disagree □	Strongly disagree □
23.	How often do you have your pet with you while relaxing, i.e. watching TV?	At least once a day □	Once every few days □	Once a week □	Once a month □	Never □
24.	My pet is there whenever I need to be comforted.	Strongly agree □	Agree □	Neither agree nor disagree □	Disagree □	Strongly disagree □
25.	How traumatic do	Very	Traumatic	Neither	Untraumatic	Very

you think it will be for your when your pet dies?	traumatic ☐	☐	traumatic nor untraumatic ☐	☐	untraumatic ☐

26.	How often do you pet your pet?	At least once a day ☐	Once every few days ☐	Once a week ☐	Once a month ☐	Never ☐
27.	How often do you take your pet to visit people?	Once a week ☐	Once a fortnight ☐	Once a month ☐	A couple of times a year ☐	Never ☐
28.	How often do you give your pet food treats?	At least once a day ☐	Once every few days ☐	Once a week ☐	Once a month ☐	Never ☐
29.	How often do you take your pet in the car?	At least once a day ☐	Once every few days ☐	Once a week ☐	Once a month ☐	Never ☐
30.	How often do you hug your pet?	At least once a day ☐	Once every few days ☐	Once a week ☐	Once a month ☐	Never ☐
31.	How often do you buy your pet presents?	Once a week ☐	Once a fortnight ☐	Once a month ☐	A couple of times a year ☐	Never ☐
32.	How often do you groom your pet?	At least once a day ☐	Once every few days ☐	Once a week ☐	Once a month ☐	Never ☐
33.	My pet is constantly	Strongly	Agree	Neither agree	Disagree	Strongly

attentive to me.	agree		nor disagree		disagree
	☐	☐	☐	☐	☐

Scoring Instructions for the C/DORS

The C/DORS consists of three subscales: Pet-Owner Interactions, Perceived Emotional Closeness, and Perceived Costs. Each item is scored on a five-point scale, from 1 to 5. Items in the Pet-Owner Interactions and Perceived Emotional Closeness subscales should be reverse-scored, such that a higher score indicates better perceived relationship quality. We recommend that all items be presented to all owners regardless of whether they are cat or dog owners. However, when scoring, the items included in specific subscales vary by species.

Scoring instructions for cat owners:

To calculate the score for the Pet-Owner Interactions subscale, reverse score items 7, 9, 15, 21, 23, and 26. Then add the scores and divide by 6.

To calculate the score for the Perceived Emotional Closeness subscale, reverse score items 2, 4, 5, 12, 13, 17, 18, 20, 22, 24, 25. Then add the scores and divide by 11.

To calculate the Perceived Costs subscale, add the scores for items 1, 3, 6, 8, 10, 11, 14, 16, 19. Then divide by 9.

Scoring instructions for dog owners:

To calculate the score for the Pet-Owner Interactions subscale, reverse score items 4, 7, 23, 27, 28, 29, 30, 31, 32. Then add the scores and divide by 9.

To calculate the score for the Perceived Emotional Closeness subscale, reverse score items 2, 5, 13, 17, 18, 20, 22, 24, 25, 33. Then add the scores and divide by 10.

To calculate the Perceived Costs subscale, add the scores for items 1, 3, 6, 8, 10, 11, 14, 16, 19. Then divide by 9.

Table 1. Items included in the CORS original adaptation from the MDORS

Items included in the adapted CORS		**Response options**				
1.	How hard is it to look after your cat?	Very hard	Hard	Neither hard nor easy	Easy	Very easy
2.	My cat gives me a reason to get up in the morning.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
3.	There are major aspects of owning a cat I don't like.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
4.	How often do you kiss your cat?	At least once a day	Once every few days	Once a week	Once a month	Never
5.	I wish my cat and I never had to be apart.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
6.	My cat makes too much mess.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
7.	How often do you play games with your cat?	At least	Once every	Once a week	Once a month	Never

		once a day	few days			
8.	It bothers me that my cat stops me doing things I enjoyed before I owned it.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
9.	How often do you spend time enjoying watching your cat?	At least once a day	Once a week	Once a month	A couple of times a year	Never
10.	It is annoying that sometimes I have to change my plans because of my cat.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
11.	My cat costs too much money.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
12.	How often do you buy your cat presents?	Once a week	Once a fortnight	Once a month	A couple of times a year	Never
*13.	My cat is constantly attentive to me.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
*14.	How often do you give your cat food treats?	At least once a day	Once every few days	Once a week	Once a month	Never

15.	How often do you tell your cat things you don't tell anyone else?	Once a day	Once a week	Once a month	Once a year	Never
16.	How often do you feel that looking after your cat is a chore?	Once a day	Once a week	Once a month	Once a year	Never
17.	How often do you talk to your cat?	At least once a day	Once every few days	Once a week	Once a month	Never
18.	How often does your cat stop you doing things you want to?	Once a day	Once a week	Once a month	Once a year	Never
19.	I would like to have my cat near me all the time.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
*20.	How often do you groom your cat?	At least once a day	Once every few days	Once a week	Once a month	Never
21.	If everyone else left me, my cat would still be there for me.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
22.	How often do you feel that having a cat is more	Once a day	Once a	Once a month	Once a year	Never

	trouble than it's worth?		week			
23.	My cat helps me get through tough times.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
24.	How often do you cuddle your cat?	At least once a day	Once every few days	Once a week	Once a month	Never
*25.	I like when my cat decides to sleep next to me, on the sofa or on my bed.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
26.	My cat provides me with constant companionship.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
27.	How often do you have your cat with you while relaxing, i.e. watching TV?	At least once a day	Once every few days	Once a week	Once a month	Never
28.	My cat is there whenever I need to be comforted.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
29.	How traumatic do you think it will be for your when your cat dies?	Very traumatic	Traumatic	Neither traumatic nor	Untraumatic	Very untraumatic

				untraumatic		
30.	How often do you pet your cat?	At least once a day	Once every few days	Once a week	Once a month	Never
*31.	I love that my pet has his/her own personality.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
*32.	I love the independent nature of my cat.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
*33.	Is there any activity or aspect that is a very important part of your relationship with your cat that we have not mentioned before?				Yes (please write)	No

* Items 13, 14, 20, 25, 31 and 32 did not load onto any of the factors in the Principal Components Analysis, so they were not included in the final version of the CORS. Item 33 was not included because it was a yes/no question with optional open-ended response.

Table 2. PCA results for final version of the CORS

Item*		**Component**			
		1 – Perceived Emotional Closeness	**2 – Perceived Costs**	**3 – Cat-Owner Interactions**	**Cronbach's α**
5.	I wish my cat and I never had to be apart.	**.854**	.048	-.154	0.883
19.	I would like to have my cat near me all the time.	**.820**	-.022	-.096	
23.	My cat helps me get through tough times.	**.737**	-.009	.126	
2.	My cat gives me a reason to get up in the morning.	**.732**	.005	.012	
28.	My cat is there whenever I need to be comforted.	**.619**	.077	.192	
15.	How often do you tell your cat things you don't tell anyone else?	**.613**	-.131	-.102	
21.	If everyone else left me, my cat would still be there for me.	**.605**	.144	.131	
26.	My cat provides me with constant companionship.	**.589**	.088	.264	
29.	How traumatic do you think it will be for your when your cat	**.503**	.007	.133	

	dies?				
4.	How often do you kiss your cat?	**.429**	-.070	.315	
12.	How often do you buy your cat presents?	**.401**	.042	.097	
10.	It is annoying that sometimes I have to change my plans because of my cat.	-.014	**.713**	-.062	0.785
11.	My cat costs too much money.	-.069	**.682**	.022	
8.	It bothers me that my cat stops me doing things I enjoyed before I owned it.	.009	**.663**	-.006	
16.	How often do you feel that looking after your cat is a chore?	.080	**.631**	-.028	
6.	My cat makes too much mess.	-.045	**.613**	.014	
3.	There are major aspects of owning a cat I don't like.	.237	**.600**	.008	
1.	How hard is it to look after your cat?	-.050	**.559**	.029	
18.	How often do your cat stop you doing things you want to?	-.190	**.519**	-.009	
22.	How often do you feel that having a cat is more trouble than it's worth?	.204	**.453**	.009	

30.	How often do you pet your cat?	-.163	-.005	**.835**	0.813
24.	How often do you cuddle your cat?	.052	.050	**.782**	
17.	How often do you talk to your cat?	-.047	-.032	**.713**	
27.	How often do you have your cat with you while relaxing, i.e. watching TV?	.073	-.022	**.670**	
7.	How often do you play games with your cat?	.135	.039	**.570**	
9.	How often do you spend time enjoying watching your cat?	.189	-.014	**.562**	

*Item numbers are from the version of the CORS shown in Table 1, not the final version included as Appendix A

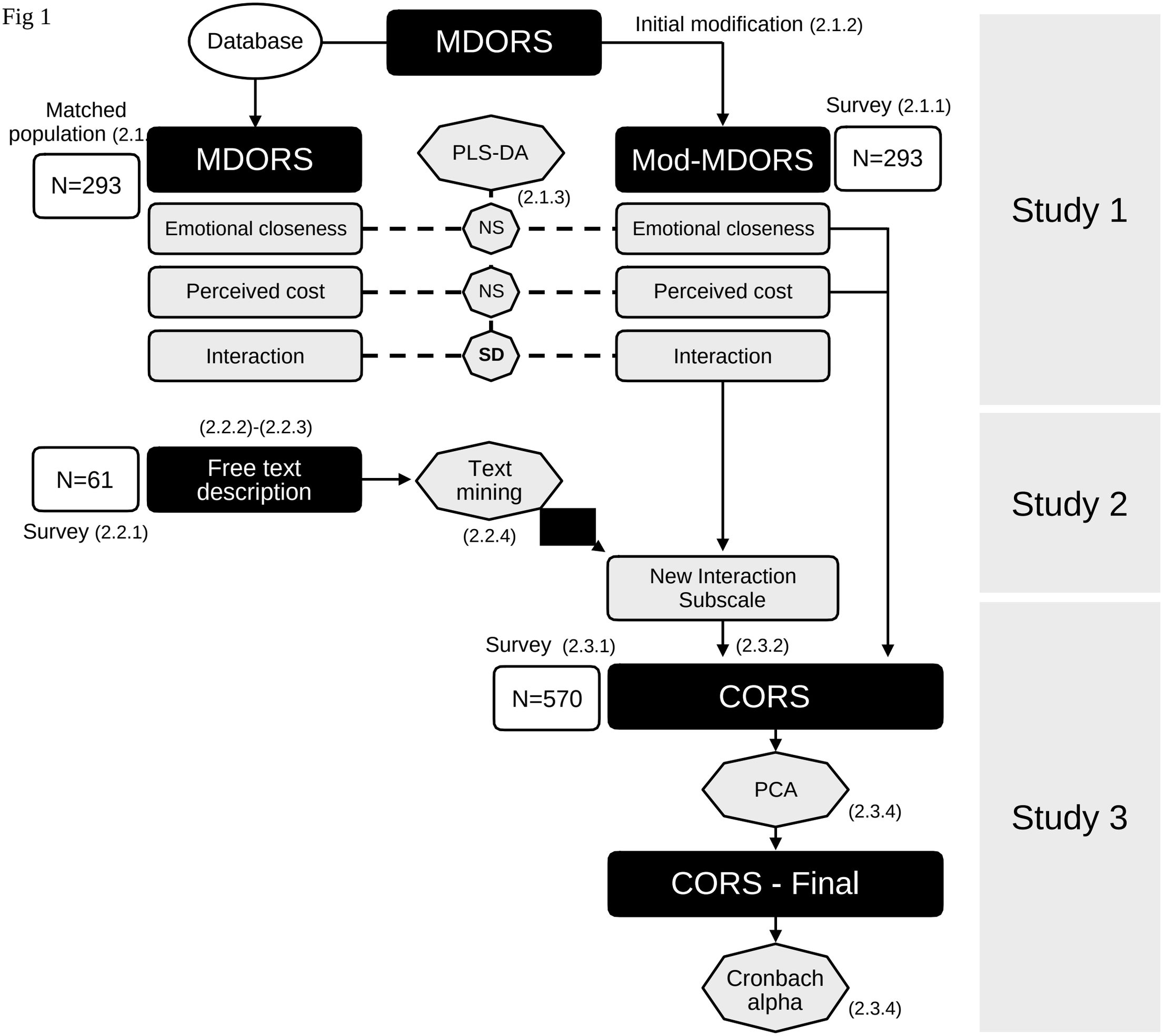
Table 3: Comparison between items on MDORS and CORS Pet-Owner Interaction subscale

MDORS Pet-Owner Interaction items	**CORS Pet-Owner Interaction items**
How often do you play games with your dog?	How often do you play games with your cat?
How often do you take your dog to visit people?	
How often do you give your dog food treats?	
How often do you kiss your dog?	
How often do you take your dog in the car?	
How often do you hug your dog?	
How often do you buy your dog presents?	
How often do you have your dog with you while relaxing, i.e., watching TV?	How often do you have your cat with you while relaxing, i.e. watching TV?
How often do you groom your dog?	
	How often do you cuddle your cat?
	How often do you pet your cat?
	How often do you talk to your cat?
	How often do you spend time enjoying watching your cat?

Table 4: Comparison between items on MDORS and CORS Perceived Emotional Closeness subscale

MDORS Perceived emotional closeness item	CORS Perceived emotional closeness item
I wish my dog and I never had to be apart.	I wish my cat and I never had to be apart.
I would like to have my dog near me all the time.	I would like to have my cat near me all the time.
My dog helps me get through tough times.	My cat helps me get through tough times.
My dog gives me a reason to get up in the morning.	My cat gives me a reason to get up in the morning.
My dog is there whenever I need to be comforted.	My cat is there whenever I need to be comforted.
How often do you tell your dog things you don't tell anyone else?	How often do you tell your cat things you don't tell anyone else?
If everyone else left me my dog would still be there for me.	If everyone else left me, my cat would still be there for me.
My dog provides me with constant companionship.	My cat provides me with constant companionship.
How traumatic do you think it will be for you when your dog dies?	How traumatic do you think it will be for your when your cat dies?
	How often do you kiss your cat?
	How often do you buy your cat presents?
My dog is constantly attentive to me.	

Fig 1


Database
MDORS
Initial modification (2.1.2)
Matched population (2.1
N=293
MDORS
PLS-DA
(2.1.3)
Survey (2.1.1)
Mod-MDORS
N=293
Emotional closeness
NS
Emotional closeness
Perceived cost
NS
Perceived cost
Interaction
SD
Interaction
(2.2.2)-(2.2.3)
N=61
Free text description
Text mining
Survey (2.2.1)
(2.2.4)
New Interaction Subscale
Survey (2.3.1)
(2.3.2)
N=570
CORS
PCA
(2.3.4)
CORS - Final
Cronbach alpha
(2.3.4)
Study 1
Study 2
Study 3