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Measuring commitment in paws: Adaptation of the Investment Model Scale to the context of companion animals with a Portuguese sample



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ABSTRACT

Commitment has a crucial role in predicting intentions and behaviors toward relationship maintenance. The Investment Model Scale (IMS; Rusbult et al., 1998) offers an empirically supported framework to describe and quantify commitment in various contexts, particularly romantic relationships. Only a few studies have attempted to extend this theoretical framework to examine human and companion animals (H-CA) relationships and measurement instruments lack psychometric evidence. We adapted the IMS to H-CA relationships based on previous studies and discussions with various experts (Study 1a), to help us clarify some items and develop new ones. We then performed Exploratory (Study 1b, N = 248) and Confirmatory Factor Analyses (Study 2, N = 236), to assess the scale's psychometric capabilities in this new context. During study 2, we also investigated scale sensitivity and criterion-based validity. Exploratory factor analyses showed that variables assessed by the IMS are stransferable to the H-CA context. The same structure was found in the Confirmatory Factor Analyses. Results showed this new version of the IMS is psychometrically sound to be used by researchers and professionals, with the added precaution that the "Quality of Alternatives" dimension does not translate completely to this new H-CA environment and warrants further study.

Introduction

Social relationships are vital to our lives (Tamir and Hughes, 2018). Research has explored this subject from many different points of view, including how they are formed (Altman and Taylor, 1973), how we stay or leave relationships (Agnew et al., 2008; Tran et al., 2019), and what are their benefits in our lives, whether at an identity level (Brewer, 2008) or a health level (Cohen, 2002; Holt-Lunstad et al., 2010). And yet, research typically approaches relationships from an interpersonal (i. e., human-centered) perspective. Instead, we focus on the often-overlooked close relationships that humans form with their companion animals (CA). CAs are beings born to be pets, live in or near a home inhabited by people, are relatively controllable and cuddled by humans, are domesticated (or at least tamed), and have an assigned name (DeMello, 2012). Common CAs include dogs, cats, and birds (Chomel, 1992) and are often considered members of the family (Cain, 1985; Carlisle-Frank and Frank, 2006; Irvine and Cilia, 2017; do Vale et al., 2021).

Research focused on the relationship between humans and CA (H-

CA) is substantially more limited when compared to interpersonal relationships, arguably due to its novelty. Still, available research indicates the importance of these relationships to health and well-being. For example, CAs are sources of social support (McConnell et al., 2011), which can protect against social isolation and its deleterious consequences for health and well-being (Holt-Lunstad et al., 2010). CAs can also facilitate the enactment of healthier behaviors, such as quit smoking (Hodgson et al., 2015).

However, the debate on the positive effects of CA on physical and psychological outcomes is not straightforward (see Chur-Hansen et al., 2010). Attempts to replicate previously reported positive results have proven ineffective (Parslow and Jorm, 2003; Parslow et al., 2005) and disadvantages of CA ownership have been reported in the literature (Amiot and Bastian, 2015). Examples of these include financial strains (e.g., high costs associated with keeping animals or animal diseases; Plaut et al., 1996; Bonas et al., 2000), negative relationships (e.g., mistreatment, abandonment; Ascione and Shapiro, 2009; Jacobetty et al., 2019), resulting in negative consequences for either the CA, the owner, or both (e.g., animal attacks resulting on injuries to other

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animals and/or people, illegal breeders and their possible legal repercussions, animal fights; Fonseca et al., 2015; Maher and Wyatt, 2021; Siegel and van Uhm, 2021).

We argue for the importance of examining *how* and *why* H-CA relationships are formed, fostered, maintained, and eventually end, to understand its benefits and potential problems. Drawing from relationship science, commitment is among the strongest predictors of interpersonal relationship maintenance and longevity (Agnew, 2009). This is one of the core constructs proposed by the Investment Model (IM; Rusbult et al., 2011), and has been reliably assessed with the Investment Model Scale (IMS; Rusbult et al., 1998). The IMS has been translated into several languages and contexts (see Agnew and Vanderdrift, 2018; Tran et al., 2019). More recently, Baker et al. (2016) extended the IMS to the H-CA context but failed to provide the psychometric properties of the scale. The current study aims to validate a version of the IMS that has been adapted to H-CA relationships and provide psychometric evidence to support its use, particularly by Portuguese-speaking researchers and professionals.

The importance of commitment to understanding humancompanion animal relationships

Commitment is essential to human social life (Michael and Székely, 2018) and can be defined as long-term orientation toward relationship stability and maintenance, including feelings of psychological interdependence toward the partner and willingness to work through any relationship problems that may arise' (Finkel et al., 2017; Agnew and Vanderdrift, 2018; Tran et al., 2019). The IM rests on the premise that commitment depends on three antecedents, such that individuals who are more satisfied in their relationships, perceive less quality among prospective alternatives, and/or invest more in their relationship tend to be more committed to their relationship. Individuals who are more (vs. less) committed are also more likely to activate protection mechanisms (e.g., forgiveness) that contribute to relationship persistence (see Fig 1).

The probability of persistence in the relationship refers to its stability and implies adopting a long-term orientation toward the relationship (Finkel et al., 2017). In the context of the IM, the intention to stay in a relationship is dictated by the individual's commitment , which in turn results from the interaction of the factors of satisfaction, quality of alternatives, and size of investment (Rusbult, 1983).

Satisfaction is defined as a person's internal evaluation of their partner's positive feelings and relationship attractiveness (Rusbult, 1983), and represents an individual's perception and evaluation of the current state of romantic relationships. In this sense, satisfaction with one's relationship depends on the experience of positive affect and attraction towards the partner, and the fulfillment of one's basic

relational needs (e.g., intimacy; Rodrigues and Lopes, 2013). Quality of alternatives refers to a subjective assessment of how appealing prospective alternative scenarios are when compared to the current relationship (Rusbult et al., 2006). These alternative scenarios can refer to other partners but also being alone or with friends or family, without the partner (Rusbult et al., 2006; Agnew, 2009). Lastly, investments refer to the intrinsic (e.g., disclosure of intimate information) and extrinsic resources (e.g., joint bank account) attached to the relationship that would be damaged or lost if the relationship ended (Le and Agnew, 2003; Agnew, 2009).

The IM in human-companion animal relationships

To the best of our knowledge, only two studies have extended the IM premises to H-CA relationships. In one study, Collisson (2015) found that commitment was related to satisfaction and investment size, but not quality of alternative animals, and that relinquishment intentions were related to satisfaction, investment size, and quality of alternatives. In the other study, Baker and colleagues (2016) extended the IMS to the H-CA context and found that H-CA relationships share similarities with Human-Human relationships in terms of predictors and outcomes of commitment. In this sense, the authors showed that increasing satisfaction and investments and decreasing the perceived quality of one's alternatives benefits H-CA relationships. However, and more importantly, neither of the studies aimed at validating the IMS in this context, rendering researchers with no psychometric information to support the validity of the scale (or lack thereof).

In both cases, the authors reported no difficulties in applying the concepts of commitment, satisfaction, and investments to H-CA relationships. Baker and colleagues (2016) further argued that some protection mechanisms found in interpersonal relationships parallel those in H-CA relationships, including forgiving their CA, accommodating their CA's behavior, and sacrificing themselves on behalf of their CA. According to the authors, the concept of quality of alternatives is less straightforward when applied to H-CA relationships. In fact, items such as "Are alternatives to the relationship with my companion animal attractive to me (e.g., spending time with friends, being alone, et cetera)?" may also raise questions, given that the activities we perform with our CAs are not equivalent to those we can perform with our friends. Putting aside neglect scenarios, it is to be expected of an individual to take part in activities they could not attend with their CAs, which happens less frequently with romantic partners (e.g., you can go to the movies with either your friends or your partner, but you can seldom take your CA).

Furthermore, and unlike Baker and colleagues (2016), no correlation between quality of alternatives and commitment was found by Collisson



Fig. 1. The investment model(adapted from Rusbult et al, 1998).

(2015). The author argues that this might be due to natural differences between romantic and H-CA relationships. Indeed, in romantic relationships alternatives to current relationship include being alone and replacing one's partner. In H-CA relationships, owners can relinquish their CA but can add more ACAs rather than replace them (individuals often have more than one CA; Krahn et al., 2015). This is unlikely to be the case in romantic relationships.

Objectives and work plan

To our knowledge, the two main scales that link the concept of commitment to CAs are the Miller-Rada scale of commitment to animals (Staats et al., 1996), and the IMS adapted to the context of CAs by Baker et al. (2016). There is also the Commitment to Pets measure, which results of a more recent work (Rauktis et al., 2021), and addresses the lack of research on commitment in this context. This scale, however, and much like the Miller-Rada scale, is conceptually based on attachment to CAs - derived from the Johnson et al. (1992) scale and not on the IM constructs (Rusbult, 1980). Although research points to an association between commitment and attachment (Rusbult and Buunk, 1993), these are distinct constructs in the field of H-CA relationships (Crawford et al., 2006). Indeed, in psychology, attachment pertains to a very specific theoretical foundation and refers to the ways people relate to others based on their past experiences (Bowlby, 1982), whereas in H-CA relationships, attachment pertains to the "bondedness" between humans and their companion animals (Ellis et al., 2024). As such, we argue that developing an instrument that specifically and objectively assesses commitment in H-CA relationships is crucial, in order to better understand the foundations and implications of these relationships. Until now, no published study presented a validation of an IMS adaptation to the context of H-CA. In the present paper, we aimed to adapt and validate the IMS to the context of H-CA. In Study 1, we used the Portuguese version of the IMS (Rodrigues and Lopes, 2013) and Baker et al. (2016) IMS adaptation to develop the IMS H-CA, and examined its content and construct validity. In Study 2, we ran a confirmatory factorial analysis on the new developed IMS H-CA and determined the scale's sensitivity and criterion-related validity.

Study 1

Adapting the IMS to the H-CA context

We started by adapting the items from the Portuguese version of the IMS (Rodrigues and Lopes, 2013; original scale by Rusbult et al., 1998) to the context of H-CA relationships. This process included replacing any reference to romantic partners with "companion animal" and making other necessary adjustments to the items. The resulting scale included 22 items assessing satisfaction (five items; e.g., e.g., "I am satisfied with my relationship with my companion animal"), perceived quality of alternatives (five items; e.g., "Other companion animals I could have [other than my current companion animal] are very appealing to me"), investments (five items; e.g., "I have invested so much in the relationship with my companion animal that I would end up losing everything if this relationship ended"), and commitment (seven items; "I am committed to maintaining the relationship with my companion animal"). Responses to items were given on 7-point rating scales (from 1 = Strongly disagree to 7 = Strongly agree).

Afterward, we compared our resulting scale with the scale proposed by Baker and colleagues (2016). We first translated the Baker et al.'s scale into European Portuguese and asked a bilingual person to backtranslate the scale. We identified and changed four items by comparing the two scales due to item readability and comprehension. Thus, in the items referring to CA exchange in the "Quality of Alternatives" dimension, Baker et al. added the terms "instead" and/or "different" where it was not clear one would be giving up their current CA (e.g., "I find the idea of having a different pet instead of my pet very appealing"). Also, in this same dimension, the IMS items referring to "getting another" partner were adapted by Baker et al. (2016) with the wording "replacing the animal" or "instead" to keep them as faithful as possible to the original philosophy between said times (e.g., "I find the idea of having a different pet instead of (Pet name) very appealing").

Study 1a - content validity

We assembled the new IMS H-CA and tested its content validity. Five interviews were conducted with six experts (as per their request, experts 4 and 5 were interviewed together; mean time per interview was 60 min). These were primarily professionals and researchers in animal welfare and behavior, except for expert 1, who was interviewed for their expertise with the IM (details regarding the interviews and results are available upon request to the first author). We recruited our experts in various ways, depending on our needs. We contacted the IM expert directly, following their published work. Some of the CA experts were also contacted directly given their work and geographical proximity to our research team. Other experts were recruited by contacting major Portuguese animal organizations, explaining our research goals, and ask for any individuals suited to help us achieve them. All of our experts were Portuguese, had published work relevant to us (Animal Welfare, CAs, IM, etc.), and most taught classes on said topics at the university level. Most interviews were conducted remotely between December 2021 and February 2022. Interviews were semi-structured, following a script previously developed by the research team. The interviewees were given the general objectives of the session and then signed an informed consent form that included consent to record the interview. Then, the researcher explained the original IM structure and defined each construct. Experts were asked to indicate whether the definitions would apply to the H-CA context and how they would define that concept in this new context.

After this, the new version of the IMS H-CA scale was presented, and experts were asked to rate the items concerning their relevance to the context of CA (from 1 = Not at all relevant to 7 = Very relevant). Experts were then asked whether they would keep, remove, or rewrite each item. They were also asked how they would change the items needing modification. Finally, experts were asked if there were any other items they thought were relevant to add to the instrument, and if they had any other comments or observations. A total of five hours of audio material was collected, to which the data collected through the questionnaires was added.

Analyses were then performed to support the change of the scale items and the introduction of new items, including Wilcoxon's Signed Ranks Test (using the scale's midpoint as the reference value). The main results are summarized in Table 1 and showed that most items were considered relevant to the scale under construction, with only an item with a value below the scale's midpoint ("It is likely that I will get a new pet to replace my pet within the next year.") receiving more support in terms of its rewriting than being removed from the scale. Note that while it is the only item below the scale's midpoint, this difference was not significant.

Regarding item changes, the experts proposed several modifications. Of the 22 items of the new IMS H-CA, 13 underwent changes based on the experts' comments. For the most part, the modifications applied to the items consisted of adding or removing some specific parts or changing words to fit the context of the CA better (e.g., adding "other species"; "attractive" alternatives became "appealing" alternatives). In two instances, it was suggested that we should create items framed positively and negatively to try to access two different dimensions that the experts took as being erroneously accessed together [e.g., "My relationships with friends and family would become more complicated if the relationship with my pet ended (e.g., my friends and family really like my pet)" (original item) and "My relationships with friends and family would become easier if the relationship with my pet ended (e.g., more time to spend with my/my children, etc.)" (added item)]. Table A

Table 1

Experts' evaluations of the translated version of the IMS H-CA.

	Descripti	ve analyse	es		
I feel satisfied with our	M (SD) 6.67	Keep 83.3	Remove 0.0	Rewrite 16.7	Z 2.33 *
relationship My relationship with my pet is much better than others'	(0.82) 4.33 (2.34)	33.3	33.3	33.3	0.42
relationships with their pets.					
My relationship with my pet is close to ideal.	(1.21)	50.0	0.0	50.0	2.12 *
Our relationship makes me very happy.	6.50 (0.84)	50.0	0.0	50.0	2.26 *
Our relationship does a good job of fulfilling my needs for, companionship, etc.	7.00 (0.00)	100.0	0.0	0.0	2.45 *
I find the idea of having a different pet instead of my pet very appealing	4.33 (2.66)	33.3	33.3	33.3	0.45
My alternatives to our relationship are close to ideal (getting a different pet, spending time with friends or on my own, et cetera)	4.83 (2.23)	66.7	16.7	16.7	0.97
If I didn't have my pet, I would do fine – I would find another pet	5.67 (1.97)	50.0	16.7	33.3	1.70
My alternatives are attractive to me (getting a different pet, spending time with friends or on my own, et cetera)	5.00 (2.76)	66.7	16.7	16.7	0.97
My needs for companionship, et cetera could be easily fulfilled with a different pet.	5.50 (1.76)	66.7	16.7	16.7	1.66
I have put a great deal into our relationship that I would lose if I no longer had my pet.	6.17 (0.75)	66.7	0.0	33.3	2.23 *
Many aspects of my life have become linked to my pet (recreational activities, et cetera), and I would lose all of this if my pet wasn't my pet anymore.	6.33 (0.82)	66.7	0.0	33.3	2.23 *
I feel very involved in our relationship – like I have to put a great deal into it	5.17 (1.72)	33.3	0.0	66.7	1.38
My relationships with friends and family members would be complicated if I were to not have my pet anymore.	4.83 (2.99)	50.0	16.7	33.3	0.56
Compared to other people I know, I have invested a great deal in my relationship with my pet	6.00 (1.26)	83.3	16.7	0.0	2.06 *
I want our relationship to last	6.83	100.0	0.0	0.0	2.33 *
I am committed to maintaining my	(0.41) 6.33 (0.82)	83.3	0.0	16.7	2.23 *
I would not feel very upset if our relationship were to end in the near future	6.33 (1.21)	50.0	0.0	50.0	2.12 *
It is likely that I will get a new pet to replace my pet within the pert year	3.67 (2.07)	33.3	16.7	50.0	-0.27
I feel very attached to our relationship – very strongly linked to my pet	6.50 (0.84)	66.7	0.0	33.3	2.26 *
I want our relationship to last forever	6.33 (1.21)	66.7	0.0	33.3	2.12 *
I am oriented toward the long- term future of my	6.33 (0.82)	66.7	0.0	33.3	2.23 *
relationship (for example, I imagine being with my pet several years from now).					

Note. Values are presented as percentage of experts. rounded to the nearest decimal point

*p < 0.050

in the Supplementary Materials shows all the items changed based on the interviewees' suggestions.

Finally, 16 items were introduced into the original scale based on the results of the interviews. Thirteen items were newly constructed, two resulted from the above-mentioned positive/negative framing, and one was adapted from Miller-Rada's commitment to CAs scale (Staats et al., 1996). The new items and the dimensions to which they pertain are listed in Table 2.

Study 1b - IMS H-CA construct validity

Participants

Data from 402 participants was collected for this study. Null answers, participants who did not give their consent to participate in the study or did not respond to the IMS in its entirety, and other answers that were too standardized or mirrored illogical data (e.g., responding with high scores to several items of commitment, including those coded inversely, conveying a contrary and meaningless notion) were removed from the database. The final sample comprised 248 participants (dropout rate = 38.3%). Participants ranged from 18 to 88 years old (M = 36.58, SD =

Table 2

New items and respective dimensions.

New Item	IM Dimension being measured
Based on my previous experiences (other animals, friends' animals, et cetera), the relationship with my companion animal meets my expectations	Satisfaction
My relationship with my companion animal fulfils my needs to have company or my needs for companionship, et cetera (1)	Satisfaction
At this point, surrendering my companion animal would be the best alternative for me	Alternatives
Replacing my companion animal with another companion animal would be a good option for me	Alternatives
From my companion animal's perspective, there are no better options around me than being with me	Alternatives
If I needed to surrender my companion animal, I could find options where it would be just as good or better than with me	Alternatives
If my companion animal needed me to make a large monetary investment, I would have to surrender it (2)	Investments
My companion animal has more costs associated with it (monetary, restrictions on my lifestyle, etc.) than benefits I derive from my relationship with it	Investments
My relationships with friends and family would become easier if my relationship with my companion animal ended (e.g., more time to spend with my children, et cetera) (1)	Investments
Surrendering my companion animal, in my opinion, would be morally wrong	Investments
Surrendering my companion animal would be frowned upon by the people around me (friends, family, colleagues, et cetera)	Investments
I already have activities planned with my companion animal in the short-medium term.	Investments
If I were to surrender my companion animal, I would lose money that I have invested in it	Investments
I have seriously considered surrendering my companion animal	Commitment
Whenever my companion animal needs something, I don't hesitate to provide it	Commitment
In general, I always try to meet the specific needs of my companion animal (for example, if it's a dog, I take it out for a walk: if it's a cat. I clean its litter box. et cetera)	Commitment

Note. (1) Items that were built based on mirroring items of the original scale, creating two opposite items in each case; (2) Item adapted from the Miller-Rada scale of Commitment to CAs (Staats et al., 1996)

14.35), most of them identified as female (57.7%), were college graduates (44.0%), non-religious (53.6%), or permanently employed (55.2%), and were living in an apartment (64.9%). These and other sociodemographic data can be seen in Table B of the Supplementary Materials.

Instruments

Investment model scale adapted to the human-companion animals relationships (IMS H-CA). The new version of the IMA H-CA has a total of 38 items rated on 7-point rating scales (1 = Strongly disagree to 7 =Strongly agree). Relationship satisfaction was assessed with seven items: five from the IMS H-CA (e.g., "I am satisfied with my relationship with my companion animal") and two new items (e.g., "My relationship with my companion animal fulfils my needs to have company or my needs for companionship, etc."). Quality of alternatives was assessed using nine items: five from the IMS H-CA (e.g., "Other pets I could have (replacing my current pet) are very appealing to me.") and four new items (e.g., "Replacing my pet with another pet would be a good option for me."). Investments were assessed with 12 items: five from the IMS H-CA (e.g., "I have invested a lot in the relationship with my pet, and I would end up losing all that if this relationship ended") and seven new items (e.g., "If I gave up my pet, I would lose money that I invested in it."). Finally, commitment was measured using 10 items: seven from the IMS H-CA (e. g., "I am committed to maintaining the relationship with my pet") and three new items (e.g., "Whenever my pet needs something, I do not hesitate to provide it.").

Procedure

This study was conducted in agreement with the Ethics Guidelines issued by Iscte - Instituto Universitário de Lisboa's Ethics Board. Data was collected through an online questionnaire created in Qualtrics and sent to participants through social networks (e.g., Facebook) and messaging applications (e.g., WhatsApp). Prospective participants were invited directly, through posts shared on Facebook and WhatsApp, or through the mailing lists of entities associated with this research project (e.g., animal welfare organizations). Participants who had CAs were invited to take part in a study aimed at understanding H-CA relationships. To take part in this study, participants had to be at least 18 years old, fluently understand European Portuguese, and have a CA. Participation was voluntary, had no associated compensation or risk, no false information or deception was employed, and responses were anonymous. Participants were greeted with an informed consent document upon opening the survey. They were informed about our study and the researchers' commitment to maintaining confidentiality and anonymity of responses. Participants were made aware that they could withdraw from the study at any time by closing the browser without their responses being considered for analysis and had to give their consent to proceed. Participants were asked to provide standard sociodemographic information (e.g., assigned sex, age, income) followed by questions about their CA (e.g., "What type of companion animals have you had?"), and the IMS H-CA. Each participant took, an average, 15 min to complete the questionnaire. At the end of the study, participants had a short open question where they could leave their feedback regarding the participation or the study at large.

Data analytic plan

Exploratory factor analyses with a Principal Axis Factoring method were used. As previous research indicates that the IMS constructs are correlated (Rusbult et al., 1998; Tran et al., 2019), the analyses were conducted using an oblique rotation (Promax). Loadings greater than 0.35 were considered adequate in deciding the distribution of items per factor. Items with loadings lower than 0.35 in any factor were discarded. Items loading highly on both factors (e.g., > 0.35) were also discarded for ambiguity.

Results

Table 3, shows the descriptive analyses of the items in this new version of the IMS H-CA, including those later removed during the factor analysis.

Factorial analysis. Given the large number of items used in this study, the subsequent factor analysis was segmented and conducted using a different exploratory factor analysis per dimension, a strategy similar to the one used to develop the original IMS (Rusbult et al., 1998). The statistical information concerning these analyses is presented in Table D of the Supplementary Materials.

The factor analysis concerning the items on the relationship satisfaction dimension presented a two-factor structure explaining 57.65% of the total variance (KMO = 0.86). This first analysis showed two ambiguous items (i.e., items 4 and 5). The final structure presented a one-factor solution explaining 53.20% of the total variance, with item loadings ranging from 0.40 to 0.80.

Concerning the quality of alternatives dimension, the factor analysis revealed a structure with three factors, explaining 55.79% of the total variance (KMO = 0.70), with loading ranging from 0.12 to 0.87. With ambiguous items removed (10, 17, and 18), the structure was still composed of two factors, and so a one-factor structure was forced. This final structure explained 43.74% of the total variance (KMO = 0.70), with loadings ranging from 0.48 to 0.65.

Regarding the investment size dimension, the first structure had three factors, explaining 54.04% of the total variance (KMO = 0.80), with loadings ranging from 0.38 to 0.81. After removing ambiguous and other anomalous items (4, 5, 23, 24, 25, and 28), the investment size dimension presented a final structure with only one factor, explaining 52.62% of the total variance (KMO = 0.82), and with loadings ranging from 0.51 to 0.82.

As for the commitment dimension, the first structure presented two factors, explaining 53.48% of the total variance (KMO = 0.84), with loadings ranging from 0.29 to 0.99. By removing the ambiguous items (37 and 38), we obtained a final one-factor structure explaining 46% of the total variance (KMO = 0.83), and with loadings ranging from 0.49 to 0.77.

A final exploratory factorial analysis with promax rotation was carried out with all the remaining items from the previous procedures. The first analysis revealed a factor structure with six factors, explaining 60.63% of the total variance (KMO = 0.85). Three items (2, 7, and 11) were then removed because they had loading values less than 0.35 on all factors (items 2 and 7) or greater than 0.35 on at least two factors (item 11). The subsequent analysis revealed a four-factor structure (forced extraction) that explains 54.38% of the total variance (KMO = 0.85), with loadings ranging from 0.43 to 0.94. Table 3 shows the values for the loadings of each item in each of the factors present in the pattern matrix of the last analysis described, as well as the eigenvalues and Cronbach's alphas of the final factors.

Finally, the dimensions obtained in these analyses were assembled by averaging the values of the items loading into each factor. The interfactor correlations, as well as their mean and standard deviation, are shown in Table 4. Our lowest correlation was 0.32, thus presenting, at a minimum, moderate correlations across the board (Cohen, 1992).

Discussion of Study 1

In this first study, we adapted the Portuguese version of the IMS scale (Rodrigues and Lopes, 2013) to the context of CAs. We compared and refined its items with the ones from the Baker et al. (2016) adaptation. Afterward, we determined the scale's content validity by interviewing experts who analyzed our IMS H-CA. This resulted in the transformation of old and the creation of new items. The original scale definitions informed these new items specifically adapted to the CA context and suggested by the experts. Translating, constructing new items, and refining the original items using expert interviews are novel procedures

Table 3

ems	Descr	iptive					
	Ν	М	SD	S	SE	Κ	SE
) I am satisfied with my relationship with my	248	6.53	0.78	-1.77	<i>s</i> .16	2.89	к .31
companion animal.) My relationship with my companion animal is much better than other people's relationships with their companion	248	4.90	1.48	-0.55	.16	0.07	.31
animals.) Based on my previous experiences (other animals, friends' animals, etc.), the relationship with my companion animal meets my	248	6.20	1.09	-1.54	.16	2.23	.31
expectations.) If my companion animal needed me to make a large monetary investment, I would have to surrender it.	248	6.09	1.56	-1.88	.16	2.76	.31
(R) My companion animal has more costs associated with it (monetary, restrictions on my lifestyle, et cetera) than benefits I derive from my relationship with it.	248	6.41	1.15	-2.64	.16	7.63	.31
(R) My relationship with my companion animal fulfils my needs to have company or my needs for companionship, et	248	6.13	1.16	-1.56	.16	2.50	.31
) The relationship with my companion animal fulfills my general needs for companionship, et	248	4.75	1.85	-0.48	.16	-0.78	.31
or the relationship with my companion animal is close to what I consider to be ideal	248	5.83	1.36	-1.55	.16	2.45	.31
) The relationship with my companion animal	248	6.33	0.98	-1.52	.16	1.64	.31
(a) Replacing my current companion animal, other types or species of companion animals I could have (e.g., cat, dog, bird) are very appealing to me.	248	3.07	1.84	0.51	.16	-0.88	.31
1) At this time, surrendering my companion animal would be the best alternative for me	248	1.31	0.90	3.94	.16	17.61	.31
2) If I were not with my	248	2.41	1.67	1.02	.16	0.12	.31

Table 3 (continued)							
Items	Descr	iptive					
13) Replacing my companion animal with another companion animal would be a good	248	1.36	0.99	3.63	.16	14.62	.31
option for me. 14) I can find alternatives to the relationship with my companion animal that match or exceed wheth this is ideal for	248	3.66	1.97	0.20	.16	-1.10	.31
what I think is ideal for me (e.g., spending time with friends, being alone, et cetera). 15) The alternatives to a relationship with my companion animal are appealing to me (e.g.,	248	3.92	1.87	-0.10	.16	-1.09	.31
spending time with friends, being alone, et cetera). 16) My needs for companionship, etc. could easily be met through a relationship	248	2.25	1.54	1.44	.16	1.67	.31
with a companion animal other than my own. 17) From my companion animal's perspective, there are no better options around me	248	2.87	1.91	0.76	.16	-0.58	.31
than for him to be with me. (R) 18) If I needed to surrender my companion animal, I could find options	248	3.39	2.03	0.40	.16	-1.14	.31
as well or better off than with me. 19) I have a lot invested in the relationship with my companion animal and would end up losing almost	248	4.13	2.04	-0.05	.16	-1.28	.31
everything if this relationship ended. 20) Several aspects of my life are connected to my companion animal (recreational activities, etc.) and I	248	3.23	1.94	0.57	.16	-0.79	.31
would lose almost everything if this relationship ended. 21) I feel very involved in the relationship with my companion animal because I do so much for my	248	5.06	1.61	-0.65	.16	-0.23	.31
nucli for fify companion animal. 22) My relationships with friends and family would become more complicated if the relationship with my companion animal ended (e.g., my friends	248	2.59	1.75	0.89	.16	-0.26	.31
and family love my companion animal very much). 23) My relationships with friends and family	248	6.22	1.34	-1.91	.16	3.11	.31

(continued on next page)

would become easier if

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Table 3 (continued)

Items	Descr	iptive					
the relationship with my companion animal ended (e.g., more time to spend with my/my children, et cetera).							
24) In my opinion, surrendering my companion animal would be morally	248	6.47	1.17	-2.86	.16	8.77	.31
wrong. 25) Surrendering my companion animal would be frowned upon by the people around me (friends, family, colleagues, et	248	4.11	2.09	-0.10	.16	-1.23	.31
cetera). 26) I already have activities planned with my companion animal in the short-medium term	248	3.94	2.01	0.05	.16	-1.18	.31
27) Compared to other people I know, I have invested quite a bit in my relationship with my companion animal	248	4.46	1.71	-0.20	.16	-0.65	.31
28) If I were to surrender my companion animal, I would lose money that I have invested in it	248	2.00	1.63	1.61	.16	1.54	.31
29) I wish for the relationship with my companion animal to last for a long time	248	6.72	0.75	-3.87	.16	19.39	.31
30) I have seriously considered surrendering my companion animal. (R)	248	6.71	0.94	-4.18	.16	18.74	.31
31) I am committed to maintaining the relationship with my commanion animal	248	6.67	0.77	-3.17	.16	13.76	.31
22) I would not be too affected if the relationship with my companion animal ended in the near future. (B)	248	6.49	1.12	-2.87	.16	8.90	.31
33) During the next year, I might consider replacing the companion animal I currently have (B)	248	6.91	0.46	-6.67	.16	49.23	.31
34) I feel very committed to the relationship I have with my	248	6.08	1.47	-1.91	.16	3.30	.31
35) I want the relationship with my companion animal to last as long as possible.	248	6.75	0.70	-3.96	.16	21.49	.31
36) I am motivated to make sure that the relationship with my companion animal has a long-term future within the expectation of its species (e.g., I envision being with my companion animal several years from now).	248	6.71	0.72	-3.09	.16	11.06	.31

Table 3 (continued)							
Items	Descr	iptive					
37) Whenever my companion animal needs something, I don't hesitate to provide it.	248	6.48	0.86	-1.62	.16	1.87	.31
38) In general, I always try to respond to my companion animal's specific needs (for example, if it's a dog, I take it out for a walk; if it's a cat, I clean its litter box, et cetera).	248	6.53	0.79	-1.88	.16	3.59	.31

Note. Skewness: six items (i.e., 14, 15, 19, 25, 26 and 27) showed a symmetric distribution, 10 items (i.e., 10, 11, 12, 13, 16, 17, 18, 20, 22 and 28) showed a positive skew, and 22 items (i.e., 1, 2, 3, 4, 5, 6, 7, 8, 9, 21, 23, 24, 29, 30, 31, 32, 33, 34, 35, 36, 37 and 38) showed a negative skew. Kurtosis: five items (i.e., 2, 12, 17, 21 and 22) presented a mesokurtic distribution, 23 items (i.e., 1, 3, 4, 5, 6, 8, 9, 11, 13, 16, 23, 24, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37 and 38) presented a leptokurtic distribution, and 10 items (i.e., 7, 10, 14, 15, 18, 19, 20, 25, 26 and 27) presented a platykurtic distribution.

(R) indicates that the item was coded in reverse. S skewness, SE S standard error of skewness, K kurtosis, SE K standard error of kurtosis

in the IMS domain. To further ensure the psychometric quality of the IMS H-CA, we determined its construct validity. Results replicated the dimensions proposed initially in the IMS, with good reliability indexes. Finally, results also showed that all dimensions were correlated as predicted by the IM and the IMS (Rusbult et al., 1998).

Although the results of Study 1 are promising for the new IMS H-CA, they are not without limitations. First the reliability values observed are slightly below what we would consider "good" (George andMallery, 2003). The lower values observed may be due to a possible heterogeneity of item concepts (Tavakol and Dennick, 2011), which is expected in a scale incorporating new items and being adapted to a new context. Another limitation was the difficulty in replicating the original structure of the IMS with our scale. This difficulty led to the segmented analyses of the IM dimensions, which is far from ideal. We attempted to address this with the final joint analysis. Hence, we conducted a new study, where a confirmatory factor analysis of the IMS H-CA was performed in a new sample and where we expected to confirm the original IMS structure.

Study 2

In this study, we tested the factor structure of the IMS H-CA using a confirmatory factor analysis. We also tested criterion-related validity (Miller and Lovler, 2016) by comparing the values obtained with the IMS H-CA with those obtained by pre-existing instruments with which we would theoretically expect to find correlations. We used the Perceived Comfort Received from a Pet scale (PCRP; Zasloff, 1996), which measures the individual's attachment to their CA by tapping the perceived comfort received from it. We also used a question previously employed by Jacobetty and colleagues (2019) in which participants are asked to indicate how often they consider their CA "a burden or a weight" in their lives. In the current study, we expect that the greater an individual's commitment to their CA, the less likely they are to consider it a weight or a burden, as well as the greater the perceived comfort received from the CA.

Scale sensitivity was also analyzed to ensure that our instrument can be used in the future with the necessary safeguards regarding the differences that may arise in the data collected from different participants. For these analyses, we explored differences according to assigned sex, species of CA owned, and the duration of the relationship with the CA.

Table 4

Exploratory factorial analysis of the IMS (final structure of Study 1).

Items	Factor					Corrected Item-
	Commitment	Investmen	nts	Satisfaction	Alternatives	FactorCorrelation
1) I am satisfied with my relationship with my companion animal.	-0.05	02			0.07	0.67
3) Based on my previous experiences (other animals, friends' animals, et cetera), the	-0.10	-0.04	0.81		0.15	0.71
6) My relationship with my companion animal neets my expectations.6) My relationship with my companion animal fulfils my needs to have company or my needs for companionship et cetera	0.08	-0.01	0.94		-0.12	0.65
8) The relationship with my companion animal is close to what I consider to be ideal.	-0.03	0.10	0.00		-0.08	0.68
9) The relationship with my companion animal makes me very happy.	0.23	0.07	0.69		-0.12	0.74
12) If I were not with my current companion animal I would be fine, since I would find another animal.	-0.08	0.10	0.00		0.64	0.52
13) Replacing my companion animal with another companion animal would be a good option for me	-0.15	0.30	-0.08	2	0.48	0.35
14) I can find alternatives to the relationship with my companion animal that match or exceed what I think is ideal for me (e.g., spending time with friends, being alone, et cetera)	0.08	-0.09	0.07		0.74	0.59
15) The alternatives to a relationship with my companion animal are appealing to me (e.	0.17	-0.14	0.14		0.73	0.58
 g., spending time with mends, being alone, et ceteral. 16) My needs for companionship, et cetera could easily be met through a relationship with a companion animal other than my own. 	-0.01	0.09	-0.05	5	0.51	0.40
19) I have a lot invested in the relationship with my companion animal and would end up losing almost everything if this relationship ended	0.08	0.61	-0.05		-0.01	0.53
20) Several aspects of my life are connected to my companion animal (recreational	-0.03	0.86	0.00	, ,	0.09	0.72
21) I feel very involved in the relationship with my companion animal because I do so	0.04	0.60	-0.02	2	-0.22	0.64
much for my companion animal. 22) My relationships with friends and family would become more complicated if the relationship with my companion animal ended (e.g., my friends and family love my companion animal very much)	-0.06	0.66	0.06 -0.07	,	0.18	0.47
26) I already have activities planned with my companion animal in the short-medium	0.03	0.58	0.06		0.00	0.55
term. 27) Compared to other people I know, I have invested quite a bit in my relationship with my companion animal.	-0.05	0.59	0.06		-0.01	0.58
29) I wish for the relationship with my companion animal to last for a long time.	0.80	-0.04	0.05	,	0.08	0.61
30) I have seriously considered surrendering my companion animal. (R)	0.56	-0.15	0.05	2	-0.04	0.46
31) I am committed to maintaining the relationship with my companion animal.	0.80	0.01	0.00		0.07	0.68
32) I would not be too affected if the relationship with my companion animal ended in the near future (\mathbf{R})	0.43	0.16	_0.01		-0.14	0.47
33) During the next year, I might consider replacing the companion animal I currently have. (R)	0.53	-0.11	-0.01		0.01	0.44
34) I feel very committed to the relationship I have with my companion animal.	0.43	0.12	_0.02)	-0.10	0.46
35) I want the relationship with my companion animal to last as long as possible.	0.74	0.10	_0.02	2	0.04	0.63
36) I am motivated to make sure that the relationship with my companion animal has a long-term future within the expectation of its species (e.g., I envision being with my companion animal several years from now).	0.63	0.08	-0.02	2	0.02	0.55
Eigenvalue	6.75	2.77	1.05		1.69	-
Cronbach's Alpha	0.79	0.81	1.85		0.72	-

Note. The values in bold indicate the highest loading value for that particular item in the factor where it was included. The numbers presented before each item refer to the order in which they were presented during data collection for the current study; (R) indicates that the item was coded in reverse

Method

Participants

Data from 484 participants was initially collected. Null answers, participants who did not give their consent to participate in the study or did not answer the IMS H-CA in its entirety, and other answers that showed patterns or displayed illogical data (e.g., responding with high scores to several engagement items, including those coded inversely, conveying a contrary and meaningless notion) were removed from the database. The final sample comprised 236 participants, i.e., a dropout rate of 51.24%. Ages ranged from 20 to 69 (M = 40.41, SD = 12.92). Most participants were female (77.5%), university graduates (48.7%),

Catholic (58.1%), permanently employed (72.0%), and in an apartment (72.5%) at the time of collection. These and other socio-demographic data can be seen in Table E in the Supplementary Materials.

Instruments

Investment model scale adapted to CA context (IMS H-CA). For Study 2, we used the resulting scale from Study 1. This new version of the IMS H-CA has a total of 24 items, all of them rated on a 7-point rating scale (1 = Strongly disagree and 7 = Strongly agree) (see Study 1, Table 3).

Perceived comfort received from a pet (PCRP). The PCRP scale measures

attachment through perceived comfort (Zasloff, 1996), with a total of 11 items (e.g., "My companion animal is a source of stability in my life"). Originally rated at only four points, the items were changed to a 7-point rating scale (from 1 = *Strongly Disagree* to 7 = *Strongly Agree*) to maintain consistency with the IMS-CA scale. The internal consistency value of this scale reported by Zasloff was high (α =.85). In the present study, the internal consistency value obtained was also high (ω =.91).

Perceiving CA as a burden. Participants answered an item adapted from previous research by Jacobetty et al. (2019). We asked the participants' agreement level regarding the sentence "Is your pet a burden or a weight for you?" (from 1 = Never to 7 = Always).

Procedure

This study was conducted in agreement with the Ethics Guidelines issued by Iscte - Instituto Universitário de Lisboa's Ethics Board. Recruitment and data collection followed the same procedure as Study 1b. The participation of each individual took, on average, 15 min. At the end of the study, participants had a short open question where they could leave their feedback regarding the participation or the study at large.

Data analytic plan

Analyses were performed in Mplus (Muthen and Muthen, 2012) using the maximum likelihood robust (MLR) estimator (Yuan and Bentler, 2000). We also analyzed model fit coefficients (relative and absolute, e.g., CFI and RMSEA) to ensure greater statistical validity of our findings. We based these analyses on the thresholds proposed in the literature (i.e., SRMR below 0.10–0.08, RMSEA below 0.08–0.05, and CFI and TLI indexes above 0.90–0.95) (Cole, 1987; Bentler, 1990; Hu and Bentler, 1999; Schumacker and Lomax, 2010). To perform the internal consistency analysis of latent factors, we used the McDonald's omega coefficient (ω ; McDonald, 1999). Additionally, sensitivity analyses of the IMS H-CA dimensions were performed using ANOVAs and *t*-tests.

Results

Table 6 shows the descriptive analyses of the items of the IMS H-CA, including those later removed during the analysis. Once again, the distributions found for each item were asymmetric. Even so, in most cases, the mean values aligned with what would be expected. The exception was item 6, which obtained a very high mean agreement for what is expected in the quality of the alternatives dimension, and a slightly high standard deviation of 1.86 showing some dispersion of answers.

Confirmatory factor analysis

In the first analysis, all 24 items of the IMS H-CA were included. The results indicated that items 6 (quality of alternatives) and 24 (commitment) were possibly problematic for the model under analysis, item 6 lambda was non-significant (p = 0.088), and item 24 lambda was barely significant (p = 0.029). Additionally, the values obtained for the adjustment coefficients also proved unsatisfactory, with most of the values obtained not being within the thresholds proposed by the literature, $\chi 2(246) = 455.88$, $\chi 2/df = 1.85$, CFI= 0.86, TLI= 0.84, SMSR= 0.07 and RMSEA= 0.06 [0.05, 0.07]. Therefore, we decided to discard these items and repeat the analysis.

A new confirmatory factor analysis was run with the remaining 22 items. The measurement errors of items 11 and 12 and items 12 and 16 were correlated. This correlation was added to the model under test due to the semantic proximity of these items and thus shared measurement error ["12 - Several aspects of my life are connected to my pet (recreational activities, etc.), and I would lose almost everything if this relationship ended." and "16 - I already have activities planned to do with

my pet in the short-medium term."]. Based on the thresholds proposed by the literature for the adjustment coefficients used, the fit of our data to the original model (Rusbult, 1980) was good, $\chi 2(201) = 320.81$, $\chi 2/df = 1.60$, CFI= 0.91, TLI= 0.90, SMSR= 0.07 and RMSEA= 0.05 [0.04, 0.06]. In general, the loadings (i.e., lambdas) were within the thresholds of the previous studies (above 0.35), and were all significant (p < 0.010). Fig. 2 shows the diagram of the model, including all items kept in the analysis, with their respective loadings and associated errors.

Reliability omega coefficients of latent constructs were as follows: relationship satisfaction $\omega = 0.88$, investment size $\omega = 0.79$, and commitment $\omega = 0.73$ reported highly acceptable values. The quality of alternatives dimension reported a low internal consistency value ($\omega = 0.56$).

The values obtained for each factor were also compared to the midpoint of the scale (4) using one-sample *t*-tests. All factors showed significantly different values from the scale's midpoint. The dimensions of relationship satisfaction, t(235) = 47.00, p < 0.001, 95% CI [2.32, 2.53], and commitment (t(235) = 94.91, p < 0.001, 95% CI [2.70, 2.81]) showed values significantly above the midpoint of the scale. In contrast, the quality of alternatives (t(235) = -23.79, p < 0.001, 95% CI [-1.64, -1.39]) and investment size (t(235) = -2.17, p = 0.031, 95% CI [-0.37, -0.02]) showed values significantly below the midpoint of the scale.

Scale sensitivity

As previously mentioned, we analyzed the scale's sensitivity concerning the different demographics of interest. The correlations between age and relationship duration and the dimensions of the IMS H-CA are presented in Table 5. We did not find any sensitivity issues related with relationship duration, which speaks to the robustness of our instrument. With regard to the age variable, we could only find a significant (negative) correlation with the dimension of investment size.

For the remaining variables used in these sensitivity analyses, we performed ANOVAs and independent samples *t*-tests. Detailed results of these analyses and descriptive statistics are included in Table 8. Starting with education, participants who reported having less than a high-school education (n=4) or other education than those specified (n=1) were removed before conducting the ANOVA. The results show a significant difference in the investment size dimension (F(2, 228) = 4.11, p = 0.018), the only dimension where education appeared to have yielded differences. The higher-education group reported higher mean values in this dimension.

Regarding the analyses with income level, participants who reported having a net monthly income higher than 5000 \in (*n*=4) were removed due to lack of participants. The ANOVA results revealed significant differences in three distinct dimensions: relationship satisfaction (F(3,226) = 3.37, p = 0.019), quality of alternatives (*F*(3, 226) = 3.90, p =0.010), and investment size (F(3, 226) = 3.70, p = 0.013). Post-hoc comparisons using the Bonferroni adjustment revealed a significant difference between the second income group (581–999€) and the fourth (2000–4999€) for relationship satisfaction (p = 0.016), where the second income group scored significantly higher (M = 6.56 vs. M = 6.06). For the quality of alternatives dimension, the same income groups differed again (M = 2.21 vs. M = 2.77, p = 0.044). In the investment size, the significant difference found was between the first group (<=580€) and the fourth (2000–4999€) (*M* = 4.48 vs. *M* = 3.33, *p* = 0.006). These results indicate that IMS dimensions are not completely independent of income level.

In the analyses regarding the CA type, we could only compare the participants who mentioned having dogs or cats since the number of participants with any other type of CA was small and/or did not discriminate which CA they had. No significant differences were found between species for the relationship satisfaction, the quality of alternatives, or commitment (p > 0.529). However, the investment size dimension proved to be significantly different between species, with



Fig. 2. IMS-CA confirmatory factorial model with loadings and measurement errors (standardized coefficients). Note: Satis. = Relationship Satisfaction; Alts. = Quality of Alternatives; Invs. = Investment Size; Comp. = Commitment Level.

Table 5 Descriptive statistics and inter-factor correlations for study 1.

		Correlation	s		
	M (SD)	1	2	3	4
1. Commitment	6.63 (0.58)	-			
2. Investments	3.90 (1.33)	0.32**	-		
3. Satisfaction	6.20 (0.87)	0.52**	0.35**	-	
4. Alternatives	2.72 (1.13)	-0.30**	-0.35^{**}	-0.32^{**}	-

p* < 0.050, *p* < 0.010

dogs scoring significantly higher (M = 4.01 vs. M = 3.51, t(211) = 2.767, p = 0.006, 95% CI [0.14, 0.86]).

Finally, we also compared responses between participants of different assigned sex. We found significant differences for the dimensions of relationship satisfaction (t(234) = -2.817, p = 0.005, 95% CI [-0.53, -0.10]) and quality of alternatives (t(234) = 3.474, p = 0.001, 95% CI [0.22, 0.81]). Women reported higher values of satisfaction (M = 6.50 vs. M = 6.16), while men obtained higher average values in the alternatives dimension (M = 2.89 vs. M = 2.37).

Criterion-related validity

Criterion-related validity was analyzed through the correlations between the IMS H-CA dimensions and two of the variables the literature predicts as related to CA commitment (perceived comfort received from CA and considering CA as a weight/burden). The results of these analyses are also presented in Table 5.

The analyses concerning the association between the dimensions of the IMS H-CA and PCRP proved significant and in the expected direction. Therefore, the dimensions of the new IMS H-CA are associated with the results of perceived comfort received from a CA. Regarding the perception of CA as a burden, only the relationship satisfaction (r = -0.32, p < 0.001) and commitment (r = -0.19, p = 0.042) dimensions were significantly correlated with this variable, with both investment size (r = -0.10, p = 0.083) and quality of the alternatives (r = 0.12, p = 0.223) yielding non-significant correlations.

Discussion of study 2

In this study, we ran a CFA on the IMS H-CA and the results

would lose almost

Table 6

Items

Descriptive analysis of the items present on the IMS adapted to the CA context Study 2.

SD

S

SE K SE

Descriptive Ν

М

Items	Descr	iptive					
everything if this							
relationship ended.							
13) I feel very involved	236	4.93	1.86	-0.58	.16	-0.71	
in the relationship							
with my companion							
animal because I do so							
much for my							
companion animal.							
14) My relationships	236	2.46	1.85	1.13	.16	0.18	
with friends and family							
would become more							
relationship with my							
companion animal							
ended (e.g., my friends							
and family love my							
companion animal							
very much).							
15) Compared to other	236	4.22	1.89	-0.13	.16	-0.99	
people I know, I have							
invested quite a bit in							
my relationship with							
my companion animal.							
16) I already have	236	3.68	1.98	0.20	.16	-1.07	
activities planned with							
my companion animal							
in the short-medium							
17) I wish for the	236	6.82	0.57	_3.46	16	11 72	
relationship with my	200	0.02	0.07	0.10	.10	11.72	
companion animal to							
last for a long time.							
18) I am committed to	236	6.81	0.57	-3.58	.16	14.83	
maintaining the							
relationship with my							
companion animal.							
19) I would not be too	236	6.74	0.83	-4.07	.16	17.50	
affected if the							
relationship with my							
companion animal							
ended in the near							
20) During the payt year	226	6.02	0.37	_5.94	16	37 59	
I might consider	230	0.92	0.37	-5.64	.10	57.58	
replacing the							
companion animal I							
currently have. (R)							
21) I feel very committed	236	6.37	1.24	-2.31	.16	5.29	
to the relationship I							
have with my							
companion animal.							
22) I want the	236	6.89	0.45	-4.67	.16	23.57	
relationship with my							
companion animal to							
last as long as possible.			a				
23) I am motivated to	236	6.75	0.67	-2.91	.16	7.82	
make sure that the							
relationship with my							
companion animal has							
a joing-term future							
of its species (e o I							
envision being with							
my companion animal							
several years from							
now).							
24) I have seriously	236	6.87	0.64	-5.90	.16	36.88	
considered					-		
surrendering my							
companion animal.							
(R)							

Note. Skewness: four items (i.e., 8, 11, 15 and 16) showed a symmetric distribution, five items (i.e., 7, 9, 10, 12 and 14) showed a positive skew, and 15 items (i.e., 1, 2, 3, 4, 5, 6, 13, 17, 18, 19, 20, 21, 22, 23 and 24) showed a negative skew. Kurtosis: two items (i.e., 6 and 14) presented a mesokurtic distribution, 15 items (i.e., 1, 2, 3, 4, 5, 9, 10, 17, 18, 19, 20, 21, 22, 23 and 24) presented a

1) I am satisfied with my	236	6.66	0.77	-2.51	S 16	6.20	K 32
relationship with my	200	0.00	0177	2101		0.20	102
companion animal.2) The relationship with my companion animal is close to what I	236	6.14	1.16	-1.56	.16	2.17	.32
consider to be ideal.3) The relationship with my companion animal	236	6.61	0.77	-2.07	.16	3.80	.32
makes me very happy.4) My relationship with my companion animal fulfils my needs to	236	6.36	1.02	-1.81	.16	3.24	.32
have company or my needs for companionship, etc. 5) Based on my previous experiences (other animals, friends' animals, etc.), the relationship with my companion animal	236	6.35	1.05	-1.81	.16	2.84	.32
meets my expectations. 6) I can find alternatives to the relationship with my companion animal that match or exceed what I think is ideal for me (e.g., spending time with friends being alone	236	4.89	1.86	-0.61	.16	-0.58	.32
etc.). 7) If I were not with my current companion animal I would be fine,	236	2.95	1.87	0.55	.16	-0.89	.32
since I would find another animal. 8) The alternatives to a relationship with my companion animal are appealing to me (e.g., spending time with friends, being alone, etc.)	236	4.13	1.95	-0.23	.16	-1.01	.32
9) Replacing my companion animal with another companion animal would be a good	236	1.21	0.67	3.93	.16	16.23	.32
option for me. 10) My needs for companionship, etc. could easily be met through a relationship with a companion	236	1.66	1.16	1.83	.16	2.59	.32
animal other than my own. 11) I have a lot invested in the relationship with my companion animal and would end up locing almost	236	4.31	1.97	-0.13	.16	-1.10	.32
everything if this relationship ended. 12) Several aspects of my life are connected to my companion animal (recreational activities, etc.) and I	236	3.25	1.99	0.48	.16	-0.97	.32

leptokurtic distribution, and 10 items (i.e., 7, 8, 11, 12, 13, 15 and 16) presented a platykurtic distribution.

(R) indicates that the item was coded in reverse. S skewness, SE S standard error of skewness, K kurtosis, SE K standard error of kurtosis

confirmed the IM structure and the correlation pattern between the dimensions of the IMS H-CA in the expected directions. Although the main dimensions of the IMS H-CA showed high internal consistency values, we obtained a low internal consistency value for the quality of alternatives dimension ($\omega = 0.56$). This result was a surprise since the same items initially used in the present study obtained a more satisfactory internal consistency value in study 1 ($\alpha = 0.72$). Differences between samples or even the reordering of the items are possible explanations for this phenomenon. Still, as we will argue later, this value indicates a need to develop further work on this dimension and requires caution in interpreting the values obtained by this subscale.

Also, we obtained criterion-related validity using two constructs with a theoretical proximity to the dimensions of the IMS H-CA. All dimensions of the IMS H-CA were significantly correlated with the dimension of comfort coming from the CA (Zasloff, 1996) in the desired directions. For example, the dimension of quality of alternatives showed a negative correlation with perceived comfort received from a CA (the higher the perceived comfort, the less likely I am to perceive alternatives of quality compared to my current CA). In the case of perceiving the CA as a weight/burden, the IMS-CA dimensions should have been equally significantly correlated with this variable, which was not the case. The lack of significance in the correlations with investment size and quality of alternatives may be due to the difficulty in interpreting and assessing these dimensions considering this new context. Indeed, when comparing the average results attained with each subscale with the scale's midpoint, only the investment size dimension (which typically shows values above the scale's midpoint) did not follow what would be expected based on the literature (Baker et al., 2016; Rusbult et al., 1998). As such, it is clear that not all IM dimensions can easily and fully translate into the CA context.

The analyses concerning the scale's sensitivity were also within our expectations. Not all dimensions of the IMS proved to be indifferent to the demographic components of the sample, as seen above. Income level reported a difference between groups in three dimensions of the IM. Given all the costs associated with keeping a CA, the results related to the investment size are to be expected, since the same absolute value of an investment will be perceived differently according to its relative weight in the individual's purchasing power (i.e., spending \$200 per month on a CA is a greater strain on an individual with a monthly income of \$2000 than one with \$4000). The results concerning relationship satisfaction and quality of the alternatives may once again be related to the hypothetical greater instrumentalization of CA by individuals with higher incomes. By having a larger amount of money at their disposal, individuals may believe they can more easily replace a CA if they so wish. It might also tie back to the amount of time they spend away from their CA due to professional commitments, so future studies will have to delve deeper into this relation. The CA type also proved relevant for the investment size variable. This result may be explained by the number of investments associated with dog care (e.g., walking, bathing) that do not exist in the case of cats. The differences in participants' education levels may be explained by a hypothetical instrumentalization of CAs from the point of view of individuals with more education. Still, more research will be needed to explain this effect specifically.

Additionally, the participant's assigned sex also appears to affect the

Table 7

r											
		Correlations									
	M (SD)	1	2	3	4	5	6	7	8		
1. Commitment	6.76 (0.45)	-									
2. Investments	3.81 (1.36)	0.26***	-								
3. Satisfaction	6.42 (0.79)	0.54***	0.37***	-							
4. Alternatives	2.49 (0.98)	-0.31*	-0.37***	-0.33**	-						
5. Age	40.41 (12.92)	-0.02	-0.13*	-0.05	0.09	-					
6. Relationship Duration	78.72 (52.87)	-0.03	-0.06	-0.01	-0.03	0.08	-				
7. Comfort Coming from the CA	5.93 (1.03)	0.39***	0.54***	0.61***	-0.34***	-0.17*	0.03	-			
8. Burden	1.48 (0.72)	-0.19*	-0.10	-0.32^{***}	0.12	-0.11	-0.05	-0.25^{**}	-		

Note. Age was coded in years, while Relationship Duration was coded in months

p < 0.050, p < 0.010, p < 0.001

Table 8

Scale sensitivity analyses and descriptive statistics.

	Investment Model Variable			
	M (SD) / Statistical Difference Test			
n	Satisfaction	Alternatives	Investments	Commitment
	F (2, 228) = 2.27	F (2, 228) = 1.85	F (2, 228) = 4.11*	F (2, 228) = 2.27
69	6.57 (0.58)	2.33 (1.03)	4.18 _b (1.50)	6.77 (0.45)
115	6.41 (0.80)	2.61 (0.96)	3.68 _a (1.29)	6.77 (0.39)
47	6.26 (0.79)	2.47 (0.89)	3.52 _a (1.26)	6.69 (0.57)
	t (211) = 0.01	t (211) = - 0.19	t (211) = 2.77**	t (211) = - 0.63
115	6.41 (0.81)	2.49 (0.93)	4.01 (1.30)	6.73 (0.49)
98	6.41 (0.82)	2.52 (0.99)	3.51 (1.33)	6.77 (0.43)
	F (3, 226) = 3.37*	F (3, 226) = 3.90*	F (3, 226) = 3.70*	F (3, 226) = 1.33
27	6.54 _{ab} (0.67)	2.21 _{ab} (0.90)	4.48 _b (1.45)	6.80 (0.23)
64	6.56 _b (0.71)	2.21 _b (0.98)	3.87 _{ab} (1.37)	6.83 (0.32)
105	6.44 _{ab} (0.71)	2.61 _{ab} (10)	3.82 _{ab} (1.32)	6.75 (0.50)
34	6.06 _{ac} (1.12)	2.77 _{ac} (0.9)	3.33 _{ac} (1.25)	6.65 (0.54)
236	t (234) = - 2.82**	t (234) = 3.47***	t (234) = 0.33	t (234) = -1.80
53	6.16 (0.94)	2.89 (0.98)	3.86 (1.32)	6.66 (0.60)
183	6.50 (0.73)	2.37 (0.95)	3.79 (1.38)	6.79 (0.39)
	n 69 115 47 115 98 27 64 105 34 236 53 183	$\begin{tabular}{ c c c c } \hline Investment Model Variable & M (SD) / Statistical Difference Terms & Satisfaction & F (2, 228) = 2.27 & feven & $	Investment Model Variable M (SD) / Statistical Difference Test n Satisfaction Alternatives F (2, 228) = 2.27 F (2, 228) = 1.85 69 6.57 (0.58) 2.33 (1.03) 115 6.41 (0.80) 2.61 (0.96) 47 6.26 (0.79) 2.47 (0.89) t (211) = 0.01 t (211) = - 0.19 115 6.41 (0.81) 2.49 (0.93) 98 6.41 (0.82) 2.52 (0.99) F (3, 226) = 3.37* F (3, 226) = 3.90* 27 6.54 ab (0.67) 2.21 ab (0.90) 64 6.56 b (0.71) 2.21 b (0.98) 105 6.44 ab (0.71) 2.61 ab (10) 34 6.06 ac (1.12) 2.77 ac (0.9) 236 t (234) = - 2.82** t (234) = 3.47*** 53 6.16 (0.94) 2.89 (0.98) 183 6.50 (0.73) 2.37 (0.95)	$\begin{tabular}{ c c c c } \hline Investment Model Variable & M (SD) / Statistical Difference Test & Investments & Investments & F (2, 228) = 2.27 & F (2, 228) = 1.85 & F (2, 228) = 4.11* & 69 & 6.57 (0.58) & 2.33 (1.03) & 4.18_b (1.50) & 115 & 6.41 (0.80) & 2.61 (0.96) & 3.68_a (1.29) & 47 & 6.26 (0.79) & 2.47 (0.89) & 3.52_a (1.26) & 115 & 6.41 (0.81) & 2.49 (0.93) & 4.01 (1.30) & 98 & 6.41 (0.82) & 2.52 (0.99) & 3.51 (1.33) & F (3, 226) = 3.37* & F (3, 226) = 3.90* & F (3, 226) = 3.70* & 27 & 6.54_{ab} (0.67) & 2.21_{ab} (0.90) & 4.48_{b} (1.45) & 644 & 6.56_{b} (0.71) & 2.21_{b} (0.98) & 3.87_{ab} (1.37) & 105 & 6.44_{ab} (0.71) & 2.61_{ab} (10) & 3.82_{ab} (1.32) & 34 & 6.66_{ac} (1.12) & 2.77_{ac} (0.9) & 3.33_{ac} (1.25) & 236 & t (234) = -2.82** & t (234) = .347*** & t (234) = 0.33 & 3.51 (1.32) & 183 & 6.50 (0.73) & 2.37 (0.95) & 3.79 (1.38) & 0.50 & 0.73 & 0.57 & 0$

Notes: means with different subscripts are significantly different, p < 0.050; *p < 0.050, **p < 0.010, *** p < 0.001

IM variables applied to CAs, specifically relationship satisfaction and quality of alternatives. This goes against what would be expected according to the literature, which reported no differences between genders in this topic (Herzog, 2007). This conflicting finding warrants further work, ideally applying a personality measurement and a more balanced sample.

Notwithstanding these observations, no demographic variable revealed an effect on all dimensions of the model, which indicates that each component is susceptible to different types of characteristics of the participants and that the scale as a whole does not present difficulties with any particular demographic characteristic.

General discussion

This paper aimed to validate the IMS H-CA, an adaptation of the Investment Model Scale (IMS) (Rusbult et al., 1998) into the context of H-CA relationship. To this end, we conducted two studies. In Study 1, based on the Portuguese version of the IMS (Rodrigues and Lopes, 2013), we adapted this scale items to mirror the human-companion animal relationships context. We reworked this version of the IMS H-CA in the light of the Baker et al. (2016) version. Experts evaluated this scale to determine its content validity. Based on the experts' interviews, the scale underwent changes to the items already included and was added with new items. Construct validity was also determined. In Study 2, the construct validity of the resulting IMS H-CA was obtained via confirmatory factorial analysis, and the analysis of its sensitivity and validity was also performed. criterion-related Regarding criterion-related validity, the IMS H-CA proved to be a good predictor of levels of perceived comfort received from a CA (PCRP; Zasloff, 1996) and perceiving the CA as a weight/burden (Jacobetty et al., 2019). Finally, regarding scale sensitivity not all dimensions of the IMS H-CA proved to be indifferent to the demographic characteristics of our sample, with assigned sex, income and education giving rise to some differences in the ways participants scored in each dimension of the scale

Our work makes a relevant contribution to the existing literature. This is the first time the IMS has been validated into the context of H-CA relations. Additionally, to our knowledge, no instrument attempting to measure an individual's commitment to their CA had been previously validated into European Portuguese. The validated IMS H-CA comprises of a 22-item instrument (five for relationship satisfaction, four for quality of alternatives, six for investment size, and seven for commitment), and the four dimensions proved to be significantly correlated in the expected directions as proposed by the IM (Rusbult et al., 1998). In a nutshell, this scale can be used by researchers and professionals focusing on H-CA relationships to examine the correlates of commitment and the impact of higher (v. lower) commitment on relationship maintenance. Any of the subscales can also be used as a stand-alone in different contexts (e.g., using the relationship satisfaction scale as a follow-up after the recent adoption of an animal), thus creating several possible combinations that can be applied to a wide range of contexts.

Limitations

The IMS-CA is not without limitations. One of the major limitation of the IMS H-CA was the quality of the alternatives dimension, reporting a rather unsatisfactory internal consistency value in Study 2. We must agree with Rauktis and colleagues' (2021) argumentation that some of the dimensions of the IMS (Rusbult et al., 1998) might prove inadequate to the context of CAs, without guarantee of construct validity. Besides the implications in theoretical terms of the lack of adjustment of this dimension (it is an essential component of the IM), these results may call into question the use of our instrument, or at least of the subscale referring to the quality of alternatives. There are some ways to proceed concerning this dimension. First, repeating the analysis, since the confidence interval for McDonald's omega (ω) obtained in Study 2 includes acceptable values at its upper limit ([0.41, 0.70]), indicating the possibility of obtaining distinct values with a different sample.

Another possible solution would be to remove this dimension altogether in the IM's applications to CAs. Several experts mentioned that this dimension had a rather difficult adaptation into the CA context since the alternatives available for a romantic relationship would not work like those considered for a CA. It was repeatedly mentioned that the most logical alternative in this H-CA context would be to be alone, an idea that, although foreseen by the original model (Rusbult et al., 2006; Agnew, 2009), is not discriminated in an isolated way in any item, only being included in items that mention examples of alternatives to the "current relationship." In addition, the experts mentioned that the scale was not prepared to measure intentions to exchange the CA for an animal of another species, as the CA does not represent a problem, but the characteristics inherent to the species (e.g., having to walk a dog may be a conditioning factor for an individual with motor problems, no matter how well-behaved their dog may be). However, our attempts to include items that merely mentioned the act of giving up the animal (rather than replacing it) or these questions about the species specificities of the CA obtained unsatisfactory psychometric values, leading to their removal still during Study 2. Further research will need to be developed on the implications of removing an entire component from the model and its effects on the quality of the data obtained by the IMS.

Additionally, the gender distribution of the participants in our studies is a possible limitation. The literature indicates that no significant gender differences are expected in the type of variables we set out to measure with our instrument (Herzog, 2007). However, when measuring the scale's sensitivity in Study 2, we found significant gender differences for two of the four IMS components. Therefore, our instrument presents an apparent sensitivity to the participant's gender. This point should be worked out in future research projects to reach more conclusive results, perhaps with a more heterogeneous sample.

Finally, and given the voluntary nature of our data collections, the missing data patterns in our samples are likely to be not entirely at random. It is possible that we have many participants with high internal motivations to participate in this study (e.g., having a deep bond with their CA and feeling highly motivated to express their opinion), while missing data is attributable to participants that do not share this motivation. Future work should replicate our findings, using samples with a more heterogeneous sample of participants (e.g., controlling for the role of primary vs. secondary caretaking of the companion animal). Ideally, future studies could also resort to longitudinal designs, granting them the ability to closely manage their samples and further test our instrument (e.g., using a test-retest measure).

Future research

It should be noted that the work needed to be carried out concerning the IMS H-CA is not yet complete. The most immediate need is to explore in more detail the dimension of the quality of alternatives, both in the IMS H-CA and in applications of IM to this context. In this sense, developing work specifically on this subscale will be highly relevant, mainly if it again includes an expert evaluation process.

Additionally, as mentioned above, it will be necessary to explore in more detail the specificities of each subscale and their relationships with other theoretical variables and the participants' sociodemographic variables. As an example, directly applying the Miller-Rada scale (Staats et al., 1996) to a population with different types of animals (besides dogs and cats) and a more balanced distribution regarding the assigned sex of the participants would allow us to draw much more secure conclusions regarding this new version of the IMS.

Furthermore, it would be interesting to look into the usage of the IM and IMS-CA with different samples and study designs. Our samples were comprised of voluntary participants measured only once, but results could be different with paid participants and/or a longitudinal design. Such data would greatly enrich our understanding of H-CA

relationships.

Finally, it will be essential to develop a reduced version of our instrument, similar to what was done in validating the IMS in Portuguese (Rodrigues and Lopes, 2013). If further research is developed to better understand the adjustment of the quality of the alternatives to the context of CAs, the best option will be to start from the instrument that already includes these findings. Otherwise, using our functional and validated instrument is a satisfactory option.

Conclusion

Commitment has been used for over 40 years as one of the basic concepts explaining the longevity of any relationship. After several applications to various contexts, we leave one more contribution to weigh on applying this concept to our domestic companions of other species. The IM is still an extremely up to date model with variables that, with greater or lesser success, seem to apply to CAs. We believe that the instrument we have developed, although not without reservations, is a helpful contribution to the field and the subject, allowing us to study the commitment variable in a much more reliable way.

CRediT authorship contribution statement

Aguiar Tiago Rôxo: Writing – review & editing, Writing – original draft, Visualization, Validation, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation. Lopes Diniz: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. Rodrigues David L.: Writing – review & editing, Validation, Supervision, Resources, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data and supplementary materials

The supplementary materials mentioned during this work, as well as the data we used to reach our results, are available in an "Open Science Framework" repository ([10.17605/OSF.IO/TC6AW]). If you need any additional help with the provided databases, please reach out to the corresponding author.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jveb.2025.01.008.

References

- Agnew, C.R., 2009. Commitment, theories and typologies. In: Reis, H.T., Sprecher, S.K. (Eds.), Encyclopedia of Human Relationships. Sage, pp. 245–248.
- Agnew, C.R., Arriaga, X.B., Wilson, J.E., 2008. Committed to what? Using the bases of relational commitment model to understand continuity and change in social relationships. In: Forgas, J.P., Fitness, J. (Eds.), Social Relationships: Cognitive, Affective, and Motivational Processes. Psychology Press, pp. 147–164.
- Agnew, C.R., Vanderdrift, L.E., 2018. Commitment processes in personal relationships. In: Vangelisti, A.L., Perlman, A. (Eds.), The Cambridge Handbook of Personal Relationships. Cambridge University Press, pp. 437–448.
- Altman, I., Taylor, D.A., 1973. Social Penetration: the Development of Interpersonal Relationships. Holt, Rinehart Winston.
- Amiot, C.E., Bastian, B., 2015. Toward a psychology of human-animal relations. Psych. Bul. 141 (1), 6–47.

Ascione, F.R., Shapiro, K., 2009. People and animals, kindness and cruelty: research directions and policy implications. J. Soc. Issu. 65 (3), 569–587.

Baker, Z.G., Petit, W.E., Brown, C.M., 2016. An investigation of the Rusbult investment model of commitment in relationships with pets. Anthrozoös 29 (2), 193–204.

- Bentler, P.M., 1990. Comparative fit indexes in structural models. Psych. Bul. 107 (2), 238–246.
- Bonas, S., McNicholas, J., Collis, G.M., 2000. Pets in the network of family relationships: an empirical study. In: Podberscek, A.L., Paul, E.S., Serpell, J.A. (Eds.), Companion Animals and Us: Exploring the Relationships Between People and Pets. Cambridge University Press, pp. 209–236.

Bowlby, J., 1982. Attachment and Loss: Vol. 1. Attachment (2nd ed.). Penguin.

- Brewer, M.B., 2008. Social Identity and Close Relationships. In: Forgas, J.P., Fitness, J. (Eds.), Social Relationships Cognitive, Affective and Motivational Processes. Routledge, pp. 167–183.
- Cain, A.O., 1985. Pets as family members. Married Fam. Rev. 8 (3-4), 5-10.
- Carlisle-Frank, P., Frank, J.M., 2006. Owners, guardians, and owner-guardians: differing relationships with pets. Anthrozoös 19 (3), 225–242.
- Chomel, B.B., 1992. Zoonoses of house pets other than dogs, cats and birds. Pediatr. Inf. Dis. J. 11 (6), 479–487.
- Chur-Hansen, A., Stern, C., Winefield, H., 2010. Commentary: Gaps in the evidence about companion animals and human health: Some suggestions for progress. Intern. J. of Evi.-Bas. Healthc. 8 (3), 140–146.
- Cohen, J., 1992. A power primer. Psych. Bul. 112 (1), 155-159.
- Cohen, S.P., 2002. Can pets function as family members? West. J. Nurs. Res. 24 (6), 621–638.
- Cole, D.A., 1987. Utility of confirmatory factor analysis in test validation research. J. Cons. Clin. Psych. 55 (4), 584–594.
- Collisson, B., 2015. Farewell to Fido: pet owners' commitment and relinquishment of companion animals. Am. J. Appl. Psych. 3 (2), 27–33.
- Crawford, E.K., Worsham, N.L., Swinehart, E.R., 2006. Benefits derived from companion animals, and the use of the term "attachment". Anthrozoös 19 (2), 98–112.
- DeMello, M., 2012. Animals and Society. Columbia University Press. Ellis, A., Stanton, S.C., Hawkins, R.D., Loughnan, S., 2024. The link between the nature
- Ellis, A., Station, S.C., Hawkins, R.D., Louginian, S., 2024. The link between the nature of the human-companion animal relationship and well-being outcomes in companion animal owners. Animals 14 (3), 441. https://doi.org/10.3390/ ani14030441.
- Finkel, E.J., Simpson, J.A., Eastwick, P.W., 2017. The psychology of close relationships: fourteen core principles. Ann. Rev. Psych. 68, 383–411.
- Fonseca, G.M., Mora, E., Lucena, J., Cantín, M., 2015. Forensic studies of dog attacks on humans: a focus on bite mark analysis. Res. Rep. Foren. Med. Sci. 39–51.
- George, D., Mallery, P., 2003. SPSS for Windows Step by Step: A Simple Guide and Reference. Allyn and Bacon, Boston
- Herzog, H.A., 2007. Gender differences in human–animal interactions: a review. Anthrozoös 20 (1), 7–21.
- Hodgson, K., Barton, L., Darling, M., Antao, V., Kim, F.A., Monavvari, A., 2015. Pets' impact on your patients' health: leveraging benefits and mitigating risk. J. Am. Fam. Med. 28 (4), 526–534.
- Holt-Lunstad, J., Smith, T.B., Layton, J.B., 2010. Social relationships and mortality risk: a meta-analytic review. PLoS Med 7 (7), e1000316.
- Hu, L., Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct. Equat. Model. 6, 1–55.
- Irvine, L., Cilia, L., 2017. More-than-human families: pets, people, and practices in multispecies households. Socio. Comp. 11 (2), e12455.
- Jacobetty, R., Lopes, D., Fatjó, J., Bowen, J., Rodrigues, D.L., 2019. Psychological correlates of attitudes toward pet relinquishment and of actual pet relinquishment: the role of pragmatism and obligation. Animals 10 (1), 63.
- Johnson, T.P., Garrity, T.F., Stallones, L., 1992. Psychometric evaluation of the Lexington attachment to pets scale (LAPS). Anthrozoös 5 (3), 160–175.
- Krahn, L.E., Tovar, M.D., Miller, B., 2015. Are pets in the bedroom a problem? Mayo Clin. Proc. 90 (12), 1663–1665.
- Le, B., Agnew, C.R., 2003. Commitment and its theorized determinants: a meta–analysis of the investment model. Pers. Relatsh. 10 (1), 37–57.
- Maher, J., Wyatt, T., 2021. European illegal puppy trade and organised crime. Trends Org. Crime. 24 (4), 506–525.
- McConnell, A.R., Brown, C.M., Shoda, T.M., Stayton, L.E., Martin, C.E., 2011. Friends with benefits: on the positive consequences of pet ownership. J. Pers. Soc. Psych. 101 (6), 1239–1252.
- McDonald, R.P., 1999. Test theory: A Unified Treatment. Lawrence Erlbaum.

Michael, J., Székely, M., 2018. The developmental origins of commitment. J. of Soc. Phil. 49 (1), 106–123.

Miller, L.A., Lovler, R.L., 2016. Foundations of Psychological Testing: A Practical Approach, 5th ed.). Sage.

Muthen, L.K., Muthen, B.O., 2012. Mplus User's Guide (7th ed.). Muthen Muthen. Parslow, R.A., Jorm, A.F., 2003. Pet ownership and risk factors for cardiovascular

- disease: another look. Med. J. Aus. 179 (9), 466–468. Parslow, R.A., Jorm, A.F., Christensen, H., Rodgers, B., Jacomb, P., 2005. Pet ownership
- and health in older adults: findings from a survey of 2,551 community-based Australians aged 60–64. Gerontology 51 (1), 40–47.
- Plaut, M., Zimmerman, E.M., Goldstein, R.A., 1996. Health hazards to humans associated with domesticated pets. Ann. Rev. Publ. Health 17 (1), 221–245.
- Rauktis, M.E., Hoy-Gerlach, J., Sewall, C.J., Lee, H., Bickel, L., 2021. Preliminary findings of a ten-item scale to assess the commitment of low-income owners to their companion Animals. Anthrozoös 34 (1), 109–126.
- Rodrigues, D., Lopes, D., 2013. The investment model scale (IMS): further studies on construct validation and development of a shorter version (IMS-S). J. Gen. Psychol. 140 (1), 16–28.
- Rusbult, C.E., 1980. Commitment and satisfaction in romantic associations: a test of the investment model. J. Exp. Soc. Psychol. 16 (2), 172–186.

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- Rusbult, C.E., 1983. A longitudinal test of the investment model: the development (and deterioration) of satisfaction and commitment in heterosexual involvements. J. Pers. Soc. Psychol. 45 (1), 101.
- Rusbult, C.E., Agnew, C.R., Arriaga, X.B., 2011. The investment model of commitment processes. In: Van Lange, P.A.M., Kruglanski, A.W., Higgins, E.T. (Eds.), Handbook of Theories of Social Psychology. Sage, pp. 218–231.
- Rusbult, C.E., Buunk, B.P., 1993. Commitment processes in close relationships: an interdependence analysis. J. Soc. Pers. Relatsh. 10 (2), 175–204.
- Rusbult, C.E., Coolsen, M.K., Kirchner, J.L., Clarke, J.A., 2006. Commitment. In: Vangelisti, A.L., Perlman, D. (Eds.), The Cambridge Handbook of Personal Relationships. Cambridge University Press, pp. 615–635.
- Rusbult, C.E., Martz, J.M., Agnew, C.R., 1998. The investment model scale: measuring commitment level, satisfaction level, quality of alternatives, and investment size. Pers. elatsh. 5 (4), 357–387.
- Schumacker, R.E., Lomax, R.G., 2010. A Beginner's Guide to Structural Equation Modeling (3rd ed.). Routledge Academic.
- Siegel, D., van Uhm, D., 2021. Illegal dogfighting: sport or crime? Trends Org. Crime. 24 (4), 563–580.

- Staats, S., Miller, D., Carnot, M.J., Rada, K., Turnes, J., 1996. The Miller-Rada commitment to pets scale. Anthrozoös 9 (2-3), 88–94.
- Tamir, D.I., Hughes, B.L., 2018. Social rewards: from basic social building blocks to complex social behavior. Persp. Psych. Sci. 13 (6), 700–717.
- Tavakol, M., Dennick, R., 2011. Making sense of Cronbach's alpha. Int. J. Med. Ed. 2, 53–55.
- Tran, P., Judge, M., Kashima, Y., 2019. Commitment in relationships: an updated metaanalysis of the investment model. Pers. Relatsh. 26 (1), 158–180.
- do Vale, B., Lopes, A.P., Fontes, M., Silvestre, M., Cardoso, L., Coelho, A.C., 2021. A cross-sectional study of knowledge on ownership, zoonoses and practices among pet owners in northern Portugal. Animals 11 (12), 3543.
- Yuan, K.H., Bentler, P.M., 2000. Three likelihood-based methods for mean and covariance structure analysis with nonnormal missing data. Soc. Method. 30 (1), 165–200.
- Zasloff, R.L., 1996. Measuring attachment to companion animals: a dog is not a cat is not a bird. Appl. Anim. Behav. Sci. 47 (1-2), 43–48.