

## The Psychological Processes Involved in the Development of a High-Quality Relation with one's Dog

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**Background.** Several studies have found an effect of pet ownership on human health and well-being. We propose that these benefits can only occur when the pet owner perceives the dog in a certain way: As having a human-like psychological functioning and experience of the world (anthropomorphism), and as part of one's identity (assimilation). These perceptions are thought to support the development of a high-quality relationship with the dog that can lead to positive effects on health and well-being.

**Method.** Two samples of dog owners (N=136 and N=928) completed an online questionnaire assessing anthropomorphism and assimilation, and relationship satisfaction and commitment to the dog (as measures of the quality of the relationship). In addition, a set of measures to validate the new anthropomorphism and assimilation scales were assessed.

**Results.** Anthropomorphism and assimilation were related to satisfaction and commitment in moderation and in mediation. That is, the relation between anthropomorphism and commitment was especially strong when assimilation was low, and the relation between assimilation and commitment was largely mediated by anthropomorphism. Furthermore, validating the new scales, anthropomorphism was significantly related to secondary emotions recognized in the dog, and assimilation was significantly and negatively related to self-esteem and loneliness.

**Conclusion.** The results show that anthropomorphism and assimilation had a significant relation with satisfaction and commitment, which is in line with the notion that this psychological process is important for the development of a high-quality relationship between owner and dog.

**Keywords:** well-being; anthropomorphism; assimilation; dog-human relationship; pet ownership.

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Several studies suggest that pet ownership is associated with human health advantages, such as a better one-year survival of patients after myocardial infarction, fewer health complaints, and lower cardiovascular risk factors (Friedmann, Thomas, & Eddy, 2000; McNicholas et al., 2005). The finding that pet owners are healthier than non-pet owners is also confirmed in longitudinal studies (Headey & Grabka, 2007). Pet ownership is also associated with benefits in psychological well-being, such as reduced feelings of loneliness and depression and enhanced feelings of self-esteem (Wells, 2009). Still, this line of research is limited in at least two aspects. The first concerns the limited statistical power of most studies (Gilbey & Tani, 2015), while the second concerns the lack of theorizing on the exact psychological mechanisms that are involved in the relation between pet ownership and health (see Herzog, 2011). In the current article, the focus is on a mechanism that might explain the association between pet ownership and benefits to human health, namely the nature of the relationship between owner and companion animal or pet (McNicholas et al., 2005). To understand this nature of the human-pet relation, it is useful to look at relationships between humans.

Humans highly value human relationships. According to the belongingness theory, humans have a strong innate drive to form and maintain lasting, positive and significant interpersonal relationships (Baumeister & Leary, 1995). A lack of close social bonds is, among other things, linked to unhappiness and depression, and people who are under stress often turn to others for social support (Taylor, Klein, Gruenewald, Gurung, & Fernandes-Taylor, 2003). Cobb (1976) defines social support as information leading the subject to understand that one is cared for and loved, esteemed, and a member of a network of mutual obligations. Previous research has

shown that pets can provide a sense of social support (Duvall Antonacopoulos & Pychyl, 2008; Duvall Antonacopoulos & Pychyl, 2010; McNicholas & Collis, 2000; Wells, 2009): People form close relationships with their pets; most pet owners see their pets either as family member or as a close friend (Blouin, 2013; Sanders, 1990; Serpell, 2003). It is unlikely that humans have evolved distinct psychological processes for relating to companion animals; it is more likely that these processes are a byproduct of human-human relationships (Collis & McNicholas, 1998). Indeed, according to Sevillano and Fiske (2016) animals are “social perception targets” that are perceived using the same psychological mechanisms as used in perceiving and relating to humans. For example, animals are together with humans recognized as distinct from inanimate objects, and humans have stereotypes of animals. Similarly, Kwong & Bartholomew (2011) present animals as attachment figures (Bowlby, 1969) with whom humans can develop attachment bonds. Epley, Waitz and Cacioppo (2007) point to the human-evolutionary roots of the need for social connection, and how this need can be satisfied by connections with animals (also see Amiot & Bastian, 2014). Therefore, in the present article it is assumed that for people to enjoy and benefit the owner-dog relationship, human relationship processes must be at play.

It is proposed here that dog ownership can lead to better human health only if the owner-dog relationship is perceived as satisfying and the owner is committed towards the relationship. Only or especially then can the relationship help meet the need to belong (Baumeister & Leary, 1995). We propose that there are two core psychological concepts involved in developing such a high-quality relationship with a dog: anthropomorphism and assimilation. These processes make the dog owner perceive the dog as having human-like and important social properties. Figure 1 shows the hypothesized relation between

anthropomorphism and assimilation and two measures of a good relationship (satisfaction and commitment). In addition, this figure shows the concepts that are expected to be related to anthropomorphism and assimilation, and that might be used to validate both core concepts.

Anthropomorphism is defined as “imbuing the imagined or real behavior of nonhuman agents with humanlike characteristics, motivations, intentions, and emotions” (Epley, Waytz, & Cacioppo, 2007, p. 864). Looking at the literature, the measurement of anthropomorphism can be conceptualized as direct or explicit versus indirect or implicit. The explicit measurement refers specifically to the extent to which animals have the same psychological and emotional mechanisms as humans (e.g., intentionality, emotion and cognition). For example, Waytz, Cacioppo, & Epley (2010) measured anthropomorphic tendencies with statements like (here applied to the dog): “To what extent does a dog have intentions?” The same questions were asked regarding emotions and consciousness. Paul et al. (2014) assessed anthropomorphism by asking people which emotions they believed their cat or dog was capable of experiencing. However, a problem with explicit measurements is that participants come to know what is being measured with the questionnaire, which may serve as a demand characteristic (Weber & Cook, 1972). It might therefore be better to measure anthropomorphism in an implicit way, in the sense that participants are not aware of what the exact measurement outcome reflects (De Houwer, 2006).

Eddy, Gallup, & Povinelli (1993) measured anthropomorphism in an implicit way by asking participants to rate the likelihood that certain animals (chosen as exemplars of the major phylogenetic classes) could engage in three complex tasks and to what extent the animal was similar to them. The implicit measurement can also refer to how people spontaneously

talk about animals when they anthropomorphize. Albert and Bulcroft (1988) measured anthropomorphism with the 10-item Anthropomorphism Scale which consists of items like ‘Do you celebrate your pet’s birthday’ and ‘To what extent do you feel that your pet is part of your family?’. The latter type can also be classified as a “weak” form of anthropomorphism that implies human states or that are used metaphorically, for example, as in “my computer hates me” or “my dog is like a child” (Epley et al., 2007). In the present study an implicit measure was used, inspired by the 10-item Anthropomorphism Scale (Albert & Bulcroft, 1988; Duvall Antonacopoulos & Pychyl, 2008; Duvall Antonacopoulos & Pychyl, 2010). According to the way anthropomorphism is measured in the current study, anthropomorphism may lead people to regard the dog as a family member, who is loved and cared for like a child and for whom the owner is willing to spend effort and make sacrifices.

This measure of anthropomorphism is validated by relating it to the recognition of secondary emotions in dogs; the perception that the own dog can have feelings of, for example, hope or shame. That is, most people believe that primary (or basic) emotions, such as fear and anger, can be experienced by both humans and animals. However, when it comes to secondary emotions, which are more cognitively complex self-conscious emotions, fewer people attribute these to animals (Demoulin et al., 2004; Morris, Doe, & Godsell, 2008; Paul et al., 2014). When an owner anthropomorphizes a dog, the owner is seeing the dog as human-like. It is therefore expected that the more an owner anthropomorphizes the dog, the more strongly the owner recognizes secondary emotions in the dog. This is in line with the findings of previous research in which anthropomorphism significantly predicted the attribution of secondary emotions to nonhuman animals (Waytz, Cacioppo, & Epley, 2010).

Prior research has also found a relationship between attachment to dogs and willingness to attribute secondary emotions (Martens, Enders-Slegers, & Walker, 2016).

The second core psychological concept that is related to the nature of the relationship with the dog is assimilation. In the present context, assimilation refers to the process of identifying oneself with the dog; seeing the dog as part of the self. People's perceptions of themselves refer to idiosyncratic characteristics (e.g., "I am impulsive"), but also to their relationships with relevant others (Leary, 2002; Onorato & Turner, 2004), in the present context, the dog. When the dog is assimilated into one's self-image, the person feels close to the dog and experiences oneself as "having a dog" or "being a person who owns a dog". This may well imply that when the person is not accompanied by the dog, the person "misses something", misses a relevant part of how one defines oneself. People not only have a descriptive self-image but they also form an opinion about that self-image; it has an affective load. Because it is about themselves, people are motivated to keep this image positive (Higgins, 1987). Therefore, we suggest that for people who value their dog, integrating the dog into the self-concept (Aron, Aron, Tudor, & Nelson, 1991) can compensate for negative evaluations of the self (Steele, 1999), which are associated with low levels of psychological well-being. More specifically, we think that a low level of self-esteem, negative self-evaluation or loneliness, each can motivate an owner to assimilate the dog more into their self-concept, given that they evaluate the dog or having a relationship with the dog as positive (see McConnell, Brown, Shoda, Stayton, & Martin, 2011).

Self-esteem reflects the perceived discrepancy between an individual's perceived actual-self state and an ideal or desired self-state (Rosenberg, 1979 as cited in Moretti & Higgins, 1990). Negative self-evaluative emotions, such as feeling

dissatisfied with oneself or ashamed, are activated when people attribute negative consequences or failures to themselves (Dijkstra & Buunk, 2008). Loneliness is the negative experience of a short of social connectedness (De Jong Gierveld & Van Tilburg, 2008). In this study, our measure of assimilation will be validated by relating it to self-esteem, negative self-evaluation and loneliness (see Figure 1).

It is expected that anthropomorphism and assimilation are both related to measures of the quality of the relationship, satisfaction and commitment. According to Le & Agnew (2003) satisfaction occurs when relational outcomes are in line with, or surpass one's expectations of the relationship. Commitment can be defined as: "a psychological phenomenon referring to a person's concern for the future and stability of a specific relationship, along with the desire for that relationship to continue" (Baker, Petit, & Brown, 2016, p. 195). An owner with, for example low self-esteem, who assimilates the dog has a need for a good relationship with the dog and will therefore be more committed to the relationship with the dog. When the need is fulfilled, the relationship will also be experienced as satisfying. If an owner anthropomorphizes the dog, the relationship with the dog may become more valuable and meaningful, thereby leading to a higher commitment and more satisfaction. It could be reasoned that if an owner endorses a high level of anthropomorphism, the relationship with the dog might be experienced more as a human-human relationship, rather than a human-dog relationship (Duvall Antonacopoulos & Pychyl, 2008).

In this article we present the data from two cross-sectional studies in which the scales for the psychological concepts of anthropomorphism and assimilation were developed. The exploratory factor analysis that was performed in the first sample is immediately replicated in the second sample. The core analyses looked at the

relation between anthropomorphism and assimilation on the one hand and satisfaction and commitment to the relationship with the dog on the other hand. Finally, we also looked at the criterion validation of the scales anthropomorphism and assimilation: Anthropomorphism was

validated by relating it to secondary emotions recognized in the dog, while assimilation was validated by relating it to measures related to the need to feel better about oneself (self-esteem, negative self-evaluation and loneliness; Figure 1).

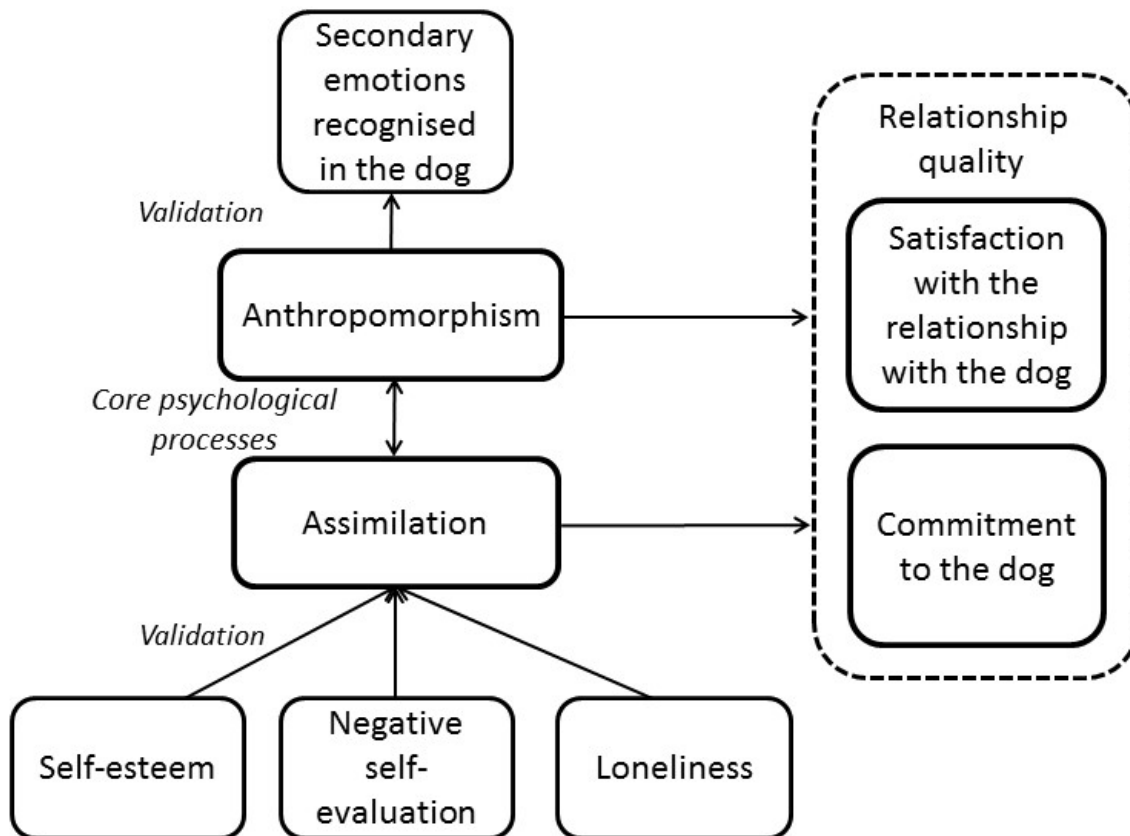


Figure 1. The hypothesized relations between anthropomorphism and assimilation and the quality of the relationship with the dog, and the validation measure.

## Method

### Sample 1

**Recruitment and procedure.** Dog owners were requested to participate in research through an appeal that was placed on several Dutch websites with information about pet keeping. By clicking on a link, participants were redirected to a website with an online questionnaire. The first screen of the questionnaire explained that the research was about “the dog-owner and his or her dog”. It was stated that the results of the questionnaire were going to be processed anonymously, that they could quit anytime they wanted without any

consequence, and that they could email the researcher for questions about the content or procedures. Participants were notified that, by continuing to the next page, they automatically gave informed consent. The questionnaire was administered in Dutch.

**Measurements.** Demographic information was assessed about both the owner and the dog. The owner was asked questions about gender, age, educational level, household composition, and perceived health. Questions relating to the dog were the age, sex, breed, weight and health of the dog, whether the dog had ever bitten a human being, the reason why the

owner had a dog and the number of dogs the participant owned. In case a participant owned more than one dog, they were asked to choose one of them (for instance the dog that was most appealing to them) and answer the questions with regard to this dog.

Self-esteem was assessed with the ten items of the Rosenberg's self-esteem scale (Rosenberg, 1965), e.g., "I take a positive attitude towards myself" and "I feel that I have a number of good qualities". These questions could be answered on a five-point scale (*strongly disagree* (1), *disagree* (2), *neither disagree nor agree* (3), *agree* (4) and *strongly agree* (5)). The mean item score was used as the self-esteem scale score ( $\alpha = .89$ ).

Negative self-evaluation was assessed with five statements about how often the respondents had experienced self-evaluative emotions during the last four weeks. The items were based on a scale assessing self-evaluative emotions in relation to smoking tobacco (Dijkstra & Buunk, 2008). In the current scale all reference to smoking was omitted, leaving items on such emotions in general. Examples of items were "I feel dissatisfied with myself" and "I am mad at myself" and the answers were given on a five-point scale (*never* (1), *sometimes* (2), *regularly* (3), *often* (4) and *very often* (5)). The mean item score was used as the negative self-evaluation score ( $\alpha = .81$ ).

Anthropomorphism and assimilation were assessed with items newly developed for this study. The items were based on psychological theory, on their linguistic meaning, and on observations of how dog owners talk spontaneously about their dog. In addition, the items were inspired by questionnaires about self-image and anthropomorphism, such as the 10-item anthropomorphism scale by Albert and Bulcroft (1988). The assimilation scale originally consisted of eleven items and the anthropomorphism scale originally consisted of ten items. After scale development each scale

consisted of six items (see paragraph on scale development in the results section for more detailed information).

Anthropomorphism was measured with six items, e.g. "My dog is a full member of the family" and "I would do everything for my dog". These items were answered on a five-point scale (*totally disagree* (1), *disagree* (2), *neither disagree nor agree* (3), *agree* (4) and *totally agree* (5)). The mean item score was used as the scale score ( $\alpha = .74$ ).

Assimilation was measured with six items, e.g. "My dog is a part of me" and "I really feel like someone who has a dog" which were answered on the same five-point disagree-agree scale as presented above. The mean item score was used as the scale score ( $\alpha = .80$ ).

Satisfaction with the relationship with the dog was based on the relationship interaction satisfaction scale by Buunk (1990) which measures relational satisfactions for humans in a close relationship. This scale consisted of eight items, e.g. "I like being around my dog" and "The relationship between me and my dog is good" that were answered on a five-point scale (*never* (1), *sometimes* (2), *regularly* (3), *often* (4) and *very often* (5)). The mean item score was used as the satisfaction scale score ( $\alpha = .70$ ).

Commitment to the dog was based on the commitment scale used by Buunk and Bakker (1997) to measure commitment between humans in a romantic relationship. This scale consisted of seven items, e.g. "To what extent are you attached to your dog?" and "How important is your dog to you?" that were answered on a five-point scale with different options for each question. The mean item score was used as the commitment scale score ( $\alpha = .75$ ).

Secondary emotions were measured using five items on the extent to which dog owners thought their dog could feel or experience certain emotions. The specific items were derived from a questionnaire assessing 55 possible emotions that dogs might experience. Five emotions that

according to Demoulin et al. (2004) were rated as prototypically secondary and more human-like were used: Tenderness, love, hope, guilt and shame, which were rated on a four-point scale (*my dog cannot feel/experience it at all* (1), *my dog can feel/experience it a little bit* (2), *my dog can feel/experience it reasonably strong* (3) and *my dog can feel/experience it very strongly* (4)). The mean item score was used as the scale score ( $\alpha = .77$ ).

Several other scales were assessed but they will not be presented here because they were not relevant to the hypotheses that are tested in this article and were not thought to influence the scoring of the other scales.

## Sample 2

**Recruitment and procedure.** The recruitment and procedure in Sample 2 was similar to that described in Sample 1.

**Measurements.** In Sample 2 the same demographic questions were asked as in Sample 1. The same questions were also used for the following scales: self-esteem ( $\alpha = .85$ ), anthropomorphism ( $\alpha = .75$ ), assimilation ( $\alpha = .78$ ), satisfaction ( $\alpha = .59$ ) and commitment ( $\alpha = .73$ ). A scale that was added in the second sample was loneliness.

Loneliness was measured with the eleven items of the loneliness scale by De Jong Gierveld and Van Tilburg (1999; 2008). Examples of these items are “I experience a general sense of emptiness” and “I miss having a real close friend”. The items were answered on the same five-point disagree-agree scale as was used above for the anthropomorphism scale. The mean item score was used as the scale score ( $\alpha = .91$ ).

## Results

### Participant characteristics

**Sample 1.** There were 139 participants in the first Sample (11 males and 128 females). The data of three participants were removed because they were younger than eighteen. The average age of the remaining participants was 39.4.

Almost half (44.1%) of the participants owned one dog, 32.4% owned two dogs and 23.5% of the participants owned more than two dogs. Most (77.9%) of the dogs were purebreds and roughly half (52.9%) of the dogs were male (Table 1).

**Sample 2.** In the second Sample there were 939 participants (95 males 844 females). The data of eleven participants were removed because they were younger than eighteen. The average age of the remaining participants was 36.9.

Almost half (44.7%) of the participants owned one dog, 30.6% owned two dogs and 24.7% of the participants owned three or more dogs. Most (79.6%) of the dogs were purebreds and approximately half (48.7%) of the dogs were male (Table 1).

### Correlations between demographic variables and main concepts

Correlations were computed between the demographic characteristics and the main concepts of anthropomorphism and assimilation. In both samples, only a significant (negative) correlation was found between age of the owner and assimilation,  $r(132) = -.22, p = .012$  (in Sample 1) and  $r(925) = -.22, p < .001$  (in Sample 2). Thus, older participants assimilated their dog less than younger participants.

Table 1  
*Demographic Characteristics of the Dog Owners and Their Dog*

<b>Demographic characteristics of the dog owner</b>		
	<b>Sample 1 (N=136)</b>	<b>Sample 2 (N=928)</b>
Gender		
Female	91.9% ( <i>n</i> =125)	89.8% ( <i>n</i> =833)
Male	8.1% ( <i>n</i> =11)	10.2% ( <i>n</i> =95)
Age	<i>M</i> =39.4 <i>SD</i> =10.8 Range=18-70	<i>M</i> =36.9 <i>SD</i> =9.8 Range=18-77
Education <sup>1</sup>		
Low/medium	58.1% ( <i>n</i> =79)	52.9% ( <i>n</i> =491)
High	41.9% ( <i>n</i> =57)	47.1% ( <i>n</i> =437)
Health		
Moderate to very bad	14.7% ( <i>n</i> =20)	16.6% ( <i>n</i> =154)
(Very) good	85.3% ( <i>n</i> =116)	83.4% ( <i>n</i> =774)
<b>Demographic characteristics of the dog</b>		
	<b>Sample 1</b>	<b>Sample 2</b>
Gender		
Female	47.1% ( <i>n</i> =64)	51.3% ( <i>n</i> =476)
Male	52.9% ( <i>n</i> =72)	48.7% ( <i>n</i> =452)
Age	<i>M</i> =5.5 <i>SD</i> =3.8 Range=0-15	<i>M</i> =4.1 <i>SD</i> =3.2 Range=0-16
Purebred		
Yes	77.9% ( <i>n</i> =106)	79.6% ( <i>n</i> =739)
No	22.1% ( <i>n</i> =30)	20.4% ( <i>n</i> =189)
Size of the dog		
Small to medium (maximum weight 25 kilogram)	46.6% ( <i>n</i> =62)	50.9% ( <i>n</i> =472)
Large (weighs more than 25 kilogram)	53.4% ( <i>n</i> =71)	49.1% ( <i>n</i> =456)

*Note.* <sup>1</sup> High education level consist of people who completed a study at a higher professional education or university.



### Scale development

The first step was the development of the scales anthropomorphism and assimilation. The starting points were the ten anthropomorphism items and the eleven assimilation items which were analyzed simultaneously. The method of analysis was exploratory factor analysis with VARIMAX rotation. In Sample 1, initially a 5-factor solution emerged but only the first two factors could be meaningfully interpreted and explained (also based on a significant amount of explained variance). Four items that were stated ambiguously and five items that did not distinctly load on one of the two factors were excluded. For each analysis, the initial solution was subjected to a visual inspection of the eigenvalues, the scree plot, the amount of variance explained by the solution and the ease of interpretation of the factors contained therein. This resulted in two factors that both consisted of six items (Table 2).

The same procedure that was conducted in Sample 1 was conducted in Sample 2. In Sample 2 initially a 4-factor solution emerged from which only the first two factors could be meaningfully interpreted. Of the five items that were removed in Sample 1 because they loaded high on both factors, three also loaded high on both factors in Sample 2. In consideration of replication all five items were removed, after which in Sample 2 there were still three items that loaded high on both factors and only loaded slightly higher on one factor in comparison to the other. However, because these items loaded higher on the same factor as they did in Sample 1 it was decided not to remove these items.

As a result, in both studies sufficiently reliable scales were found that consisted of the same items in both populations. The Cronbach's alpha's for anthropomorphism respectively were .74 in Sample 1 and .75 in Sample 2, the Cronbach's alpha's for assimilation were

.80 in Sample 1 and .78 in Sample 2. These internal consistencies were acceptable and indicated that the items together assessed various aspects of the underlying concepts.

The correlations between anthropomorphism and assimilation were  $r(136) = .40, p < .001$  in Sample 1 and  $r(928) = .54, p < .001$  in Sample 2. These correlations indicate that anthropomorphism and assimilation overlap between 16% and 29%. To correct for this correlation between anthropomorphism and assimilation, the presented correlations are partial correlations: the correlations between anthropomorphism and the different concepts are controlled for the correlation with assimilation, and the correlations between assimilation and the different concepts are controlled for the correlation with anthropomorphism.

### Interaction-effects with quality of relationship

Before testing main effects of anthropomorphism and assimilation in relation to the quality of the relationship with the dog, interaction effects were computed. That is, it may be that the quality of the relationship is only high when both, anthropomorphism and assimilation are high. Therefore, in both samples the interaction between both measures was computed using analysis of variance, once with satisfaction and once with commitment as dependent variable. The model also included the main effects and the covariates gender and age of the owner and gender and age of the dog. In Sample 1 the interactions in relation to both measures of relationship quality were not significant: For satisfaction:  $F(1, 119) = 0.44, p = .51, \eta_p^2 = .004$ , and for commitment:  $F(1, 119) = 2.31, p = .13, \eta_p^2 = .019$ . In Sample 2, however, both interactions were significant: For satisfaction:  $F(1, 920) = 4.76, p = .029, \eta_p^2 = .005$ , and for commitment:  $F(1, 920) = 66.30, p < .001, \eta_p^2 = .067$  (Figure 2).

Table 2  
*Mean Scores on Items included in the Scales Anthropomorphism and Assimilation*

Anthropomorphism	Sample 1	Sample 2
1. My dog is great.	4.57 (0.61)	4.50 (0.67)
2. I love my dog a lot.	4.75 (0.48)	4.73 (0.51)
3. I take care of my dog like I would take care of a child.	3.73 (1.21)	3.11 (1.23)
4. Love for animals is also 'real love'.	4.46 (0.64)	4.17 (0.94)
5. My dog is a full member of the family.	4.33 (0.85)	3.95 (1.0)
6. I would do anything for my dog.	4.22 (0.84)	3.99 (0.93)
Scale total:	4.34 (0.53)	4.08 (0.62)
Assimilation	Sample 1	Sample 2
1. Regarding character I look a lot like my dog.	3.24 (1.15)	2.99 (1.12)
2. Together with my dog I feel more confident about myself.	3.49 (1.23)	3.06 (1.20)
3. Without my dog I feel 'bare' (as if I am missing something).	4.26 (0.94)	4.02 (1.14)
4. Together with my dog I feel stronger.	3.54 (1.20)	3.21 (1.22)
5. My dog is a part of me.	4.18 (0.93)	3.88 (1.06)
6. I really feel like someone who has a dog	4.16 (1.01)	4.0 (1.07)
Scale total:	3.81 (0.77)	3.53 (0.79)

*Note.* Items were scored on a five-point scale ranging from *totally disagree* (1) to *totally agree* (5). Standard deviations are reported between the brackets.

To further study the meaning of the interactions in Sample 1, contrast analyses were conducted: 1) to test the relation of anthropomorphism with satisfaction and commitment when assimilation was high versus low, and 2) to test the relation of assimilation with satisfaction and commitment when anthropomorphism was high versus low. To do so, the complete dataset was used to model anthropomorphism and assimilation being low versus high by decreasing and increasing all individuals' standardized means on the anthropomorphism and assimilation scales with one standard deviation, respectively (Cohen, Cohen, West, & Aiken, 2003; Siero, Huisman, & Kiers, 2009).

*Satisfaction.* The relations with satisfaction were as follows (Figure 2): When assimilation was modeled as low, high anthropomorphism was significantly associated with more satisfaction,  $F(1, 920) = 84.14, p < .001, \eta_p^2 = .084$ . When assimilation was modeled as high, a similar significant association was found,  $F(1, 920) = 28.66, p < .001, \eta_p^2 = .030$ . It seems the significant interaction was caused by a difference in strength of the relation. The other way around, when anthropomorphism was either modeled as low or high, assimilation was not significantly related to satisfaction.

*Commitment.* The relations with commitment were as follows (Figure 2): When assimilation was modeled as low, high anthropomorphism was significantly associated with higher commitment,  $F(1, 920) = 256.70, p < .001, \eta_p^2 = .218$ . When assimilation was modeled as high, a similar level of significance was found but the effect size was noticeably smaller,  $F(1, 920) = 21.41, p < .001, \eta_p^2 = .023$ . Again, the significant interaction seems to be caused by a difference in strength of the relation.

Although the interaction concerning commitment in Sample 1 was not significant (see above), the same contrasts analyses were computed showing a similar pattern: When assimilation was low, high anthropomorphism was significantly associated with higher commitment,  $F(1, 119) = 35.33, p < .001, \eta_p^2 = .229$ , but when assimilation was high this relation was less strong,  $F(1, 119) = 5.27, p = .023, \eta_p^2 = .042$ .

Conversely, in Sample 2, when anthropomorphism was modeled as low, high assimilation was significantly associated with more commitment,  $F(1, 920) = 42.69, p < .001, \eta_p^2 = .044$ , but when anthropomorphism was (modeled as) high, the association was the opposite,  $F(1, 920) = 9.35, p = .002, \eta_p^2 = .010$ . In Sample 1 both relations were not significant.

In conclusion, anthropomorphism was especially strongly related to satisfaction and commitment when assimilation was low. In addition, the means in Figure 2 (which are calculated using the parameter estimates) show that when both anthropomorphism and assimilation are low, commitment was the lowest.

### **Associations with anthropomorphism**

It was predicted that anthropomorphism would be positively correlated to both measures of relationship quality, satisfaction and commitment. In both samples anthropomorphism was correlated (partialing out the relation with assimilation) significantly to satisfaction (Sample 1,  $r(133) = .41, p < .001$ ; Sample 2,  $r(925) = .30, p < .001$ ) and to commitment (Sample 1,  $r(133) = .49, p < .001$ ; Sample 2,  $r(925) = .41, p < .001$ ). These correlations without partialing out were all four somewhat larger (see Table 3).

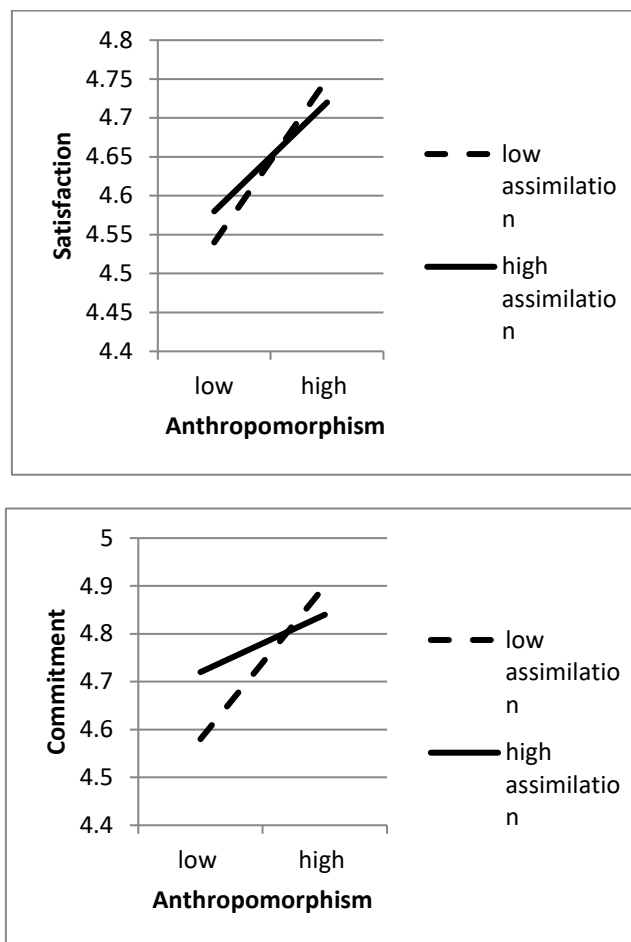


Figure 2. The Interaction effects Between Anthropomorphism and Assimilation on the Quality of the Relationship with the Dog (Satisfaction and Commitment) in Sample 2.

To validate the anthropomorphism scale, it was related to the extent to which the dog owner thinks the dog can feel or experience secondary emotions (only assessed in Sample 1). Again partialing out assimilation, this correlation was significant,  $r(133) = .24, p = .005$ . In addition, in Sample 2 anthropomorphism was significantly related to self-esteem,  $r(925) = .09, p = .006$  and to loneliness,  $r(925) = -.08, p = .011$ , although the correlations were very small. Not partialing out assimilation in these correlations hardly made a difference. An overview of the correlations is presented in Table 3.

### Associations with assimilation

It was predicted that assimilation would be positively correlated to both measures of relationship quality, satisfaction and commitment. However, in Sample 1 the correlations (partialing out the relation with anthropomorphism) were not significant. In Sample 2 assimilation was only related significantly, but weakly to commitment,  $r(925) = .07, p = .033$ . However, these correlations without partialing out were all four somewhat larger and three of the four were significant (see Table 3).

Table 3  
(Partial) correlations between Anthropomorphism and Assimilation with the Core Process Variables and Validation Variables

	Mean (SD)		Anthropomorphism		Assimilation	
	Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2
<b>Core process</b>						
Satisfaction	4.74 (0.37)	4.71 (0.27)	.41*** (.44***)	.30*** (.36***)	-.01 (.17)	.02 (.21**)
Commitment	4.91 (0.20)	4.84 (0.27)	.49*** (.53***)	.41*** (.50***)	.01 (.22*)	.07* (.32**)
<b>Validation</b>						
Self-esteem	4.01 (0.61)	3.96 (0.57)	.08 (-.02)	.09** (-.02)	-.25** (-.24**)	-.19*** (-.17**)
Neg. Selfeva.	1.92 (0.84)	--	.00 (.15)	--	.35** (.38**)	--
Loneliness	--	2.07 (0.68)	--	-.08* (-.01)	--	.14*** (.12**)
Second. Emo.	2.37 (0.73)	--	.24** (.32**)	--	.16 (.27**)	--

Note. Standard deviations with means are reported between the brackets. The correlations between brackets are Pearson's (not partial) correlations (anthropomorphisation versus assimilation); -- not measured in this sample; significance \* < .05, \*\* < .01, \*\*\* < .001.

The relations between assimilation and the validation variables were tested. Assimilation was (partialing out the relation with anthropomorphism) significantly related to self-esteem in both samples (Sample 1,  $r(133) = -.25$ ,  $p = .003$ ; Sample 2,  $r(925) = -.19$ ,  $p < .001$ , but not to negative self-evaluation (only assessed in Sample 1). In Sample 2 assimilation was significantly related to loneliness,  $r(925) = .14$ ,  $p < .001$ , only assessed in Sample 2 (see Table 3). Not partialing out anthropomorphism in these correlations hardly made a difference, except that the correlation of assimilation with secondary emotions went from a not significant .16 to .27,  $p < .001$ .

### Mediation analyses

The above results on anthropomorphism and assimilation in relation to commitment and satisfaction suggest a mediation effect. This may mean that the relation of assimilation

with measures of quality of the relationship is mediated by anthropomorphism. Therefore, mediation analyses were conducted using the SPSS Process macro (Hayes, 2013). Controlled for the same covariates as in the above analyses of variance, in Sample 1, with regard to commitment the results revealed partial mediation: The bootstrap interval of the indirect effect did not contain zero, 95% CI [.016, .098]. With regard to satisfaction, however, the results did not indicate mediation, 95% CI [-0.022, .126]. In Sample 2, the analysis revealed partial mediation in relation to commitment, 95% CI [.064, .114], and complete mediation in relation to satisfaction, 95% CI [.048, .083].

### Discussion

Previous research has found positive effects of pet ownership on human health and well-being (Friedmann et al., 2000; McNicholas et

al., 2005; Wells, 2009). The background of this article is the notion that the positive health effects of owning a dog might occur through the nature of the relationship between owner and dog, and that these health effects may only occur if the relationship is good. We investigated the underlying psychological processes that were believed to affect whether or not someone has a good relationship with the dog: anthropomorphism and assimilation. These scales were developed and validated in two cross-sectional samples of dog owners. The relation between anthropomorphism and assimilation on the one hand and satisfaction and commitment to the relationship with the dog on the other hand was complex. Firstly, there was a moderation effect: The relation of anthropomorphism with commitment and satisfaction was especially strong when assimilation was low. One way or another, stronger assimilation may suppress the relation of anthropomorphism. Secondly, the correlational analyses controlling for each other showed that anthropomorphism was indeed related to satisfaction with the relationship and to commitment to the dog, the two indicators of relationship quality. Regarding assimilation, these analyses (controlled for anthropomorphism) only showed a weak relation to commitment in one sample. The pattern of results suggested possible mediation. Thirdly, indeed, the data revealed that the relation of assimilation with commitment was partially mediated by anthropomorphism (in both samples). With regard to satisfaction this mediation was complete (but only in the large sample). These data suggest that assimilation leads to anthropomorphism, which leads to a higher commitment and more satisfaction. Together, the present result

suggest that anthropomorphism and assimilation may not only be interesting human individual differences in how dogs are perceived, but also causes of a high quality relationship with the dog.

The reliabilities of the new scales were acceptable, high enough to know what was measured but not extremely high. The latter may suggest that the concepts of anthropomorphism and assimilation are multifaceted; that the items of the scales refer to somewhat different aspects of the construct (Streiner, 2003). The formulations of the items of the anthropomorphism scale mainly referred to loving the dog, taking care of the dog as if it is a child, and the dog as family member. These may be viewed as “weak” (Epley et al., 2007), or indirect indicators of the psychological process of anthropomorphism. These kinds of items were used because in our experience dog owners more often spontaneously talk in terms of love for the dog and the dog being a family member rather than explicitly about the dog having thoughts or feelings. Thus, our scales were developed to be adapted to the way of thinking of our participants. This indirect measure of anthropomorphism was validated by its significant relation to secondary emotions recognized in the dog. This is in line with the findings of previous research in which anthropomorphism significantly predicted the attribution of secondary emotions to nonhuman animals (Waytz et al., 2010).

Assimilation was assessed with items that referred to a dog as adding something to one’s self or being part of one’s self. This scale was validated by its relation to measures related to the need to feel better about oneself. Assimilation was significantly related to self-esteem and to loneliness, not to negative self-evaluation. Lower self-esteem was related to stronger

assimilation, and the more loneliness was experienced, the stronger assimilation was. These results are in line with our expectation that stronger assimilation can be in function of coping with a threatened self (i.e., low self-esteem, loneliness). It suggests that assimilation of the dog adds to a secure self and feelings of connectedness (Ryan, Stiller & Lynch, 1994). The data also suggest that assimilation may contribute to anthropomorphism, which may lead to a higher quality relationship. This means that incorporating the dog as part of one's self-image would lead to projecting more human-like traits to the dog. Here a theory is needed that can be tested empirically.

Our results were consistent with the notion that both psychological process are relevant for the development of a high quality relationship between owner and dog. In addition to the mediation, the interaction between anthropomorphism and assimilation in relation to commitment seems relevant. Firstly, especially a combined score of low anthropomorphism and low assimilation was associated with a lower quality of the relationship with the dog. These data suggest that scoring high on one of both scales is sufficient to form a higher quality relationship, although the effect of anthropomorphism is the strongest. Secondly, the same interaction showed that, especially when assimilation was low, the relation of anthropomorphism and commitment was strong. This may mean that high assimilation lowers the influence of anthropomorphism on the quality of the relationship. Speculating, this might mean that high assimilation lowers the need for anthropomorphism to connect to the dog. Future studies will be necessary to explain these relations.

This study had some limitations that should be taken into account. No causal conclusions can be drawn from this research as correlations do not necessarily imply causation. Our model predicted specific relations between certain concepts, but it could be argued that these pathways can also run in reverse. That is, we argue that anthropomorphism and assimilation lead to commitment and satisfaction; i.e., only when people perceive a dog as human-like and/or they make the dog part of the self they may become emotionally attached to the dog and satisfy their need to belong. The other way around, that commitment and satisfaction lead to anthropomorphism, is harder to explain. When it comes to assimilation, it might be possible that experiencing high commitment and satisfaction can make people take the dog "in their heart", and in their self-image. Furthermore, we assume that especially lower self-esteem, but also higher loneliness, indicate the need to assimilate the dog into one's self-image. It is harder to explain how stronger assimilation would lower one's self-esteem and lead to more loneliness. Still, the quality and direction of these relations should be studied further, preferably in experimental designs. For example, measures of commitment or satisfaction might be applied (self-report or observational) after anthropomorphization is induced with an experimental manipulation (Butterfield, Hill & Lord, 2012; Riva, Sacchi & Brambilla, 2015).

There was a high percentage of women in our samples (respectively 92% and 90%) which is not uncommon in online studies on human-animal relationships (for instance 90% women in the study by Duvall Antonacopoulos & Pychyl, 2010; and 91% in a study by Martens et al., 2016). This might limit the extent that the present findings can

be generalized to the population of dog owners because both health differences and differences in relating to animals are reported between men and women (Herzog, 2007). Prior research indicates that women were more likely to engage in anthropomorphic behavior than men (Duvall Antonacopoulos & Pychyl, 2008) and that women use more verbal communication when interacting with their dog (Prato-Previde, Fallani, & Valsecchi, 2006). Unfortunately, the percentage of men in comparison to the percentage of women was too small to adequately analyze the data separately for males and females.

Another limitation of the study was that no objective health measures were included to test our basic assumption that relationship quality (satisfaction and commitment) is related to health. However, even if health was measured objectively, the cross-sectional design is not appropriate to validate this relation (Friedmann, Thomas, & Eddy, 2000). As the long-term physical health effects of animals need time to develop the psychological measures should be applied long before

the health effects are measured. For example, health effects might be assessed months or even years after a person has entered the relation with, preferably, his or her first dog.

Presently, it is too early to recommend practitioners to support the development of the processes of anthropomorphisation and assimilation in dog-owners to improve relationships. For example, high dependency on the relationship with the dog may undermine the search for human relationships. Still, it might be relevant for practitioners to diagnostically ask and observe clients concerning their anthropomorphism and assimilation, as these processes most probably do play a role in the relationship between owner and dog. The present study hopes to inspire the study on the psychological mechanisms by which dog ownership promotes human health and well-being. More data are needed on how and what levels of anthropomorphism and assimilation in the owner-dog relationship can contribute in concert to health and well-being of the human but also of the dog.

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