The Human-Dog Bond as a Mediator in the Relationship Between Loneliness and Emotional Well-Being

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Loneliness is prevalent in contemporary Western society and although it is commonly believed that pets can buffer owners against the effects of loneliness on emotional well-being, empirical research is limited. This study addressed the question of whether loneliness positively predicts the strength of the human-dog bond, and whether the human-dog bond mitigates the deleterious effects of loneliness on emotional well-being. A community sample of Australian pet-dog owners ($N = 639$: 123 men, 516 women) aged 18-80 participated in the study. Loneliness was conceptualised as a tri-dimensional construct comprised of social-, family-, and romantic-loneliness, while emotional well-being was operationalised in terms of positive and negative affect. Higher social-loneliness and family-loneliness predicted higher negative affect, and higher levels of all three types of loneliness predicted lower positive affect. Higher levels of family-loneliness and romantic-loneliness predicted a stronger human-dog bond, which in turn predicted higher positive affect. No relationship was evident between the human-dog bond and either social-loneliness or negative affect. The human-dog bond mediated the relationship between family-loneliness and positive affect as well as the relationship between romantic-loneliness and positive affect. These mediating effects were of the suppressor-type, indicating that the human-dog bond mitigated the deleterious effects of family-loneliness and romantic-loneliness on positive affect. These findings demonstrate the importance of conceptualising loneliness as a multi-dimensional construct in future studies regarding loneliness and human-animal relationships.

In Western societies such as Australia, there is an epidemic of loneliness (Holt-Lunstad, 2017). The poet John Donne famously said that "no man is an island" (quoted in Stubbs, 2006, p. 403), and research supports the notion humans are fundamentally social beings, biologically hardwired for social connection (Cacioppo & Patrick, 2008; Hombrados-Mendieta, Garcia-Martin, & Gomez-Jacinto, 2013; Rokach, 2013). This is an evolutionary adaptation, with survival through the ages dependent on us living and working together in groups (Cacioppo et al., 2006).

Loneliness has been defined as the distressing feeling that accompanies a perceived deficit in the quality or quantity of one's social relationships (Peplau & Perlman, 1982). It is a subjective experience, distinguishable from the objective state of aloneness (Mellor, Stokes, Firth, Hayashi, & Cummins, 2008). While aloneness is often viewed positively as an opportunity for self-reflection and contemplation (Tillich, 1980), loneliness is, by definition, an aversive state (Peplau & Perlman, 1982). The issue of loneliness has recently become particularly pertinent because of increased social isolation due to the global health pandemic of COVID-19. However, it is not a new social or psychological concern. The current phenomenon of the COVID-19 pandemic has been described as a form of "social recession" by Surgeon General of the United States, Dr. Vivek Murthy (2020). Nevertheless, even prior to the global pandemic, loneliness was being regarded as an important social concern in Australia, with research indicating that one in six Australians are emotionally lonely, and one in ten individuals lack social support (Relationships Australia, 2018).

Loneliness is associated with poor emotional well-being (Hawkley & Cacioppo, 2010; Holt-Lunstad, 2017). It has been shown to positively predict depression (e.g. Courtin & Knapp, 2017; Vanhalst, Luyckx, Raesk, & Goossens, 2012), anxiety (Lasgaard, Goossens, Bramsen, Trillingsgaard, & Elklit, 2011), psychological distress (Hawkins-Elder, Milfont, Hammond, & Sibley, 2018), and negative affect (NA) (Ben-Zur, 2012; Hombrados-Mendieta et al., 2013). It has also been shown to negatively predict happiness (Cacioppo et al., 2008), life satisfaction (Hawkins-Elder et al., 2018), and positive affect (PA) (Hombrados-Mendieta et al., 2013). Much of the research pertaining to loneliness and emotional well-being is cross-sectional, meaning that causation cannot be inferred (Cacioppo & Patrick, 2008). However, a growing body of experimental and longitudinal research indicates that there may be a causal relationship between loneliness and at least some aspects of emotional well-being (Cacioppo, Hawkley, & Thisted, 2010; Shevlin, McElroy, & Murphy, 2015).

Prevalence of Loneliness in Australia

Current social conditions in contemporary Western societies such as Australia, North America, and the United Kingdom are not conducive to the development and maintenance of close human relationships (Rokach, 2013). The fluidity of the family unit, increased mobility, and the strong emphasis on individualism in Western cultures means that loneliness is becoming increasingly prevalent (Rokach, 2013).

Until recently, it was generally thought that loneliness affected older adults more than it affected other age groups (Victor & Yang, 2012). Consequently, much of the research regarding loneliness has focused on older populations (Holt-Lunstad, Smith, Baker, & Stephenson, 2015; Krause-Parello, Gulick, & Basin, 2019; Nicolaisen & Thorsen, 2017). However, studies in Australia and elsewhere indicate that loneliness affects adults of all ages. The Australian Psychological Society (2018) reported that in a national sample of Australian adults ($N = 1,678$), loneliness was more prevalent among people aged 18 to 65 than in people aged over 65. Such findings challenge the common perception that loneliness is predominantly an issue faced by elderly people and raise

questions around the social fabric of modern life, in particular close attachment relationships.

Loneliness: A Perceived Lack of Companionate Bonds and Attachment Bonds

Drawing on Bowlby's (1969) attachment theory, Weiss (1973, 1974, 1988) proposed two distinct forms of loneliness: social-loneliness and emotional-loneliness. According to Weiss (1973), social-loneliness is due to an inadequate network of friends or affiliates. These relationships are based on shared interests and they provide companionship. In contrast, Weiss conceptualised emotional-loneliness as due to the lack of an attachment figure. He proposed that each type of loneliness can only be ameliorated by having satisfying relationships within that domain. For example, a large network of acquaintances will not ameliorate a felt need for a close attachment bond such as that which occurs between a child and their caregiver, or between romantic partners (Mikulincer & Shaver, 2016). Similarly, a fulfilling relationship with a romantic partner will not negate the desire for a broader network of friends and acquaintances. According to Weiss (1974), this is because different types of relationships fulfil different social needs.

Based on Weiss' seminal work, DiTommaso and Spinner (1993) constructed the Social and Emotional Loneliness Scale for Adults (SELSA). Using a Principal Components Analysis, they found that Weiss' construct of emotional-loneliness was best conceptualised as being comprised of two distinct domains, which they termed family-loneliness and romantic-loneliness. They defined family-loneliness as being dissatisfaction with the quality of familial relationships generally, and romantic-loneliness as distress over the lack of a satisfying relationship with a romantic partner (DiTommaso & Spinner, 1993). Family-loneliness, romantic-loneliness and social-loneliness have been shown to differentially predict various measures of emotional well-being (e.g. DiTommaso, Brannen, & Best, 2004; Lasgaard et al., 2011; Peerenboom, Collard, Naarding, & Comijs, 2015). This means information may be lost when loneliness is measured as a uni-dimensional construct.

Pets as a Prescription for Loneliness

It is commonly believed that pets reduce feelings of loneliness and thereby enhance emotional well-being (Herzog, 2011). However, according to Herzog, much of this research lacks methodological rigour and consequently, despite more than thirty years of research the idea that people derive psychological benefits from owner-pet relationships remains an unsubstantiated hypothesis (Herzog, 2011). This view is supported by the findings of Islam and Towell (2013), who undertook a systematic review of empirical studies pertaining to pet ownership and owners' well-being. They concluded that the research findings to date are mixed and that there remains a need for robust scientific enquiry in this area. More recently, Gilbey and Tani (2015) concluded that most studies lack methodological rigour and there is currently no substantive evidence that pets reduce loneliness.

Research regarding pets and emotional well-being commonly focuses on ownership status, comparing pet owners to non-owners on various measures of well-being without considering the strength of the owner-pet relationship (e.g. Jacobs-Bao & Schreer, 2016; Koivusilta & Ojanlatva, 2006; Mullersdorf, Granstrom, Sahlqvist, & Tillgren, 2010). In addition, when researchers do consider the strength of the owner-pet relationship, poorly constructed scales are commonly utilized (Meehan, Massavelli, and Pachana, 2017).

Although the benefits of pet ownership are unclear, the costs are readily apparent. Australians spend an estimated $12 billion annually on food, accessories and veterinary care for their pets (Animal Medicines Australia, 2016). Furthermore, some evidence suggests that pet ownership may impede owners from engaging in other activities that may

reduce feelings of loneliness and enhance well-being (Luhmann & Kalitzki, 2018). For example, a participant in an Australian qualitative study reported that she chose to spend Christmas alone rather than with her family because she did not want to be away from her pet dog (Wells & Rodi, 2000). In addition, coping with the death of a pet or relinquishing a pet that has failed to live up to expectations can negatively impact on emotional well-being (Gilbey, McNicholas, & Collis, 2007; Hewson, 2014). Given these known financial and emotional costs of pet ownership, and the propensity of health professionals to prescribe pets for lonely people (Smith 2012), further investigation of possible relationships between loneliness, emotional well-being and the owner-pet relationship is warranted.

In understanding human-animal relationships, it is important to acknowledge the heterogeneity of these relationships. In particular, researchers have emphasised the need to be species specific when investigating owner-pet relationships (e.g. Dwyer, Bennett, & Coleman, 2006; Kurdek, 2008). Notably, dogs (*Canis lupus familiaris*) are the most commonly kept species of pet in many countries, including Australia, where 38% of households have a pet dog (Animal Medicines Australia, 2016). Furthermore, people tend to form closer relationships with dogs than with other pet species (Wu, Wong, & Chu, 2018), thus increasing the importance of understanding the psychological impact of these particular inter-species relationships.

Pet dogs as Companions and Attachment Figures

The most commonly cited reason for dog ownership is that dogs provide companionship (Meyer & Forkman, 2014). Companionship has been defined as a social bond that provides intrinsic satisfaction through the sharing of pleasurable experiences (Rook, 1987). Research suggests that dogs fulfil a companionate role for many owners. For example, in a community sample of 945 Australian pet-dog owners, Franklin (2006) found that 82% of participants reported owning their dog for companionship. Furthermore, in a qualitative study by Wells and Rodi (2000), a participant exemplified the theme of dogs as companions when she described the pleasure she derived from sitting in the garden with her dog and taking walks with him. Moreover, the terms *pet* and *companion animal* are used interchangeably in the literature, with the latter term favoured in some arenas because it connotes a mutual relationship and psychological bond (Walsh, 2009).

Research suggests that, as well as being companions, pet dogs can be perceived as attachment figures (Beck & Madresh, 2008; Kurdek, 2008; Meehan et al., 2017; Zilcha-Mano, Mikulincer, & Shaver, 2012). An attachment figure, as defined by Bowlby (1969), is a stronger and wiser relational partner who is a secure base from which one ventures to explore the environment, and a safe haven to return to during times of threat. Furthermore, physical proximity to the attachment figure is sought and enjoyed, and separation from the individual causes distress (Ainsworth, 1991; Bowlby, 1969). Although Bowlby and Ainsworth focused their research on the infant-caregiver attachment bond, later researchers have demonstrated that the concept of an attachment bond can be meaningfully applied to adult relationships (Bartholomew & Horowitz, 1991; Doherty & Feeney, 2004; Mikulincer & Shaver, 2016) as well as to inter-species relationships (Kurdek, 2009; Zilcha-Mano et al., 2012).

As several researchers have noted, the term *attachment* is often poorly defined within the pets and well-being literature (Julius, Beetz, Kotrschal, Turner, & Uvnas-Moberg, 2013; Peacock, Chur-Hansen, & Winefield, 2012). Historically, the term has been used as a general descriptor of the owner-pet relationship, without regard for the more specific way an attachment bond is conceptualised in psychology. However, within the last decade, some researchers have begun to consider the owner-pet relationship specifically

within the framework of Bowlby's (1969) attachment theory (e.g. Beck & Madresh, 2008; Kurdek, 2009, Meehan et al., 2017; Zilcha-Mano, Mikulincer, & Shaver, 2011; Zilcha-Mano et al., 2012). For example, Kurdek (2009) investigated whether dogs can fulfil the role of being an attachment-figure and thereby a safe haven during times of distress. He found that in a large community sample of dog owners ($N = 975$), people reported being more inclined to turn to their dog for emotional support than to their parents, siblings, or best friends. Only romantic partners were rated higher than dogs as a source of safe haven during times of emotional distress. These findings demonstrate that for many people, their dog is an important part of their social support network and the emotional support they derive from this inter-species relationship may be more important than that derived from their intra-species relationships.

The notion that the human-dog bond can be meaningfully conceptualised as both a companionate bond and an attachment bond is concordant with the findings of Dwyer et al. (2006), who developed a measure of the human-dog bond based on information gathered from focus groups comprised of Australian dog owners. The authors noted that a single factor, which they termed Perceived Emotional Closeness, consisted of items which reflected the constructs of both companionship and attachment. According to Dwyer et al., this indicates that the human-dog bond is multifaceted and that pet dogs can fulfil multiple social roles for owners.

Loneliness, Emotional Well-Being and the Human-Dog Bond

If, as previous research suggests, pet dogs can serve as both companions and attachment figures, then it is possible that dog-owners who have an unsatisfied felt need for intra-species relational bonds may turn to their dog to fulfil that role. The findings of an experiment by Epley, Akalis, Waytz and Cacioppo (2008) support this possibility. They found that participants who were induced to feel lonely by viewing a movie clip, subsequently ascribed anthropomorphic social connectedness traits (e.g. thoughtful, considerate, sympathetic) to a pet more so than did participants in a control group. This suggests that as theorised by Epley et al., loneliness prompts people to connect relationally with pets. According to Epley et al., the next step in this area of research is to consider whether, when people turn to pets in this way, the pet is effective in mitigating the deleterious effects of loneliness on emotional well-being. The aim of the current study is to investigate this possibility, specifically focusing on human-dog relationships.

Although several researchers have investigated whether the owner-pet relationship moderates the relationship between perceived social support and emotional well-being (e.g. Duvall-Antonacopoulos & Pychyl, 2010; McConnell, Brown, Shoda, Stayton, & Martin, 2011; Peacock et al., 2012) only one study (Krause-Parello, 2012) has been conducted to investigate a possible inconsistent mediating effect as proposed by Epley et al. (2008). An inconsistent mediating effect is one in which the indirect effect (i.e. the effect via the mediator) acts in the opposite direction to the direct effect, thereby suppressing the direct effect (MacKinnon, Fairchild, & Fritz, 2007; Stapleton, Pituch, & Dion, 2014).

In a sample of 150 women aged 55-84, Krause-Parello (2012) reported that greater loneliness was associated with a stronger owner-pet bond, and this bond mitigated the relationship between loneliness and depressive symptomatology. Although Krause-Parello avoided the possibility of age and sex effects confounding her results by restricting the sample to older women, this means the findings are not generalizable to men or adults of other ages. Consequently, one of the aims of the current study was to sample a broad range of Australian adult dog-owners. There is some evidence to suggest that participants' age, sex and marital status predict both the strength of the human-dog bond (Dotson & Hyatt, 2008; Reid & Anderson, 2009) and various measures of emotional well-being (Ben-Zur,

2012; Bromet et al., 2011; Diener & Ryan, 2009; Peacock et al., 2012). For this reason, these variables were controlled for in the current study.

As discussed by Diener et al. (2010), emotional well-being involves more than just the absence of a pathological state such as depression. According to Pavot and Diener (2013), a comprehensive understanding of emotional well-being should encapsulate the full circumplex of emotions. That is, it should include both positive affect (PA) and negative affect (NA). For this reason, both these variables were included in the current study.

To our knowledge, McConnell et al. (2011) are the only researchers who have considered how the human-dog bond may relate to any aspect of PA. They reported that social-needs fulfilment by a pet dog was a unique positive predicator of subjective happiness after social-needs fulfilment from human relationships was controlled for. Although this study was limited by small sample size ($N = 56$), the findings suggest that further investigation of the possible relationship between the human-dog bond and PA is warranted.

Furthermore, previous researchers who have investigated a possible relationship between loneliness and the owner-pet bond have invariably considered loneliness as a uni-dimensional construct (e.g. Duvall-Antonacopoulos & Pychyl, 2010; Gilbey et al., 2007; Krause-Parello, 2008, 2012; McConnell et al., 2011). By delineating between social-, family- and romantic-loneliness, the current study will extend the existing literature and provide a useful next step in understanding the possible relationships between loneliness, emotional well-being and the human-dog bond.

Research Question and Hypotheses

The aim of this study was to investigate whether loneliness positively predicts the strength of the human-dog bond and whether the human-dog bond mitigates the deleterious effects of loneliness on emotional well-being. It was hypothesised that social-, family-, and romantic-loneliness would each uniquely and positively predict the strength of the human-dog bond. It was also hypothesised that a stronger human-dog bond would predict higher PA and lower NA. Finally, for each of the three types of loneliness, it was hypothesised that higher levels of loneliness would predict lower PA and higher NA, and that these relationships would be mediated by the human-dog bond.

Method

Participants

A convenience sample of Australian adults who owned one or more pet dogs participated in the study. Six-hundred and thirty-nine people (123 men, 516 women) aged between 18 and 80 ($M = 42.1$, $SD = 12.99$) were included. Most participants (72.6%) were in a couple relationship, while the remaining participants were single (19.6%), divorced (5.8%) or widowed (2%). As shown in Table 1, most participants reported that they owned one dog, had owned their dog for more than two years, and regarded their dog as a companion rather than as a best friend or soulmate.

Materials

The questionnaire included demographic questions (age, sex, marital status), general questions about aspects of the human-dog relationship, and three established scales.

Table 1

Characteristics of Participants' Human-Dog Relationship

Characteristic	*N*	(%)
Number of dogs owned		
1	375	(58.7)
2-3	241	(37.7)
> 3	23	(3.6)
Length of ownership		
Less than 1 year	61	(9.5)
1-2 years	80	(12.5)
More than 2 years	498	(77.9)
Term used to describe dog		
Just a dog	45	(7.0)
A companion	387	(60.6)
Best friend	173	(27.1)
Soulmate	34	(5.3)

Note. N = 639

Human-dog bond. The human-dog bond was assessed using the Perceived Emotional Closeness subscale of the Monash Dog Owner Relationship Scale (MDORS) (Dwyer et al., 2006). The 10 items of this subscale address affectional bonding, psychological attachment and companionship (Dwyer et al., 2006). The scale's authors reported a Cronbach's alpha for this subscale of .84 and it has established construct validity (Dwyer et al., 2006; Handlin, Nilsson, Ejdeback, Hydbring-Sandberg, & Uvnas-Moberg, 2012; Payne, Bennett, & McGreevy, 2015). In the present study, a Cronbach's alpha of .90 was obtained. Participants responded to items using a 5-point rating scale wherein higher ratings indicated a stronger human-dog bond.

Emotional well-being. The Scale of Positive and Negative Experience (SPANE) (Diener et al., 2010) was used to assess emotional well-being. This 12-item scale consists of two 6-item subscales, which assess PA and NA, respectively. The SPANE has been shown to have good construct validity (Diener et al., 2010; Silva & Caetano, 2013; Sumi, 2014). Regarding internal reliability, Diener et al. (2010) reported Cronbach's alphas of .87 and .81 for the PA and NA subscales respectively. Cronbach's alphas in the present study were .89 for the PA subscale and .83 for the NA subscale.

Participants indicated how frequently they had experienced each listed feeling and emotion during the previous four weeks using a 5-point rating scale, which ranged from 1 (*very rarely or never*) to 5 (*very often or always*). A higher score on the PA subscale indicated greater PA. Likewise a higher score on the NA subscale indicated greater NA.

Loneliness. The short version of the Social and Emotional Loneliness Scale for Adults (SELSA-S) (DiTommaso et al., 2004) was used to assess loneliness. The SELSA-S consists of three 5-item subscales that assess social-, family- and romantic-loneliness, respectively. The SELSA-S has been shown to have good construct validity (DiTommaso et al., 2004). Regarding internal reliability, the scale's authors reported that the subscales

had Cronbach's alphas of between .87 and .90. In the current study, the obtained Cronbach's alphas were .88, .90, and .91 for the social-, family-, and romantic-loneliness scales respectively.

In the present study, participants were instructed to think about their interpersonal experiences during the past two weeks and indicate how strongly they agreed with each item using a 7-point rating scale that ranged from 1 (*strongly disagree*) to 7 (*strongly agree*). For each of the subscales, higher total scores indicated greater loneliness.

Procedure

The School of Psychology Ethics Committee at Charles Sturt University granted ethical approval for this study. A power analysis was conducted using G*power (version 3.1.9.2) (Faul, Erdfelder, Buchner, & Lang, 2009). Power was set at .80 and alpha was set at .05 as recommended by Cohen (1992). A small effect size of $f^2 = 0.02$ was set to maximise the likelihood of detecting any statistically significant effects. Based on these criteria, the power analysis revealed that a sample of 602 participants was required. Therefore, the obtained sample of $N = 639$ was sufficient.

Both a paper and an electronic version of the questionnaire were constructed. A link to the electronic version of the questionnaire was placed on the online forums of Charles Sturt University and on Facebook. The researcher also recruited participants face-to-face from amongst friends and acquaintances using the paper version. People were invited to participate if they self-identified as an Australian adult who owned at least one pet dog. Those who completed the electronic version were invited to forward the link to others who they thought may want to participate. Participants were provided with an information sheet detailing who the target population for the study was and the purpose of the study. Those who completed the paper version of the questionnaire were given an envelope to ensure confidentiality. All of the data was imported into the statistical computer program SPSS (version 24). The mediation analyses were conducted using Hayes' PROCESS macro (version 3.3, model 4) for SPSS.

Results

Preliminary Analysis

All analyses were conducted using bootstrapping, which is robust to univariate and multivariate outliers, violations of the assumptions of normality of variables, and violations of linearity and homoscedasticity of the residuals in multivariate analyses (Field, 2013). As recommended by Field (2013), 2,000 bootstrap samples were used for each analysis. Scatterplots depicting the bivariate relationships between variables used in the main analysis were inspected. No non-linear relationships were evident. Table 2 shows the bivariate correlations between variables. Weak but statistically significant relationships were observed between the human-dog bond and romantic- and family-loneliness respectively, but no statistically significant relationship was identified between the human-dog bond and social-loneliness. Furthermore, a statistically significant relationship was not identified between the human-dog bond and PA or NA. The highest correlation between variables was -.60, meaning there were no apparent issues of multicollinearity or singularity (Field, 2013).

Descriptive Statistics

Table 3 shows the descriptive statistics for the continuous variables. The median (*Md)* and inter-quartile range (*IQR*) are reported together with the mean (*M*) and standard deviation (*SD*). This is because the mean can be distorted in skewed data (Pallant, 2013).

Table 2
Bivariate Pearson Correlations of Variables Used in Regression Analyses

Variable	1	2	3	4	5	6	7	8
1. Age	-							
2. Sex	-.11** [-.19, -.03]	-						
3. SL	.02 [-.05, .10]	-.04 [-.12, .04]	-					
4. FL	.07 [-.01, .15]	.04 [-.03, .11]	.46** [.38, .54]	-				
5. RL	.10* [.02, .18]	.07 [-.01, .14]	.20** [.12, .28]	.33** [.25, .41]	-			
6. PA	-.01 [-.09, .06]	.03 [-.05, .10]	-.46** [-.53, -.39]	-.43** [-.51, -.35]	-.27** [-.34, -.19]	-		
7. NA	-.06 [-.14, .02]	.07 [-.01, .16]	.37** [.30, .45]	.37** [.29, .44]	.17** [.10, .25]	-.60** [-.66, -.54]	-	
8. HDB	-.11** [-.18, -.03]	.19** [.10, .26]	-.01 [-.09, .08]	.12** [.04, .20]	.14** [.06, .22]	.03 [-.05, .11]	.06 [-.02, .14]	-

Note: SL = social-loneliness, FL = family-loneliness, RL = romantic-loneliness, PA = positive affect, NA = negative affect, HDB = human-dog bond. 95% Percentile CIs based on 2,000 bootstrap samples shown in brackets.
*p < .05 (2-tailed). **p < .01 (2-tailed).

Table 3
Descriptive Statistics for Continuous Variables (N = 639)

Variable	M	SD	Md	IQR	Range Potential	Range Actual
Age	42.09	12.99	43.00	(31, 52)	18+	18-80
Soc. loneliness	13.24	6.13	12.00	(9, 17)	5-35	5-35
Fam. loneliness	11.36	6.39	10.00	(6, 14)	5-35	5-34
Rom. loneliness	15.64	8.98	13.00	(8, 23)	5-35	5-35
PA	22.74	3.74	23.00	(20, 25)	6-30	11-30
NA	14.64	3.80	15.00	(12, 17)	6-30	6-29
HDB	35.94	7.47	36.00	(31, 42)	10-50	10-50

Note. Soc. Loneliness = social-loneliness, Fam. Loneliness = family-loneliness, Rom. Loneliness = romantic-loneliness, PA = positive affect, NA = negative affect, HDB = human-dog bond. For all variables, higher scores indicate more of the variable.

Primary Analysis

Table 4 shows the summary table for the standard multiple regression model in which the dependent variable was the human-dog bond. The independent variables were the three types of loneliness and the demographic variables of age, sex and marital status. This regression model provided the coefficient for the path between each of the independent variables and the human-dog bond in the mediation model (path *a*). As shown in Table 4, this regression model had an R^2 value of .074, $F(6, 632) = 8.423$, $p < .001$. This means that only 7.4% of the variance in the human-dog bond was accounted for by the three types of loneliness and the three demographic variables.

Table 4

Regression Model Predicting the Human-Dog Bond

Independent variable	path	β	b	[95% PCI]	*BootSE*	*p*
			Dependent variable: Human-dog bond			
Constant			32.137	[28.406, 36.311]	2.039	< .001
Social-loneliness	a_{SL}	-.07	-0.089	[-0.195, 0.020]	0.055	.091
Family-loneliness	a_{FL}	.12	0.140	[0.042, 0.238]	0.050	.008
Romantic-loneliness	a_{RL}	.11	0.088	[0.018, 0.156]	0.035	.011
Age	a_{Age}	-.09	-0.051	[-0.096, -0.008]	0.022	.033
Sex	a_{Sex}	.16	3.041	[1.518, 4.514]	0.762	< .001
Marital status	$a_{Marital}$	-.05	-0.707	[-1.726, 0.327]	0.533	.192
		$R^2 = .074$				
		$F(6, 632) = 8.423, p < .001$				

Note. SL, FL, and RL = social-loneliness, family-loneliness and romantic-loneliness, respectively. Standard errors and 95% Percentile CIs based on 2,000 bootstrap samples.

The β-values and *p*-values indicate that participants' sex (β = .16, $p < .001$) and age (β = -.09, $p = .033$) each uniquely predicted the human-dog bond. Specifically, a stronger human-dog bond was reported by younger people than by older people, and women reported a stronger human-dog bond than men did. Marital status was not a unique predictor of the human-dog bond (β = -.05, $p = .192$) in this model.

As hypothesised, family-loneliness (β = .12, $p = .008$) and romantic-loneliness (β = .11, $p = .011$) positively predicted the human-dog bond. This means that higher levels of these two types of loneliness were associated with a stronger human-dog bond. In contrast, the relationship between social-loneliness and the human-dog bond was not statistically significant (β = -.07, $p = .091$), indicating that contrary to expectation, social-loneliness failed to positively predict the human-dog bond.

Table 5 shows the summary table for the standard multiple regression model in which the dependent variable was PA, and the independent variables were the three types of loneliness, the human-dog bond, and the demographic variables. This regression model provided the coefficient for the direct effect (path *c'*) for each of the three types of loneliness on PA, when the other independent variables were held constant. It also provided the coefficient for the path between the human-dog bond and PA (path *b*).

Table 5

Regression Model Predicting Positive Affect

Independent variable	path	β	b	[95% PCI]	*BootSE*	*p*
			Dependent variable: PA			
Constant			25.136	[23.062, 27.144]	1.020	< .001
Social-loneliness	c'_{SL}	-.32	-0.195	[-0.245, -0.143]	0.026	< .001
Family-loneliness	c'_{FL}	-.25	-0.147	[-0.200, -0.096]	0.026	< .001
Romantic-loneliness	c'_{RL}	-.13	-0.054	[-0.086, -0.022]	0.016	.001
Age	c'_{Age}	.02	0.006	[-0.017, 0.026]	0.011	.599
Sex	c'_{Sex}	.02	0.170	[-0.450, 0.806]	0.319	.602
Marital status	$c'_{Marital}$	.05	0.337	[-0.173, 0.836]	0.252	.156
HDB	b_{HDB}	.08	0.042	[0.007, 0.078]	0.019	.015
		$R^2 = .296$				
		$F(7, 631) = 37.816, p < .001$				

Note. SL, FL, and RL = social-loneliness, family-loneliness and romantic-loneliness respectively. HDB = human-dog bond. Standard errors and 95% Percentile CIs based on 2,000 bootstrap samples.

As shown in Table 5, this regression model had an R^2 value of .296, $F(7, 631) =$ 37.816, $p < .001$. This indicates that the three types of loneliness, the demographic variables and the human-dog bond together accounted for 29.6% of the variance in PA. The β-values and p-values indicate that none of the demographic variables uniquely predicted PA. As expected, social-loneliness (β = -.32, $p < .001$), family-loneliness (β = -.25, $p < .001$) and romantic-loneliness (β = -.13, $p = .001$) each negatively predicted PA, with higher levels of each type of loneliness associated with lower levels of PA. Also as expected, the human-dog bond was a unique positive predictor of PA (β = .08, $p = .015$) such that a stronger human-dog bond was associated with a higher level of PA. Therefore, to summarise, the hypothesis that each type of loneliness would negatively predict PA was supported. The hypothesis that the human-dog bond would positively predict PA was also supported.

Table 6 shows the summary table for the standard multiple regression model in which the dependent variable was NA, and the independent variables were the three types of loneliness, the human-dog bond and the demographic variables. This regression model provided the coefficient for the direct effect of each type of loneliness on NA (path c'), when the other independent variables were held constant. It also provided the coefficient for the path between the human-dog bond and NA (path b).

As shown in Table 6, this regression model had an R^2 value of .199, $F(7, 631) =$ 22.44, $p < .001$. This indicates that, altogether, the demographic variables, the three types of loneliness and the human-dog bond accounted for 19.9% of the variance in NA. The β-values and p-values indicate that social-loneliness (β = .26, $p < .001$) and family-loneliness (β = .24, $p < .001$) were the only unique predictors of NA in this model. As hypothesised, these two types of loneliness positively predicted NA such that a higher level of each was associated with a higher level of NA. However, contrary to expectation, neither romantic-loneliness (β = .04, $p = .284$), the human-dog bond (β = .01, $p = .779$), nor any of the demographic variables were significant predictors of NA in this model.

Table 6

Regression Model Predicting Negative Affect

Independent variable	path	β	b	[95% PCI]	*BootSE*	p
				Dependent variable: NA		
Constant			10.458	[8.316, 12.547]	1.08	< .001
Social-loneliness	c'_{SL}	.26	0.159	[0.101, 0.213]	0.029	< .001
Family-loneliness	c'_{FL}	.24	0.141	[0.082, 0.203]	0.031	< .001
Romantic-loneliness	c'_{RL}	.04	0.018	[-0.015, 0.050]	0.016	.284
Age	c'_{Age}	-.07	-0.020	[-0.042, 0.001]	0.011	.074
Sex	c'_{Sex}	.06	0.596	[-0.141, 1.316]	0.376	.092
Marital status	$c'_{Marital}$	-.02	-0.115	[-0.594, 0.362]	0.244	.654
HDB	b_{HDB}	.01	0.005	[-0.032, 0.043]	0.019	.779

$$R^2 = .199$$
$$F(7, 631) = 22.44, p < .001$$

Note. SL, FL, and RL = social-loneliness, family-loneliness and romantic-loneliness respectively. HDB = human-dog bond. Standard errors and 95% Percentile CIs based on 2,000 bootstrap samples.

When using PROCESS, a mediating effect is deemed to exist if the bootstrapped CI for the indirect effect does not include zero (Hayes, 2018). Table 7 shows the indirect effect via the human-dog bond, for the relationship between each type of loneliness and each of the two types of affect. These indirect effects were computed while the alternative types of loneliness and the demographic variables were held constant. As shown in Table 7, the CI for the indirect effect of family-loneliness on PA via the human-dog bond was positive and did not include zero (0.0006, 0.0135). This indicates that the human-dog bond mediated the relationship human-dog bond between family-loneliness and PA. Similarly, the CI for the indirect effect of romantic-loneliness on PA is positive and does not include zero (0.0002, 0.0090). This indicates that the human-dog bond also mediated the relationship between romantic-loneliness and PA. The CI for each of the remaining indirect effects included zero. This indicates that the human-dog bond failed to mediate the relationship between social-loneliness and PA. It also failed to mediate the relationship between any of the types of loneliness and NA.

Table 7
Indirect Effect of Loneliness on Affect via the Human-Dog Bond

| | Dependent Variable | | | | | |
| | PA | | | NA | | |
Independent Variable	Effect	*BootSE*	[95% PCI]	Effect	*BootSE*	[95% PCI]
Social-loneliness	-0.004	0.003	[-0.0103, 0.0009]	-0.001	0.002	[-0.0052, 0.0035]
Family-loneliness	0.006	0.003	[0.0006, 0.0135]	0.001	0.003	[-0.0048, 0.0070]
Romantic-loneliness	0.004	0.002	[0.0002, 0.0090]	0.001	0.002	[-0.0030, 0.0043]

Note. PA = positive affect, NA = negative affect. Standard error and 95% Percentile CIs based on 2,000 bootstrap samples. Indirect effects were computed while the alternate types of loneliness and participants' age, sex and marital status were held constant.

The index of mediation for the indirect effect of family-loneliness on PA via the human-dog bond was 0.010 [0.0009, 0.0232]. Based on Kenny's (2014) recommended interpretation of effect sizes, this is a small effect. Similarly, the index of mediation for the indirect effect of romantic-loneliness on PA via the human-dog bond was 0.009 [0.0004, 0.0218]. This is also a small effect.

Figures 1 and 2 show the ordinary-least-squares path analyses undertaken in this study. For clarity, only paths for which the coefficients were statistically significant are included.
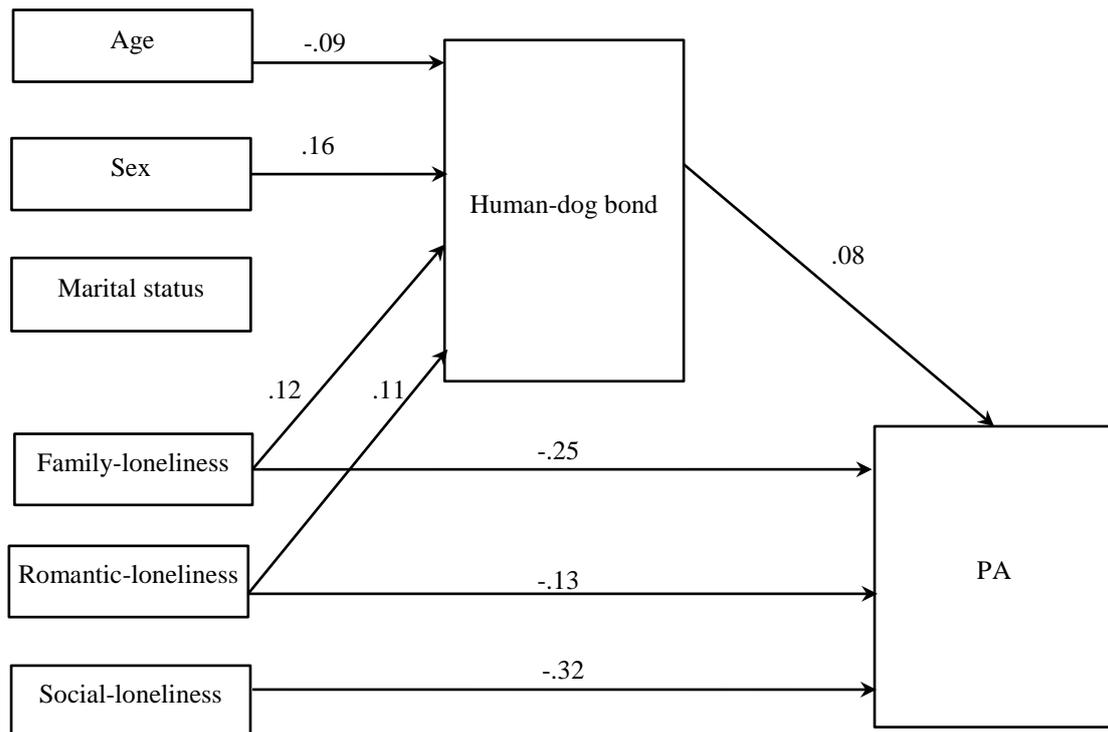
Figure 1. Model testing the human-dog bond as a mediator between each of social-, family- and romantic-loneliness, and positive affect (PA). Standardized coefficients shown for significant relations.
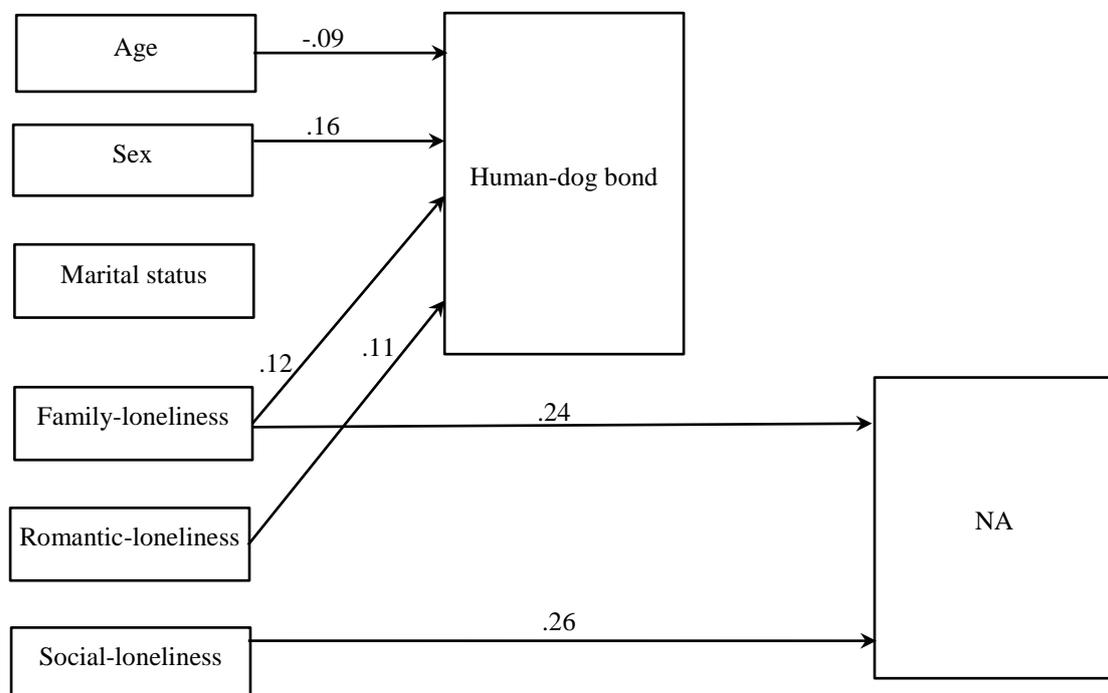

Figure 2. Model testing the human-dog bond as a mediator between each of social-, family- and romantic-loneliness, and negative affect (NA). Standardized coefficients shown for significant relations.

Discussion

The aim of this study was to investigate whether loneliness positively predicts the strength of the human-dog bond and whether the human-dog bond mitigates the deleterious effects of loneliness on emotional well-being. Emotional well-being was conceptualised as PA and NA, and three forms of loneliness, social, family and romantic loneliness, were examined. In the following paragraphs, the substantive findings of the study will be outlined, and the implications of these findings considered. This analysis will be accompanied by an examination of demographic factors in relation to the key psychological constructs of the study.

In this study, younger people tended to report a stronger human-dog bond than older people. This is consistent with previous research (e.g. Reid & Anderson, 2009), and challenges the common assumption that older adults form particularly strong bonds with pets (e.g. Suthers-McCabe, 2001). Also consistent with previous research (e.g. Archer & Ireland, 2011; Dotson & Hyatt, 2008; Reid & Anderson, 2009), women reported a stronger human-dog bond than men. However, in contrast to previous findings (e.g. Dotson & Hyatt, 2008; Reid & Anderson, 2009), marital status was not shown to predict the human-dog bond in this study. This could be due to the small group size in some of the marital status categories, as less than 6% of participants were divorced and only 2% were widowed.

None of the demographic variables uniquely contributed to the variance in either PA or NA in the respective regression models. This is discordant with the findings of previous researchers (e.g. Ben-Zur, 2012; Bromet et al., 2011; Diener & Ryan, 2009; Peacock et al., 2012). The current findings may be due to uneven group sizes and sampling biases. As already noted, most participants were married. Furthermore, most (80.8%) were women. The finding that age failed to predict either PA or NA may reflect a sampling bias, given an online questionnaire was used and the older adults who accessed the study via Facebook, for example, may not be representative of the broader population in this age demographic.

Social-, Family-, and Romantic-Loneliness as Predictors of PA and NA

It was hypothesised that higher social-, family- and romantic-loneliness would predict lower PA and higher NA. In support of this, and consistent with previous research (e.g. Hombrados-Mendieta et al., 2013), it was found that the bivariate correlations between each type of loneliness and PA were negative and statistically significant. Each type of loneliness also uniquely contributed to the variance in PA in the regression model, with social-loneliness the strongest predictor. Given that social-loneliness reflects a lack of companionate bonds (Weiss, 1973), and family- and romantic-loneliness reflect a lack of attachment bonds (DiTommaso & Spinner, 1993), this finding is consistent with Rook's (1987) argument that companionship is a stronger predictor of positive emotions than attachment.

Also consistent with the hypothesis, it was found that the bivariate correlations between each type of loneliness and NA were positive and statistically significant. This is consistent with the findings of Hombrados-Mendieta et al. (2013). However, whereas Hombrados-Mendieta et al. reported medium effect sizes for the relationships between each type of loneliness and NA, in the current study these effect sizes were small.

In the current study, social- and family-loneliness, but not romantic-loneliness uniquely contributed to the variance in NA in the regression model. This suggests that the observed bivariate correlation between romantic-loneliness and NA may have been confounded by one or more of the other independent variables included in the regression model. Given that previous researchers have shown that emotional-loneliness is a stronger predictor of negative emotions than social-loneliness is (e.g. Peerenboom et al., 2015), the

current finding is unexpected and may be due to the generally low levels of romantic-loneliness reported by participants.

The Human-Dog Bond as a Predictor of PA and NA

It was hypothesised that a stronger human-dog bond would predict higher PA and lower NA. The bivariate correlations between the human-dog bond and each of PA and NA were not statistically significant, however the human-dog bond uniquely contributed to the total variance in PA in the regression model and consistent with the hypothesis, this relationship was positive. In contrast, the human-dog bond did not significantly contribute to the total variance in NA in the regression model.

The finding that the human-dog bond was a unique positive predictor of PA is consistent with that of McConnell et al. (2011), who reported that social-needs fulfilment by a pet dog positively predicts subjective happiness. As previously discussed, in much of the research pertaining to pets and well-being, emotional well-being is conceptualised in terms of aversive mood states such as depression (e.g. Krause-Parello, 2012; Peacock et al., 2012). However, as explained by Diener et al. (2010), emotional well-being involves more than the absence of psychological distress. Moreover, McNicholas et al. (2005) suggested that pets may improve emotional well-being by enhancing positive emotions, rather than by reducing negative ones. Although the effect size for the observed relationship between the human-dog bond and PA was small, the findings are consistent with this possibility. Furthermore, given that companionship is the most commonly cited reason for dog ownership (Meyer & Forkman, 2014), and companionate-type relationships are thought to enhance positive emotions rather than reduce negative ones (Rook, 1987), this interpretation is plausible.

The finding that the human-dog bond was not a significant predictor of NA in this study is discordant with that of McConnell et al. (2011), who reported that social-needs fulfilment by a pet dog was associated with lower levels of depression. The large sample size in the current study means the non-significant finding is unlikely to be due to insufficient statistical power. It may, however, be due to most participants having reported low levels of NA. A relationship may exist between the HDB and NA which is only evident in specific populations with relatively high levels of NA, such as in a clinical sample of people with depression.

Social-, Family-, and Romantic-Loneliness as Predictors of the Human-Dog Bond

It was hypothesised that social-, family- and romantic-loneliness would each uniquely and positively predict the strength of the human-dog bond. This hypothesis was only supported with respect to family- and romantic-loneliness. The bivariate correlation between each of these types of loneliness and the human-dog bond was significant. Family- and romantic-loneliness also each uniquely contributed to the variance in the human-dog bond in the regression model where, as expected, higher levels of each of these types of loneliness predicted a stronger human-dog bond. In contrast, the bivariate correlation between social-loneliness and the human-dog bond was not significant. Nor did social-loneliness uniquely contribute to the variance in the human-dog bond in the regression model.

The current findings suggest that associations between loneliness and the strength of owner-pet relationships can be best understood using a tri-dimensional model of loneliness (DiTommaso & Spinner, 1993). Epley et al. (2008) posed the question of whether loneliness drives people to seek social connectedness with pets, and although the cross-sectional design of the current study means that causal inferences can only be

speculative, the findings suggest that family- and romantic-loneliness, but not social-loneliness, may prompt people to form a stronger relationship with their pet dog.

Family- and romantic-loneliness together constitute Weiss' (1973) broader construct of emotional-loneliness, which is due to a perceived lack of attachment bonds. This is in contrast to social-loneliness, which Weiss defined as being due to a perceived lack of companionate bonds. Considered within this theoretical framework, the finding that family- and romantic-loneliness, but not social-loneliness, positively predicted the human-dog bond, suggests that in this sample of pet-dog owners, a perceived lack of attachment bonds was associated with a stronger human-dog bond, whereas a perceived lack of companionate bonds was inconsequential to it. It is only in the past decade that researchers have begun to conceptualise the owner-pet relationship as an attachment bond in the specific way that this term is used within the framework of Bowlby's (1969) attachment theory. The finding that a perceived lack of attachment bonds and a perceived lack of companionate bonds differentially predict the strength of the human-dog bond is a critical new finding in the field of human-animal studies.

The finding that family- and romantic-loneliness positively predicted the human-dog bond has practical implications for mental healthcare professionals. For example, the findings suggest that mental health professionals should be cognizant of the role a dog may play in a person's support network. Owners with a strong human-dog bond are likely to feel distress over the loss of a dog through death or other means, and this distress may be magnified if the person also lacks close intra-species relationships. Such people may seek support from psychologists or other mental healthcare professionals, who need to be sensitive to the possibility that the animal might have been an important relational figure and source of support for the client. This means that comments such as that the animal was "just a dog", or that the person should simply "get another one", are likely to cause distress and serve to delegitimatize a critical social relationship.

Similarly, healthcare professionals should be sensitive to the potential distress individuals may experience when separated from a pet dog, such as when an owner is hospitalized. People lacking close intra-species relationships may be particularly prone to distress in such circumstances because as well as having a strong bond with the dog, they may not have anyone to care for it in their absence. In an Australian context, small organisations such as Care for Pets and Paws for Purrfect Patient Therapy provide care for animals when owners are hospitalized, however, these organisations are currently in their infancy. Expanding such services and increasing awareness of them among social workers and healthcare professionals, particularly in acute care settings, may help to address the concerns of people unable to care for their dog or other pet for a period of time.

The Human-Dog Bond as a Mediator Between Loneliness and Emotional Well-Being

It was hypothesised that the human-dog bond would mediate the relationship between each type of loneliness and PA and NA, respectively. The indirect effect of family-loneliness on PA via the human-dog bond was statistically significant, as was the indirect effect of romantic-loneliness on PA via the human-dog bond. This indicates that, as hypothesised, the human-dog bond mediated the relationship between family-loneliness and PA, and the relationship between romantic-loneliness and PA. However, contrary to expectations, the human-dog bond did not mediate the relationship between social-loneliness and PA, nor did it mediate the relationship between any of the types of loneliness and NA.

As anticipated, the two detected mediating effects were of the suppressor type, meaning the direct effect acted in the opposite direction to the indirect effect (Stapleton et

al, 2014). Specifically, family-loneliness and romantic-loneliness negatively predicted PA. Conversely, family-loneliness and romantic-loneliness positively predicted the human-dog bond, which in turn positively predicted PA. These suppressor-type mediating effects indicate that for this sample, the human-dog bond mitigated the deleterious effects of family- and romantic-loneliness on PA.

These findings are a useful addition to the pets and well-being literature. Although several previous researchers have considered whether owner-pet relationships can moderate the effects of loneliness on emotional well-being (e.g. Duvall-Antonacopoulos and Pychyl, 2010; McConnell et al., 2011; Peacock et al., 2012), to our knowledge, Krause-Parello (2012) is the only researcher to investigate a possible mediating effect. In her study, Krause-Parello conceptualised loneliness as a uni-dimensional construct and used depressive symptomatology as her only outcome variable. Furthermore, the owner-pet relationship was measured using a non-species-specific scale, and the sample included both cat and dog owners, a practice that other researchers (e.g. Dwyer et al., 2006; Kurdek, 2008) have cautioned against. The current study extends the work of Krause-Parello by utilizing a tri-dimensional conceptualisation of loneliness, using a species-specific scale to measure the human-dog bond, and including both PA and NA as outcome variables.

The current findings also address the question posed by Epley et al. (2008), concerning whether pets can reduce the adverse effects of loneliness on emotional well-being if lonely people are driven to seek social connection with them. The current findings suggest that the answer to this question may depend on the type of loneliness under investigation.

Further to this, within the framework of Bowlby's (1969) attachment theory, it is noteworthy that the two types of emotional-loneliness (i.e. family- and romantic-loneliness), but not social-loneliness, positively predicted the strength of the human-dog bond. The additional finding that the human-dog bond appeared to mitigate the deleterious effects of both types of emotional-loneliness on PA, suggests that pet dogs may be effective in fulfilling the role of an attachment figure when intra-species attachment-type relationships are inadequate. Although the mitigating effects of the human-dog bond were small, it is possible that such effects may be magnified in populations prone to emotional-loneliness, such as the recently bereaved (Stroebe, Stroebe, & Abakoumkin, 2005), those with autism (Gantman, Kapp, Orenski, & Laugeson, 2012), and those who struggle to form healthy intra-species attachment bonds due to an insecure attachment style (Mikulincer & Shaver, 2016).

Limitations

The correlational cross-sectional design of this study means that although mediation models are mathematically causal models (Hayes, 2018), causal relationships between variables cannot be established. Furthermore, although the large sample size was a notable strength of the study, some statistically significant findings may reflect a Type I error, which is important to note given some of the statistically significant, but weak correlational findings identified.

Given that a survey-based, self-report methodology was used, the integrity of the data may have been compromised by participants responding carelessly or in a socially desirable manner. Although the anonymity of the data collection process may have reduced social desirability bias, given the stigma associated with loneliness some participants may still have under-reported their experiences of it. Furthermore, because participants were made aware of the purpose of the study, some may have responded in the way they thought the researcher wanted them to, rather than in a way that reflected their genuine experiences.

To avoid over-sampling people with a particularly strong human-dog bond, participants were not recruited from places likely to attract avid dog lovers such as dog parks or online dog-related forums. However, because the study was promoted as a study about human-dog relationships, people who particularly value their dog may have been more inclined to participate than those who merely tolerate a dog in their household. Consequently, although a ceiling effect was not identified for the human-dog bond scale, the sample still may not be broadly reflective of Australian dog-owners. Moreover, most of the participants were female and married, which means the findings may not be generalizable to men, or to those who are single, divorced, or widowed. Furthermore, because cultural factors can influence the way dogs are perceived and valued (Knight & Herzog, 2009), the findings from this study may not be generalizable to non-Western societies.

Future Directions

To our knowledge, this was the first study in the pets and well-being literature wherein loneliness has been conceptualised as a tri-dimensional construct. A useful next step would be to investigate whether individual differences in variables such as owners' personality traits or attachment style influence the findings. For example, given that it was specifically a perceived lack of attachment bonds, as opposed to a lack of companionate bonds, that predicted a stronger human-dog bond, it would be instructive to investigate whether these relationships are more pronounced among people identified as having an insecure attachment style and who therefore struggle to form healthy intra-species attachments.

Most participants in the current study indicated that they regard their dog as a companion. However, a small proportion reported that their dog was their soulmate. A potentially fruitful avenue for future research may be to undertake qualitative studies involving participants who describe their dog in this way. This may provide valuable insights into how, and for whom, pet dogs can serve as attachment figures. For example, while the findings of the current study indicate that people who perceive a deficit in their romantic- and familial relationships tend to report a strong human-dog bond, it may be that some people actively choose to form attachment-type relationships in inter-species rather than intra-species relationships due to a personal preference for the former. Alternatively, others may experience strong attachment bonds across both their intra-species and inter-species relationships, and this warrants further consideration. Furthermore, while this study focused on dogs as attachment figures and companions, future researchers may want to consider other potential roles that dogs play in their owners' lives, such as that of being the object of a caregiving bond. Such a role may be particularly important for people who self-identify as "pet parents."

Conclusion

The aim of this study was to investigate whether loneliness positively predicts the strength of the human-dog bond and whether the human-dog bond mitigates the deleterious effects of loneliness on emotional well-being. It was found that family-loneliness and romantic-loneliness positively predicted the strength of the human-dog bond in this sample of Australian pet-dog owners. In contrast, no relationship was detected between social-loneliness and the human-dog bond. Two suppressor-type mediating effects were detected, which indicate that the human-dog bond mitigated the deleterious effects of family- and romantic-loneliness on PA.

These findings show that greater insight into the relationship between loneliness and the human-dog bond is achieved when social-, family-, and romantic-loneliness are

conceptualised as distinct constructs as per DiTommaso and Spinner's (1993) extended version of Weiss' (1973) model of loneliness. They also highlight the importance of considering both positive and negative aspects of emotional well-being when examining the human-dog bond.

People in contemporary Western societies such as Australia face a dilemma. Humans have evolved to be fundamentally social beings, yet aspects of modern society make developing and maintaining close human relationships difficult. The findings of this study indicate that people who perceive their familial-, and romantic-relationships to be inadequate form stronger relationships with pet dogs. Furthermore, these human-dog relationships appear to have the potential to mitigate the deleterious effects of family- and romantic-loneliness on at least some aspects of emotional well-being. Such findings do not imply, however, or serve to reinforce a hierarchical model of social relationships whereby inter-species relationships may be erroneously regarded as secondary or inferior to intra-species relationships. The identified relationships in this study between loneliness, emotional well-being and the HDB represent a valuable step towards greater understanding of the role that pet dogs play in the lives of those who choose to own them.

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