

People and Companion Animals: It Takes Two to Tango

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Animals have accompanied humans for thousands of years, with a strong bond forged between humans and other species. Our relationships with animals can take different forms. On one hand, animals can serve instrumental purposes: We currently use animals for clothing, for testing a range of human products, for gaining basic insights into human biology and behavior, and as food. On the other hand, human–animal relations are social. The clearest example is the practice of pet keeping, with people attributing a special status to their companion animals. We review the current state of research on human–animal relations by focusing particularly on companion animals and on the psychological mechanisms involved in this special relationship. Our aim is to highlight key findings from human–animal relations research that also have implications for different scientific disciplines.

Keywords: companion animals, human–animal relations, human health

Our relations with animals clearly have consequences for both animals and for humans (Beck 2014, Amiot and Bastian 2015). These consequences range from the physical to the psychological. For instance, research has demonstrated that human relationships with animals are good for human health, because they can reduce stress and medical complaints while also increasing self-confidence (Herzog 2011). However, research suggests that human–animal interactions are no panacea, with a number of detrimental outcomes also identified, such as through the spread of disease.

The goal of this article is to first highlight that our relationships with animals—particularly companion animals—are a central element of human life. To this end, we first discuss how human–animal relations have been prevalent over the course of human history and how they are rooted in our shared evolution. Next, we provide an overview of research into the beneficial aspects of human–animal interactions. We then bring nuances to these conclusions by presenting empirical evidence that identifies some of the boundary conditions for these effects and reveals how our relations with animals can also be detrimental (zoonoses, meat eating), both for humans and/or for animals. Our aim is to highlight human–animal relations as a field of research that merits continued theoretical and empirical attention from a diversity of scientific disciplines, providing a basis for new research directions.

Human–animal relations from a historical and evolutionary perspective

For more than 99% of human history, people have lived in hunter–gatherer bands totally and intimately involved with

other living organisms (Wilson 1993), suggesting that the evolution of human responses to animals were shaped by these interactions. Through paintings in caves and other art forms, such as epitaphs on animals' tombs, we know that animals played significant roles in the lives of our ancestors. From historical evidence, we also know that many examples of “relationships” between people and animals are emotional in nature (Serpell and Paul 1994). *Companion animals*, or pets—formally defined as animals we live with and that have no obvious function—represent one category of animals that have been assigned a special status by humans. Whereas the value we attribute to most animals stands on economic and practical considerations, the importance ascribed to companion animals comes from the benefits of the relationship we have with them (Serpell and Paul 1994). Indeed, approximately 90% of pet owners consider their companion animals as fully fledged family members (Cohen 2002, Carlisle-Frank and Frank 2006). This relationship is longstanding and enduring: Recent genetic analyses suggest that the co-evolution of dogs and humans started as long as 32,000 years ago (Wong 2013). Dogs and their owners are therefore an excellent example of the co-evolution that took place between humans and animals.

The ability for humans to communicate and coordinate with dogs became increasingly possible because of this co-evolution and domestication process. Indeed, dogs have a unique ability to adjust their behavior in response to nonverbal cues from humans (Kubinyi et al. 2003, Hare and Tomasello 2005), a sensitivity that is also evident at the biological level. Recent research shows that gazing

behavior from dogs (but not wolves) increased oxytocin concentrations in owners. Dogs given exogenous oxytocin looked at their owners more, and owner oxytocin increased following these interactions. This suggests the existence of an interspecies oxytocin-mediated positive feedback loop (Nagasawa et al. 2015, but see Wynne 2015). Pet owners have also been found to attribute both basic (anger, joy, fear, disgust, sadness) and complex emotions (shame, jealousy, disappointment, compassion) to their companion animals (see figure 1)—particularly to dogs compared with cats (Martens et al. 2016). This increased attribution of complex emotions to dogs may be explained by the high level of mutual understanding and shared emotions that are suggested to exist between humans and dogs.

Our history with cats is still unclear. Most authorities on the subject believed that cats were first domesticated in ancient Egypt (between 3000 BCE and 30 BCE), but a recent study suggests that cats were domesticated at the same time as the cultivation of wheat and barley in the Near East, about 10,000 years ago (Driscoll et al. 2007). Today, cats, dogs, and a number of other species we consider companion animals (rabbits and other rodents, reptiles, horses, fish, birds) continue to play an important role in society. Two out of three Americans live with animals, spending more than \$55 billion annually on their welfare (APPA 2013). In Australia, 63% of households own companion animals (AHA 2013), whereas in Canada, 57% of people live with companion animals (Perrin 2009).

These historical accounts indicate that over time, humans became part of a co-evolutionary system in which we evolved with other animals that are not part of the same ecological niche. Moreover, we have forged particular bonds with some of those animals such that they became domesticated. Where does this attraction toward animals, or at least interest in them, come from? One of the most often cited theories as to why humans are interested in animals is the biophilia hypothesis (Wilson 1993). *Biophilia* refers to the tendency of humans to focus on life and lifelike processes. It involves the emotional affiliation that humans have toward other life forms, including animals. Revised theoretical accounts of the biophilia hypothesis state that biophilia is not a single instinct but rather a complex of learning rules that trigger a variety of emotional reactions to animals, which are themselves shaped by culture (Wilson 1993). Importantly, the feelings molded by these learning rules fall along several emotional spectra: from attraction to aversion, from awe to indifference, and from peacefulness to fear-driven anxiety. In this sense, biophilia refers to a selective attentiveness to other forms of life, which is neither inherently positive nor negative. In line with the biophilia hypothesis, the human mind appears to be wired to think about animals differently from how they think about inanimate objects, suggesting that part of the brain evolved to specialize in processing information about animals (see also New et al. 2007).

Empirical evidence confirms this proposition and provides support for the biophilia hypothesis (Kahn 1997,

DeLoache and Pickard 2010). In a series of experiments, children were more attentive to animals than they were to inanimate objects. In free-play sessions, children aged 1–3 interacted more with live animals than with interesting toys. Furthermore, they behaved toward the animals differently from how they reacted to the toys, talking about the animals more than the toys and asking more questions about them (LoBue et al. 2013).

In line with Lorenz's (1942) "cute response," humans are innately drawn to animals—especially young ones—possibly because these animals share perceptual features with human infants, such as big eyes, large foreheads, and soft contours. This tendency to prefer juvenile features in an adult animal (as in an adult human) is referred to as *neoteny*. It has been argued that the human tendency to care and feel empathy for animals may have been a trait that was selected for, because it could reflect a more general capacity to care for human infants. Concern for animal welfare may have also given certain groups of humans an evolutionary advantage because it allowed for the efficient domestication of animals and herding (Bradshaw and Paul 2010). In support of this contention, faces with infant features—including baby animal faces—are rated by adult participants as more attractive than those without such features (Archer and Monton 2011).

The co-evolution of humans and animals has been observed across cultures and contexts, suggesting that this is a built-in, universal human drive. People from a diversity of cultures and social classes (Messent and Horsfield 1985) own and are in contact with animals. However, it is the specifics of our relationships with animals that vary across cultures. Whereas in the United States, Western Europe, and Western-oriented countries, companion animals act as "family members," in many non-Western countries, the welfare of those same animals is of little concern. Culture can determine whether an animal is considered a companion or food (Gray and Young 2011). For example, dogs are kept as companions in the United States but are eaten in South Korea (Podberscek 2009), and stag beetles are kept as companions in Japan but not in the United States. Although cultural differences in attitudes toward animals exist (Kellert 1993), even within the same culture, pet preferences—such as preference for dog breeds—have been found to change over time, often in a highly random manner (Herzog et al. 2004).

Companion animals and human health and well-being

Humans have developed an interdependent relationship with many animal species—and dogs in particular (Hare and Tomasello 2005). More recently, research has begun to reveal whether this human–animal bond may have well-being consequences. The general assumption has been that people benefit from the presence of animals and in particular companion animals. However, emerging evidence suggests that the association between the presence of animals and human health is varied and complex (for reviews, see Friedmann and Son 2009, Wells 2009, Herzog 2011, Amiot and Bastian 2015). Both significant and nonsignificant research findings

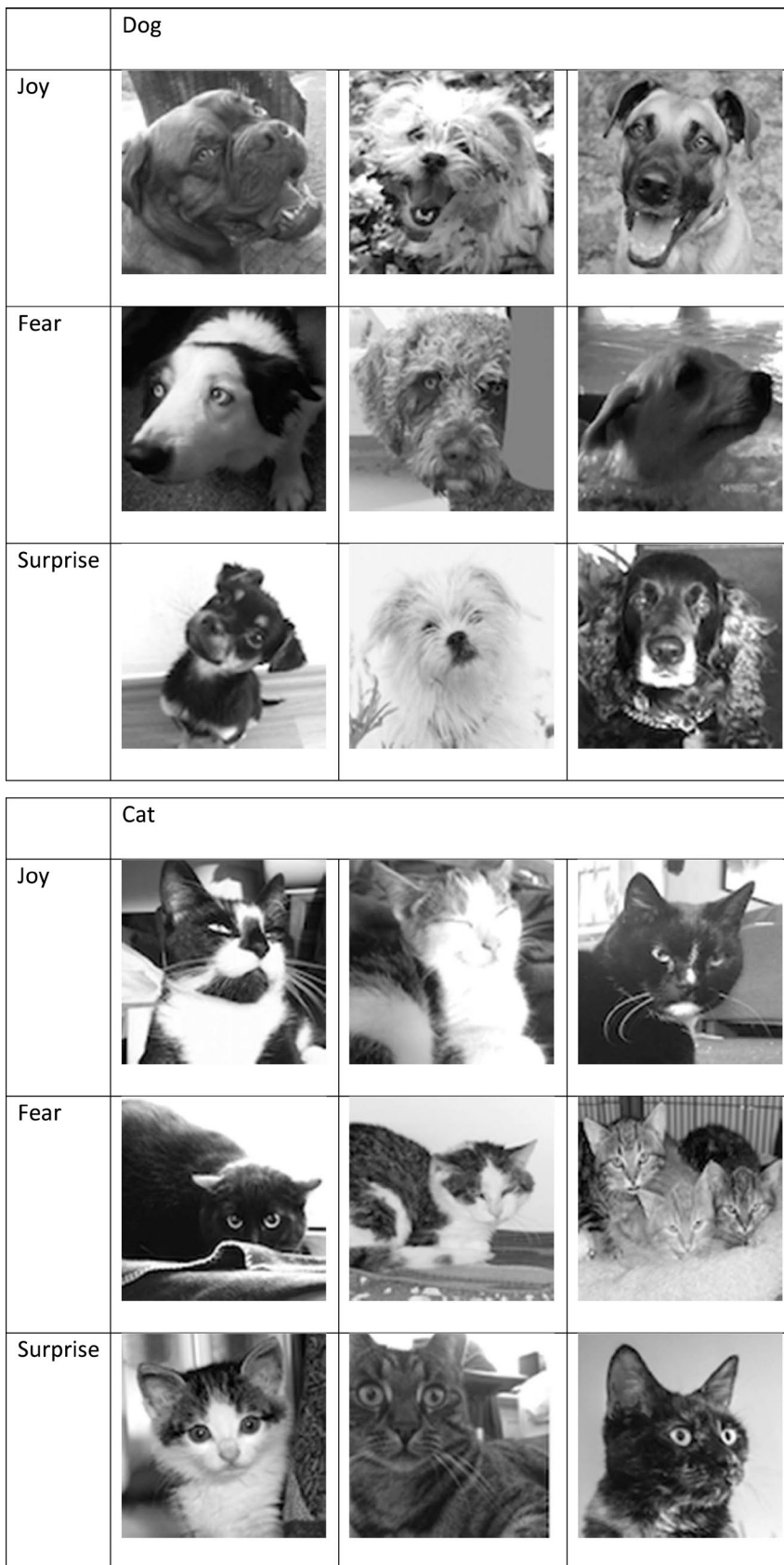


Figure 1. Pet owners have also been found to attribute both basic emotions (anger, joy, fear, disgust, sadness) and complex emotions (shame, jealousy, disappointment, compassion) to their companion animals.

need to be considered and reviewed in order to paint a full picture of human-animal relations and understand when and for whom these relations are beneficial or not (Herzog 2011). To reflect the state of these findings, we first review empirical evidence that confirms the beneficial role that companion animals play in people's lives. Next, we review evidence highlighting the detrimental and null effects of human-animal relations. We end by identifying the potential moderating factors that could explain who is likely to benefit most from the presence of animals.

Beneficial physical outcomes

One of the best-known studies showing the effect of animal presence on human health is a longitudinal study by Friedmann and colleagues (1980). This seminal work, focusing on 92 heart-attack victims, revealed that 28% of pet owners survived for at least a year, compared with 6% of non-pet owners. This study generated great interest in the benefits of animals to human health and inspired a series of replications and extensions (e.g., Friedmann et al. 2007). One of the few experimental studies showing the association between the presence of companion animals and human health randomly assigned hypertensive stock-brokers to either a pet-ownership or a no-pet-ownership condition (Allen et al. 2001). After 6 months of owning an animal or not, measures of blood pressure during a stressful task revealed smaller increases in blood pressure in the pet-ownership compared with the non-pet-ownership group.

One pathway through which the presence of companion animals may alleviate stress is via neurochemical responses that increase the capacity to cope with stress. Research has shown increases in oxytocin, dopamine, and endorphins in both humans and dogs when they interacted positively with one another, such as when gently stroking or scratching the dog. In comparison, the activation of these neurochemicals was more modest when reading a book (Odendaal and Meintjes 2003, see also Kis et al. 2014). A brain-imaging experiment also revealed that pet owners displayed a

lower stress response when they were in the presence of their own companion animal than when their animal was absent (Sugawara et al. 2012), and elderly people exposed to fish in tanks reported lower physiological stress compared with those who were not (DeSchrive and Riddick 1990). Epidemiological and longitudinal studies have also uncovered positive associations between the presence of companion animals and human physical well-being, revealing that people living with companion animals had fewer physician visits than similar patients without companion animals (e.g., Headey et al. 2002).

Beyond reducing the likelihood of illness, dogs may even have the capacity to detect the emergence of illness. Dogs have been trained to detect cancer among humans beyond chance levels (McCulloch et al. 2006), to alert their owners of upcoming epileptic seizures (Brown and Goldstein 2011), and to respond to their owners' hypoglycemic states (Rooney et al. 2013). Apart from companion animals *per se*, animal care farms can also play a role in "green care" for those with dementia, psychiatric problems, and physical disabilities (De Bruin et al. 2012).

Beneficial psychological outcomes. Just thinking about one's animal may confer psychological benefits. Indeed, experimental evidence revealed that when a companion animal is either physically or cognitively present (i.e., recalled to memory), pet owners expressed higher aspirations and report greater feelings of self-efficacy in attaining personal goals (Zilcha-Mano et al. 2012). Other work has shown that writing about how one's companion animal fulfilled social needs in the context of social rejection had the same psychological benefits compared to thinking about one's best friend, suggesting that companion animals provide a direct source of social support (McConnell et al. 2011).

Epidemiological and longitudinal studies have both uncovered positive associations between the presence of companion animals and human psychological well-being. For example, in a 10-month prospective study, new pet owners reported a significant reduction in minor health problems during the first month following the acquisition of their companion animal (Serpell 1991). This effect persisted among dog owners at a 10-month follow-up, and dog owners also reported improved self-esteem over this time period. Companion animals have also been found to play a soothing and calming role in the well-being of those who suffer from dementia and the families who care for them (Baun and McCabe 2003).

Beneficial psychosocial outcomes. Companion animals can also serve as a springboard toward more positive relations with fellow humans. Children with companion animals often develop improved empathy, self-esteem, and social participation (Melson 2001). Furthermore, companion animals can be involved in the treatment of conduct disorder in children (Levinson 1969). In support for these contentions, a longitudinal study conducted among children aged 8 to

12 who had just acquired a new dog showed that compared with a matching group of non-dog owners, children with the new dog were visited more often by their friends, and their families engaged in more leisure activities together at the 1-month follow-up (Serpell 1991). Exposure to affectionate relationships with companion animals during childhood also predisposes people—at least retrospectively—to develop more positive affect not only toward animals later in their lives but even to report greater empathy and positive attitudes toward humans (e.g., Miura et al. 2002).

To account for these intriguing beneficial effects, commentators have proposed that animals can facilitate human-human relations by acting as "social lubricants" who help to catalyze social relationships more broadly (Collis and McNicholas 1998). Even our perception of another individual changes depending on whether or not an animal accompanies them. For example, therapists accompanied by a dog are evaluated more positively than those without a dog (Schneider and Harley 2006). These perceptions in turn affect human-human behaviors. In experiments that systematically compare human-human interaction when a dog is present versus absent, being accompanied by a dog was associated with increased frequency of social interactions among humans (McNicholas and Collis 2000). When accompanied by a dog, people were also more likely to receive help from others, such as a money donation, and others were more likely to trust them, more often providing their phone number to those accompanied by a dog (Guéguen and Ciccotti 2008).

Although dogs, who are highly social animals, were used in many of these studies, even rabbits and turtles encouraged approaches by other people and stimulated conversations between children and unfamiliar adults in a community park setting (Hunt et al. 1992). Whereas service and assistance animals can forge deep relationships with their owners, their presence can also lead to increased interactions among humans *per se* (Bernstein et al. 2000). Parents of autistic children (Burrows et al. 2008) also reported that service dogs promoted positive social interactions, also improving these families' social recognition and status and contributing to others' awareness of autism.

Therapeutic interventions. Some types of contact with animals are more structured than others and aim specifically to be therapeutic. This includes animal-assisted therapy (AAT), which is defined as an intervention with specific goals and objectives that is delivered by health professionals with specialized expertise in using an animal as an integral part of treatment (Fine 2006). In AAT, animals are seen as playing the role of secure attachment figures who may then serve to facilitate more permanent and positive (human) relationships (Zilcha-Mano et al. 2011).

To summarize and integrate the quantitative research findings on the effectiveness of AAT, Nimer and Lundahl (2007) conducted a meta-analysis that included 49 studies with appropriate methodology. Dogs were the most

common animal therapists. AAT had moderate beneficial effects on well-being outcomes such as anxiety and depression, moderate beneficial effects on behavioral and medical outcomes such as blood pressure and heart rate, and also highly beneficial therapeutic effects on autistic-spectrum behaviors (see also O’Haire et al. 2013).

Do animals benefit, too?

Empirical evidence indicates that human–animal relations may not only benefit human health but may benefit animals’ health as well. For instance, the action of stroking an animal has been found to reduce the animal’s heart rate (Lynch and McCarthy 1969). Other work has shown that dogs with owners who consider them as social partners showed lower levels of morning cortisol (Schoberl et al. 2012), suggesting that how dogs are integrated into their owners’ lives more generally is associated with the dogs’ level of stress. Positive human–animal interactions even have effects at the neurotransmitter level (increased levels of phenylacetic acid, catabolite of aphenylethylamine) in both humans and animals, suggesting that both gain benefits from the interaction (Odendaal and Lehmann 2000).

Detrimental or inefficient human–animal relations?

Some studies support a negative association between the presence of companion animals and human health and well-being. Research conducted among 425 heart-attack victims revealed that pet owners (22%) were more likely than non-pet owners (14%) to die or suffer remissions within a year of suffering from their heart attack (Parker et al. 2010). In a longitudinal study conducted among children, those who owned a dog reported an increase in ill-health symptoms by the 12-month follow-up (Paul and Serpell 1996). In another longitudinal study conducted among older adults, Pikhartova and colleagues (2014) found that owning a pet positively predicted subsequent loneliness among women, and that reported loneliness also predicted subsequent pet ownership, suggesting a negative spiral between animal presence and loneliness over time. Large epidemiological studies also revealed that pet owners suffered more from psychological problems than non-pet owners (anxiety, depression, panic attacks; Parslow et al. 2005, Koivusilta and Ojanlatva 2006).

Nonsignificant associations between the presence of animals and human health and well-being have also been observed. For example, new pet owners taking part in a 6-month prospective study did not report reduced loneliness over time relative to non-pet owners (Gilbey et al. 2007), and depression scores between pet and non-pet owners in a 9-year longitudinal study were not significantly different (Simons et al. 2000). When directly comparing relationship satisfaction with animals and with people, satisfaction with friends and social groups predicted psychological well-being (i.e., higher self-esteem and life satisfaction; lower loneliness, sense of isolation, and depression). However, satisfaction with companion animals did not (Hawkey and Cacioppo

2010). These results suggest that relations with humans are more important to well-being than those we have with animals.

Other negative effects of human–animal relations come from the medical history of our relationship with animals, including dogs and cats. Here, the detrimental effects of animal contact include infectious diseases, zoonoses, parasitism, and injury from bites. In terms of zoonoses specifically, a study conducted among Canadian pet owners revealed a range of practices that increase zoonotic-disease risk: allowing dogs (13%) and cats (30%) to sleep in a child’s bed, allowing dogs to lick a child’s face (24%), and allowing a reptile (14%) to roam through the kitchen. Despite the fact that hand washing by children was high (76% washed hands after touching the pet), the authors concluded there is a need to educate people on zoonotic-disease-prevention practices (Stull et al. 2013). On a more positive note, being exposed to a companion animal during childhood was consistently associated with a reduced risk of allergic reactions and atopic asthma at the age of 7 but tended to be associated (particularly for rabbits and rodents) with an increased risk of non-atopic asthma (Collin et al. 2014).

Bringing the findings together: Potential moderators. In order to bring together the contradictory associations between the presence of companion animals and human well-being, Amiot and Bastian (2015) have recently proposed different moderating factors that could explain why animals sometimes appear to have positive, negative, or null effects on human well-being. For instance, life conditions and stages, as well as the nature of our relations with animals, may represent such moderators (see Blazina et al. 2011). Specifically, the presence of companion animals may be particularly beneficial for individuals who have illnesses that reduce their mobility, when they have limited access to social support, or when living alone. In terms of age, companion animals appear to play a more beneficial role among children and the elderly than among younger and middle-age adults (Enders-Slegers 2000, cf. Wells 2009). Indeed, companion animals become especially important during the “empty-nest” stage of life. Although the majority of studies on human–animal relations have been conducted in individualistic and Westernized countries (Amiot and Bastian 2015), future research will also need to systematically address the moderating role of culture. For example, whether animals will be associated with more versus less human well-being is possibly aligned with other factors, such as the prevalence of pet ownership in a particular culture and the role assigned to a specific animal in that culture (Gray and Young 2011).

The nature of our link to animals may also help to predict when the animals’ presence will be associated with more versus less human well-being. For instance, the more pet owners perceived discrepancies between their own personality and their companion animal’s personality, the less likely they were to report higher life satisfaction and lower negative affect (El-Alayli et al. 2006). Similarly, the more pet

owners perceived that their behaviors are compatible with their companion animals', the higher they reported being attached to their animal and the more likely they were to report positive overall mental health (Budge et al. 1998). Together, these studies confirm the importance of accounting for moderating factors that can explain the conditions under which animals are associated with more positive human health and well-being.

Capturing the nature of our link with nonhuman animals

What are the specific ways that humans develop a psychological "link" to animals? Attachment is an important factor that has been studied in the human–animal relations literature (McNicholas et al. 2005). *Secure attachment*, which is also beneficial to well-being, refers to the ability of an attachment figure to provide a secure basis, or a sense of safety when the other feels threatened or unsafe. Although it is mostly humans who act as caregivers and meet their companion animals' immediate needs (e.g., exercise, food, health), companion animals may also serve as attachment figures for their owners (Zilcha-Mano et al. 2011). In this sense, both humans and their animals can serve as attachment figures for each other. There are a number of self-report instruments that measure the degree of attachment to animals, such as the Lexington Attachment to Pets Scale (Johnson et al. 1992), the Pet Relationship Scale (e.g., Lago et al. 1988), and the more recent Pet Attachment Questionnaire, based on Bowlby's psychological attachment taxonomy (Zilcha-Mano et al. 2011). Studies that have adapted the Strange Situation Test—in which dogs (instead of babies) are placed in the "strange situation"—show that dogs display attachment patterns toward their human caregivers that are similar to those patterns observed in human–human relations. It is also possible that the nature of our attachment to animals could serve as an additional moderator in the association between the presence of animals and well-being. In this sense, more secure forms of attachment could foster higher well-being compared with *insecure attachment* (i.e., anxious or avoidant attachment). Indeed, Zilcha-Mano and colleagues (2011) found that insecure-attachment patterns in human–pet relationships were associated with poor mental health. Importantly, this association was not explained by attachment insecurities in human relationships; attachment insecurity in human–pet relationships was uniquely associated with poor mental health beyond its association with attachment patterns to humans.

Apart from attachment, other work shows that self-expansion may capture the strength of the human–animal relationship. Self-expansion is defined as the capacity to integrate, to some extent, another individual's resources, perspectives, and characteristics into the self-concept (Aron et al. 1991). In the realm of human–animal relations, self-expansion has been measured by adapting the Inclusion of the Other in the Self Scale (IOS) to assess the inclusion of one's companion animal in the self (McConnell et al. 2011).

This feeling of closeness, proximity, and intimacy with an animal can also be beneficial to well-being (Cavanaugh et al. 2008).

Where to from here: Broader issues involved in human–animal relations

Although the focus of this article is on our relations with companion animals, highlighting the "special" status of companion animals in human lives (Serpell and Paul 1994), the ways in which humans relate to animals more broadly remains an important focus for investigation. Tackling this broader view of human–animal relations requires a different type of approach, one that takes into account that such relations may be fraught with conflict and prejudice (or speciesism; Singer 2009). Understanding human–animal relations as an *intergroup* topic allows for this broader understanding. In many cases, animals may be viewed as an *outgroup* (i.e., a group one does not belong to) in the same way that members of other cultures, religions, or nationalities are regarded as outgroups. From this starting point, the psychological research on intergroup relations and us-versus-them dynamics becomes relevant to understanding human–animal relations (Plous 1993). Social psychological theories of intergroup relations (e.g., Tajfel and Turner 1986) are particularly useful for capturing these dynamics and for understanding cases in which human interests conflict with those of endangered species (e.g., the use of land for human development versus protecting the environment; Plous 1993). Just as intergroup hostility can emerge between human groups under these conditions (e.g., conflict over valued resources such as oil), so, too, can conflicting goals and competition over limited resources lead to hostility and conflict within human–animal relations.

Sometimes, too, animals themselves are the resources that humans hunt and kill. Meat eating is a longstanding human behavior. Meat is an important source of protein and calories, and by integrating meat into their diet, humans gained important benefits, such as increased body size and enhanced mobility due to increased energy levels. Eating meat also meant that less time was spent foraging for lower-quality foods and more time could be spent advancing social and cognitive abilities. Indeed, meat eating has played a central role in the emergence of human culture (Leroy and Praet 2015). Today, around 97% of Americans are meat eaters, with around 9 billion animals processed for meat annually (AMI 2013). Despite the popularity of meat, preferences for which animals are considered appropriate for consumption vary considerably. This is evident in the shocked reactions of those from the Western world when people from other cultures put their beloved companion animals, such as dogs and cats, on the menu. Denying animals human characteristics (consciousness and the capacity to think) and their individuality is a concrete strategy that allows us to distance ourselves from animals prior to harming and exploiting them (Burghardt 2009). These processes have been observed when people were reminded of their own meat-eating

practices and the harm this brings to animals (Bastian et al. 2012). Even just categorizing a novel animal as food reduced concern over its welfare (Bratanova et al. 2011).

Other factors that are well established within the tradition of research on intergroup relations can also be applied to human–animal relations. For instance, perceiving similarities between humans and animals can lead to a perception of relatedness, empathy, and an increased desire to protect their rights (Plous 1993). Similarly, the tendency to anthropomorphize animals—which involves assigning them human-like characteristics, such as emotions and cognitions (Waytz et al. 2010)—has been associated with greater concerns for their welfare (Butterfield et al. 2012). In summary, adopting an intergroup perspective to human–animal relations provides important insights into the broader nature of our relationships with animals and the conditions under which these relations are likely to be harmonious versus conflictual and exploitative. This wider-lens approach therefore has the potential to identify the factors leading to more versus less speciesism and to pave the way to social interventions that are likely to foster mutually beneficial relations between animals and humans.

The current article focused on the nature of human–animal relations, with a particular emphasis on companion animals, and the implications of this relationship for both humans and animals. The evidence we reviewed also suggests that the nature of our relationships with animals has broader consequences for human–human relations. According to anthropologist Lévi-Strauss (1966), by “thinking with” animals and investigating how we interact toward other species, we can gain insights into human nature and understand human societies in new ways. These questions will become increasingly important to tackle as we (humans) are confronted with progressively scarce resources due to human overpopulation and as we need to make decisions about how to distribute these resources between both humans *and* animals.

References cited

- [AHA] Animal Health Alliance. 2013. Pet Ownership Australia Report. AHA. (6 August 2015; <http://223.27.22.40/~sh10135/wp-content/uploads/2013/08/Pet-Ownership-in-Australia-2013-Summary-report-2013.pdf>).
- Allen KM, Shykoff BE, Izzo JL. 2001. Pet ownership, but not ACE inhibitor therapy, blunts home blood pressure responses to mental stress. *Hypertension* 38: 815–820.
- [AMI] American Meat Institute. 2013. The United States meat industry at a glance. AMI. (7 November 2013; www.meatami.com/ht/d/sp/i/47465/pid/47465).
- Amiot CE, Bastian B. 2015. Toward a psychology of human–animal relations. *Psychological Bulletin* 141: 6–47.
- [APPA] American Pet Products Association. 2013. APPA National Pet Owners Survey 2013–2014. APPA. (19 August 2013; www.americanpet-products.org/press_industrytrends.asp).
- Archer J, Monton S. 2011. Preference for infant facial features in pet dogs and cats. *Ethology* 117: 217–226.
- Aron A, Aron EN, Tudor M, Nelson G. 1991. Close relationships as including other in the self. *Journal of Personality and Social Psychology* 60: 241–253.
- Bastian B, Loughnan S, Haslam N, Radke HRM. 2012. Don't mind meat? The denial of mind to animals used for human consumption. *Personality and Social Psychology Bulletin* 38: 247–256.
- Baun MM, McCabe BW. 2003. Companion animals and persons with dementia of the Alzheimer's type: Therapeutic possibilities. *American Behavioral Scientist* 47: 42–51.
- Beck AM. 2014. The biology of the human–animal bond. *Animal Frontiers* 4: 32–36.
- Bernstein PL, Friedmann E, Malaspina A. 2000. Animal-assisted therapy enhances resident social interaction and initiation in long-term care facilities. *Anthrozoos* 13: 213–224.
- Blazina C, Boyraz G, Shen-Miller D, eds. 2011. *The Psychology of the Human–Animal Bond: A Resource for Clinicians and Researchers*. Springer.
- Bradshaw JWS, Paul ES. 2010. Could empathy for animals have been an adaptation in the evolution of *Homo sapiens*? *Animal Welfare* 19: 107–112.
- Bratanova B, Loughnan S, Bastian B. 2011. The effect of categorization as food on the perceived moral standing of animals. *Appetite* 57: 193–196.
- Brown SW, Goldstein LH. 2011. Can seizure-alert dogs predict seizures? *Epilepsy Research* 97: 236–242.
- Budge CR, Spicer J, Jones B, St-George R. 1998. Health correlates of compatibility and attachment in human–companion animal relationships. *Society and Animals* 6: 219–234.
- Burghardt GM. 2009. Ethics and animal consciousness: How rubber the ethical ruler? *Journal of Social Issues* 65: 499–521.
- Burrows KE, Adams CL, Spiers J. 2008. Sentinels of safety: Service dogs ensure safety and enhance freedom and well-being for families with autistic children. *Qualitative Health Research* 18: 1642–1649.
- Butterfield ME, Hill SE, Lord CG. 2012. Mangy mutt or furry friend? Anthropomorphism promotes animal welfare. *Journal of Experimental Social Psychology* 48: 957–960.
- Carlisle-Frank P, Frank JM. 2006. Owners, guardians, and owner-guardians: Differing relationships with pets. *Anthrozoos* 19: 225–242.
- Cavanaugh LA, Leonard HA, Scammon DL. 2008. A tail of two personalities: How canine companions shape relationships and well-being. *Journal of Business Research* 61: 469–479.
- Cohen SP. 2002. Can pets function as family members? *Western Journal of Nursing Research* 24: 621–638.
- Collin SM, Granule R, Westgarth C, Paul E, Sterne JAC, Henderson AJ. 2014. Pet ownership is associated with increased risk of non-atopic asthma and reduced risk of atopy in childhood: Findings from a UK birth cohort. *Clinical and Experimental Allergy* 45: 200–210.
- Collis GM, McNicholas J. 1998. A theoretical basis for health benefits of pet ownership: Attachment versus psychological support. Pages 105–122 in Wilson CC, Turner DC, eds. *Companion Animals in Human Health*. Sage.
- De Bruin SR, Oosting SJ, Tobi H, Enders-Slegers M-J, van der Zijpp A, Schols J. 2012. Comparing day care at green care farms and at regular day care facilities with regard to their effects on functional performance. *Dementia: The International Journal of Social Research and Practice* 9: 503–519.
- DeLoache JS, Pickard MB. 2010. Of chimps and children: Use of spatial symbols by two species. Pages 486–501 in Dolins FL, Mitchell RW, eds. *Spatial Cognition, Spatial Perception: Mapping the Self and Space*. Cambridge University Press.
- DeSchraver MM, Riddick CC. 1990. Effects of watching aquariums on elders' stress. *Anthrozoos* 4: 44–48.
- Driscoll CA, et al. 2007. The Near Eastern origin of cat domestication. *Science* 317: 519–523.
- El-Alayli A, Lystad AL, Webb SR, Hollingsworth SL, Ciolli JL. 2006. Reigning cats and dogs: A pet-enhancement bias and its link to pet attachment, pet–self similarity, self-enhancement, and well-being. *Basic and Applied Social Psychology* 28: 131–143.
- Enders-Slegers M-J. 2000. The meaning of companion animals: Qualitative analysis of the life histories of elderly cat and dog owners. Pages 237–256 in Podberscek AL, Paul ES, Serpell JA, eds. *Companion*

- Animals and Us: Exploring the Relationships Between People and Pets. Cambridge University Press.
- Fine AH. 2006. Incorporating animal-assisted therapy into psychotherapy: Guidelines and suggestions for therapists. Pages 167–206 in Fine AH, ed. *Animal-Assisted Therapy: Theoretical Foundations and Guidelines for Practice*, 2nd ed. Academic Press.
- Friedmann E, Son H. 2009. The human–companion animal bond: How humans benefit. *Veterinary Clinics of North America: Small Animal Practice* 39: 293–326.
- Friedmann E, Katcher AH, Lynch J, Thomas S. 1980. Animal companions and one-year survival of patients after discharge from a coronary care unit. *Public Health Reports* 95: 307–312.
- Friedmann E, Thomas SA, Cook LK, Tsai C-C, Picot SJ. 2007. A friendly dog as potential moderator of cardiovascular response to speech in older hypertensives. *Anthrozoos* 20: 51–63.
- Gilbey A, McNicholas J, Collis GM. 2007. A longitudinal test of the belief that companion animal ownership can help reduce loneliness. *Anthrozoos* 20: 345–353.
- Gray PB, Young SM. 2011. Human–pet dynamics in cross-cultural perspective. *Anthrozoos* 24: 17–30.
- Guéguen N, Ciccotti S. 2008. Domestic dogs as facilitators in social interaction: An evaluation of helping and courtship behaviors. *Anthrozoos* 21: 339–349.
- Hare B, Tomasello M. 2005. Human-like social skills in dogs? *Trends in Cognitive Sciences* 9: 439–444.
- Hawkey LC, Cacioppo JT. 2010. How can I connect with thee: Measuring and comparing satisfaction in multiple relationship domains. *Journal of Individual Psychology* 66: 43–67.
- Headey B, Grabka M, Kelley J, Reddy P, Tseng YP. 2002. Pet ownership is good for your health and saves public expenditure too: Australian and German longitudinal evidence. *Australian Social Monitor* 5: 93–99.
- Herzog HA. 2011. The of pets on human health and psychological well-being: Fact, fiction, or hypothesis? *Current Directions in Psychological Science* 20: 236–239.
- Herzog HA, Bentley RA, Hahn M. 2004. Random drift and large shifts in popularity of dog breeds. *Proceedings of the Royal Society B* 271: S353–S356.
- Hunt SJ, Hart LA, Gomulkiewicz R. 1992. Role of small animals in social interactions between strangers. *Journal of Social Psychology* 132: 245–256.
- Johnson TP, Garrity TF, Stallones L. 1992. Psychometric Evaluation of the Lexington Attachment to Pets Scale (LAPS). *Anthrozoos* 5: 160–175.
- Kis A, et al. 2014. Oxytocin receptor gene polymorphisms are associated with human directed social behavior in dogs (*Canis familiaris*). *PLOS ONE* 9 (art. e83993).
- Koivusilta LK, Ojanlatva A. 2006. To have or not to have a pet for better health? *PLOS ONE* 1 (art. e109).
- Kubinyi E, Miklósi Á, Topál J, Csányi V. 2003. Social mimetic behaviour and social anticipation in dogs: Preliminary results. *Animal Cognition* 6: 57–63.
- Lago D, Kafer R, Delaney M, Connell C. 1988. Assessment of favorable attitudes toward pets: Development and preliminary validation of self-report pet relationship scales. *Anthrozoos* 1: 240–254.
- Leroy F, Praet I. 2015. Meat traditions: The co-evolution of humans and meat. *Appetite* 90: 200–211.
- Levinson BM. 1969. *Pet-Oriented Child Psychotherapy*. Charles C. Thomas.
- Lévi-Strauss C. 1966. *The Savage Mind*. University of Chicago Press.
- LoBue V, Bloom Pickard M, Sherman K, Axford C, DeLoache JS. 2013. Young children's interest in live animals. *British Journal of Developmental Psychology* 31: 57–69.
- Lorenz K. 1942. Die angeborenen Formen möglicher Erfahrung [The innate conditions of the possibility of experience]. *Zeitschrift für Tierpsychologie* 5: 235–409.
- Lynch JJ, McCarthy JF. 1969. Social responding in dogs: Heart rate changes to a person. *Psychophysiology* 5: 389–393.
- Martens P, Ender-Slegers M, Walker J. 2016. The emotional lives of companion animals: Attachment and subjective claims by owners of cats and dogs. *Anthrozoos* 29: 73–88.
- McConnell AR, Brown CM, Shoda TM, Stayton LE, Martin CE. 2011. Friends with benefits: On the positive consequences of pet ownership. *Journal of Personality and Social Psychology* 101: 1239–1252.
- McCulloch M, Jezewski T, Broffman M, Hubbard A, Turner K, Janecki T. 2006. Diagnostic accuracy of canine scent detection in early- and late-stage lung and breast cancers. *Integrative Cancer Therapies* 5: 30–39.
- McNicholas J, Collis GM. 2000. Dogs as catalysts for social interaction: Robustness of the effect. *British Journal of Psychology* 91: 61–70.
- McNicholas J, Gilbey A, Rennie A, Ahmedzai S, Dono J-A, Ormerod E. 2005. Pet ownership and human health: A brief review of evidence and issues. *British Medical Journal* 331: 1252–1254.
- Melson GF. 2001. *Why the Wild Things Are: Animals in the Lives of Children*. Harvard University Press.
- Messent PR, Horsfield S. 1985. Pet population and the pet–owner bond. Pages 7–17 in Institute for Interdisciplinary Research on the Human–Pet Relationship [IEMT]. *The Human–Pet Relationship*. IEMT.
- Miura A, Bradshaw JWS, Tanida H. 2002. Childhood experiences and attitudes towards animal issues: A comparison of young adults in Japan and the UK. *Animal Welfare* 11: 437–448.
- Nagasawa M, Mitsui S, Ohtani N, Ohta M, Sakuma Y, Onaka T, Mogi K, Kikusui T. 2015. Oxytocin-gaze positive loop and the coevolution of human–dog bonds. *Science* 348: 333–336.
- New J, Cosmides L, Tooby J. 2007. Category-specific attention for animals reflects ancestral priorities, not expertise. *Proceedings of the National Academy of Sciences* 104: 16598–16603.
- Nimer J, Lundahl B. 2007. Animal-assisted therapy: A meta-analysis. *Anthrozoos* 20: 225–238.
- Odendaal JSJ, Lehmann SMC. 2000. The role of phenylethylamine during positive human–dog interaction. *Acta Veterinaria Brno* 69: 183–188.
- Odendaal JSJ, Meintjes RA. 2003. Neurophysiological correlates of affiliative behaviour between humans and dogs. *Veterinary Journal* 165: 296–301.
- O'Haire ME, McKenzie SJ, Beck AM, Slaughter V. 2013. Social behaviors increase in children with autism in the presence of animals compared to toys. *PLOS ONE* 8 (art. e57010).
- Parker GB, Gayed A, Owen CA, Hyett MP, Hilton TM, Heruc GA. 2010. Survival following an acute coronary syndrome: A pet theory put to the test. *Acta Psychiatrica Scandinavica* 121: 65–70.
- Parslow RA, Jorm AF, Christensen H, Rodgers B, Jacomb P. 2005. Pet ownership and health in older adults: Findings from a survey of 2551 community-based Australians aged 60–64. *Gerontology* 51: 40–47.
- Paul ES, Serpell JA. 1996. Obtaining a new pet dog: Effects on middle childhood children and their families. *Applied Animal Behaviour Science* 47: 17–29.
- Perrin T. 2009. The Business of Urban Animals Survey: The facts and statistics on companion animals in Canada. *Canadian Veterinary Journal* 50: 48–52.
- Pikhartova J, Bowling A, Victor C. 2014. Does owning a pet protect older people against loneliness? *BMC Geriatrics* 14 (art. 106).
- Plous S. 1993. Psychological mechanisms in the human use of animals. *Journal of Social Issues* 49: 11–52.
- Podbersek AL. 2009. Good to pet and eat: The keeping and consuming of dogs and cats in South Korea. *Journal of Social Issues* 65: 615–632.
- Rooney NJ, Morant S, Guest C. 2013. Investigation into the value of trained glycaemia alert dogs to clients with type 1 diabetes. *PLOS ONE* 8 (art. e69921).
- Schneider MS, Harley LP. 2006. How dogs influence the evaluation of psychotherapists. *Anthrozoos* 19: 128–142.
- Schoberl I, Wedl M, Bauer B, Day J, Mostl E, Kotrschal K. 2012. Effects of owner–dog relationship and owner personality on cortisol modulation in human–dog dyads. *Anthrozoos* 25: 199–214.
- Serpell JA. 1991. Beneficial effects of pet ownership on some aspects of human health and behaviour. *Journal of the Royal Society of Medicine* 84: 717–720.
- Serpell JA, Paul ES. 1994. Pets and the development of positive attitudes to animals. Pages 127–144 in Manning A, Serpell JA, eds. *Animals and Human Society*. Routledge.

- Simons LA, Simons J, McCallum J, Friedlander Y. 2000. Pet ownership is not associated with future health: A nine-year prospective study in older Australians. *Australasian Journal on Ageing* 19: 139–142.
- Singer P. 2009. *Animal Liberation: The Definitive Classic of the Animal Movement*, 4th ed. Harper Collins.
- Stull JW, Peregrine AS, Sargeant JM, Weese JS. 2013. Pet husbandry and infection control practices related to zoonotic disease risks in Ontario, Canada. *BMC Public Health* 13 (art. 520).
- Sugawara A, Masud MM, Yokoyama A, Mizutani W, Watanuki S, Yanai K, Itho M, Tashiro M. 2012. Effects of presence of a familiar pet dog on regional cerebral activity in healthy volunteers: A positron emission tomography study. *Anthrozoos* 25: 25–34.
- Tajfel H, Turner JC. 1986. The social identity theory of intergroup behavior. Pages 7–24 in Worchel S, Austin WG, eds. *Psychology of Intergroup Relations*. Nelson-Hall.
- Waytz A, Morewedge CK, Epley N, Monteleone G, Gao J-H, Cacioppo JT. 2010. Making sense by making sentient: Effectance motivation increases anthropomorphism. *Journal of Personality and Social Psychology* 99: 410–435.
- Wells DL. 2009. The effects of animals on human health and well-being. *Journal of Social Issues* 65: 523–543.
- Wilson EO. 1993. Biophilia and the conservation ethics. Pages 31–41 in Kellert SR, Wilson EO, eds. *The Biophilia Hypothesis*. Island Press.
- Wong K. Scrappy pets. 2013. *Scientific American* 308: 24.
- Wynne C. 2015. Did dogs hack the oxytocin love circuit? Comparing dogs to wolves doesn't necessarily inform about domestication. *Psychology Today* (22 February 2016; www.psychologytoday.com/blog/dogs-and-their-people/201504/did-dogs-hack-the-oxytocin-love-circuit).
- Zilcha-Mano S, Mikulincer M, Shaver PR. 2011. An attachment perspective on human–pet relationships: Conceptualization and assessment of pet attachment orientations. *Journal of Research in Personality* 45: 345–357.
- . 2012. Pets as safe havens and secure bases: The moderating role of pet attachment orientations. *Journal of Research in Personality* 46: 571–580.

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