

AnimalWise Report May 2016

www.animalwise.info

The (im)possibility to classify dogs' and cats' facial expression from photographs

Pim Martens & Marie-José Slegers-Enders



Abstract

There is a growing body of scientific evidence supporting the existence of emotions in non-human animals. Companion animal owners show a strong connection and attachment to their animals and readily assign emotions to them. Regarding dogs and cats, most people that live together with these companion animals claim to recognize emotional facial expressions and body postures in their pet. However, the 'decoding' of facial expression across species has been rather limited. In this report we used photographs of dogs and cats to which companion-animal owners attributed an emotion, and used these photos to be rated by experts.

Introduction

Evidence for a relationship between humans and dogs extends beyond 12,000 years (Clutton-Brock, 1995), with recent genetic analysis of both species suggesting the co-evolution of dogs and humans occurred from 32,000 years ago (Wang et al., 2013). Our history with cats is still ambiguous. Up until very recently, most sources believed that cats were first domesticated in ancient Egypt, but a recent study suggests that cats were domesticated at the same time as the cultivation of wheat and barley in the Near East region, about 10,000 years ago (Driscoll et al., 2007). Today, cats and dogs play an important role in the lives of many people. The relationship between owners and their companion animal can affect psychological, physical and social wellbeing of humans (Kurdek, 2009; Zilcha-Mano, Mikulincer, & Shaver, 2011), with positive research outcomes of human-animal interactions frequently reported in the literature (Enders-Slegers, 2000; Friedmann & Thomas, 1998; Headey, Na, & Zheng, 2008; Julius, Beetz, Kotrschal, Turner, & Uvnas-Moberg, 2013; Wilson & Turner, 1998). Companion animal owners express strong emotional connections to their animals (Hall et al., 2004), often considering them part of the family and providing them with levels of affection, comfort and support similar to that of another human family member (Donohue, 2005; Wrobel & Dye, 2003; Zilcha-Mano et al., 2011). Additionally, companion animals can fulfil 'basic social needs' of their owners, such as emotional closeness (attachment), social integration, reassurance of worth, reliable alliance, guidance, advice and information and the opportunity for nurturance (Enders-Slegers, 2000; Wang et al., 2013).

Electrical stimulation of the brains of both human and non-human animals has evidenced that all mammals have similar brain structures and similar unconditioned emotional responses (Panksepp, 2011). It is therefore plausible that both intra and inter-species understanding and mirroring of emotions may occur (Rizolatti, Fogassi, & Gallese, 2001). In the case of inter-species social referencing, dogs have been repeatedly documented to refer to their owners' appraisal and portrayed emotional message to seek information about a

situation and determine their behaviour (Hare & Woods, 2013; Merola, Prato-Previde, & Marchall-Pescini, 2012; Wang et al., 2013). Costa et al. (2014) carried out a research in which humans were asked to identify the facial expressions (food, alone, reunion) in pictures of (unfamiliar) dogs. The results showed that professionals and dog owners recognized the emotions significantly better than did people with no experience with dogs.

How emotions manifest themselves in animals (i.e. whether animals experience emotions in the same way as humans) presents a fundamental difficulty in the measurement (and determination of existence) of animal emotions, as animals are unable to vocalize their experiences in the same way as humans. However, there is general agreement that basic (or primary) emotions such as anger, joy, sadness, disgust and fear can be found across a wide range of (vertebrate) species (Boissy et al., 2007; Le Doux, 1996; Panksepp, 1982). Complex (or secondary) emotions such as surprise, shame, jealousy, disappointment and compassion are often restricted to humans and other primates (Preston & De Waal, 2002), with relatively sparse claims of complex emotions in (non-primate) animals (Bekoff, 2002). Rather than being confounded by anthropomorphic interpretations, owner reports have been demonstrated to provide reliable and consistent interpretation of their animal's behaviour and emotions (Mariti et al., 2012; Morris, Doe, & Godsell, 2008). Additionally, owners are the primary source of information regarding companion animal behavior problems (Arhant, Bubna-Littitz, Bartels, Futschik, & Troxler, 2010; Bennett & Rohlf, 2007; Blackwell, Twells, Seawright, & Casey, 2008), and are able to identify overt behavioral indicators of stress (e.g. trembling, crying or excessive barking) indicative of reduced welfare (Mariti et al., 2012).

Although humans are able to read other humans' facial expressions (Ekman, 2003), discriminating emotional expressions in other species is particularly challenging, as emotions are not necessarily expressed in similar ways across species. Therefore, the ability to recognize emotional expressions in individuals of a different species is likely dependent on (professional) expertise of animal behavior and emotions. Similar experience effects have previously been shown,

for example, for the ability to discriminate individual faces of another species (Hare et al., 2002; Dufour and Petit, 2009; Bloom and Friedman, 2013).

Regarding dogs and cats, most people that live together with these companion animals claim to recognize emotional facial expressions and body postures in their pet (Martens et al., 2015). However, the 'decoding' of facial expression across species has been rather limited. In this paper we used photographs of dogs and cats to which companion-animal owners attributed an emotion, and used these photos to be rated by experts.

Dogs' and cats' expression of emotions

Dogs use facial expressions, ear set, tail carriage and overall demeanour to signal their intentions and feelings to others. Dogs can, within limits, vary the shape and size of his eyes or the direction and intensity of his gaze. Next to facial expressions, dogs also use their bodies to communicate their intentions. If a dog's feeling happy and contented, he will have relaxed muscles and his weight evenly balanced on all four feet. Similar when he's playful. He may be bouncing around or running wildly with exaggerated movements, but his facial expression and his muscles will be relaxed and nothing about his body will look unnatural.

Cats are known for their independence and solitary hunting methods. Unlike dogs they do not work together in the hunt or do not form groups for protection. Yet they interact with other cats, not only to mate or to bring kittens large, but also for more 'social' contacts. In a cat, the posture of the head, ears, eyes and whiskers can tell us a lot about the feelings of the cat. The many facial muscles create a large number of expressions, while the attitude of the head itself can indicate whether the cat is trying to make contact or whether he would prefer to be invisible.

Methods

As part of a Dutch online questionnaire (Martens et al, 2015) (distributed amongst Dutch speaking cat and/or dog owners (mainly in the Netherlands and Belgium)) related to the perception and attribution of emotions to companion, we asked the respondents to send us pictures of their dog and/or cat in which they clearly recognized one of the following basic (anger, joy (happiness), fear, disgust and sadness) and complex (surprise, shame, jealousy, disappointment and compassion) emotions. The photos of the dogs and cats received were subsequently put online randomly, and experts in the field of dog and/or cat behaviour and a group of companion animal owners that were no experts (and were not part of the earlier questionnaire) were asked to assign one of the emotions mentioned above to the pictures.

Results

Of the photos that we received, 100 were from dogs and 74 were from cats (see Appendix). Ten experts naively judged the photos: six experts related to dog behaviour, two cat behavioural experts, and two experts on both cat and dog. Of the experts involved, three had working experience between 5 and 10 years, the others over 10 year of working with dogs and/or cats. The experts judging the photos were either scientific consultants, animal coaches, of animal caretakers. Next to this, twenty-nine 'non-expert' companion animal owners categorized the photos (of the pets that were thus not their own) as well: four of them interpreted the dog photos only, seventeen the cat photos only, and eight people looked at both the dog and cat photos

Table 1: Proportion of experts that think dogs and cats can feel or show a particular emotion

	Do you think dogs and cats can feel this emotion?	Do you think dogs can express this emotion by their body language and facial expression?	Do you think cats can express this emotion by their body language and facial expression?
Anger	100%	87.5%	100%
Joy	100%	100%	100%
Sadness	90%	100%	100%
Disgust	90%	87.5%	100%
Fear	100%	87.5%	100%
Surprise	90%	87.5%	100%
Shame	30%	25%	25%
Jealousy	70%	75%	25%
Disappointment	90%	62.5%	50%
Compassion	50%	25%	25%

We calculated the proportion of the experts that assigned the same emotion as the companion animal owner that send in the photo (Table 2). Most photos that were send in assigned the emotion joy. There were also relatively many pictures with the emotion fear and surprise assigned to it. These three emotions showed the most agreement between the expert judgement and the attribution of the emotion by the dog or cat owner. The emotions in cats showed less similarity between owner and expert than the emotions in dogs. As for most emotions there is only a small number of photographs evaluated, we did not test differences in recognition statistically.

Table 2: Proportion of (non) experts that attributed similar emotions as assigned by owner

Dogs	Mean proportion Experts (%)	Mean proportion Non-experts (%)	n (# pictures)
Anger	13	17	1
Joy	65	62	44
Sadness	28	27	5
Disgust	47	23	4
Fear	51	34	15
Surprise	47	47	17
Jealousy	25	31	3
Disappointment	17	20	9
Compassion	25	0	2

Cats	Mean proportion Experts (%)	Mean proportion Non-experts (%)	n (# pictures)
Joy	53	78	18
Sadness	10	9	5
Disgust	0	11	7
Fear	50	48	20
Surprise	37	59	13
Jealousy	19	31	4
Disappointment	1	18	4
Shame	8	17	3

Discussion and conclusions

To get a complete picture of how an animal feels, we typically need to take a look at the full body - meaning head (eyes, ears, whiskers and mouth) and body (tail, attitude, size and angle), Because, for example, the attitudes of fear and anger can greatly resemble each other, signals are the separate "components" then seemingly contradict each other. In order to get the full image, the whole body is to be viewed, as well as the context in which the picture is taken. As appears from the examples, isolating one particular element can be misleading because signals often change very quickly.

In conclusion we note that the emotions of dogs and cats are rather difficult to determine. Instruments to measure are not available yet. Moreover, the individual facial expressions of the divers species may differ importantly,

within species as well as between species. Specialized species-related knowledge of professionals as well as specific knowledge of the individual dog or cat of owner may be needed to obtain reliable and valid data.

Appendix

Emotions Dogs (as ascribed by owners)

Anger



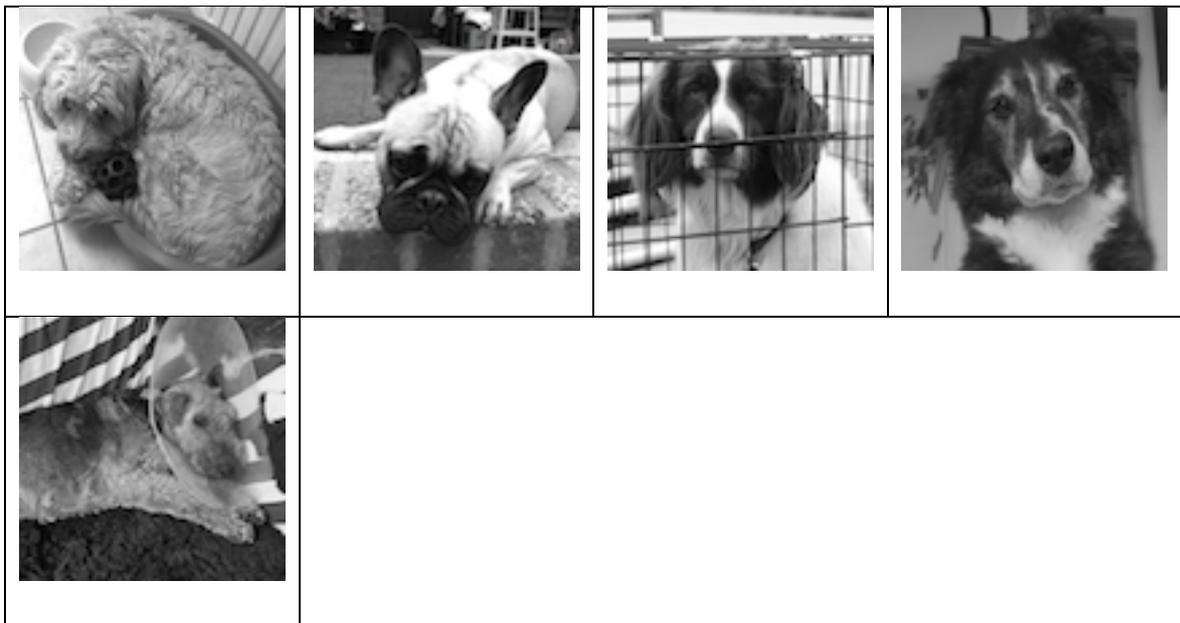
Joy







Sadness



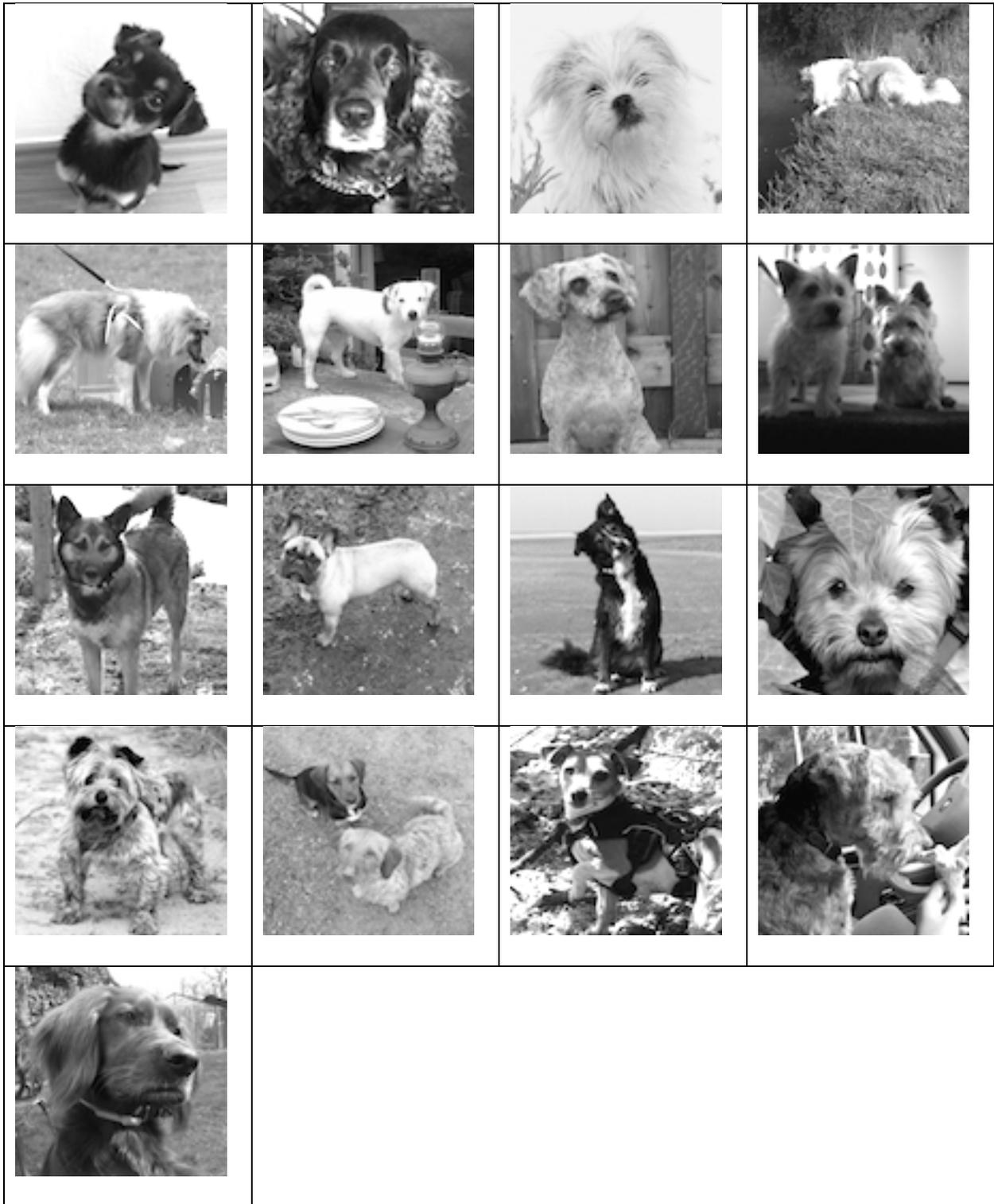
Disgust



Fear



Surprise



Jealousy



Disappointment



Compassion

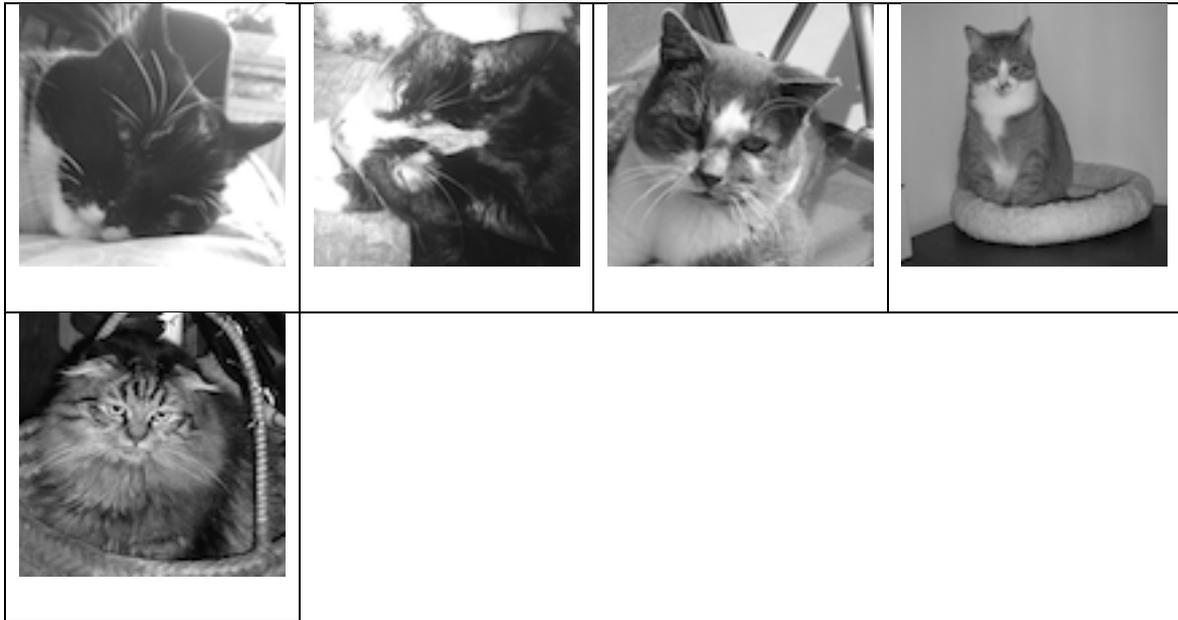


Emotions Cats (as ascribed by owners)

Joy



Sadness



Disgust



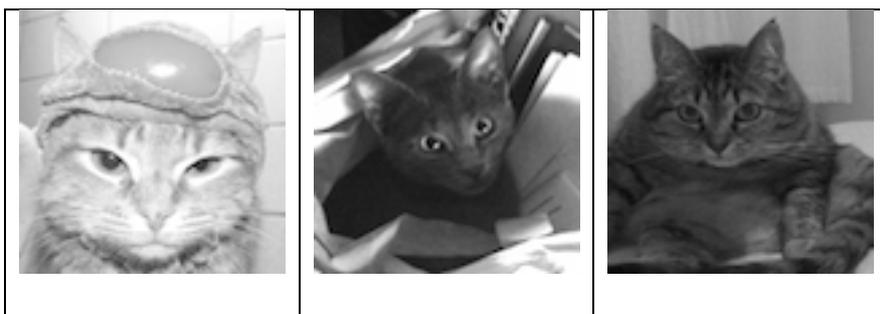
Fear



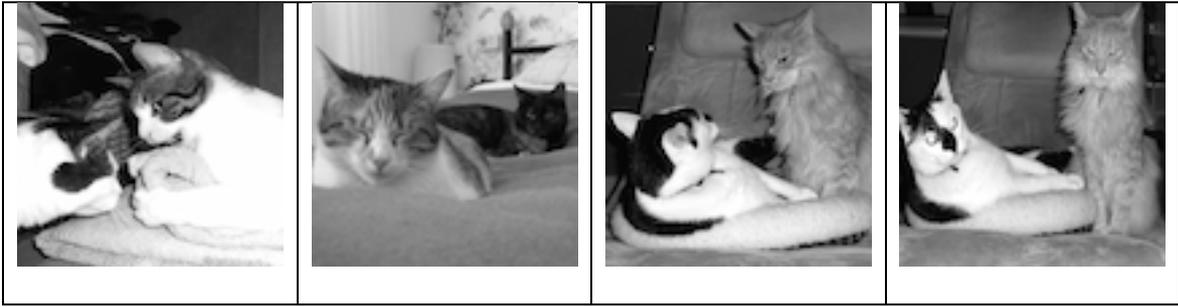
Surprise



Shame



Jealousy



Disappointment



References

- Arhant, C., Bubna-Littitz, H., Bartels, A., Futschik, A., & Troxler, J. (2010). Behaviour of smaller and larger dogs: Effects of training methods, inconsistency of owner behaviour and level of engagement in activities with the dog. *Applied Animal Behaviour Science*, *131*, 131-142.
- Bekoff, M. (2002). *Minding animals: Awareness, emotions and heart*. New York: Oxford University Press.
- Bennett, P. C., & Rohlf, V. I. (2007). Owner-companion dog interactions: Relationships between demographic variables, potentially problematic behaviours, training engagement and shared activities. *Applied Animal Behaviour Science*, *102*, 65-84.
- Blackwell, E. J., Twells, C., Seawright, A., & Casey, R. A. (2008). The relationship between training methods and the occurrence of behavior problems, as reported by owners, in a population of domestic dogs. *Clinical Applications and Research*, *3*, 207-217.
- Boissy, A., Manteuffel, G., Jensen, M. B., Moe, R. O., Spruijt, B., Keeling, L. J., . . . Aubert, A. (2007). Assessment of positive emotions in animals to improve their welfare. *Physiology and Behavior* *92*, 375-397, *92*, 375-397.
- Clutton-Brock, J. (1995). Origins of the dog: domestication and early history. In J. Serpell (Ed.), *The domestic dog* (pp. 7-20). Cambridge: University Press.
- Donohue, K. M. (2005). Pet loss: implications for social work practice. *Social Work*, *50*, 187-190.
- Driscoll, C. A., Menotti-Raymond, M., Roca, A. L., Hupe, K., Johnson, W. E., Geffen, E., . . . Kitchener, A. C. (2007). The Near Eastern origin of cat domestication. *ScienceExpress*, *28*, 1-6.
- Enders-Slegers, M. J. (2000). The meaning of companion animals: Qualitative analysis of the life histories of elderly dog and cat owners. In A. Podberscek, E. Paul, & J. A. Serpell (Eds.), *Companion Animals and Us. Exploring relationships between people and pets* (pp. 237-256). Cambridge: Cambridge University Press, U.K.
- Friedmann, E., & Thomas, S. A. (1998). Pet ownership, social support, and one-year survival after acute myocardial infarction in the cardiac arrhythmia suppression trial (CAST). In C. C. Wilson & D. C. Turner (Eds.), *Companion animals in human health* (pp. 187-201): Thousand Oaks, CA: Sage.
- Hall, M. J. M., Ng, A. M., Ursano, R. J. M., Holloway, H. M., Fullerton, C. P., & Casper, J. D. (2004). Psychological impact of the animal-human bond in disaster preparedness and response. *Journal of Psychiatric Practice*, *10*, 368-374.
- Hare, B., & Woods, V. (2013). *The genius of dogs: how dogs are smarter than you think*. Dutton, USA: Penguin Group.
- Headey, B., Na, F., & Zheng, R. (2008). Pet dogs benefit owners' health: A natural experiment in China. *Social Indicators Research*, *84*, 481-493.
- Julius, H., Beetz, A., Kotrschal, K., Turner, D., & Uvnas-Moberg, K. (2013). *Attachment to pets*: Hogrefe Publishing, USA.
- Kurdek, L. A. (2009). Pet dogs as attachment figures for adult owners. *American Psychological Association*, *23*(4), 439-446.
- Le Doux, J. E. (1996). *The mysterious underpinnings of emotional life*: Simon & Schuster Touchstone edition.
- Martens, P., Enders-Slegers, M. & Walker, J.K (2016). The emotional lives of companion animals: attachment and subjective claims by owners of cats and dogs, *Anthrozoös*, *29*:1, 73-88
- Mariti, C., Gazzano, A., Moore, J. L., Baragli, P., Chelli, L., & Sighieri, C. (2012). Perception of dogs' stress by their owners. *Clinical Applications and Research*, *7*, 213-219.
- Merola, I., Prato-Previde, E., & Marchall-Pescini, S. (2012). Social referencing in dog-owner dyads? *Animal Cognition*, *15*(2), 175-185.
- Morris, P. H., Doe, C., & Godsell, E. (2008). Secondary emotions in non-primate species? Behavioural reports and subjective claims by animal owners. *Cognition and Emotion*, *22*(1), 3-20.
- Panksepp, J. (1982). Toward a general psychobiological theory of emotions. *The Behavioral and Brain Sciences*, *5*, 407-467.

- Panksepp, J. (2011). The basic emotional circuits of mammalian brains: Do animals have affective lives? *Neuroscience and Biobehavioral Reviews*, 35(9), 1791-1804.
- Preston, S. D., & De Waal, F. B. M. (2002). Empathy: Its ultimate and proximate cause. *Behavioural and Brain Sciences*, 25, 1-72.
- Rizolatti, G., Fogassi, L., & Gallese, V. (2001). Neurophysiological mechanisms underlying the understanding and imitation of action. *Nature Review Neuroscience*, 2(9), 661-670.
- Wang, D. D., Zhai, W., Yang, H., Fan, R., Cao, X., Zhong, L., . . . Zhang, Y. (2013). The genomics of selection in dogs and the parallel evolution between dogs and humans. *Nature Communications*, 4, 1860.
- Wilson, C. C., & Turner, D. C. (Eds.). (1998). *Companion animals in human health*: Thousand Oaks, California, Sage Publications.
- Wrobel, T. A., & Dye, A. L. (2003). Grieving pet death: Normative, gender, and attachment issues. *OMEGA--Journal of Death and Dying*, 47, 385-393.
- Zilcha-Mano, S., Mikulincer, M., & Shaver, P. R. (2011). An attachment perspective on human-pet relationships: conceptualization and assessment of pet attachment orientations. *Journal of Research in Personality*, 45, 345-357.