aps ASSOCIATION FOR PSYCHOLOGICAL SCIENCE

Current Directions in Psychological Science
2016, Vol. 25(5) 327–333

DOI: 10.1177/0963721416662647
cdps.sagepub.com
SAGE

Are Dogs Social Generalists? Canine Social Cognition, Attachment, and the Dog-Human Bond

Monique A. R. Udell and Lauren Brubaker
Department of Animal and Rangeland Sciences, Oregon State University

Abstract
Reports of variability in the social behavior of the domestic dog (*Canis lupus familiaris*) are common across populations, breeds, and individuals. This has often been considered a challenge for characterizing the nature and origins of the domestic dog's social cognition. Here, we propose that this variability might be explained by social plasticity, a trait that could contribute to the success of the domestic dog and facilitate the dog-human bond. Additional research specifically aimed at investigating population and individual variation in canine social behavior, such as attachment-style research, may provide important insight into domestic dogs' biological success, as well as knowledge that could benefit both dogs and humans in a wide range of applied settings.

Keywords
dog, social behavior, cognition, individual variability, attachment

It has been well established that domestic dogs are capable of forming strong bonds with humans. While this comes as no surprise to dog owners worldwide, disagreement among scientists about the origins and nature of the dog-human bond has led to many critical questions about canine social cognition (Udell, Dorey, & Wynne, 2010b). Canine research spans many scientific disciplines. Therefore, challenges associated with assimilating theoretical ideas across scientific frameworks may be responsible for some of this intellectual disagreement. However, there has also been a substantial amount of variability in the data themselves, making it difficult to draw broad generalizations about the unique qualities of dogs' social cognition (Bentosela, Wynne, D'Orazio, Elgier, & Udell, 2016; Gácsi, Kara, Belenyi, Topál, & Miklósi, 2009; Udell, Hall, Morrison, Dorey, & Wynne, 2013). In fact, the presence of robust individual and population variability in dogs' social behavior may be one of the strongest points of agreement among canine behavioral researchers. It seems pragmatic to consider the possibility that variability in dogs' social behavior, or domestic dogs' social plasticity, may contribute to their success as a species and facilitate dog-human bonding.

In the current review, we provide evidence that dogs may best be described as social generalists. The term "generalist" is often applied to species that can thrive in many different environments, typically as a by-product of being able to eat a wide variety of foods and adopt different foraging strategies. Here, we will use the term "social generalist" to mean a species that can thrive in many different settings as a result of an ability to adapt to a wide variety of social environments and adopt different social strategies. Dogs are already known to be facultatively social; the degree to which free-living dogs form social groups with other dogs is dependent on environmental conditions, including resource availability and quality (Paul, Majumder, Nandi, & Bhadra, 2015). However, there is a need to better understand the substantial variability in the kinds of relationships dogs form with other individuals, including humans, when environmental conditions favor prolonged social relationships.

While the full diversity of dog social behavior may be most evident when taking into account broad populations around the world, including feral, free-roaming, shelter, and working populations, it is possible to identify meaningful individual variability even within the single

Corresponding Author:
Monique A. R. Udell, 308 Withycombe Hall, Department of Animal and Rangeland Sciences, Oregon State University, Corvallis, OR 97331
E-mail: moniqueudell@gmail.com

most studied subpopulation: pet domestic dogs. Likewise, it is possible to discuss social relationships with respect to other dogs, humans, or any number of other species (e.g., relationships between livestock-guarding dogs and sheep). Here, we will focus on the social behavior of pet dogs toward humans.

The aim of the current review is not to claim that dogs are the only species with this level of social flexibility or this social strategy. Rather, we propose that the long-observed variability in dogs' sociocognitive performances may be an important feature of their social success instead of a roadblock to understanding it.

Canine Social Cognition and Responsiveness Toward Humans

Over the past two decades, much attention has been given to reported differences between wolves and dogs in social behavior and cognition (Kubinyi, Virányi, & Miklósi, 2007; Miklósi et al., 2003; Udell et al., 2010b). While early reports hypothesized that dogs alone should have the capacity to understand human pointing, gaze, and other communicative actions, there is now ample evidence demonstrating that human-reared wolves, dingoes, coyotes, and foxes (as well as other nondomesticated species) can respond to human social cues (Barrera, Jakovcevic, Mustaca, & Bentosela, 2012; Smith & Litchfield, 2009; Udell, Spencer, Dorey, & Wynne, 2012).

Importantly, reports that subpopulations of dogs perform differently from one another on tests of social cognition are becoming more common than reports of dog-wolf differences, illustrating the importance of environment, experience, breed, and individual differences in the development of a dog's social cognition. For example, while many pet dogs excel at following a range of human points to distant locations or containers to find a reward, dogs living in shelters (Udell, Dorey, & Wynne, 2010a) and kennel-reared laboratory dogs (Lazarowski & Dorman, 2015) often fail to follow a human's point unless additional training is provided. When presented with an unsolvable task, dogs with agility training gaze longer at their owners than do pets or search-and-rescue dogs (Marshall-Pescini, Passalacqua, Barnard, Valsecchi, & Prato-Previde, 2009). Highly trained obedience dogs spend more time interacting with a testing apparatus and appear to be better independent problem-solvers compared to untrained pet dogs, which look at their owners more (Marshall-Pescini, Valsecchi, Petak, Accorsi, & Previde, 2008; Osthaus, Lea, & Slater, 2003). Dogs reared in kennels from birth spend significantly less time gazing at humans than do pets when confronted with an unsolvable task (D'Aniello & Scandurra, 2016).

Even within pet populations, differences in responsiveness to human actions vary depending on a dog's morphology (size, muzzle shape, eye positioning; Helton & Helton, 2010), testing environment (Udell, Dorey, & Wynne, 2008), age (Dorey, Udell, & Wynne, 2010), and gesture type (Udell et al., 2013). Breed selection for different predatory-motor-pattern sequences has also been associated with different levels of performance on human-guided tasks (Udell, Ewald, Dorey, & Wynne, 2014); see Figure 1. Another study by Gácsi et al. (2009) tested 180 pet dogs on their ability to follow a momentary distal human point to a container concealing hidden food over 20 trials. While on average, dogs performed above chance level on the task, less than half of the dogs tested followed the human point to the correct container reliably. These studies provide evidence not only that individual variability in performance on social tasks is common in dogs, but also that few individual dogs behave like the "average" dog.

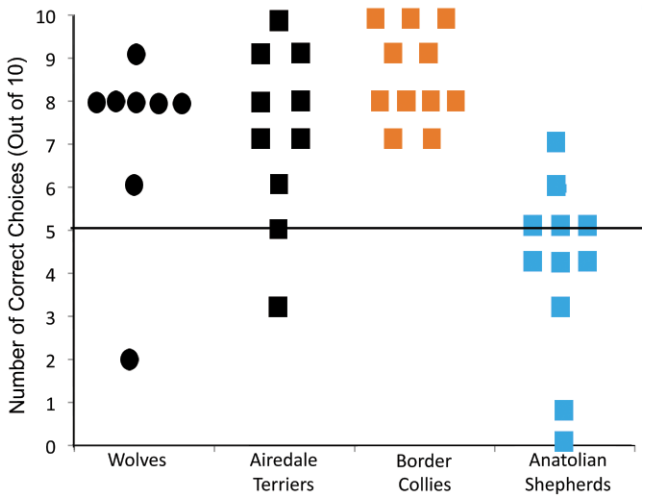

Fig. 1. Species, breed, and individual differences in point-following performance demonstrated by Udell, Ewald, Dorey, and Wynne (2014). Data points indicate the number of times (across 10 trials) that an individual dog or wolf followed a human experimenter's momentary distal point to a container where the animal would receive a food reward. The horizontal line represents performance at chance level. Dogs from breeds selected for the maintenance or exaggeration of the first part of the ancestral predatory motor sequence (orient, eye, stalk, chase), Border Collies and Airedale Terriers, performed better on this human-guided task than did those from a breed selected for inhibition of predatory behavior, Anatolian Shepherds. Significant individual variability in performance can also be seen within each breed.

Role of Domestication and Experience

While domestication does not predict absolute differences in the social intelligence of wild versus domesticated canines, it may set the stage for greater flexibility in social behavior. Domestication has been associated with greater behavioral plasticity in many species, from songbirds and farm animals to domestic dogs. This plasticity

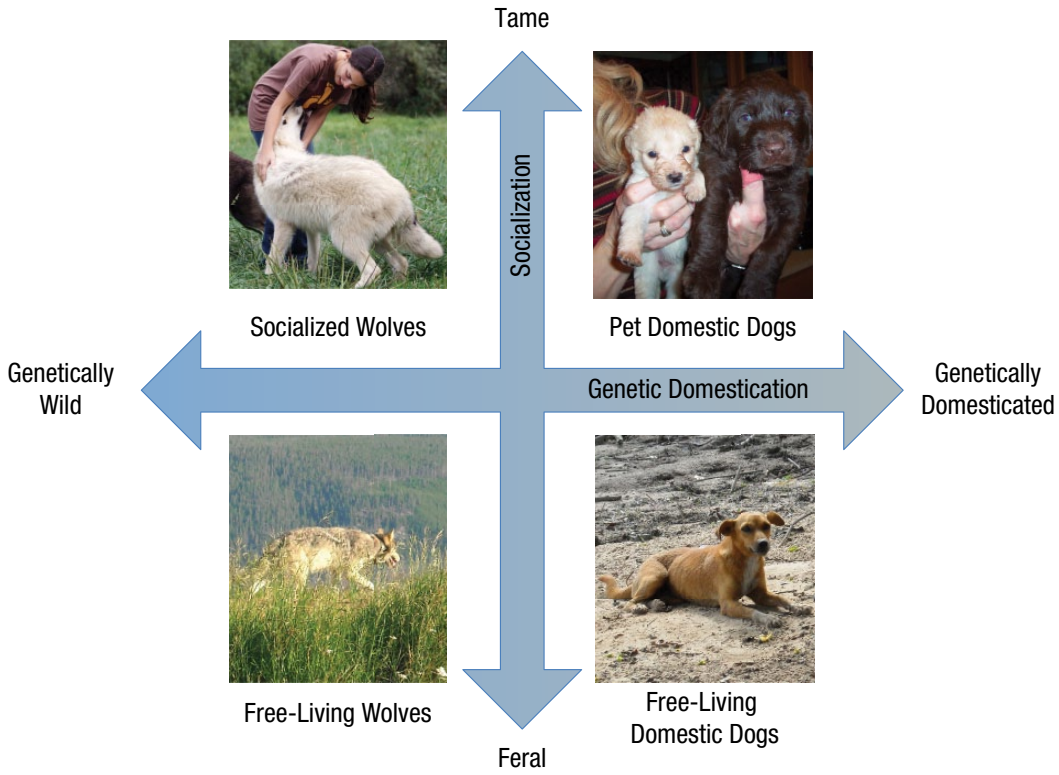

Fig. 2. Domestication and socialization as interacting evolutionary and developmental continuums. Individuals can vary in their degree of socialization (e.g., in terms of the timing, quality, and quantity of prior interactions with humans or other species) and in their degree of genetic domestication (e.g., in terms of number of generations or strength of selection). This contributes to the variability in social behavior observed within and between each of these broad categories.

has been attributed to developmental delays that result in the extension and increased rate of juvenile-type behavior into adulthood, or neoteny (Price, 1984). In dogs, this includes prolonged gaze, extended greetings (Bentosela et al., 2016; Nagasawa et al., 2015), and a tendency toward hypersocial responses (Udell, 2015). Such developmental delays are also responsible for the extended period of time during which initial socialization is possible for dogs, increasing the ease with which dogs can bond to humans or other species compared to wild canids (Udell et al., 2010b). For dogs, the sensitive period for initial socialization starts around 3 weeks of age and extends to 12 to 16 weeks of age. For wolves and other wild canines, this window starts a few days after birth and ends much earlier. If a wolf has not been socialized to humans by 1 month of age, it is unlikely that a lasting bond will be formed (Udell et al., 2010b). This affords domestic dogs greater social plasticity, allowing for greater diversification of social strategy compared with wild canids, whose pups may have little chance under natural conditions to encounter other species or social environments outside of their den before the end of their sensitive period for social development.

However, even for domestic dogs, prosocial behavior toward humans still depends heavily on exposure during the sensitive period of socialization. While an extended window for socialization increases the likelihood that dogs will form a bond with humans, it does not guarantee it. The interaction between domestication and socialization best predicts the social phenotype an individual will display as an adult (Coppinger & Coppinger, 2001; Udell et al., 2010b; Fig. 2). In other words, domestication does not give dogs new "social languages," but it does give them more time to learn them.

Dog-Human Attachment

From an ethological perspective, attachment has been described as an affectionate tie between two individuals that promotes a balance of proximity seeking and independent activity/exploration. For species that require care after birth, proximity and contact-seeking behavior enhance the likelihood that the young of a species will have access to warmth, protection, food, and other resources provided by their caretakers early in life (Bowlby, 1973). However, young animals also have to

Table 1. Behavioral Indicators and Predictors of Attachment Styles (Based on Schaffer & Emerson, 1964)

Attachment type	Behavioral indicators	Relationship predictors
Secure attachment	Preference for caretaker over stranger; some distress when separated from caretaker; is quickly calmed by caretaker's return (facilitating return to independent exploration and play: secure base effect)	Has received positive and consistent support from attachment figure when encountering new challenges/environments and in times of stress
Ambivalent/anxious attachment	Distress when separated from caretaker; seeks comfort and prolonged contact with caretaker after an absence, but slow to calm down or find comfort even after caretaker returns	Has received mixed or inconsistent availability and support from attachment figure
Avoidant attachment	Heavily self-reliant and independent; withdraws from or avoids caretaker after an absence and in times of stress	Has been ignored or dismissed by attachment figure in times of stress

learn how to succeed as individuals within the broader environment. Thus, another important role of the attachment figure is to serve as a secure base, providing a source of comfort and security that allows young to investigate new territory and environmental features and, ultimately, develop independence (Bowlby, 1973).

While there is evidence that dogs can form attachments to humans (Topál, Miklósi, Csányi, & Dóka, 1998), this attachment is not unique to the dog-human relationship. There have been many scientific demonstrations of cross-species attachments (Lorenz, 1952), as well as animal attachments toward moving objects, puppets, and artificial mother figures made of wire and cloth (Harlow, 1958). Furthermore, the simple presence of behavior associated with attachment, including proximity seeking, separation distress, and caretaker preference, does not provide sufficient information to assess the quality of an individual dog-human attachment relationship (Rehn, McGowan, & Keeling, 2013). For example, while some minor distress upon the departure of an attachment figure is normal, Gaultier, Bonnafous, Bougrat, Lafont, and Pageat (2005) reported that 56% of pet dogs living in the United States exhibit behavior suggestive of separation anxiety disorder, which is characterized by fear, extreme distress, and destructive behavior when separated from attachment figures. Hypersocial behavior in dogs has also been found to interfere with independent problem-solving persistence and ability (Udell, 2015). Therefore, the presence, quantity, and quality of attachment behaviors are relevant when evaluating the dog-human relationship.

Embracing Variation: Attachment Styles

Attachment-style research, originally developed to evaluate the quality of bonds between human children and their mothers (Ainsworth & Bell, 1970), has recently been adapted to explore different patterns of attachment between dogs and humans. Although more than one method for measuring attachment exists, many dog-human attachment studies have utilized modified versions of the Strange Situation Test developed by Ainsworth and Bell (1970). In the original test, infants would accompany their mother to an unfamiliar room where they were allowed to explore freely and play with a range of available toys. Infants would then experience seven 3-minute episodes during which their response to the presence, absence, and return of their mother and a stranger were evaluated: (1) mother and infant are alone; (2) mother, stranger, and infant are together; (3) mother leaves stranger and infant alone; (4) mother returns, stranger leaves; (5) mother leaves, infant is completely alone; (6) stranger returns; and (7) mother returns, stranger leaves. Different human infant attachment styles are best predicted by caretaker behavior and home environment (Schaffer & Emerson, 1964; Table 1). While children often form a strong preference for one individual during a brief period of development (typically between 7 and 12 months of age), the development of multiple attachments by 18 months of age is considered the norm (Schaffer & Emerson, 1964). Childhood attachment style has also been used as a predictor of future outcomes, including quality of future relationships, risk of depression, aggression, social competence, risk-taking, problem-solving, and motivation (Lynne, Shaver, & Collins, 1998; Ruiter, IJzendoorn, & Wetenschappen, 1993).

The Strange Situation Test has been successfully adapted for use with dog-owner pairs, beginning with Topál, Miklósi, Csányi, and Dóka (1998). While the dog-specific attachment-style methodology and analysis is still evolving (see Rehn et al., 2013, for a discussion), this demonstrated ability to detect reliable and distinct patterns of dog-owner attachment is promising. Additional evidence that dogs can form multiple and new

attachments with distinct attachment styles, as well as the identification of reliable predictors of differing social responses, will likely be of critical importance to understanding social flexibility in dog-human relationships (Gácsi, Topál, Miklósi, Dóka, & Csányi, 2001). Therefore, more research is needed, especially with regard to canine attachment-style classifications. Although Topál et al. (1998) divided dogs into different categories of attachment behavior along insecure-secure dimensions, use of the attachment-style labels found in the human literature has posed challenges, given that analysis of human attachment styles has relied more heavily on behavior during separation (alone) and reunion episodes than has been the case in the dog literature (Rehn et al., 2013). Different coding techniques, including holistic categorization and bin scoring, have also been found to provide more reliable attachment-style designations in humans (Waters, 1978) than the duration measures typically used in studies with dogs—an important consideration for the future design and interpretation of dog attachment research. A better understanding of dog-human attachment styles may help inform fostering and adoption practices, the diagnosis or treatment of behavior problems, and the determination of suitability for working roles, and could even serve as an indicator of the effects that major life events, environmental changes, or stressful work environments have on established dog-human bonds. It may also allow us to compare the human-directed social behavior of pet dog populations in different parts of the world and to evaluate possible cultural influences on dog-human attachment, social behavior, and cognition.

Conclusion: Dogs as Social Generalists

While prior studies have reported individual and population variability in domestic dogs' social behavior and cognition, a greater focus on individual variability as a feature of dogs' success in human environments may yield new insights into the origins and nature of the dog-human relationship. Attachment research provides an important model for how embracing findings of variability in the dog-human relationship can enhance our knowledge instead of obstructing it.

It has been proposed that in quickly evolving anthropogenic (human-controlled) environments, generalist species outperform specialists because of their superior ability to quickly adapt and thrive (Clavel, Julliard, & Devictor, 2011). Dogs may represent one important example of this trend. However, future research should also consider the potential costs of being a social generalist. For example, while dogs quickly learn to respond to communicative gestures and vocalizations of other bonded species (Udell et al., 2010b), this may be associated with reduced precision in signaling to other dogs (Goodwin, Bradshaw, & Wickens, 1997). Neoteny, including the extended period for social development that contributes to dogs' social plasticity, may make dogs more prone to separation anxiety (Gaultier et al., 2005). Increased attentiveness to human social stimuli may inhibit effective independent problem-solving behavior (Udell, 2015). Interestingly, a similar pattern of behavior has also been observed in grey parrots with intensive human socialization (Pepperberg, 2004), further suggesting that these trends may be strategy-specific instead of species-specific.

Reported variation in the social behavior of owned dogs toward humans, while significant, is just the tip of the iceberg. Three-quarters of the world's dogs are free-living scavengers (Coppinger & Coppinger, 2001). At the species level, dogs' normal social behavior toward humans varies dramatically—ranging from fearful and aggressive (Ortolani, Vernooij, & Coppinger, 2009) to securely bonded (Topál et al., 1998). Therefore, understanding socialization and domestication as interacting continuums driving significant individual variability in social behavior will be especially important to our future understanding of the domestic dog.

Recommended Reading

Ainsworth, M. D. S., & Bell, S. M. (1970). (See References). Provides more detail on the original Strange Situation Test methodology.

Clavel, J., Julliard, R., & Devictor, V. (2011). (See References). A review article proposing that generalist species may be replacing specialists in some environments, with implications for biodiversity.

Coppinger, R., & Coppinger, L. (2016). *What is a dog?* Chicago, IL: University of Chicago Press. Explores the origins, biology, behavioral ecology, and social behavior of dogs around the world, the majority of which live very different lives from our pets.

Rehn, T., McGowan, R. T. S., & Keeling, L. J. (2013). (See References). Addresses the strengths and limitations of attachment-style methodologies used to study dog-human relationships and provides more complete coverage of the existing literature in this area.

Udell, M. A. R., Dorey, N. R., & Wynne, C. D. L. (2010b). (See References). A more detailed review of the interacting effects of domestication and socialization on the development of dogs' social cognition.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

References

Ainsworth, M. D. S., & Bell, S. M. (1970). Attachment, exploration, and separation: Illustrated by the behavior of one-year-olds in a strange situation. *Child Development*, *41*, 49–67.

Barrera, G., Jakovcevic, A., Mustaca, A., & Bentosela, M. (2012). Learning interspecific communicative responses in Pampas foxes (*Lycalopex gymnocercus*). *Behavioural Processes*, *89*, 44–51. doi:10.1016/j.beproc.2011.10.013

Bentosela, M., Wynne, C. D. L., D'Orazio, M., Elgier, A., & Udell, M. A. R. (2016). Sociability and gazing toward humans in dogs and wolves: Simple behaviors with broad implications. *Journal of the Experimental Analysis of Behavior*, *105*, 68–75. doi:10.1002/jeab.191

Bowlby, J. (1973). *Attachment and loss: Vol. 2. Separation: Anxiety and anger*. New York, NY: Basic Books.

Clavel, J., Julliard, R., & Devictor, V. (2011). Worldwide decline of specialist species: Toward a global functional homogenization? *Frontiers in Ecology and the Environment*, *9*, 222–228. doi:10.1890/080216

Coppinger, R., & Coppinger, L. (2001). *Dogs: A startling new understanding of canine origin, behavior & evolution* (1st ed.). New York, NY: Scribner.

D'Aniello, B., & Scandurra, A. (2016). Ontogenetic effects on gazing behaviour: A case study of kennel dogs (Labrador Retrievers) in the impossible task paradigm. *Animal Cognition*, *19*, 565–570. doi:10.1007/s10071-016-0958-5

Dorey, N. R., Udell, M. A. R., & Wynne, C. D. L. (2010). When do domestic dogs, *Canis familiaris*, start to understand human pointing? The role of ontogeny in the development of interspecies communication. *Animal Behaviour*, *79*, 37–41. doi:10.1016/j.anbehav.2009.09.032

Gácsi, M., Kara, E., Belenyi, B., Topál, J., & Miklósi, Á. (2009). The effect of development and individual differences in pointing comprehension of dogs. *Animal Cognition*, *12*, 471–479. doi:10.1007/s10071-008-0208-6

Gácsi, M., Topál, J., Miklósi, Á., Dóka, A., & Csányi, V. (2001). Attachment behavior of adult dogs (*Canis familiaris*) living at rescue centers: Forming new bonds. *Journal of Comparative Psychology*, *115*, 423–431.

Gaultier, E., Bonnafous, L., Bougrat, L., Lafont, C., & Pageat, P. (2005). Comparison of the efficacy of a synthetic dog-appeasing pheromone with clomipramine for the treatment of separation-related disorders in dogs. *The Veterinary Record*, *156*, 533–538.

Goodwin, D., Bradshaw, J. W. S., & Wickens, S. M. (1997). Paedomorphosis affects agonistic visual signals of domestic dogs. *Animal Behaviour*, *53*, 297–304. doi:10.1006/anbe.1996.0370

Harlow, H. F. (1958). The nature of love. *American Psychologist*, *13*, 573–685.

Helton, W. S., & Helton, N. D. (2010). Physical size matters in the domestic dog's (*Canis lupus familiaris*) ability to use human pointing cues. *Behavioural Processes*, *85*, 77–79. doi:10.1016/j.beproc.2010.05.008

Kubinyi, E., Virányi, Z., & Miklósi, Á. (2007). Comparative social cognition: From wolf and dog to humans. *Comparative Cognition & Behavior Reviews*, *2*, 26–46.

Lazarowski, L., & Dorman, D. C. (2015). A comparison of pet and purpose-bred research dog (*Canis familiaris*) performance on human-guided object-choice tasks. *Behavioural Processes*, *110*, 60–67. doi:10.1016/j.beproc.2014.09.021

Lorenz, K. (1952). *King Solomon's ring*. New York, NY: Thomas Y. Crowell.

Lynne, M., Shaver, P. R., & Collins, N. L. (1998). Attachment styles, emotion regulation, and adjustment in adolescence. *Journal of Personality and Social Psychology*, *74*, 1380–1397. doi:10.1037/0022-3514.74.5.1380

Marshall-Pescini, S., Passalacqua, C., Barnard, S., Valsecchi, P., & Prato-Previde, E. (2009). Agility and search and rescue training differently affects pet dogs' behaviour in socio-cognitive tasks. *Behavioural Processes*, *81*, 416–422. doi:10.1016/j.beproc.2009.03.015

Marshall-Pescini, S., Valsecchi, P., Petak, I., Accorsi, P. A., & Previde, E. P. (2008). Does training make you smarter? The effects of training on dogs' performance (*Canis familiaris*) in a problem solving task. *Behavioural Processes*, *78*, 449–454. doi:10.1016/j.beproc.2008.02.022

Miklósi, Á., Kubinyi, E., Topál, J., Gácsi, M., Virányi, Z., & Csányi, V. (2003). A simple reason for a big difference: Wolves do not look back at humans, but dogs do. *Current Biology*, *13*, 763–766. doi:10.1016/S0960-9822(03)00263-X

Nagasawa, M., Mitsui, S., En, S., Ohtani, N., Ohta, M., Sakuma, Y., . . . Kikusui, T. (2015). Oxytocin-gaze positive loop and the coevolution of human-dog bonds. *Science*, *348*, 333–336. doi:10.1126/science.1261022

Ortolani, A., Vernooij, H., & Coppinger, R. (2009). Ethiopian village dogs: Behavioural responses to a stranger's approach. *Applied Animal Behaviour Science*, *119*, 210–218. doi:10.1016/j.applanim.2009.03.011

Osthaus, B., Lea, S. E. G., & Slater, A. M. (2003). Training influences problem-solving abilities in dogs (*Canis lupus familiaris*). In *Proceedings of the Annual Meeting of British Society of Animal Science, York* (Vol. 103), 103.

Paul, M., Majumder, S. S., Nandi, A. K., & Bhadra, A. (2015). Selfish mothers indeed! Resource-dependent conflict over extended parental care in free-ranging dogs. *Royal Society Open Science*, *2*(12), Article 150580. doi:10.1098/rsos.150580

Pepperberg, I. M. (2004). "Insightful" string-pulling in Grey parrots (*Psittacus erithacus*) is affected by vocal competence. *Animal Cognition*, *7*, 263–266. doi:10.1007/s10071-004-0218-y

Price, E. O. (1984). Behavioral aspects of animal domestication. *The Quarterly Review of Biology*, *59*, 1–32.

Rehn, T., McGowan, R. T. S., & Keeling, L. J. (2013). Evaluating the Strange Situation Procedure (SSP) to assess the bond between dogs and humans. *PLoS ONE*, *8*(2), e56938. doi:10.1371/journal.pone.0056938

de Ruiter, C., van IJzendoorn, M. H., & Wetenschappen, I. P. (1993). Attachment and cognition: A review of the literature. *International Journal of Educational Research*, *19*, 525–540.

Schaffer, H. R., & Emerson, P. E. (1964). The development of social attachments in infancy. *Monographs of the Society for Research in Child Development*, *29*(3), 1–77. doi:10.2307/1165727

Smith, B. P., & Litchfield, C. A. (2009). Dingoes (*Canis dingo*) can use human social cues to locate hidden food. *Animal Cognition*, *13*, 367–376.

Topál, J., Miklósi, A., Csányi, V., & Dóka, A. (1998). Attachment behavior in dogs (*Canis familiaris*): A new application of Ainsworth's (1969) Strange Situation Test. *Journal of Comparative Psychology*, *112*, 219–229.

Udell, M. A. R. (2015). When dogs look back: Inhibition of independent problem-solving behaviour in domestic dogs (*Canis lupus familiaris*) compared with wolves (*Canis lupus*). *Biology Letters*, *11*(9), Article 20150489. doi:10.1098/rsbl.2015.0489

Udell, M. A. R., Dorey, N. R., & Wynne, C. D. L. (2008). Wolves outperform dogs in following human social cues. *Animal Behaviour*, *76*, 1767–1773. doi:10.1016/j.anbehav.2008.07.028

Udell, M. A. R., Dorey, N. R., & Wynne, C. D. L. (2010a). The performance of stray dogs (*Canis familiaris*) living in a shelter on human-guided object-choice tasks. *Animal Behaviour*, *79*, 717–725. doi:10.1016/j.anbehav.2009.12.027

Udell, M. A. R., Dorey, N. R., & Wynne, C. D. L. (2010b). What did domestication do to dogs? A new account of dogs' sensitivity to human actions. *Biological Reviews*, *85*, 327–345. doi:10.1111/j.1469-185X.2009.00104.x

Udell, M. A. R., Ewald, M., Dorey, N. R., & Wynne, C. D. L. (2014). Exploring breed differences in dogs (*Canis familiaris*): Does exaggeration or inhibition of predatory response predict performance on human-guided tasks? *Animal Behaviour*, *89*, 99–105. doi:10.1016/j.anbehav.2013.12.012

Udell, M. A. R., Spencer, J., Dorey, N. R., & Wynne, C. D. L. (2012). Human-socialized wolves follow diverse human gestures… and they may not be alone. *International Journal of Comparative Psychology*, *25*(2), 97–117.

Udell, M., Hall, N. J., Morrison, J., Dorey, N. R., & Wynne, C. D. L. (2013). Point topography and within-session learning are important predictors of pet dogs' (*Canis lupus familiaris*) performance on human guided tasks. *Revista Argentina de Ciencias del Comportamiento*, *5*(2), 3–20.

Waters, E. (1978). The reliability and stability of individual differences in infant-mother attachment. *Child Development*, *49*, 483–494. doi:10.2307/1128714