

INTRODUCTION

NANCY R. GEE, LAYLA ESPOSITO, SANDRA McCUNE,
LISA S. FREUND, AND PEGGY McCARDLE

Humans are a fundamentally social species, preferring to live in dyads, families, groups, communities, and cultures (Cacioppo & Ortigue, 2011). As a species, we have a wonderful capacity to develop and engage in social interactions, both with other humans and with members of other species, most obviously companion animals such as dogs and cats. In fact, the latest figures indicate that 68% of U.S. households (American Pet Products Association, 2014; American Veterinary Medicine Association, 2007) and 46% of British households (Pet Food Manufacturers Association, 2014) include at least one companion animal. Pet ownership has also been shown to facilitate “social capital” in that the presence of pets tends to facilitate social contact and a sense of community (Wood, Giles-Corti, & Bulsara, 2005; Wood et al., 2015).

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The Social Neuroscience of Human–Animal Interaction, L. S. Freund, S. McCune, L. Esposito, N. R. Gee, and P. McCardle (Editors)

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A number of studies have suggested that human–animal interaction (HAI) may play a role in improving human health (Anderson, Reid, & Jennings, 1992; Friedmann & Thomas, 1995; Friedmann, Thomas, & Eddy, 2000; Gorrity & Stallones, 1998), preventing emotional distress, reducing stress (Allen, Blascovich, Tomaka, & Kelsey, 1991; Serpell, 1991), and increasing well-being across the lifespan. The multidisciplinary field of HAI is still young, with much of its research base being descriptive in nature (relying on survey methods and correlational techniques) and with little focus on specifics such as the underlying neurobiological mechanisms associated with HAI.

THE PROMISE OF SOCIAL NEUROSCIENCE

Like HAI, social neuroscience is also a relatively new interdisciplinary field, emerging over the past 2 decades. Cacioppo and Berntson (1992) popularized the term *social neuroscience*, which incorporates a multilevel approach to the study of mental and behavioral phenomena. Social neuroscience is an interdisciplinary academic field devoted to understanding how biological systems implement social processes and behavior, and how these social structures and processes impact the brain and biology. Historically, this field grew out of two disciplines that represented previously separate lines of scientific inquiry. One focused on the investigation of the human experience of interacting with one another and how those interactions, real or imagined, influence thought, feelings, and behavior. The other, grounded in biology and biomedicine, focused on understanding how our biological makeup enables such things as behavior, cognition, and emotion, as well as how to explain, predict, and ultimately prevent such things as illness, disease, and psychological disorders. By bridging the gap between these two lines of inquiry, social neuroscience contributes to our understanding of the mechanisms by which our social interactions impact health, lifespan, and cognition (Cacioppo & Ortigue, 2011).

HAI PROVIDES A RICH AREA FOR SOCIAL NEUROSCIENCE INVESTIGATION

HAI is a fertile area for social neuroscientific investigations into our neural, genetic, and basic affiliation and motivation processes. Because this area of public health inquiry has only recently emerged, researchers with expertise in studying neurobiological mechanisms supporting human behaviors have rarely been involved in HAI and are not necessarily familiar with the intriguing public health results and questions generated by early HAI research. Likewise, researchers who have been involved in HAI studies are

typically less familiar with neurobiological approaches or the types of collaborations they could establish to investigate basic biological mechanisms underlying the effects of HAI.

ORIGIN OF THIS BOOK

In 2008, the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD) and the WALTHAM Centre for Pet Nutrition, a division of Mars, Inc., entered a public–private partnership to explore HAI, in particular, as it pertains to child development and health. To further explore the possibilities, the partners held a series of meetings that brought together researchers and practitioners working in animal behavior and cognition, and child health and development, with those studying or clinically applying principles of HAI. Out of these meetings grew two books. The first (McCardle, McCune, Griffin, & Maholmes, 2011) was targeted to research psychologists seeking to know more about research design and methods as used in behavioral investigations of HAI in homes and community settings as well as in intervention studies. The second (McCardle, McCune, Griffin, Esposito, & Freund, 2011) focused more on the human side of HAI, on the need for evidence-based practice in a field that is growing rapidly. In 2011, a workshop was held on the social neuroscience of HAI, which forms the basis of this volume, addressing the basic neurobiological mechanisms that underlie the effects observed in HAI.

This volume brings together researchers who study the neural bases of attachment, social bonds, emotions in social interactions, cognition and the social bases of cognition, responses to social stressors, and genetics. Some of these researchers are investigating HAI; others primarily study humans but have interests in HAI. The volume raises relevant questions regarding basic mechanisms of HAI of mutual interest to human and animal behaviorists and neurobiological researchers, as well as questions about the methods and measures appropriate for investigating those questions.

DEVELOPMENTS IN HAI AND SOCIAL NEUROSCIENCE

The chapters and integrative commentaries in this volume demonstrate that interdisciplinary social neuroscience investigations within and across species are becoming increasingly valuable. Contributors represent multiple disciplines, with a preponderance of psychologists but also biologists, ethologists, psychiatrists, veterinarians, and an ethicist. Their research is conducted in countries throughout North America and Europe.

An area of particular interest to social neuroscience is the effects of neuropeptides on humans, nonhuman animals, and the relationships between them (see especially the chapters in Part II). Research in this area has advanced our understanding of the relationship between pituitary hormones and both pair bonding and social behaviors, and it provides an exciting direction for researchers exploring the nature of both social and biological aspects of attachment and bonding in human–companion animal relationships.

SCOPE AND ORGANIZATION OF THIS BOOK

The volume is based on three main themes: Cognition fundamental to social neuroscience; applying neuroscience to HAI; and science and research considerations, that is, methods and approaches to help to unlock the potential of research in this field. It presents predominantly research involving dogs and horses, as these are the animals with which the most HAI research has been conducted. But as the research agenda makes clear, research on HAI and animal-assisted interventions should include all animals currently involved in these activities, and the important focus on the mechanisms of action that underlie the results being reported for HAI and related interventions is critical to the field's progress and to our more complete understanding of the relationship between humans and animals.

In the first part of this volume, *Cognition: Setting the Stage for Deeper Social Neuroscience*, psychologists Quinn and Guo each discuss research related to perceptual recognition and identification of stimulus cues. Quinn (Chapter 1) presents his work on cognitive categorization, specifically, how young infants mentally organize information from stimuli around them, including people, places, and things, including cats and dogs. Guo (Chapter 2) discusses visual attention and recognition of facial cues in both humans and animals. The ability to categorize stimuli (including animals) and the ability to recognize and identify facial cues are fundamental aspects of human cognition known to influence social interactions and are likely to influence how humans and animals recognize one another, interact, and potentially form attachments.

Coming from a cognitive neuroscience perspective, Ling, Kelly, and Diamond (Chapter 3) discuss the development of executive functions in children and offer indications of how HAI may link to this set of developmental abilities that are crucial to academic success and overall success in life. In making this connection between the development of executive functions and HAI, they lay the foundation for the possibility that the presence of animals in the lives of children has the potential to enhance learning environments and help them to achieve a greater level of success in life than if they had not been exposed to animals during their early development.

This first part concludes with an integrative commentary by biologist Kotrschal, who has worked extensively on the topic of HAI and attachment. Based on his experience in examining both the animal and the human side of the HAI equation, while also focusing on the importance of the formation of attachment to social development, his thoughtful commentary provides a unique and valuable perspective to help set the stage for linking work on social cognition and neuroscience to the investigation of mechanisms underlying the effects of HAI.

In the second part, *Neurobiology: Applying Neuroscience to Human–Animal Interaction*, Carter and Porges (Chapter 4), a behavioral neurobiologist and a psychobiologist, respectively, delve into the evolutionary development of the autonomic nervous system and the neuropeptides oxytocin and vasopressin as they apply to HAI. Psychologists Beetz and Bales (Chapter 5) then explore how these molecules may affect affiliation and attachment in HAI. Brown and Coan (Chapter 6) outline their research on the social regulation of humans' response to threat, including their social baseline theory, and how this social ecology could apply to humans and their household pets. In Chapter 7, Lozier, Brethel-Haurwitz, and Marsh discuss the relationship between empathy, psychopathy, and animal abuse, viewed through the lens of cognitive neuroscience.

This part also concludes with a thought-provoking integrative commentary. Freund, a developmental psychologist and cognitive neuroscientist, highlights and extends the possibilities these authors raise for a deeper exploration of the social neuroscience of HAI to enable a mechanistic account of HAI's effects.

In the third part, *Science and Research Considerations*, geneticist Jones and ethologist McCune (Chapter 8), after a presentation of information about the genetic components of companion animals, describe recent advances in genetic technologies and discuss how genetic diversity in both dogs and cats can be clearly linked to specific behaviors. This chapter also highlights the promise for future research in behavioral genetics to inform HAI, such as in the selection of the best-suited animals for therapeutic interventions. In Chapter 9, veterinarian and biobehaviorist Dreschel and psychologist Granger detail the applications and limitations of salivary bioscience. Their discussion includes both human and animal bioscience considerations, including saliva sample collection, research design, and analytical strategies, as well as specific analytes in saliva that are likely to be of interest to research on HAI. Because the sampling of oral fluid is minimally invasive, and the number of substances that can be reliably measured using this approach is increasing, salivary bioscience has the potential to make profound contributions to the future of research and theory in the social neuroscience of HAI.

In the final chapter (Chapter 10) in this part, psychologist Gee, veterinarian Hurley, and ethicist Rawlings team up to address the animal welfare implications of HAI research and practice. The authors focus specifically on dogs as the animal most commonly involved in animal-assisted interventions. They describe behavioral expectations for the dog and provide specific recommendations for dog selection, training, and evaluation. Most important from a welfare perspective, they describe behavioral indicators of stress in dogs, make recommendations for reducing that stress, and, finally, discuss the unique challenges of working with special populations. In the integrative commentary for this part, McCardle highlights the value of these chapters, encouraging both researchers interested in HAI and those seeking to better understand the complex science that will of necessity be involved in some social neuroscience of HAI research to further their own education in these key areas. She also emphasizes the importance and value of interdisciplinary collaborations if we are to take advantage of the recent scientific advances made in other fields.

CONCLUSION

Over the past several decades, a considerable amount of evidence has amassed demonstrating that elements in the psychological and physiological domains can be influenced by a multiplicity of factors (Plomin, 1989). Cacioppo and Berntson (1992) made the case that more can be achieved by considering a multilevel integrative approach that jointly pursues the understanding of phenomena at both a micro level (biological/neurological) and a macro level (social psychology). We concur with this view and see it as a natural step in the exploration of the underlying mechanisms that can in part explain the—until now—seemingly inexplicable attachment humans have to their pets, the comfort they draw from them, and the already observed but largely unexplained health, developmental, and psychological benefits such interactions apparently provide.

REFERENCES

- Allen, K. M., Blascovich, J., Tomaka, J., & Kelsey, R. M. (1991). Presence of human friends and pet dogs as moderators of autonomic responses to stress in women. *Journal of Personality and Social Psychology*, 61, 582–589. <http://dx.doi.org/10.1037/0022-3514.61.4.582>
- American Pet Products Association. (2014). *Pet industry market size & ownership statistics*. Retrieved from http://www.americanpetproducts.org/press_industry-trends.asp

- American Veterinary Medicine Association. (2007). *U.S. pet ownership and demographics sourcebook*. Schaumburg, IL: Author.
- Anderson, W. P., Reid, C. M., & Jennings, G. L. (1992). Pet ownership and risk factors for cardiovascular disease. *The Medical Journal of Australia*, 157, 298–301.
- Cacioppo, J. T., & Berntson, G. G. (1992). Social psychological contributions to the decade of the brain: Doctrine of multilevel analysis. *American Psychologist*, 47, 1019–1028. <http://dx.doi.org/10.1037/0003-066X.47.8.1019>
- Cacioppo, J. T., & Ortigue, S. (2011). Social neuroscience: How a multidisciplinary field is uncovering the biology of human interactions. *Cerebrum*, 17.
- Friedmann, E., & Thomas, S. A. (1995). Pet ownership, social support, and one-year survival after acute myocardial infarction in the Cardiac Arrhythmia Suppression Trial (CAST). *The American Journal of Cardiology*, 76, 1213–1217. [http://dx.doi.org/10.1016/S0002-9149\(99\)80343-9](http://dx.doi.org/10.1016/S0002-9149(99)80343-9)
- Friedmann, E., Thomas, S. A., & Eddy, T. J. (2000). Companion animals and human health: Physical and cardiovascular influences. In A. L. Podberscek, E. Paul, & J. Serpell (Eds.), *Companion animals and us: Exploring the relationship between people and pets* (pp. 125–142). New York, NY: Cambridge University Press.
- Gorrity, T. F., & Stallones, L. (1998). Effects of pet contact on human well-being: Review of recent research. In C. C. Wilson & D. C. Turner (Eds.), *Companion animals in human health* (pp. 3–22). Thousand Oaks, CA: Sage. <http://dx.doi.org/10.4135/9781452232959.n1>
- McCardle, P., McCune, S., Griffin, J. A., Esposito, L., & Freund, L. S. (Eds.). (2011). *Animals in our lives: Human-animal interaction in family, community, and therapeutic settings*. Baltimore, MD: Paul H. Brookes.
- McCardle, P., McCune, S., Griffin, J. A., & Maholmes, V. (Eds.). (2011). *How animals affect us: Examining the influence of human-animal interaction on child development and human health*. Washington, DC: American Psychological Association.
- Pet Food Manufacturers Association. (2014). *Statistics*. Retrieved from <http://www.pfma.org.uk/statistics/>
- Plomin, R. (1989). Environment and genes. Determinants of behavior. *American Psychologist*, 44, 105–111. <http://dx.doi.org/10.1037/0003-066X.44.2.105>
- Serpell, J. (1991). Beneficial effects of pet ownership on some aspects of human health and behaviour. *Journal of the Royal Society of Medicine*, 84, 717–720.
- Wood, L., Giles-Corti, B., & Bulsara, M. (2005). The pet connection: Pets as a conduit for social capital? *Social Science & Medicine*, 61, 1159–1173. <http://dx.doi.org/10.1016/j.socscimed.2005.01.017>
- Wood, L., Martin, K., Christian, H., Nathan, A., Lauritsen, C., Houghton, S., . . . McCune, S. (2015). The pet factor—companion animals as a conduit for getting to know people, friendship formation and social support. *PLoS ONE*, 10(4), e0122085. <http://dx.doi.org/10.1371/journal.pone.0122085>