Technology for Bonding in Human-Animal Interaction

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Technology for Bonding in Human-Animal Interaction

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Abstract
This workshop focuses on the use and influence of technology on human-animal bonding, and how to facilitate them with technology. We explore the elements and characteristics of human-animal bonding, and how technology is connected to emotions and bonding between the human and the animal. We are particularly interested in animal's experiences, emotions, and welfare in bonding. The workshop facilitates discussion, creates a framework to support design activities, identifies future research themes, and creates ideas on facilitating the mutual bonding in human-animal interaction. The main focus is on dogs, but workshop aims is to pave way for further investigations and research with other domestic animals, such as cats, horses, and rabbits.

Author Keywords
Animal-Computer Interaction; Human-Animal Interaction; emotion; bonding; dog

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction
Creating technological solutions to facilitate human-animal bonding offers exciting opportunities to explore both for academics as well as companies creating products for the market. Indeed, there is an exploding

number of solutions on the market, for example, for dogs, which seem to address the human-animal interaction. There are also questions hanging in the air: Are the solutions facilitating the human owner's bond to the animal calming the owner's conscience while away, or are they facilitating the mutual bond and positive emotions of both the human and the animal? How do the animals perceive and experience the solutions? What kind of solutions can enhance the welfare of both the human and the animal, facilitate and deepen the bonding, and create positive emotions for both?

This workshop aims to address aspects of human-animal bonding from experiences to technology design. We aim to bring together academics and practitioners to discuss and ideate opportunities for research and design in this field. The main focus is on dogs, as this relationship is currently most known about. The aim is that the dog acts as an example species, paving way for exploring other human-animal interactions and bonding to be facilitated and expanded with technology.

Motivation

When creating new technological solutions to facilitate and expand human-animal interaction and bonding, we need to explore and understand what are the elements and characteristics of human-animal bonding: what cognitive, affective, and social aspects are involved. How do humans and animals experience the solutions? What new technology could be developed for bonding?

Problem formulation

Dogs share many of the socio-cognitive skills with humans [22]. Attachment bond between pet dogs and their owners resembles relationship with their own species [15]. However, we lack a comprehensive understanding of how dogs experience their life with us. Human-animal interaction (HAI) has been shown to have positive influence on human health and well-being [19], [23]. For example, the affiliative interaction of humans and dogs (e.g. owner petting the dog) lowers cortisol levels and increase oxytocin and dopamine levels in both species [14]; [5]; [12].

Generally, people agree that domestic animals, such as dogs, experience emotions [11]. However, the existence of emotions in dogs and perception of dog emotions by the caretakers are separate issues [6]. Human attention is generally drawn to the facial expressions of dogs, although emotions are visible in dog's whole body [17]. Humans recognize friendly behavior/ happiness of a dog most easily, but other emotions such as aggression and fear are more difficult to identify [21]. The emotional expressions of dogs and their responses to human emotional signals could have evolved during domestication and have adaptive significance [10], [24], [20]. However, subtle changes in dog's behavior related to their affective states can be difficult to notice. Nonverbal dogs cannot be requested how they are feeling, for example, whether they have pain.

Dogs are loved family members and companions [4]. Pet owners have strong interest in understanding their pets' emotions [7]. According to Mancini [9], Animal-computer interaction (ACI) aims to, among other things, "foster the relationship between humans and animals by enabling communication and promoting understanding between them; technology that allows companion animals to play entertaining games with their guardians or enables guardians to understand and respond to the emotions of their companion animals might be consistent with this aim".

Three existing approaches for enhancing bonding

Increased understanding. The role of the technology should be to support the human-animal interactions but not to replace human interpretation and direct observation [13]. Substituting human interpretation may undermine or even harm human-animal

Activities at the workshop:

-Introductions of participants, their contribution and future vision related to the workshop theme.

-Invited talk on human-animal interaction and bond. Invited speaker: Animal behaviorist, Dr. Katriina Tiira, CEO of SmartDOG on "*Human-dog bond at best? Optimal personality and cognitive traits for working and family dogs – a theory*".

-Results of the online questionnaire to spark off the discussion.

-Identifying elements of human-animal bonding to create a framework.

-SWOT on opportunities, benefits and possible drawbacks, as well as pitfalls to avoid when using technology in HAI and bonding.

-Hands on workshop in small groups applying Lean design thinking approach to ideate facilitating human-dog bonding.

-Presentation of ideas and created concepts.

relationship [7]. In the future, technology could deepen the relationship by opening the dog's world to the human, e.g., by visualizing the invisible scent-universe to the owner [2]. It is thus important to consider how technology may best serve in establishing and deepening the emotional and social bonding between the animal and the human.

Doing activities together. Using playful technology together [16] or even simply observing the animals use the technology [25] can enhance the emotional relationship between people and animals. Technology may also enable remote communication, e.g. via Skype, to support long distance social interactions [18]. Technology may help in the early bonding with new pets. For example, Alcaidinho et al. [1] gave a Whistle activity monitoring device for people who wanted to adopt a shelter dog. The participants of this study felt that the device helped in understanding the dog's needs, encouraged them to spend more active time with the dog, and facilitated bonding with the dog.

Developing shared interaction techniques. Touch is important for both animals and humans. It has been proposed to have potential for technology mediated communication of relatedness and intimacy in human-animal relationship [3]. Lee et al. [8] experimented with wearable computing for remote human-poultry interaction. The human could stroke a chicken doll, with embedded touch sensors that transferred the movements to the real animal via a wearable haptic vest. Results from an experiment showed that people enjoyed being able to remotely touch the animals and the system seemed to be pleasurable for the pet, too. Cheklin et al. [3] extended the idea to dogs; they propose that working humans could remotely play with rescued dogs and nurture them via haptic vest. This kind of interaction could help both parties, by easing the stress of a worker as well as the rescued dog. Remote touching of animals would enable pet nurturing also for people with allergies [8].

How are these raised aspects and what other aspects are connected to designing technology aiming to facilitate and expand the human-dog, or more generally, human-animal, bonding?

Goals and activities

Goals of the workshop are:

- Bring together interested researchers and practitioners from different disciplines and backgrounds with interest in emotions, human-animal bonding and technology.
- Build a network of the participants to facilitate further collaboration and research activities.
- Create discussion from different disciplinary perspectives and practitioners' viewpoint on human-animal bonding and its elements.
- Identify opportunities for research and design in the area of human-animal interaction and bonding.
- Create ideas for technological solutions supporting and expanding human-animal bonding, e.g. to enhance understanding, and sharing of emotions with the use of technology.

Activities prior to the workshop: Participant selection (max 15) based on an online questionnaire prior to workshop with background and contribution statement and view on HAI and bonding. Participants are selected based on diversity of backgrounds and contributions.

After the workshop we report results at workshop website, and aim for an academic publication.

Biographies of organizers

Heli Väätäjä is a postdoctoral researcher at the Research Group for Emotions, Sociality, and Computing (ESC), Faculty of Communication Sciences, at the University of Tampere. Her research interests in ACI include experience design and evaluation with animals, innovative use of technology for animal welfare,

human-animal relationship, training, and daily activities.

Päivi Majaranta is a researcher at the Research Group for Emotions, Sociality, and Computing (ESC), Faculty of Communication Sciences, at the University of Tampere. Her research interest include human-technology interaction, human-animal-technology interaction and multimodal interaction methods. She has special knowledge in gaze based interaction.

Heini Törnqvist is a researcher at University of Helsinki, Faculty of Veterinary Medicine, Finland. She is currently working in a project studying dog's cognitive processes with eye-tracking and EEG methods, and in a project developing technical devices for monitoring dog's well-being. Her research interests include developing animal friendly research methods for dog studies, and comparative cognition studies between humans and dogs.

Mari Ainasoja works as a researcher and project coordinator at the University of Tampere. Her work focuses at transmitting the voice of customers into business development. Her research interests cover customer experiences, from feelings and emotions in business to service development and digital customer journeys. Currently, she studies these topics in the project "Buddy and the Smiths 2.0" that develops technology related to dogs.

Veikko Surakka received the MA, Lic, and PhD degrees in psychology in 1990, 1993, and 1999, respectively from the University of Tampere. He is a Professor of interactive technology (2007-present) and the head of the Research Group for Emotions, Sociality, and Computing (http://www.cs.uta.fi/hci/esc/), Tampere Unit for Computer-Human Interaction, Faculty of Communication Sciences, University of Tampere. The research group focuses especially on research on emotion, cognition, human-human as well as human-technology interaction research.

Oskar Juhlin is a Professor at the Department of Computer and Systems Sciences at Stockholm University. His research interest include human animal interaction, social media and road traffic, video interaction and fashion. He is one of the leading founders of ACI research and community. He has studied, e.g., interaction between dogs and humans in urban environments as well as in the wild.

Clara Mancini is a Senior Lecturer at The Open University and the founding director of the Animal-Computer Interaction (ACI) Laboratory. Clara is especially interested in ACI's methodological challenges, innovation opportunities and potential for contributing to human and wellbeing, social inclusion, interspecies cooperation and environmental restoration.

References

[1] Joelle Alcaidinho, Giancarlo Valentin, Stephanie Tai, Brian Nguyen, Krista Sanders, Melody Jackson, Eric Gilbert, and Thad Starner. 2015. Leveraging mobile technology to increase the permanent adoption of shelter dogs. In *Proceedings of the 17th International Conference on Human-Computer Interaction with Mobile Devices and Services* (MobileHCI '15), 463-469.

[2] Fredrik Aspling, Oskar Juhlin, and Elisa Chiodo. 2015. Smelling, pulling, and looking: unpacking similarities and differences in dog and human city life. In *Proceedings of the 12th International Conference on Advances in Computer Entertainment Technology* (ACE '15), p. 64.

[3] Marianna Cheklin, Florian 'Floyd' Mueller, and Stefan Greuter. 2016. Designing mediated nurturing play with dogs to alleviate workplace stress. In *Proc. 2016 ACM Conference Companion Publication on Designing Interactive Systems* (DIS '16 Companion), 153-156.

[4] Michael J Dotson and Eva M. Hyatt. 2008. Understanding dog–human companionship. *Journal of*

Business Research, 61, 5: 457-466.
[5] Linda Handlin, Eva Hydbring-Sandberg, Anne Nilsson, Mikael Ejdebäck, Anna Jansson, and Kerstin Uvnäs-Moberg. 2011. Short-term interaction between dogs and their owners: Effects on oxytocin, cortisol, insulin and heart rate-An exploratory study. *Anthrozoös*, 24, 3: 301-315
[6] Miiamaaria V. Kujala. 2017. Canine emotions as seen through human social cognition. *Animal Sentience: An Interdisciplinary Journal on Animal Feeling*, 14, 1.
[7] Shaun Lawson, Ben Kirman, Conor Linehan, Tom Feltwell, and Lisa Hopkins. 2015. Problematising upstream technology through speculative design: the case of quantified cats and dogs. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (CHI '15), 2663-2672.
[8] Shang Ping Lee, Adrian David Cheok, Teh Keng Soon James, Goh Pae Lyn Debra, Chio Wen Jie, Wang Chuang, and Farzam Farbiz. 2006. A mobile pet wearable computer and mixed reality system for human–poultry interaction through the internet. *Personal and Ubiquitous Computing*, 10, 5: 301-317.
[9] Clara Mancini. 2011. Animal-computer interaction: a manifesto. *interactions,* 18, 4, 69-73002E
[10] Isabella Merola, Emanuela Prato-Previde, and Sarah Marshall-Pescini. 2012. Dogs' social referencing towards owners and strangers. *PLoS ONE*, 7, 10: e47653.
[11] Paul H. Morris, Christine Doe, and Emma Godsell. 2008. Secondary emotions in non-primate species? Behavioural reports and subjective claims by animal guardians. *Cognition and emotion*, 22, 1: 3-20.
[12] Miho Nagasawa, Shouhei Mitsui, Shiori En, Nobuyo Ohtani, Mitsuaki Ohta, Yasuo Sakuma, Tatsushi Onaka, Kazutaka Mogi, and Takefumi Kikusui. 2015. Social evolution. Oxytocin-gaze positive loop and the coevolution of human-dog bonds. *Science*, 348, 6232: 333-336.
[13] Jonathan K. Nelson and Patrick C. Shih . CompanionViz: Mediated platform for gauging canine health and enhancing human–pet interactions. 2017. *International Journal of Human-Computer Studies, 98*, 169-178.
[14] Johannes S. J. Odendaal and Roy Alec Meintjes. 2003. Neurophysiological correlates of affiliative behaviour between humans and dogs. *The vet. j.*, 165: 296-301.
[15] Elyssa Payne, Pauleen C. Bennett, and Paul D. McGreevy. 2015. Current perspectives on attachment and bonding in the dog–human dyad. *Psychology research and behavior management*, 8: 71–79.
[16] Patricia Pons, Javier Jaen, and Alejandro Catala. 2015. Envisioning future playful interactive environments for animals. In *More Playful User Interfaces*, 121-150.
[17] Paul C. Quinn, Matthew M. Doran, Jason E. Reiss, and James E. Hoffman. 2009. Time course of visual attention in infant categorization of cats versus dogs: evidence for a head bias as revealed through eye tracking. *Child development*, 80, 1: 151-161.
[18] Alexandre Pongrácz Rossi, Sarah Rodriguez, and Cassia Rabelo Cardoso dos Santos. 2016. A dog using skype. In *Proc. ACI 2016,* Article 10, 4 pages.
[19] James Serpell. 1991. Beneficial effects of pet ownership on some aspects of human health and behavior. *Journal of the royal society of medicine*, 84: 717-720.
[20] Sanni Somppi, Heini Törnqvist, Miiamaaria V. Kujala, Laura Hänninen, Christina M. Krause, and Outi Vainio. 2016. Dogs evaluate threatening facial expressions by their biological validity- evidence from gazing patterns. *PLoS ONE*, 11: e0143047.
[21] Gabriella Tami and Anne Gallagher. 2009. Description of the behavior of the domestic dog (Canis familiaris) by experienced and inexperienced people. *Applied animal behavior science*, 120, 3: 159-169.
[22] József Topál, György Gergely, Ágnes Erdőhegyi, Gergely Csibra, and Ádám Miklósi. 2009. Differential sensitivity to human communication in dogs, wolves, and human infants. *Science*, 325, 5945: 1269-1272.
[23] Javier Viués-Ortega and Gualberto Buela-Casal. 2006. Psychophysiological effects of human-animal interaction. Theoretical issues and long-term interaction effects. *J. Nerv. Ment. Dis*, 194: 52-57.
[24] Bridget M. Waller, Kate Peirce, Cátia C. Caeiro, Linda Scheider, Anne M. Burrows, Sandra McCune, and Juliane Kaminski. 2013. Paedomorphic facial expressions give dogs a selective advantage. *PLoS ONE*, 8, 12: e82686.
[25] Sarah Webber, Marcus Carter, Sally Sherwen, Wally Smith, Zaher Joukhadar, and Frank Vetere. 2017. Kinecting with Orangutans: Zoo Visitors' Empathetic Responses to Animals? Use of Interactive Technology. In *Proc. CHI 2017*, 6075-6088.