From Quantified Self to Quantified Other: Engaging the Public on Promoting Animal Well-being

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Abstract
The Quantified Self movement has resulted in tracking and visualization technologies that allow people to become more aware of their own and their pets' activity levels as incentives for living healthier lifestyles. Zoos provide another opportunity within this movement to further promote public awareness of human and animal well-being. In this position paper, we extend the possibilities of the Quantified Self movement to those of the Quantified Other and the Smart Habitat. We explore the possibility of engaging virtual and in-person zoo visitors by allowing them to compare their activity data to that of their pets and zoo animals, and also to promote awareness of animal well-being by comparing the activity data of zoo animals in a variety of habitat configurations. We propose the notion of Interspecies Computer Interaction (ICI) to mutually benefit human and non-human animal well-being.

Author Keywords
Animal Computer Interaction; Quantified Other; Smart Habitat; Interspecies Computer Interaction; Mobile Health; Physical and Emotional Well-being; Animal Welfare.

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

Introduction

In this position paper, we argue on behalf of the potential benefits of a nascent category of research and practice that we call Interspecies Computer Interaction (ICI). ICI provides both an important way to visualize a growing body of work and to approach the goal of increasing wellness across human and nonhuman animal populations. By combining efforts within Human-Computer Interaction (HCI) and Animal-Computer Interaction (ACI), ICI allows us to tap into humans' fascination with and attachment to other species in order to benefit a larger and more diverse group of users. We explore one such area of possibility by considering the extension of the Quantified Self (QS) and Smart Home technology to those of the Quantified Other (QO) and the Smart Habitat. By allowing humans to compare their daily activity levels with those of animals living in zoos across a variety of habitats, we believe it is possible to increase wellness for all these individuals. We conclude with a taxonomy of potential ICI subject areas, rooted in long-standing traditions within the history and development of technology for animal husbandry, conservation, and companionship.

Quantified Other: Bridging Human Computer Interaction and Animal Computer Interaction

In the United States today, computer-mediated interaction is pervasive. The QS movement is an initiative within the HCI field that both reflects this pervasiveness and attempts to put it to good use by encouraging individuals to adopt healthier lifestyles. Customizable sensors such as GPS, pedometers, accelerometers, gyroscope, and others enable anyone in possession of these devices to track and compare detailed information about their personal physical activity. The QS movement was started by technologists and early adopters who are enthusiastic about using sensor technology to accurately capture and portray one's daily activities [1] so that people can make use of and reflect on their data.

One outcome of having historical activity data is the ability of an individual to see their progression in a given activity. Recent research has attempted to use past physical activity level as a trigger to encourage people to carry out more physical activities [3]. This has been found to be largely ineffective in the general population, however, with most people failing to sustain activity levels through a six-month period [14]. It appears most people either do not share the strong intrinsic motivation possessed by the stalwart QS population, face difficulty in troubleshooting and maintaining their devices, and/or lack the ability to infer the meaning of the tracked data [7, 16, 18].

Thus, the ability to measure and interpret one's activity is not sufficient for sustaining wellness behaviors. As [11] suggest, in order for wellness activities to stick and persist, the activity should also be social, customizable in terms of its competitive/noncompetitive nature, fun, and its benefits need to be immediately apparent. The challenge remains, therefore, to find compelling ways to meet these additional needs for a larger group of people if the possibilities of the QS movement are to be realized.

Loosely defined, the Smart Home also is an initiative that builds on the pervasiveness of computer-mediated interactions, especially the diffusion of sensor technology in the U.S. Precursor to and a subset of the Internet of Things, like QS, Smart Homes allow people to collect daily activity and usage data, adjusting both the environment and residents' behavior (including consumption patterns) accordingly. From timed adjustments in ambient temperature, lighting, hot water availability, large appliance use and the charging of solar cells and car batteries to power use and home security and aging-in-place warning systems, information gathered from residential sensors also allows users to improve their quality of life, possibly while reducing their impact on the environment [5].

ACI is a field that has recently emerged from the HCI tradition. Initially, it focused on designing technologies that could empower assistance dogs so that they can better serve their human companions [9]. ACI has also recently expanded to include Smart Home-type initiatives, for instance, inquiries that involve the design of smart kennels [10] and the use of digital technology for the zoo [2]. The goal in all of these efforts is to promote animal well-being. When combined with activity data provided by QO sensors, Smart Habitat data can potentially help distinguish activities such as exploration, play, foraging, and other reward acquisition behaviors [17] from problematic behaviors such as pacing or aggression, assist zoo researchers in data collection, and promote public understanding of zoo animal behaviors.

Interspecies Computer Interaction (ICI)

Meaningful relationships between human and nonhuman animals are at least prehistoric. Our desire to carefully observe and befriend animals seems to be at least as old as our desire to avoid, torment, and eat them. Humans' compassion for other species and especially for pets has proved a highly effective motivator for people to change their behaviors, sometimes significantly altering their own lives if it means connecting with and improving the lives of other species. We see this in a wide range of individuals' behaviors, from the adoption of vegan lifestyles to reducing the use of chemicals, fossil fuels, palm oil and other natural resources to rescuing abandoned dogs, cats, birds, stranded whales, and orphaned gorillas, crowdsourcing and citizen science animal care efforts, feeding wild animals in the winter, to name a few.

The Internet is also alive these days with numerous examples of voluntary inter-species interactions and attachments that do not include humans. Dog-human interactions may be universal and universally taken for granted, for example, but what about documented dog-cat, dog-elephant, dog-tiger, dog-rhino, and dog-orangutan relationships? There are documented orangutan-gorilla, lion-antelope, hippo-turtle, horse-goat and crow-cat relationships, too, just to name a few. The desire for sociality, to cooperate especially in order to fulfill the emotional side of our wellness needs, seems to result in many permutations of positive, sustained interactions between species.

As a field, ICI could tap into this very proclivity in any social species in order to improve all individuals' qualities of life. Recent ICI efforts by the first author, for instance, provide one example of how this strategy might work. Nelson and Shih [12] have offered the idea of the QO as a compliment to the QS, where dog owners were encouraged to visualize their pets' activity

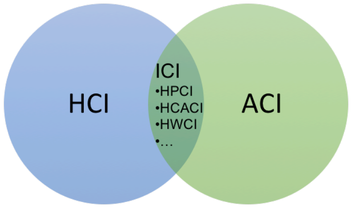

Figure 1: Interspecies-Computer Interaction includes areas of substantive inquiry within Human-Computer Interaction and Animal-Computer Interaction with subspecializations in Human-Pet Computer Interaction (HPCI), Human-Captive Animal Computer Interaction (HCACI), and Human Wildlife Computer Interaction (HWCI).

levels as a mechanism to persuade the people to walk more; early results are quite promising, too.

We believe this is because when the "other" being quantified is a beloved pet, there is a good chance that the additional ingredients necessary for newly adopted activity behaviors to stick will be present. A shared activity with one's beloved dog increases motivation and sociality [8, 15], makes the benefits of the activity immediately discernible, and may present a higher fun factor than an activity involving another human.

Our vision to design for both humans and zoo animals in mutually beneficial ways using tracking technology builds on this work while integrating the insights of animal experts [6] and health professionals in considering where, where, and through what means people might see information about zoo animals and how this could integrate with their own data. Tracking animal activity levels and making them available to the public has several benefits. First, the data can be used as educational material to help visitors learn about animal lifestyles, including, for example, daily number of steps taken and amount of time spent sleeping. Second, visitors can compare their or their pets' activity levels to that of the zoo animals. This will provide a frame of reference for better relating to the amount of exercise that zoo animals and pets get on a regularly basis. It may be that if a person sees that his or her pet gets less physical exercise compared to a similar species in a zoo, then s/he may decide to walk the pet more, resulting in positive health benefits to both.

Having access to animal activity level data may allow zookeepers as well as the public to compare healthy versus stress-related behaviors as well as different configurations of habitats and find those that are most conducive to animal well-being and exercise. This not only provides reassurance to keepers and visitors [13], but it could also provide a platform to compare animal well-being across multiple zoos. If visitors see that certain zoo animals are not getting the same exercise as their counterparts living in different, better designed habitats, they may be willing to advocate for change by offering monetary donations or other forms of support at the community level.

Conclusion

ICI captures aforementioned overlaps between HCI and ACI (e.g., Human-Pet-Computer Interaction, Human-Captive Animal-Computer Interaction), and points to potential research areas such as Human-Wildlife-Computer Interaction (see Figure 1). In this position paper, we describe using an ICI approach, drawing on QS, QO, and Smart Habitat as a means to affect positive outcomes for multiple species. We emphasize the mutually beneficial aspects of tracking and visualizing animal activity levels across species. By making such data available, it could help zoo visitors to learn, be engaged, and further participate in improving zoo conditions. We further propose the notion of ICI and point to potentially fruitful research areas that involve making the activity levels of wild animals available to the public and designing technologies to facility interactions between non-human animals.

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