Animal-Computer Interaction: Shifting Perspectives in a World of Ubiquitous Computing

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[Presented at Minding Animals 2012]

We live in a society where computing technology has become ubiquitous and interacting with computing devices no longer means using a keyboard. Embedded in the fabric of our cities, workplaces, homes, vehicles, clothes and even bodies, 'smart' systems now allow us to relate to the world around us, one another and even ourselves in unprecedented ways. *Smart phones* can alert us to interesting places behind the corner, tell us when our friends are close by and give us information on objects we walk past; *smart cars* can monitor our physiological parameters while we drive and so can *smart clothes* when we wear them; *smart homes* allow us to control furnishings such as lights or curtains with simple gestures and can also tell us what groceries to put in our shopping list and which ingredients to put in our recipes; *smart games* can detect our emotions, adjusting gaming scenarios accordingly, and can even let us control objects merely by the power of our thoughts. These and many other achievements have been driven by what interaction designers call the *user-centred approach* to the development of computing systems, which has shaped the field of Human-Computer Interaction (HCI) as we know it today.

Animals too are ubiquitous in society. They are directly or indirectly involved in every aspect of our life and, like us, they too interact with computing technology. For example, modern operant conditioning chambers used in behavioural experiments are often computerised environments affording complex interactivity. Robotic milking systems used in precision dairy farming are an example of cutting-edge ubiquitous computing technology enabling cows to engage in voluntary milking. Tracking and telemetric sensor devices used to monitor wildlife, laboratory animals and even pets also support various forms of interaction. But is the interactive technology intended for animals developed with a user-centred approach comparable to that taken when developing interactive technology intended for humans?

In HCI, *user-centred* means that an interactive technology needs to satisfy specific usability goals (e.g., efficiency, safety, learnability) as well as more subjective experience goals (e.g., satisfaction, motivation, stimulation) in order to best support a specific target user group in their tasks. Hence developing new technology entails eliciting requirements from all stakeholders and, based on these, producing alternative designs which are prototyped and then evaluated, in an iterative process that involves end users at all stages. Each stage employs an arsenal of specific theoretical and methodological tools (only some of which presume the use of rationality and verbal communication on the user's part), derived from a variety of related disciplines such as ergonomics, psychology, cognitive science, sociology and anthropology, to name a few.

How does the development of animal technology 'map onto' HCI's *user-centred* approach? What does the lack of correspondence between the two say about the place of animals in our society? What would it take to develop the field of Animal-Computer Interaction (ACI) and a user-centred approach to the development of technology intended for animal users? What would be the practical advantages and the cultural influence of ACI?

Using as an example the case of robotic milking systems, I will illustrate how ACI could change the way in which animal technology is developed and deployed, and how it could contribute to changing the way in which we look at animals. I will elaborate on the benefits that ACI could have for our understanding of animal behaviour, cognition and affect, and for our inter-species relationships. I will conclude by summarising current efforts to develop ACI in collaboration with animal scientists and practitioners.