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Robots in Pain, Humans in Play: Soma as a Qualitative Method for Investigating Intelligent Human-Robot Configurations.

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Abstract

Introduction

In this piece we start to explore the ways in which we somatise our interaction with robots as a symbiotic system - both as human and robot, and as human-robot. We also consider the ways that we might want to take our physical nature (existence), for example how we experience pain, and imbue other non-human entities with it – embed our somatised experiences into technology. To reflect on and explore this we use the examples of play and pain as a provocation to approach the notion of this inter-Soma Design (*based on our ongoing research [Benford et al, Ngo et al, Schneiders et al]* – 'inter' being the cross over from human to beyond human (more-than-human [*Coulton et al*] entities, in this case, robots. But why is this an important area to study? In many respects we think of robots as something other, something physically external to us, and yet we are seeing the emergence of new ways of physically engaging and interacting with such technologies which highlights the ways that robots become an 'extension' of the human and demonstrates the ways in which we may become an 'extension' of the robot. In experiencing and examining such systems we are at the early stages of starting to understand and appreciate this human-machine entanglement and need to reflect on how we might start to develop somatic understandings of an embodied symbiotic socio-technical system, predominantly from a design perspective. In considering this we have started to examine how to bring together disciplines and approaches from HCI (Human-Computer Interaction), the humanities and more critical academic understandings to frame and open up the area. Taking a Soma Design [*Hook*] approach will help us to move beyond language-based thematic responses and analyses to the non-textual felt world, which premises the need for further investigation into a *shared* felt, embodied world. This in turn moves us away from the perceived abstractions, utility and generalisation of standard *technical design* approaches and discourses, and instead prioritises the personal, somatic lived individual experience – which we would argue is key to understanding health and wellbeing when we engage in play, experience pain…and pleasure.

Situating Soma Design

In Play

How do we play with robots, how do children understand and engage in somatic-symbiotic play, and can we apply these understandings to other areas, such as health, wellbeing, entertainment and education? These are design questions that we are researching in our ongoing '*in the wild*' [*see Chamberlain and Crabtree*] research where we are examining the ways that children engage with robots in the real world. Our approach has been to carry out qualitative, observational studies and interviews in real world settings using artist-led robotic experiences. A key part of this research has started to look at and extend upon design trajectories and the ways in which the children physically react to the installation. In carrying out this work we have started to envisage, develop and visualise how a soma design trajectory might appear, but how could we embody this to show/embody how somatic interaction feels?! Can we start to develop tools and techniques that enable us to feel the interaction, and could we do this from the perspective of the human, and the perspective of the robot who has more-than-human, beyond human capabilities? These are things that we would like the community

to think about as we move to truly embed the notion of Soma Design into our research and design practices.

In Pain

Creating embodied technologies 'in pain' requires a degree of embodied felt empathy from the perspective of the person who, in our understandings, may engage with and become part of a human-robotic configuration to alleviate/manage pain. Engagement with humanoid robotics need to display and signify being in pain - if they're required to appear 'human', and additionally we need to control, and develop robots that can deliver pain (or what may be perceived as painful experiences) – as is the case for example in many medical contexts, or in the future this could even be in a sports-based setting, such as full contact sports involving robotics. In developing this area, designing human-robot symbiosis needs a Somaesthetic [*Shusterman*] appreciation (*what does pain culturally look and feel like*); we need to design using somatic reflection. As we have already stated, this needs to go beyond thematic analysis (often used with interview data) and generalised designed findings that so often do not fully recognise the nature of the self and the auto-somatic in self-design, particularly for many people who are often minoritised and made invisible by the methods of the mainstream.

Somatic More than Human Futures

As we move to a world where robotics, AI and the felt nature of experience are becoming more prominent we need to start to appreciate, discuss and develop new ways of thinking about Soma Design – from both our perspective and from the perspective of the technologies that currently and will inhabit space with us. In our work we are aware that this is a complex and rapidly emerging area and that dealing with design, issues around somatisation, symbiosis and the felt world can be radical and disruptive. However, we feel that the opportunities that are opening up are important, particularly when we look towards domains such as health and wellbeing, and when we look towards a future that offers the possibility that we as individuals will be able to design our own human-robot configurations for play, pain and pleasure.

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Bios

Dr Alan Chamberlain is a Principal Research Fellow in the Mixed Reality Lab and the Director of the interdisciplinary STAHR Collective at the University of Nottingham. His research crosses disciplines, relating to the Arts & Humanities, Design and Technological innovation. He focuses on human-centred design, which is underpinned by qualitative research approaches, using ethnographic methods, in both real world and experimental 'blue sky' environments. He has published in the leading Human-Computer Interaction venues, with international researchers and carried out award winning research with partners such as the BBC, BT, Microsoft, Blast Theory and National Gallery. He is the Creative Sector industry theme lead on the £15 million UKRI TAS Hub, and Co-Directed the AHRC Theatre, AI and Ludic Tech Network.

Victor Ngo is a PhD student at the University of Nottingham, he work in collaboration with the Arts company Makers of Imaginary Worlds (MoIW), will investigate, develop, and implement (in a live environment with a real audience) adaptive robotic behaviours that can respond to changing audience states, such as excitement, boredom and attention using Computer Vision (CV) and Artificial Intelligence (AI) methods, to enhance and enrich the audience experience.

Dr Glenn McGarry is a Research Fellow in the School of Computer Science's Mixed Reality Lab, working in the interdisciplinary field of Human-Computer Interaction. His research interests centre on music technologies and his work in this area has been published in a leading international design conference CSCW. He is experienced in conducting fieldwork and analyzing the data gathered using an ethnomethodological approach, as well as other qualitative methods appropriate to addressing the research questions at hand. He is also experienced in working with systems designers, which involves presenting field study findings, working through their implications for design, and formulating design specifications.

Dr Ayse Kucukyilmaz is an Associate Professor in Computer Science at University of Nottingham, UK. Her research interests include haptics, physical HRI, assistive robotics, and machine learning. Previously, she was a senior lecturer and a member of the Lincoln Centre for Autonomous Systems (L-CAS) at the School of Computer Science in University of Lincoln. Her research focuses haptic shared control for physical human-robot interaction (pHRI). The aim is to build adjustable autonomy paradigms to enable dynamic switching behaviours between different levels of robotic autonomy (e.g. full human control vs. full autonomy) during shared control of a physical task.

Steve Benford is the Dunford Professor of Computer Science at the University of Nottingham where he co-founded the Mixed Reality Laboratory. He is Director of the EPSRC-funded Horizon Centre for Doctoral Training and also Director of the University's Smart Products beacon of research excellence. He was previously an EPSRC Dream Fellow, a Visiting Researcher at Microsoft Research Cambridge and a Visiting Professor at the BBC. He is the holder of a Turing AI World Leading Researcher Fellowship in Somabotics: Creatively Embodying Artificial Intelligence.

Angela Higgins is a PhD student with Horizon CDT, and the University of Nottingham. Her research explores the lived experiences of older adults to imagine future robotic technologies that physically engage with the body. Drawing on her expertise as a product designer, she employs creative and embodied participatory design methods

to co-create devices that are not only functional and useful but also desirable. She imagines a future where technology integrates effortlessly into our lives and bodies, developing robots that enhance health and well-being.