

Socially responsible design for social robots in public spaces

by Meg Tonkin

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the degree of

Doctor of Philosophy

under the supervision of Professor Mary-Anne Williams and
Dr Benjamin Johnston

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Faculty of Engineering and Information Technology

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CERTIFICATE OF ORIGINAL AUTHORSHIP

I, *Meg Tonkin* declare that this thesis, is submitted in fulfilment of the requirements for the award of *Doctor of Philosophy*, in the *School of Computer Science, Faculty of Engineering and Information Technology* at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution.

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ABSTRACT

Social robots are an innovative technology using artificial intelligence (AI), that can combine social, physical and digital interactions to create unique user experiences. Potential applications require a good user experience to encourage adoption by people. Social robots can also be considered surveillance devices, with sensors, image recording and AI that can identify faces and emotions. Therefore, organisations deploying social robot applications must meet privacy legislation requirements regarding the personal data used and collected in an interaction. Furthermore, to be socially responsible, organisations must behave in a manner that benefits society. Hence deploying a social robot in a public space must be carefully managed for the impact it might have on people within that environment. Design methods, that incorporate privacy considerations for public spaces and that enable a good user experience, are not yet available.

This dissertation contributes a design framework for organisations, that enables discovering potential applications, designing these applications with consideration for both privacy and user experience, and implementing these applications for use with humanoid social robots in public spaces.

This research used an Action Design Research (ADR) approach to develop methods that allow organisations to discover and implement socially responsible social robot applications, incorporating purposefully designed User Experience (UX) and privacy considerations, in public spaces. Embodying ADR principles of practice-inspired research and theory-ingrained artifact, two experiments were firstly undertaken.

The first experiment indicated that a social robot could function as a social agent, effectively undertaking a task requiring social engagement. However, greater value for organisations might be realised through applications utilising the full capabilities of a social robot across the social, physical and digital realms. The second experiment investigated privacy and UX, discovering that people may provide more personal information to a humanoid robot than to a kiosk when using transparency, which is a core component of Privacy-by-Design. Both experiments contributed to the development of a UX Human-Robot Interaction (HRI) design framework for social robot applications, that combines Lean UX (composed of Lean Startup, Design Thinking and Agile practices), privacy theory and HRI theory.

This UX-HRI framework was refined in iterative cycles of building, testing and evaluating social robot applications with design studies in three different environments, using the ADR principles of reciprocal shaping, mutually influential roles, and authentic and concurrent evaluation. Design principles were formulated through the generalisation of the context-specific findings. Guided by this UX-HRI design framework, socially responsible social robot applications can be created.

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Finally, I would like to pay respect to country, to the Elders—past, present and emerging—acknowledging them as the traditional custodians of knowledge on this land, on which this research has been undertaken.

LIST OF PUBLICATIONS

RELATED TO THE THESIS :

1. Privacy by design in machine learning data collection: a user experience experimentation [397]
2. Would you like to sample? Robot engagement in a shopping centre [384]
3. Embodiment, privacy and social robots: May I remember you? [383]
4. Design methodology for the UX of HRI: A field study of a commercial social robot at an airport [382]
5. Be more transparent and users will like you: A robot privacy and user experience design experiment [396]
6. Privacy First: Designing Responsible and Inclusive Social Robot Applications for in the Wild Studies [381]

OTHERS :

7. Bon appetit! robot persuasion for food recommendation [171]
8. Do you trust me, blindly? Factors influencing trust towards a robot recommender system [172]
9. UTS Unleashed! RoboCup@ Home SSPL Champions 2019 [300]

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