The Forgotten in HRI: Incidental Encounters with Robots in Public Spaces

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ABSTRACT

HRI research has predominantly focused on laboratory studies, producing a fundamental understanding of how humans interact with robots in controlled settings. As robots transition out of research and development labs into the real world, HRI research must adapt. We argue that it should widen its scope to explicitly include people who do not deliberately seek an interaction with a robot (users) but find themselves in coincidental presence with robots. We refer to this often-forgotten group as *InCoPs* (incidentally copresent persons). In this one-day workshop, we aim to explore studies, design approaches, and methodologies for testing robots in real-world environments, considering both users and InCoPs. The first part of the workshop will consist of invited talks addressing the subject from different angles, followed by plenary discussions. Building upon this common basis, participants will work in small groups to explore (1) human behavior, (2) robot and interaction design and (3) methodology, respectively. This group phase will focus on the exemplary scenario of delivery robots in urban environments. At the end, key aspects across all three topics will be identified and discussed to map out research needs and desirable next steps in the field.

CCS CONCEPTS

• **Human-centered computing** → *Empirical studies in HCI*

KEYWORDS: Real-world interaction, InCoPs, incidentally copresent persons,human-robot interaction

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1 Introduction

As robots are increasingly capable of navigating complex environments, we will start to spontaneously encounter them in public spaces. Soon, an increasing number of people could share sidewalks with delivery robots, considerately wait for service robots to carry out their tasks for other people and cross the street as pedestrians in front of robotic vehicles. In the past 30 years, research in HRI has gained significant insight into how people interact with different robots in various tasks and settings. However, HRI research needs to develop theories suitable for more diverse and complex social environments [2]. Especially when considering robots in public spaces, many people affected will in fact not be users of robots but will just "happen to be there". This group of people will in some scenarios (e.g., delivery robots) even make up the majority of a robot's encounters. The fact is striking that there is, to the best of our knowledge, not even an established term within HRI research to refer to these incidentally copresent persons. Going forward, will refer to this often-forgotten group as *InCoPs* (*incidentally copresent persons*). In recent years, exploratory research in the field has already shown how different groups react to robots in public spaces, be it with social robots [1,4] or driverless cars [3]. Observed phenomena range from indifference to explorative, obstructive and aggressive behavior. In a public space in South Korea, passers-by touched, kicked and punched the unattended *Piero* robot [5]. The social robot *Robovie2* was set up in a shopping mall and while most people were willing to follow the robot's request to be let through, some groups of children resisted the request and ended up physically and verbally abusing the robot [1]. In 2014, the hitchBot hitch-hiked across Canada and parts of Central Europe, being taken along to go camping and getting invited to a wedding. Its travel ended in the US where it was found vandalized by the side of the road [6]. In contrast to these instances of robot abuse, passers-by have also been shown to be willing to help a guide robot by showing it the right direction [7].

2 Workshop Objectives

The one-day workshop will explore human behavior, design approaches, and methodologies for testing robots in real world environments from different disciplinary backgrounds,

considering not only a primary user but InCoPs as well. We want to shift the attention from a user-centered to a holistic, human-centered approach, thus focusing on the coincidental interaction with pedestrians on sidewalks and in shopping centers as well as with hospital visitors, passengers at airports, and many others.

3 Format and Schedule

The first part of this full-day workshop will include invited talks as well as short presentations based on submitted papers. All speakers will have 10 minutes to present their work, followed by a moderated 5-minute discussion. Invited speakers are Dr. Astrid Weiss (Technical University Vienna): "Bystanders as informants for HRI in public space"; and Dr. Dylan James Moore (Stanford University): "The Design of Implicit Pedestrian-Autonomous Vehicle Interactions". In the second part of the workshop, a delivery robot will be introduced by the workshop hosts via a brief video as a common example for the work phase. Groups of up to 10 people will focus on the following topics:

(1) HUMAN BEHAVIOUR: What types of behaviors have been observed or are to be expected from InCoPs when encountering a robot?

(2) DESIGN: How to design for InCoPs? How is it different from designing for a user?

(3) METHODOLOGY: How to study the behavior and experience of InCoPs in the real world?

Accompanied by a moderator from the team of workshop organizers, participants will share and discuss ideas and lessons learned from their own background. Beyond the exchange of experiences, each group will include societal and ethical issues as well as what they consider needs for action. The workshop will conclude with each group presenting their ideas developed in the work phase and discussing them in plenary. Key aspects across all three topics will be identified and discussed to map out research needs and desirable next steps in the field. All results from the group work and discussion will be documented (e.g. on cards and flipchart paper) and will be made available after the workshop.

3 Targeted Audience and Submission Requirements

We invite participants from all fields in HRI who are concerned with bringing robots into the real world. We would like to represent the diversity of fields in HRI in our workshop to gather innovative ideas and have fruitful discussions. However, we will especially focus on scenarios of coincidental human-robot encounters in the wild and welcome participants designing for and studying these encounters. The following topics are exemplary:

(1) HUMAN BEHAVIOUR: e.g., verbal and nonverbal behavior (e.g. to negotiate the right of way), explorative behavior, robot abuse or robot bullying, attempted thefts, etc.;

(2) DESIGN: e.g., approaches to approximating the very diverse group of InCoPs, approaches to testing and validating robot design in the wild, etc.;

(3) METHODOLOGY: e.g., the role of field studies and exploratory studies, the use of qualitative data and mixed methods; potentials and limits of covert observation studies, etc.

Submissions can range from technical navigation and control topics that explicitly considered InCoPs over designing robots and their interaction with humans, psychological theories and empirical field studies of robots, to ethical and societal issues with robots in wild. We welcome theoretical papers and position papers as well as empirical studies and design and development concepts (4 pages max.) in PDF format following the proceeding specifications of LBRs to arvdp@humtec.rwth-aachen.de until January 31st. Submissions will be peer-reviewed (by February 22nd) and accepted authors will be asked to give a 10-minute presentation. The workshop organizers will commit to publicize their workshop. The call for participation for this workshop will be distributed via HRI- and HCI-related and specialized mailing lists (e.g. ACM SIGCHI, HRIWeb, European Robotics Platform etc.) and websites (e.g. HRI Community, IEEE Robotics and Automation Society, etc.). A website will be created to provide information about the workshop. Position papers will be grouped into several sessions during the first phase of the workshop, to organize the discussion thematically.

5 Organizers

Astrid Rosenthal-von der Pütten is a Full Professor and director of the group Individual and Technology at RWTH Aachen. Her research interests include social effects of artificial entities, human-robot interaction and linguistic alignment with robots and virtual agents.

David Sirkin is a Research Engineer and Executive Director for Interaction Design at Stanford University's Center for Design Research. His research focuses on design methodology, as well as the design of physical interactions between humans and robots, and automated vehicles and their interfaces.

Anna Abrams is a Research Associate at the group Individual and Technology at RWTH Aachen interested in the social and cognitive influencing factors in human-robot interaction, human-centered technology, and user experience.

Laura Platte is a Research Associate at the group Individual and Technology at RWTH Aachen interested in communicative and linguistic phenomena in human-robot interaction.

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