ICSR 2013 – Workshop #3: Final Report and Results

Taking Care of Each Other: Synchronization and Reciprocity for Social Companion Robots

Astrid Weiss[1], Tamara Lorenz[2]

[1] Vision4Robotics Group, Automation and Control Institute, Vienna
University of Technology, Austria
astrid.weiss@tuwien.ac.at

[2] Institute for Information-Oriented Control,
Technische Universität München, Germany
t.lorenz@tum.de

1 General Statement

The overall aim of this workshop was to discuss where the research on companion robots might lead us when we take interaction paradigms such as synchronization and reciprocity into account. Intentionally the workshop proposal mentioned the rather provocative term "compassion" and raised the question if we should aim for companion robots that are perceived as compassionate.

Fortunately, we received very different contributions from various disciplines, which reflected this general question, specific empirical results on user studies with companion robots for children and older adults, research on mirroring and behavior imitation, and investigations on how to integrate social cognition mechanisms into HRI – which led to great and even sometimes controversial discussions.

Subsequently to sessions of position talks and poster presentations, we split in small groups for two break-out sessions in which the following questions were discussed: What are the building blocks for social companion robots and how can we measure if a robot is actually perceived as a companion robot? The main conclusions that can be drawn from these discussions are:

- Emotions, drives and feedback will always play a role in the development of companion robots.
- The purpose of the robot should define if sociality is actually needed (e.g. in therapy as a benefit); in other words sociality should not be integrated just to ease interaction or as end in itself.
- The user should be in control of how much he or she wants a robot to be a companion and it needs to be transparent that the robot does only simulate sociality and is not actually a compassionate entity.
- Regarding the evaluation of companion robots, we will need baselines (e.g. the level of loneliness of the user) to which we can actually compare the ef-

adfa, p. 1, 2011.

fect of the robot. Moreover, more measures on a behavioral level are needed, such as physiological measurements and posture measurements, which can achieve replicable results with different robot platforms. Finally we need to consider bigger evaluation scenarios, which not only take into account the social context of the user, but also relatives, friends and the change in social life that the robot might cause.

2 Short summary of position statements

Our workshop was split into three main parts (1) 10-15 min. position talks, (2) poster presentations, and (3) break out sessions. In the following short summaries on the talks and posters are given; the full position statements can be found in the workshop proceedings.

2.1 Talks

The first two introductory talks were given by two of the workshop organizers, **Astrid Weiss and Tamara Lorenz,** who focused on the questions: How can we understand the term *compassion*? How does *reciprocity, synchrony* and *adaptation* relate to it? Furthermore, Astrid Weiss presented two related research projects, namely: Vision4Human-Robot Collaboration and HOBBIT. The introduction talks ended with the open questions: What is the best adaptation mechanism to achieve compassion? - and: Do we deceive users if we let a robot pretend to be compassionate?

The next talk was given by **Joanna Bryson** and focused on the topic that evolution necessitates both compassion and competition and that AI should not be motivated to compete with us and therefore robots should not appear human. A similar position was represented by **Frank Broz** who raised the question if we should stop in HRI research to use human terms (such as compassion) to describe robot capabilities. Moreover, in his talk he reminded that we should not lose sight on whether the relationships with a social companion robot are beneficial to their users.

Tehran Davis then presented research on a joint action approach to use synchrony and imitation for HRI. He advocated that these dynamics and principles guide and facilitate social interaction between humans and that they can serve as basis for the design of socially perceived companion robots. A similar stance was taken **by Agnieszka Wykowska** who presented several experimental studies on gaze-cuing paradigms to examine the user's readiness to engage with robots. The presented finding s also supported the claim that there is a need to evaluate social companion robots not only on a reflective, but also on an implicit automatic response level, as such fundamental mechanisms of social cognition can also be observed in HRI.

Next **Jorge Gallego-Perez** presented an empirical study on companion robots in which it was investigated if it makes a difference when a robot takes over the role of a therapist or a coach. This preliminary study already demonstrated that even just a role attribution initiated by a small change in dialogue can affect how people perceive a robot. These effects in HRI between older adults and care robots were also discussed

by **Susanne Frennert**, who raised critical questions in her talk: Social companion robots in elder care – who gains who loses? She raised issues, such as that the deployment of social companion robots might affect how we view aging, our bodies and the selves in future and that we need to critically reflect not only technical matters, but also if this development is desirable.

2.2 Poster

Posters covered a wide variety of topics within the given framework of social companion robots: **Wan-Ling Chang** demonstrated how PARO can be successfully integrated to nursing homes. By including staff and family members into the integrative process, the elder inhabitants were able to overcome their suspicions and frame PARO as a social entity. Framing a robot in a social way was also important for **Arzu Güneysu** and **İklal Karataş** who presented results form a study on child-robot interaction with a NAO robot in a kindergarden environment. The main goal of the study was to determine whether and to what extend children would imitate the robot's behavior in order to establish it as a positive role model in the future.

Praminda Caleb-Solly described experience from user studies with the Robosoft platform MOBISERV-Kompaï. Together with her collaborators she is interested in the question how a robot has to be modified to become a social agent, but also points out that this question can only be answered individually. Thus the robot needs to be customizable and every user must have the possibility to decide whether it should be a social companion or rather an assistive device. One of such was presented by **Torsten Metzler** who showed how a walking companion robot can be improved by integrating cognitive functions such as path slope detection and obstacle avoidance. With this work also the need for integration of cognitive functions already in the early design stage is highlighted.

That design can play a crucial role for social behavior was also followed up by **Nigel Crook** who showed an approach on how to increase reciprocity between humans and social companion robots by attempting to replicate natural human head movements mechanically. With an interdisciplinary team Nigel is working on controlling a skeletal head and neck by means of artificial muscles and tendons.

Coming more from the robot's point of view, **Georgi Petkov and Luiza Shbazyan** presented their approach on analogy making to be used for intention recognition in robots. Their RecMap model uses visual features to create an internal representation of the scene and compares this to an analogical scene from memory which then allows for determining missing information (anticipation) and action planning.

3 Summary of Breakout Session 1: What are building blocks for social interaction with companion robots?

The aim of the first break-out session was to identify key elements a social companion robot needs to have from the view point of different disciplines. What does a social companion robot need to be capable of?

3.1 Group 1

Participants: Thorsten Metzler, Nigel Crook, Arzu Güneysu, İclal Karataş, Wan-Ling Chang, Astrid Weiss

Fig. 1. Outcome Group #1

The first group started with identifying building blocks from all participants based on their research, namely societal impact/cultural differences, empathy, mirroring, movement, posture, and embodiment (first column in Fig.1). During the discussion of theses building block it became obvious that we had to define what this building blocks mean for the user and the robot side. Thus, the society or cultural context shapes user's attitudes and beliefs and also defines the context in which the robot is used (which means the robot needs to adapt e.g. to language, greeting behavior etc.). Regarding empathy, the user shows emotions and may perceive emotions of the robot and the robot should be able to recognize emotions and display an emotional state. Mirroring is a technique with which users experience social engagement and the robot can learn from the human. Movement is an important building block, as the user can adapt his/her movements to the robot and the other way round. The same is true for posture and moreover both can also shape the attitude of the user or express a specific "robot attitude", similar to embodiment. Finally, the aspect of the purpose of the robot

was discussed, concluding that companion robots may be useful for science to explore humans' social cognition on the one hand – or as servants, assistants, and for entertainment and education. However, companion robots should adapt to the needs and demands of the human and not in general be social (only if there is a higher societal benefit that can be achieved, e.g. with therapeutic robots).

3.2 Group 2

Participants: Susanne Frennert, Tehran Davis, Joanna Bryson, Praminda Caleb-Solly, Denise Lengyel.

First of all, a companion robot needs to create a value for the user. This value can be social, but can also be in terms of money or other valuable attributes. The underlying reason is that if the companion has no value, it will not be "used". Following this line, a companion robot needs to create or induce a motivation in the human opponent to interact with it in a long term manner (drives and emotions are needed).

To achieve that, the companion has to be able to interact and communicate with the human and with its surrounding – and this interaction and communication has to be bidirectional. A bidirectional interaction however requires mutual feedback.

Furthermore, when putting an artificial agent into our private environment, it might also be important to respect people's need for deference. This means, one has to make sure that if other people are around, the social agent should "tune down" – in order not to embarrass its user (or owner).

Based on this consideration, the possibility for tuning the companionship-level of a robot was discussed: people should be able to decide how much companionship they want. In an ideal case, the social companion robot's companion mode could be turned up, down or out. This is not only considered due to possible embarrassment, but especially because we want to support people that are lonely, but we don't want them to stay at home instead of going out and meet real people. This possibility of tuning the companion level would also reduce the risk of deceiving users, as it becomes obvious that companionship is a functionality and not actual empathy.

3.3 Group 3

Participants: Jorge Gallego Pérez, Georgi Petkov, Luiza Shahbazyan, Agnieszka Wykowska, Tan Yeow Kee, Tamara Lorenz.

After very lively discussions group 3 came up with a schema of the different dimensions that have to be considered when attempting to build social companion robots, see Fig. 2.

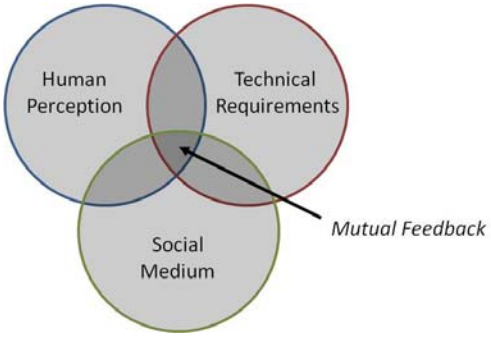

Fig. 2. Outcome Group 3: Different dimensions of requirements

When looking at the problem from the human perspective, a social companion needs to trigger attachment and emotion in the human counterpart to be considered a social entity. It needs to show compassion and must be able to communicate in a bidirectional way, meaning a give and take relation. This also includes giving feedback and receiving feedback which can be processed based on implicit mechanisms of social cognition.

Coming from the technical side, a social companion first of all needs to be proactive. This includes acting, but also reacting to the perceived environment. For being able to act social, the agent needs to have a certain degree of autonomy and individualism. Furthermore, it should be able to perceive and express emotions – and with this also provide feedback to a human opponent.

As a last point, social mediums were considered that could link human needs to technical possibilities of a companion, provoke emotions and translate them after receiving feedback.

In summary, mutual feedback was identified to be one of possibly several core factors to enable social interaction with a companion robot.

4 Break Out Session 2: Success Measures

For the second break-out session we again split up in groups. However, as the results of the groups were very similar and only shortly discussed in the plenary (also due to time constraints) only a short summary of results will be given here.

The guiding question was: How can we measure if an intended companion robot was actually successful in being a social companion?

All three groups agreed that there are different evaluation methods out there already (e.g. questionnaires, observation, diaries etc.), which already have proven their feasibility to assess HRI. However, it was also agreed that there is a lack of long-term studies and physiological (implicit) measurements. Similarly, study challenges were discussed such as the problem that changes in companionship can only be observed over time and that it might not be observed with the end user of the robot, but in his/her relationships towards other humans. Ecological validity of user studies were discussed as one of the biggest challenges, above all regarding reproducibility of results

and the question if it is more beneficial for the research field of social robotics to only study small behavioral changes or companionship as a whole.

Finally it was discussed that we need to study in a systematic manner (1) how the end user is affected by the robot, (2) how the social context of the user changes, and (3) how the robot behavior (companion level) changes over time.

5 Concluding Remarks

Finally we would like to thank all the workshop organizers, participants, and contributors for all their efforts which made this workshop a great success. We had lively discussions, interesting talks, informative posters, and internal workshop proceedings of high level quality!

Due to the success of the workshop we are currently preparing a Special Issue for the International Journal of Social Robotics on the topic: Taking Care of each Other – The Future of Social Companion Robots (working title).

Acknowledgements

The research leading to the organization of this workshop has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement No. 288146, Hobbit and from the Austrian Science Foundation (FWF) under grant agreement T623-N23, V4HRC