Social
Robotics
Consortium of the
Capital
Region

First workshop of the Social Robotics Consortium of the Capital Region (SRCCR)

Nick Webb
e-mail: nwebb@albany.edu

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1 Overview

The first workshop of the Social Robotics Consortium of the Capital Region (SRCCR) was held on 20th March, 2008 at the Schenectady Museum and Suits-Bueche Planetarium, in Schenectady, NY. The agenda for the workshop can be seen in Section 6.

We are a group of academics, teachers, researchers and educators based in the Capital Region of New York State. Our goal, funded by the NSF, is to build a community of people interested in using Social Robots as a platform to deliver an education in Computer Science.

To revolutionize teaching in Computer Science we need to explore platforms of delivery that are exciting, interesting to study, and provide mechanisms for teaching abstract concepts in a practical, hands-on way. Robotics presents such a practical platform, on top of which we can deliver an education that addresses the central needs of CS and Engineering graduates of today and tomorrow.

Social Robotics looks beyond the purely physical or software engineering challenges, toward the variety of roles such robots can play in a modern society, the challenges of technology interacting with humans, and the ethical issues such interaction implies. By expanding the topic into these social areas, we hope to draw in students from beyond traditional Science and Technology backgrounds, and disseminate key CS education to students from non-CS majors.

We will hold four open workshops to bring together stake-holders, students and industry representatives in order to outline key aims and goals of a program in Social Robotics. We are committed as a group to exploring the range of teaching practices and synergies amongst our existing courses, to discover and exploit a novel pedagogical approach to teaching fundamental CS principles through Social Robotics.

The goal of our first workshop was to try to define Social Robotics, to hear about current efforts to use robots as the basis for a computer science education, and to hear from industry about the role social robots (and social roboticists) may play in the future.

We invited participation from a number of schools and colleges around the area. In total, we had 40 participants, representing 15 academic institutions, and a range of departments including computer science, engineering and cognitive science.

2 What is Social Robotics?

The first session took aim at a definition of Social Robotics. There were three invited speakers: Reid Simmons, Research Professor from CMU's Social Robots project, Brian Scassellati, Director of the Social Robotics lab at Yale, and Tim Bickmore, Director of the Relational Agents Group at NorthEastern.

These three speakers were brought together to provide different perspectives on the social robotics field. Prof. Simmons presented work at CMU on social robots, including robots that had scripted personality, with observations on the manner in which people interacted with them. He also provided an overview of work on robots moving in human space - that is, how do machines navigate spaces that contain humans, and how do humans react to them. An interesting point was that of expectation - that humans do not necessarily know what to expect, so perhaps do not feel comfortable sharing an environment with autonomous machines. Building models of social interaction - performing as a human would when, for example, passing people in corridors - seems to make the acceptance of machines (in these limited circumstances) more achievable.

Prof. Scassellati presented current work at Yale, and reflected on some work conducted whilst at MIT, on the nature of human responses to social robots - specifically children, and those with autism. There are some remarkable effects - the reactions (and underlying inferences) children have when interfacing with machines (they do not seem them as machines, but as personalities, if not people), and the connection that autistic children make with robots that they seem unable to make with other humans. These could be seen as indicators of the potential to forge social relationships with robots, if we suspend our disbelief that they are incapable of intelligence.

The final speaker, Prof. Tim Bickmore from Northeastern presented the view from the embodied conversational agents perspective. Whilst these agents are software only, they incorporate many aspects of social interaction - speech, gesture and relationship building approaches that have been shown to be successful in, for example, out-patient care. Again, it was a demonstration of people and machines creating and sustaining a relationship, where these relationships are designed to advance specific goals - such as taking regular exercise in the example Prof. Bickmore presented.

Following these presentations, there was a panel discussion, where the three presenters were joined by Volkan Isler from RPI, to discuss what social robotics is, or could be.

3 Robotics in Education

The second session invited speakers with experience in using robotics as an educational tool. Prof. Deepak Kumar, from Bryn Mawr, is the co-PI of the Institute for Personal Robots in Education (IPRE). This effort is very much in sync with our own, in that the Institute seeks to revolutionise undergraduate teaching of Computer Science using a robot (the Scribbler) and associated software (Myro). This is an inexpensive platform (around $150), and has as a companion a completely revised introductory course to Computer Science that teaches core principles without explicitly teaching algorithm design or programming.

IPRE is partly funded by Microsoft Research, and the Myro code is supported by Microsoft Robotics Studio. Both hardware and software adopted by IPRE can serve as a baseline approach for our goals of social robots - neither explicitly supports social interaction (speech in or out, visual feedback through LEDs, gestures or video screen, for example), although a new version of the scribbler robot due summer 2008 will have an LED screen. Both Scribbler/Myro and Microsoft Robotics Studio will be invited to participate in our next workshop on platforms for Social Robotics.

Prof. Ken Livingston from Vassar shared experiences with his undergraduate students, teaching Computer Science through small robotic platforms which included a virtual robotic simulator. This software was such that an understanding, at least in the first instance, of programming was not required - students could play with a visual interface, arranging robot behaviours, and see the result in a simulated environment. In this way, students began to understand the impact of behaviours before they were required to know how to implement them. The tool could then help them to create the code for these behaviours - and their work could move from the virtual to the real. Access to such a tool, to explore robotics concepts apart from the inconsistencies of the underlying hardware, seems to be an excellent idea.

The final speaker in this session was Dr. Ken Berry, a representative of a group called RoboEducators - and a former NASA educator tasked with bridging the gap between the work of NASA's scientists and the surrounding education community. He found that robots were an interesting way to deliver excitement and education at the same time.

All of the speakers in this session, joined on the final panel by Prof. Lester Rubenfeld from RPI, were keen to highlight the engagement factor that robots caused in students. Robots remain a technology that gets students excited - from K-through-12 up to graduate study. The important work

here is to turn this excitement into real results - students learning about core CS concepts - and the work at Vassar, and particularly the efforts of IPRE, show that this is more than possible.

4 Industrial Perspectives

The final session of the day featured two speakers. The first was Dianne Fodell from IBM, who presented IBM's vision of software services as something that required machines, and automated processes in general, to have an increasing awareness of social functions that will in turn make service oriented applications more efficient and customer focused. The development of service science by IBM can incorporate intelligent, social machinery as nodes in an information architecture - either to be customer facing, or as internal information points.
Add to this that IBM is a prime consumer of CS graduates, and therefore is continually interested in the quality and quantity of Computer Scientists being graduated from our institutions. Dianne presented the model of student IBM is seeking - the T-model, where *depth* of knowledge in the chosen field is supplemented by a *breadth* of education across a range of disciplines. Social robotics is a model that actively supports such breadth of exploration.
The second presentation was from Sandbox Innovations which brought their hexapod robot to the workshop. This is being marketed as a product for search and rescue, capable of rapid deployment in challenging environments. An interesting addition is the release of this platform as an educational tool (the RespondBot RDK), and its use in an education program, at the University of Pennsylvania.
This session closed with a panel discussion including Dr. Nick Cassimatis from RPI, that looked to the role that Social Robots can play in the world, the skills necessary to deploy them, and the acceptance by the public of these robots.

5 Discussion

One interesting conclusion is that social robots exist, or will exist, on a spectrum of increasingly intelligent machines - there are not discrete sets of machines, social and non-social. There will be ranges of social behaviour - not all machines will need to exhibit or recognise social behaviour, it will be entirely dependent on context in which the machine operates. For example,

the current Roomba robot vacuum (produced by iRobot[1]) is not at all social - but some simple social understanding ("stop that now, do it later", "get out of my way"), might enhance operation in some situations. It's not only the social function of the robot, but how we as humans react to the them that create the need for social understanding.

As an example of the spectrum of social behaviour, imagine a line as in Figure 1, with an autonomous factory assembly arm at one end, and C3P0 from *Star Wars*™ at the other. Clearly, the autonomous arm extreme has (and requires) no social interaction whatsoever. By comparison, C3P0 is highly social, capable of translating via gesture, vision, humour - key functions of the protocol aid that is his function. That is not to say that C3P0 is the pinnacle of social robot design - he is not - but only indicates his relative social position.

What is interesting is that we could place C3P0's companion, R2D2, on this spectrum with some ease, putting it far closer to C3P0 than the industrial robot, yet with a distinctly more limited set of social functions. Whilst R2D2 has emotions, and can recognise human social behaviour, he is not as capable at generating human-like social output - constrained as he is by his form, informed in turn by his function. Likewise, we can place existing, real robots - the SONY AIBO, and HONDA ASIMO somewhere on this hypothetical line, and see how increasingly social functions are a consideration in modern robotics research.

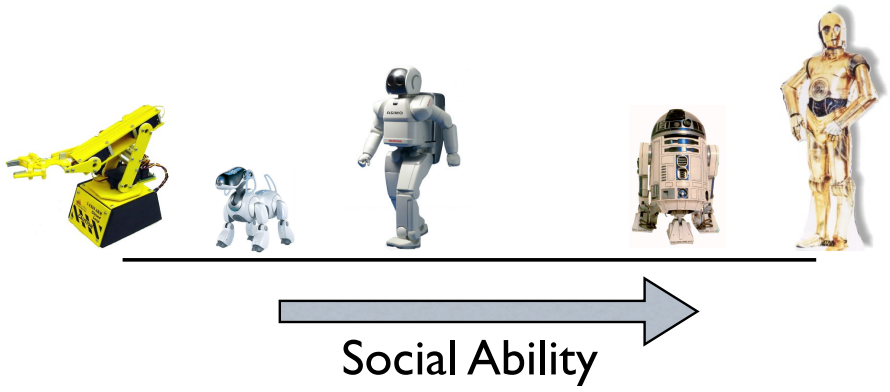

Figure 1: Social Robotics Spectrum

In discussion during the workshop, some presenters spoke about lowering ex-

[1] http://www.irobot.com/

pectations when dealing with the public - that people were ready to interact with machines in ways that were as yet unsupported by the technology. This is understandable given the capabilities of today's technology, but seems to be counter to what we want to achieve. If humans are ready to anthropomorphise current computer and robotic systems, we need to be able to raise the proof rather than lower the expectation, to meet that level of assumed expectation. This is a challenge for technologists and social scientists alike. People already have social relationships with machines. We need to make them able to recognise and respond appropriately to these relationships.
Social Robots are inherently interesting artifacts. They deploy their own social agendas, or can promote social reactions in the people around them. An increasing social awareness in the technology we use has the potential to make that technology better to use, and for machines to behave in a manner more readily predictable and understandable to us as humans. Current research and education in social aspects of robotics is disjointed, championed largely by individuals, and comes mostly from a computer science or engineering perspective.
Taking these advances in the science and technology of social robotics, we intend to use social robots as a means for delivering a Computer Science education. Many others have identified the need to change the delivery of a basic, core Computer Science education - great work is being achieved by, for example, IPRE on changing the way computer science is taught. However, their focus, quite rightly, is on existing computer science undergraduates. Our model, in line with the T-model presented by Dianne Fodell of IBM, is a broader base of recruitment - to encourage those who would never consider taking courses, such as a minor, or contemplate transferring to a major in Computer Science. We believe Social Robotics is a way to achieve this transformation. An important aspect of our collaboration is NOT to re-implement the robots in education work, but to build on this effort - to incorporate aspects of social robotics, to achieve two clearly stated goals:

1. To extend existing work on revising the computer science curriculum - to draw into the conversation others from related disciplines of communication, information science, design, philosophy, psychology and social science. Social robots are a platform that can sustain interest and input - indeed, requires them for significant advancement.

2. To advance current technology to include social awareness - both recognition of, and appropriate response to, humans working with, around or in proximity to robots and technology in general.

6 Agenda

8:30 a.m. Breakfast

9:00 a.m. **Welcome: Introduction to NSF grant**
Ilene Frank (Schenectady Museum)

9:30 a.m. Session: **What is Social Robotics?**
Chair: Selmer Bringsjord (RPI)
3 presentations (20 min, plus 10 min for Q&A)
Tim Bickmore (Northeastern)
Brian Scassellati (Yale)
Reid Simmons (CMU)

11:00 a.m. Break

11:15 a.m. **Panel on Social Robotics** featuring:
Tim Bickmore, Reid Simmons & Volkan Isler (RPI)

12:15 p.m. Lunch

1:30 p.m. Session: **Robotics in Education**
Chair: Valerie Barr (Union)
3 presentations (20 min, plus 10 min for Q&A)
Ken Berry (RoboEducators)
Deepak Kumar (Bryn Mawr)
Ken Livingston (Vassar)

3:00 p.m. Break

3:15 p.m. **Panel on Robotics in Education** featuring:
Ken Berry, Deepak Kumar, Ken Livingston & Lester Rubenfeld (RPI)

4:15 p.m. Session: **Industry/Future Applications**
Chair: Tomek Strzalkowski (UAlbany)
2 presentations 20 min, plus 10 min for Q&A)
Dianne Fodell (IBM)
Haldun Komsuoglu (SandBox Innovations)

5:15 p.m. **Panel on Future Applications** featuring:
Dianne Fodell, Haldun Komsuoglu & Nick Cassimatis (RPI)

6:30 p.m. Dinner with Keynote Speaker
Natalie Jeremijenko