

# An Inter-Disciplinary Workshop Based Around Social Robotics

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## ABSTRACT

We present a workshop developed to increase interest in computing academic options and career pursuits, which allows Middle and High School students to explore key concepts in computer science and robotics, with a focus on social robotics applications. By this, we mean creating robots that have some form of social interactions with humans in the environment.

## 1. INTRODUCTION

In the past decade there has been a significant proliferation of educators deploying robotic platforms in the classroom. At the undergraduate level, many of these have been in existing Computer Science and Artificial Intelligence programs [4], with particular focus on Introductory or CS1 courses [6, 2, 3, 5], some with specific appeal to students outside of CS [1]. This increase is in large part due to the availability of low cost robotic platforms, and an existing set of resources for offering courses in these areas (cf. the 2007 AAAI Spring Symposium on Robots and Robot Venues: Resources for AI Education<sup>1</sup>, or the Spring 2006 issue of AI Magazine, Volume 27, Issue 1, on Robots and Robotics in Undergraduate AI Education). Meanwhile, in Middle and High School education, there has been an increase of interest in robotics through initiatives such as the FIRST Lego League<sup>2</sup>. For over 10 years, FIRST has conducted themed competitions, designed to get groups of students creating autonomous robots to complete challenges.

<sup>1</sup><http://www.cs.hmc.edu/roboteducation/>

<sup>2</sup><http://www.firstlegoleague.org/>

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Whilst there is increasing interest in robotics, social robotics remains a relatively new topic. The goal for us is to create robots that can work alongside, and collaborate with, humans in real world environments. In order to achieve this successfully, such robots need to be able to interpret and produce a wide range of social functions. This includes principles of human-robot interaction, communication, philosophy, psychology and design. We see social robotics as an interesting, inter-disciplinary platform to bring together a spectrum of students and research areas. We have taken the challenge approach, and created a 3-hour workshop which focuses on creating Social Robots, where students from all disciplines can gain exposure to technology, and programming in particular, whilst focusing on wider, engaging issues relating to the future of human-robot collaboration.

We chose to use the Lego NXT platform, in part because it is already popular as a K-12 platform, in part because of its low cost and wide choice of sensing, and in part because it is supported by a number of different interfaces and programming languages, giving us future flexibility for the development of our workshop. We have 10 complete Lego NXT kits, sufficient to support a classroom of up to 30 students. We are working to design a series of exercises using these software platforms that allow students to try simple, social robotic experiments (such as talking, indicating primitive emotions, simple vision exercises), initially using the NXT hardware.

## 2. CONTENT: A SOCIAL ROBOTICS WORKSHOP

In our poster, we will expand on our Social Robotics workshop, detailing the structure, and the development issues we faced over three particular iterations of staging the workshop.

### 2.1 Workshop Development

We started to develop an outreach workshop for K-12 students, starting with grades 6-12, in the summer of 2009. This early workshop, presented to 25 girls ranging in age from 5 to 16, focused both on the core fundamentals of

robotics and aspects of social interaction. We asked the students to “design” a social robot for a task of their choosing, such as a home help, a medical assistant or pet care assistant. In doing so, the students faced questions such as “what the robot needs to know”, “how it gets around” and “what it looks like, and how this impacts the function”. As a side note, it was interesting to note that every one of the ‘home help’ robots designed and drawn by the students was a female.

We next presented the workshop to 29 students, mostly 8<sup>th</sup> and 9<sup>th</sup> graders, with an equal split (15 to 14) of females to males, from a total of 17 different schools around the region. We conducted surveys both pre- and post-workshop, to gauge interest in computer science and robotics. Most students (20 of the 29) had no prior programming experience of any kind, and of the 9 that had, 3 had taken no formal course in programming. However, 17 did have prior exposure to robotics, mostly in after school programs, as part of lego programs, or in science and technology classes. After the workshop, 61% of responders thought that robots would ‘help people in their daily lives’. When asked how much they knew about computing prior to the workshop, around 50% answered ‘some’ (corresponding with a score of 3), with the remainder distributed equally between the other available answers (5 points on a Likert scale). After the workshop, there was a significant shift, with 50% now answering with score of 4, representing greater knowledge. There was a less significant shift when asked about their interest in robotics. 12 students scored either 4 or 5 prior to the workshop (representing some interest), with this increasing to 13 post-workshop. However, prior to the workshop, 7 students indicated little or no interest in robotics, which decreased to just 3 student post-workshop. When asked to choose the most interesting part of the workshop, the only category that drew multiple responses was ‘the programming’, chosen by over 50% of the students. Finally, when asking about potential future careers, more than 50% indicated that before the workshop they had no interest in a career in computing. Post-workshop, the numbers were far more evenly distributed amongst the five potential scores, although the largest number of respondents still indicated no interest in computing as a career.

We decided that our third presentation of the workshop should be to a group of K-12 teachers. In our region there is an annual ‘Games in Education’ Workshop series<sup>3</sup>, where teachers explore the use of games technology in an educational environment. We presented our 3 hour workshop to a group of 15 teachers from around the country, and again garnered extremely useful feedback through a question-answer session, which resulted in some of the most significant changes to the workshop structure this far. For example, we made radical changes to our survey information, reducing the size of both the pre- and post-workshop survey significantly. We changed the order of the workshop, to allow students practical access to the robots almost immediately, and reduced the amount of slides we used to present information, emphasising role play and group work as an alternative.

## 2.2 Current Workshop Format

We begin by asking students what robots mean to them, with them working in groups (the same groups they will work in throughout the workshop). Then we give a quick

<sup>3</sup><http://www.gamesineducation.org/>

overview of robotics from an academic perspective. Next, we have them participate in a role play exercise. One staff member per group plays the role of a robot, and asks the students to control the robot with voice commands, to achieve some simple goal (such as pick up and deposit some garbage), the aim being to introduce the students to the complexity of operating in the real world.

We introduce students incrementally to the sense, plan, act paradigm, relating it to the previous role-play exercise. We begin with ‘acting’, introducing effectors first through slides, then through the NXT-G environment, by making their robots move, and culminating in a series of exercises. We do the same with ‘sensing’, and finally, we explain the planning aspect, and relate it to the programming they have already completed. We then introduce social robotics, again making connections to both robots in the real world, and the programming experience they have attained. The students then create simple, social behaviours, such as polite or angry robots, using the control mechanisms they learnt earlier. The final sections of the workshop are a paper design exercise, where students plan a robot that will perform some social function (and we have examples of 5 types of robot, or students can choose their own), and finally abstract that to program a social robot that completes this function using the NXT.

To wrap up, we tie the students’ experience to the future of social robotics in general, and specifically to the role of computer science in solving challenging problems. All the information about this workshop is available online, including the complete PowerPoint slide package (which encapsulates the entire workshop), and the evaluation surveys, from our website.<sup>4</sup>

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<sup>4</sup><http://www.albany.edu/robotics/srw>