# Contrasting Perspectives on Robots: a study among artists, researchers and the general public

Ylva Fernaeus, Mattias Jacobsson, Sara Ljungblad, Maria Håkansson, Lars Erik Holmquist
Swedish Institute of Computer Science
Box 1263, SE-164 29 Kista, Sweden

## ABSTRACT
This paper aims to broadly discuss the challenges of developing socially acceptable robotic products, grounded on a perspective of user-centred design. Instead of addressing this topic from a certain system or technology, we started by exploring current perspectives of designers, researchers and the general public in their engagement with various kinds of robots. The multitude of approaches, as well as the many meanings of what constitutes a robot, highlights a general gap between what is expected from fiction, and more mundane ethical concerns such as sustainability, subtle social values and aesthetics. The discussion is based on responses to a questionnaire sent out to a group of researchers in the field of HRI, as well as data collected at an exhibition of robotic artworks.

## Categories and Subject Descriptors
I.2.9 [**Computing Methodologies**]: Robotics, K.4.0 [**Computers and Society**]: General

## General Terms
Design, Human Factors, Ethics

## Keywords
User centred design, HRI, Experience centred design

## 1. INTRODUCTION
Developing socially acceptable robots is fundamentally a matter of empathically addressing the needs, desires and expectations of the people that will experience and interact with these products. Defining methods and guidelines for how this could be practically done as parts of a development process is therefore one of the major themes within the research field of Human-Robot Interaction. One of its main discussion points, that we will focused on here, is what potential ethics questions that may become important in such work, and how to properly address them as parts of design and research efforts.

This paper reports on an initial analysis of ethics issues relevant to the international research project LIREC (Living with Robots and Interactive Companions). As a project directed towards the general society, the stance on ethics that may become most prominent in this work will concern issues involved in the design and use of robot technology in civil settings, from a user-oriented perspective. We believe that in contrast to previous discussions on "roboethics" for e.g. military and industrial settings, this requires a balanced discussion that may not begin with life and death, e.g. Asimov's three laws [1, 2], but on a more general level grounded in everyday life . Relevant questions then concern how the technology that we build may affect existing social practices, how the image of robots in popular media affect researchers and their designs, and the values that people in general associate with robotic technology.

Our approach to exploring this broad field includes not only conventional studies of the use and development of research prototypes, but also use patterns of commercial products, robots in popular media, and robotic technologies explored on the art scene. By welcoming perspectives of from outside of our own immediate research community, we hope to get a fuller view on what may constitute important ethics issues of our field, than if for instance focusing solely on our own systems and potential users.

During the fall 2008, we conducted several activities related to this theme. One of these was held at the ArtBots festival in Dublin (September 2008), focusing on the view on robots among artists as well as the general public. In addition to interviewing all of the designers, engineers and artists participating in the show, we invited the visitors to respond to a series of questions on a shared surface in the exhibition space (see figure 1). In total we received 680 annotated sticky notes from visitors, including reflective statements, feedback on the exhibit, and a large number of drawings of robots. As a complement to these activities, we sent out a questionnaire to all the European research groups involved in the LIREC project, with a similar set of questions as used in the interviews with the artists.

Based on these forms of data, interviews with artists, notes from visitors, and responses from researchers, we here present some reflections on the relationship between research, real world robotic artefacts, and popular culture.

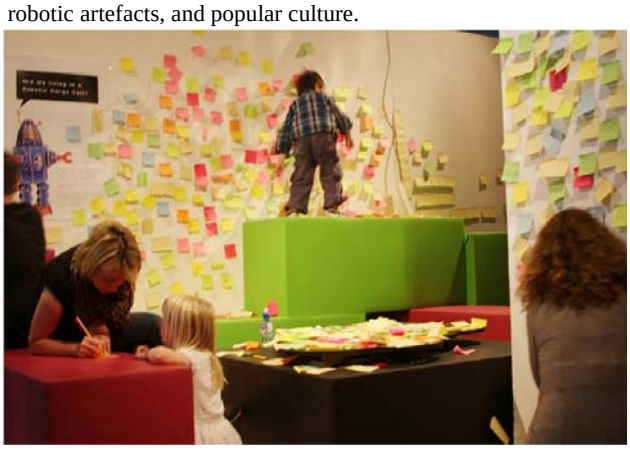

**Figure 1**. Participatory sticky notes workshop, adjacent to the exhibition space at Artbots.


*HRI'09*, March 11–13, 2009, La Jolla, California, USA.

## 2. ARTBOTS: PRELIMINARY ANALYSIS

ArtBots is an international 'talent show' for robotic art and art making robots, and this year the show consisted of 15 very different installations. It attracted more than 6000 visitors of the general public. As researchers in the field of human-robot interaction, we saw this as an ideal event for investigating the state of the art, and also to reflect on more conceptual aspects of robot technology. We did this by interviewing all of the artists and engaging the audience in a participatory workshop.

Looking at the variety of works presented, most of the exhibitors seemed to actively strive to move away from the general conception of what a robot should look like, presenting something very original, both in appearance and function (see Figure 2). In the interviews with the artists it was often made explicit that their pieces were not really considered as robots, but may be more suitable to refer to as e.g. *"kinetic sculptures"* or definitions closer to what their machines were actually doing, for instance *"Oribotics"* for the machine that was constructed around the folding of paper. The artists also generally expressed a perspective of their work in relation to values and ethics, focusing on robotic *materials*, and that it is the responsibility of the designers what robots are doing.

Only one of the exhibitors, the designer of Cubinator (a Rubik's cube solving robot), Peter Redmond, actively worked with popular pre-conceptions of how robots look like. He also made clear in his interview that the design was intentionally made to be interpreted as "a robot". This was manifested in a number of design features, including: the robot covered by a metallic shield, its head having two flashing lights as "eyes" and an animated red LED display as "mouth". The robot also had a computer display at its front, purposefully designed with a retro looking science fiction inspired black background, decorated with series of fake binary code and a sphere wire frame model, with the sole purpose of *"making it look complicated… and intelligent"*. Thus playing and making use of depictions from fiction worked as an important vehicle for making the Rubik's cube solving machine more interesting and fun to play with.

Peoples' imagination was generally an important design consideration that the artists actively engaged with. One example was the Hexapod robot, which was able to catch and physically follow the gaze of visitors. The designer Matt Denton explained the purpose of the dual lenses on the robot face, out of which only one was actually used as an instrument for the robot to "see" with. Apart from providing the robot with a more face-like appearance, the second (and larger) lens did not record any data, but by physically moving its apparatus, the user was effectively getting the experience of the robot "focusing" or "zooming in" on him or her, which was an important design feature for the interaction. This was also the robot that received the audience award of the show.

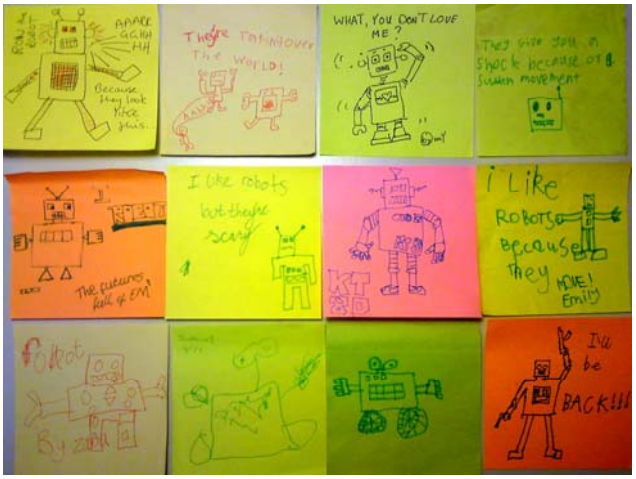


**Figure 3**. Examples of drawings provided by visitors.

Another much appreciated exhibit was the "Mechanical Dolls" presented by Yuliya Lanina. By physically reconstructing and animating traditional dolls and teddy bears in unconventional ways, this work made humorous yet relevant comments on our sometimes absurd society. Other pieces that directly concerned ethical concerns were presented by Christopher Kaczmarek (on sustainability), Riley Harmon (on war and video games), Allison Kudla (robot-flower symbiosis), and Joan Healy (with reference to manufacturing circumstances of electronic equipment). Naturally, aesthetics was also brought up as an important value, which sometimes was very closely interlinked with ethics in general. An example was the sound pieces by Jack Pavlik, where an important focus had been to create machines that made peaceful sounds, in comparison to the sometimes quite disturbing noises that motor movement usually produces.

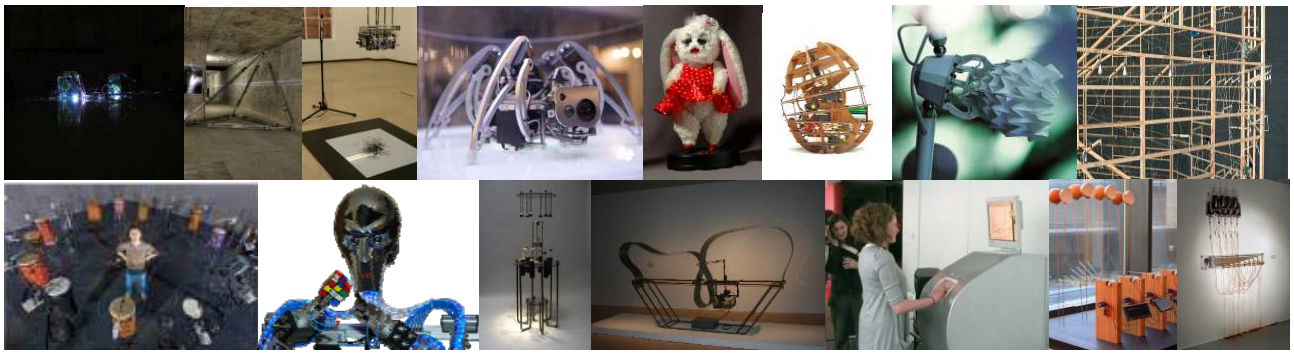

**Figure 2.** The pieces presented at the festival: "Circadia" by Paula Matthusen, "der Zermesser" by Leo Peschta, "gossamer-1" by Koichiro Mori, "iC hexapod" by Matt Denton, "Mechanical Dolls" by Yuliya Lanina, "momo" by Kristin O'Friel and Che-wei Wang, "Oribotics" by Matthew Gardiner, "Rechnender Raum" by Ralf Baecker, "Telematic Drum Circle" by Byeong Sam Jeon, "RuBotII" by Peter Redmond, "The Search for Luminosity" by Allison Kudla, "The Storm & 6 bands" by Jack Pavlik, "Two Stage Transfer Drawing (Cyberskin)" by Joan Healy, "Untitled" by Christopher Kaczmarek, and "What It Is Without the Hand That Wields It" by Riley Harmon.

Compared to the diversity displayed among the exhibited pieces, the visitors of the show seemed to have very specific ideas of what a robot should look like. In the participatory workshop, we got almost 100 drawn pictures of robots (see examples in Figure 3). Only four of these directly resembled any of the robots seen at the exhibition, the rest were all either drawn as "caricature robots" with square heads, or as representations of well known robot figures such as Wall-e, Bender or Terminator. This gave a quite clear illustration of what they think robots *look* like, while not so much of what they do, or how they work.

When responding to the question *"why are you afraid of robots"*, a surprising amount of sticky notes, even those written by adults, were of the style *"because they are more intelligent than us"* and *"because they may take over the world"*. This again reflects a view of robot capabilities, grounded in something quite different from the pieces presented at the exhibition.

## 3. LIREC: PLELIMINARY ANALYSIS

Inspired by the rich responses from the artists and the audience of Artbots, questions were sent out to all nine research partners of the LIREC project (see Figure 4). The questions were intentionally open and explorative, and based on a similar set of questions used for interviewing the artists. The respondents were research groups at Queen Mary University London (UK), The University of Hertfordshire (UK), Heriot Watt University (UK), Otto-Friedrich Universitat Bamberg (Germany), Eötvös Loránd University (Hungary), Wroclaw University of Technology (Poland), INESC-ID Instituto de Engenharia de Sistemas e Computadores, Investigacao e Desenvolvimento (Portugal), FoAM (Belgium), and Cnotinfor Ltd (Portugal). This analysis focuses on how the researchers expressed their concerns about their work, regarding their views of the technology that they were studying, their research approaches, and how other people have reacted on their work.

From the responses of the questionnaire, it is prominent that the researchers, just as the artists, did not have a shared view of what constitutes a robot. Some partners gave a very broad definition (*"a machine that is useful"*), while others were more specific (*"physically embodied mobile system with its own sense-reflect-act cycle"*). Importantly, none of the research groups mentioned the looks of the artefact as a defining part of what a robot is.

The properties that the researchers emphasised were also concretely based on their respective disciplinary backgrounds, as well as the questions and scenarios explored in the different research groups. Properties that were emphasised most often were: ability to act autonomously, physical embodiment, sensing and acting upon the physical world, programmability, and social companionship.

The responses suggest that depending on which of these qualities that are stressed most, different ethics questions will become more prominent. For instance, if the definition is focused more on the ability to act autonomously, ethics considerations may get more directed towards issues such as authorship, accountability, and responsibility. If focus is instead directed to social companionship, the questions may be more concerned with human motivation, affect, privacy issues, and means for communication.

Another observation among the responses was that ethics in relation to HRI is approached differently by those who build their own systems and prototypes, and those who perform studies based on readily available technologies.

1. *Describe the work that you are presenting (artists)/technology and/or scenario that you are working with (researchers)?*
2. *What is the main motivation for working with this particular concept/technology/scenario?*
3. *What would you say are the underlying ideas behind your work/research?*
4. *How do people (general public and other researchers) react to your work? E.g. common questions.*
5. *What are the reasons that you work with robots (instead of another kind of technology or design solution)?*
6. *Do you think that your work expresses any particular values? Please describe these. For example, does it reflect any cultural, moral or aesthetic values, and how?*
7. *How do you think that your own values and interest may affect your research/scenario?*
8. *How do you think that your work may affect society (both negative and positive)? Does it emphasize, change or follow an existing tradition?*
9. *What are your thoughts about robots in general?*
10. *How would you define a robot?*
11. *Do you have other comments reflections about ethics and robotics/robots?*

**Figure 4.** Questions used in interviews with artists and questionnaire for researchers.

*"The research is usually driven by researcher's personal interests, passions,capabilities, prejudices, and idiosyncrasies. In the design of robotic companions the researcher's moral values may affect both the functionalities implemented in the design as well as the conduct of the researcher, his/her style of collaboration, and attitude toward inferiors, superiors, and sponsors. "*

*" We want to better understand how children relate with robots, if they prefer more autonomous or more programmable robots; how they would design new robots and what kind of features they like to give to robots."*

In the first case, important ethics questions include how researchers own values get embodied in the design of prototypes and scenarios. If the technology already exists, the ethics may be more concerned with how to set up studies and to involve users in appropriate ways. Moreover, some partners also expressed a clear vision of what their intended robots should be able to do, whereas others were less focused in that respect, and regard the technology rather as a means for explorations on how people naturally act emotionally and socially. Thus, understanding and studying robotic companions can take many different starting points.

In the motivations expressed by the research groups and the ideas about robot companions in general, it was prominent that ethics questions were often concerned with future scenarios rather than what exists already. This could be explained partly due to the early stage of the project, and also the general ambition to design and explore novel technology. A challenge that this may bring

about is to not further emphasise unrealistic scenarios and expectations driven from popular media and fiction.

Several of the research groups implicitly expressed a vision of companion technology in terms of their research focus e.g. by performing comparative studies on how people act towards robots and how they interact with people and animals. This could be interpreted as what is being studied (robots) have more in common with people and animals, than with other forms of existing technology (e.g. communication technology, physical tools, vehicles, electronic toys). This stance could be interesting to explore further in reference to e.g. what is meant by ”natural” and ”intuitive” interfaces [4], and questions of ”use” versus ”experience” [3]. It may for instance be suggested that aiming to design technology that involves social affective abilities (as explored by some partners) or that can maintain social relationships with users (explored by others), may not necessarily need to involve mimicking human behaviour in the design. Just as the pieces presented at ArtBots, an alternative focus could be on designs that trigger affection and social interests from a much broader perspective.

A third aspect concerns how research results are *perceived*, by media, the general public, by other researchers, as well as by participants in studies. Several of the partners emphasised a difference in how researchers and how the general public react to their work.

*” People are either interested and curious and find the idea of interacting with a robot bizarre, but interesting, or they dislike the idea of socially interacting with a robot. Concerns are e.g. that robots only fake social interaction, that social interaction should be reserved only for human-human interaction, and that any human social interaction is better than HRI.”*

As noted by one of the partners, it is important also for those who only do user studies to take into account general prejudices and stereotyped visions of robots that users as well as researchers may bring into the studies. This is especially relevant as research visions are not always aligned with currently available technology, but rather on expectations of future technology.

## 4. DISCUSSION AND FUTURE WORK

Robots of varying shapes, sizes and forms are getting used in very different use contexts, ranging from autonomous consumer products such as vacuum cleaners to sophisticated interactive toys, industrial robots, service robots and interactive sculptural artworks, to list but a few broad areas. At the same time, robots is a well known and quite specific concept in popular culture. Most people can draw a robot, or say something about their idea of what a robot is, what a robot should be used for, and how it could look and behave. This is often inspired by what they have experienced on film, in science fiction literature, children’s books, comics, cartoons, toys and other media. Our preliminary analysis suggests that depending on which of these interpretations that is leaned towards, different ethics issues will become more relevant to explore.

Our own research group has its background in the area of user-centred design, which touches upon a broad range of themes, including aesthetics, sustainable interaction, and contextual and cultural values. An important aspect in such work is to focus on how people are using and relating to technology in real world settings. This requires designers and analysts to stay open to interpretations that may go beyond the assumptions made by the designers, or even the use qualities that end users expect before they experience a new technology [see e.g. 5]. A thought-provoking question is whether bottom-up user-centred design is really possible in the field of HRI. The problems of applying user-centred approaches appear problematic, both as robots are particularly difficult to study because of the complexity of resources needed to build them and the cost/sophistication of materials. Thus it is very difficult to get any informed sense of what human-robot interaction might be like in practice. Moreover, it seems users, when asked, struggle to imagine what robots might do. They may quickly resort to stereotypical sci-fi imagery.

Independent of what definition that is used, questions that were emphasised in this study included partly how the technology may affect existing social practices, but more importantly how the image of robots in popular media affect how researchers perform studies, and what is looked for in research efforts. For the case of designing socially acceptable robotic products, these aspects may become especially relevant to consider, as we live in a culture populated by many simultaneous visions of future robotic technology.

In order to perform discussions on user values that are truly grounded, we need to find ways of concretely addressing these kinds of challenges. This does not only involve investigating people’s expectations and fears of future robots, but perhaps more importantly to balance these against existing technology and empirical studies of real practices.

## 5. ACKNOWLEDGMENTS

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