Chapter LXI
Human–Robot Interaction

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ABSTRACT

Some people regard the personal mobile robot as a candidate for the next digital revolution as it might become a future ubiquitous tool and everyday partner of humans. This new "socio-emotional" robot is supposed to conduct dialogue, to develop social competencies and to support users in everyday life. In this chapter, I sketch out the epistemological, ontological and techno-material groundings of personal service robotics which is based on new models of human-machine interaction like caregiver-infant or pet-owner. I discuss the conversational paradigm in Human-Robot Interaction (HRI) with its problematic concepts of "pre-given" social mechanisms, uninformed users as well as its new understanding of sociality as service.

INTRODUCTION

Some people see the so-called social robot of the personal service economy as the future ubiquitous tool and everyday partner of humans. For example, Bill Gates writes: "… when I talk to people involved in robotics–from university researchers to entrepreneurs, hobbyists and high school students–the level of excitement and expectation reminds me so much of that time when Paul Allen and I looked at the convergence of new technologies and dreamed of the day when a computer would be on every desk and in every home. And

as I look at the trends that are now starting to converge, I can envision a future in which robotic devices will become a nearly ubiquitous part of our day-to-day lives" (Gates, 2006, p.1).

Robotics today no longer concentrates on industrial and professional service applications only, but moves toward applications in the personal service economy. Traditional robotics has been a field for experts only, in which industrial and professional service robots were developed as programmable machines for carrying out physical tasks like robots for the automobile industry or for logistics, for military or medical applications.

The field of so-called "*social robotics*" or HRI emerged in the last 10 years. Social robots are developed to interact physically, affectively and socially with humans, to support them in everyday life, to play with them, to educate them or even "learn" from them. This new field concentrates on robots for entertainment, care, therapy, assistance, and education (see Christaller et al., 2001; Fong, Nourbakhsh, & Dautenhahn, 2003; Kiesler & Hinds, 2004; Rogers & Murphy, 2004).

One well-known example of these "socio-emotional" robots is the robodog Aibo, a toy developed by Sony in 1999. Since then thousands of robodogs, robocats and other roboanimals have been sold not only in Japan but also in Europe and the USA. In the last years an AIBO online community with its own chats, mailing lists and Web sites emerged. With regard to these developments it is unclear what status these pseudo-autonomous robots have; whether their status differs from such toys like Tamagochis, whether they are regarded as "real" friends (not only by children) and whether they get endowed with a moral status (Friedman, Kahn, & Hagman, 2003). There is also the question whether children as well as adults make bonds with robots (think, for example, also of sex robots) and what are the consequences for human-animal or human-human relationships and society as a whole.

Another example for the meaning and consequences of new human-robot communication is the case of so-called therapeutic robots. Think for example of the robot called Paro which is substituting real animals in hundreds of Japanese homes for elderly people. It is supposed to trigger nurturing responses via baby scheme and to serve as a mediator to engage elderly people in mutual interaction (Shibata, Wada, Saito, & Kazuo, 2005).

The status, function and usefulness of these robots are unclear and contested (Weber, 2005b; Giusti & Marti, 2006). But while the sales in the field of therapeutic robots are still very small, the edutainment industry with its robot toys is a grow-ing field. In 2005 there were ca. 1 million units worldwide (mainly in Europe, the USA, Korea and Japan). For 2006-2009 the new numbers of units are estimated about five and a half million (Hägele, 2006, p. 379).

A Very Short History: From AI Toward Autonomous, Behavior-Based Robotics

Traditional Artificial Intelligence as well as robotics rested on the cognitivist paradigm, which focussed on calculation, symbol processing and knowledge representation. This approach worked very well for strict rule-based tasks like playing chess or assembling car parts in factories. Moving toward other tasks, it became more and more obvious that knowledge acquisition and interaction with the world does not exclusively work according to logical rules that can be translated in algorithms and run on a computer, which ironically has been pointed out by philosophers and science studies scholars for quite a while (Dreyfus, 1973; Suchman, 1987). In the 80s and 90s of the 20th century, more and more researchers stressed that embodied interaction with the social and physical world is central for real intelligence. Autonomous systems were envisaged to interact with the world in changing environments and to solve tasks they were not explicitly programmed for (Brooks, 1991; Pfeifer, Verschure, 1992). From today's perspective this was an important step toward *social robotics* relying mostly on the interaction between everyday users and robots. This new approach did not only orient itself toward *embodiment* of agents in the real world as well as a tight coupling of system and environment, but also integrated concepts such as emergence, co-evolution (of human and machine), social and emotional intelligence (Weber, 2005a) in its research. While in the beginning of behavior-based robotics, most researchers oriented themselves toward biology and social group behavior of anonymous groups (like insects, birds, or fish). Only in the late 90s of

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