On January 24, 2009 at Ritsumeikan University in Kyoto an international workshop on "technology and empathy in the context of health care" was held. The focus of the meeting was to analyze the impact of new technologies on the relationships between doctors, patients and family members. 1) and the second (b) centered on the relational implications of the therapeutic use of robots.

Given the thematic orientation of this blog, the following report will concentrate on the second half of the workshop that was organized around the interventions of two internationally recognised pioneers in the therapeutic use of robots.

Maja J. Matarić [3], Professor of Computer Science and Neuroscience, and Director of the Center for Robotics and Embedded Systems, at the University of Southern California (USA). Professor Matarić's research concerns the interactions between humans and robots in the context of medical therapy or in other situations related to health care where robots
are used. She heads an interdisciplinary research group that includes specialists in the cognitive sciences, neuroscience, social sciences, medicine and education.

Takanori Shibata [4] is Senior Researcher at Japan’s Institute of Advanced Industrial Sciences and Technology (AIST) in Tsukuba, Japan. Doctor Shibata is the inventor of PARO [5], an animal like robot that is mainly used in the context of mental (psychological) therapies. PARO is presently the most used psycho-therapeutic robot in the world. Doctor Shibata defines its use as a form of «robot therapy» inspired by animal therapy.

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Maja J. Matarić
Social Assistive Robotics for Health and Medical Applications

The intervention of Professor Matarić which was a PowerPoint presentation with a simultaneous telephone conference from the United States, and offered a general panorama on the therapeutic use of robots. Within robotics, a field whose objective is social interaction between machine and human, she identified two major and interdependant research objectives pursued in her work. Apart from the goal which is most commonly emphasized in the media, (a greater satisfaction of human user's needs and requirements through engineering development), there is second fundamental goal, she argues, which is the exploration of human behavior. As Professor Matarić underlines, robots acting as social agents provide a new, and potentially very powerful, instrument of research that may lead to important scientific discoveries concerning human behavior and social interactions.

This emphasis on the genuinely cognitive character, as opposed to purely
technical aspect of research in robotics was also one of the premisses of her presentation as it constitutes a fundamental assumption for her research activity in social assistive robotics. This research essentially centers on human-robot interactions in the cure of patients suffering either from short term or chronic physical or cognitive disabilities. With her research team she addresses issues related to the use of robots in medical care with the help of the following heuristic principles:

- Humans react or respond differently to different types of artificial agents. In particular human-agent interaction changes radically depending on the way the artificial agent is embodied (whether it has a three dimensional physical body or whether it simply is a virtual agent).
- The creation of a lasting interaction between humans and artificial agents, one that is able to capture and maintain the attention of the human person, requires the use of embodied artificial agents, agents that have a body that allows them to move in physical space (hence robots) in opposition to virtual agents that only exists on computer screens.
- The level at which humans are willing to participate in such a relation depends essentially not on the form of the robot (how much it is human-like) but on the behaviour of the robotic agent.
- In order to obtain a lasting relation, what is important is not so much the overall abilities of the robot as its credibility within the particular context in which it is used. This leads to resorting to artificial agents which in many ways are technically imperfect, but which nonetheless are autonomous machines. (Robots that are not directly controlled by humans, contrary to those we encountered when we visited Professors Kanda and Ishiguro at ATR.)

It is with the help of these four principles that Professor Matarić’s team has explored diverse avenues of research and experimented with different forms of the embodiment of robots since 2004 in attempts to establish human robot interaction that produces significant therapeutical results.

Professor Matarić essentially presentated two types of applications for her research. The first type finds its place in care that aims at the recovery of the normal physical or cognitive abilities of adult patients who have suffered from strokes or cardiac problems. The second type of applications concerns robots used in the treatment of autism in children. In both cases, the robot has to anticipate the stimulus from the patient as he or she develops his or her cognitive competence and (especially in the case of adults) to adapts its own behavior in order to accompany this development. The examples on which Professor Matarić focused during her presentation concern the first type of applications and involved a minimally embodied agent (in this case a video camera set on a metallic cube and able to talk). The artificial agent asked the human user to re-order a pile of magazines following given
Professor Matarić not only showed images of interactions between the robots and human agents, but also presented data from an interview with patients who had been "trained" by the robot. Together this information illustrated the strength of the interaction between robots and humans. In spite of the rather primitive embodiment of the artificial agent, patients claimed that they found interacting with robot entertaining and often preferred this type of interaction to the traditional interventions of nurses or orderlies.

Similarly, autistic children often exhibited marked enthusiasm for interacting with robots and afterwards showed more initiative in their interactions with adults. Confronted with relatively simple robots (for example a robot made of a torso to which are attached two mobile arms and a head and sometimes an apparatus that allows the robot to blow soap bubeses), children manifested behavior that was somewhat unusual given their level of cognitive development. As mentioned before not only did the children develop stronger and more complex communication with the adult present during the experiment, but also many succeeded in imitating the behavior of the robot, for example the motion of its arms. This is an ability which autistic children rarely show in relation to other humans.

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Asked about her hypothesis concerning the success of robots in therapeutic context, Matarić responded that the cognitive and expressive simplicity of such machines makes them easier to interact with, for those who have impaired or limited cognitive capacities. This may especially be case with autistic children, the reduced complexity of the behavior of robots and their reduced expressivity may reassure them, providing a world of interaction they feel they are more able to understand and anticipate and in consequence allowing them to express themselves more freely.

(...) Next post: Takanori Shibata [6]...)

Note 1: The first section was composed from interventions by Japanese and Italian speakers: (Dr. Stefano Tomelleri, Università di Bergamo; Pr. Sergio Manghi, Università di Parma; Dr. Hotta and Prof. Yoko Matsubara, both from Ritsumeikan University).

Links in this document:

1] /schedabiografica/Redazione FGB
2] http://www.ritsumei.ac.jp/acd/re/k-rsc/ars_vivendi/english.html
3] http://www-robotics.usc.edu/~maja/
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