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Moving Robots from Industrial Sectors to Domestic Spheres: A Foreword

Leopoldina Fortunati

Abstract
This foreword analyses how in the shift from industrial sectors to social and domestic sectors the form of robots is actually subjected to great changes. Furthermore, it reports some recent data on robot diffusion, implicitly inviting researchers to reflect on the trends of robot diffusion that give the precise indication to focus on the material sphere of the housework.

Keywords Social robotic autonomous systems · Physical · Social and organizational context · Social robots

This volume represents an important step for social robotics studies. It shows how this field of knowledge is advancing consistently on making increasingly "natural" human interactional exchanges with social robotic autonomous systems. Said this, the present collection does not hide the limitations of the research carried out so far on modeling social signals and calls for a strong engagement by social sciences. Implicating also social sciences is in fact the only way for assuring the improvement of the quality of life of the end-users of social robots [1–5].

The focus of this volume is on the physical, social and organizational context, which is proved to be so crucial in affecting the whole communication and interaction process. The main characteristics of human interaction exchanges are explored and the cognitive and emotional processes at the core of interactions are modeled.

The purpose behind this research is to develop robotic system prototypes able to socially behave in specific contexts. The research on social robotics field needs to advance substantially because now many different care sectors, the healthcare, the entertainment, the education, and the domestic setting are pressing for useful products.

The shift from the industrial setting to the reproduction sphere of individuals obliges us to be aware that it intertwines in parallel with another shift from the unitary conception of robots as machines to a more articulated conception of robots.

We inherited from the past some forms of robot: zoomorphic; android or gynoid; machine with a very different profile from human beings; particular objects [6]. However, with the current proliferation of technologies in the social body we do not need now to remain bound to these forms. What is increasingly emerging is the attempt to take advantage of the network of information and communication technologies so diffused in the social body for developing robotic systems [7]. Thus, along with the development of robots as continuation of the classic forms of robot—agents as drones, humanoids, swarms, cleaning, manufacturing, emergency and space exploration robots-, we face in fact the de-construction of robots in many new forms: from intelligent agents to automated personal assistants, from future smart environments to ambient assistive living technologies, from computational intelligent games/storytelling devices to embodied conversational avatars, and automatic healthcare and education services [8].

This shift is made possible by the new level reached by social robotics science, of which this volume is an important witness, and is made necessary by two factors. First, the new social needs and desires expressed by people at immaterial level [9, 10], which call for practical and innovative solutions and can be addressed through robots or algorithms. I allude here to the increasing use of robots in the Web 2.0, in information, education, entertainment, health and care sectors, which can be considered as forms of proto-roboticization of the immaterial sphere in society.
Second, the domestic needs at material level call also to be addressed: see the extraordinary success of vacuum cleaner and floor cleaner robots and the launch of several kitchen robot (which are multi-functional food processor, cooker, steamer and self-cleaner) that propose to radically change the way we cook, learn about cooking, coordinate and time plan our food practices at home.

To have a more precise idea of the diffusion of social robots, it is wise to recur to the World Robotics Report 2015, released by the Statistical Department of the International Federation of Robotics (IFR) [11]. In this report industrial and service robots (those sold for professional or personal/domestic use) are distinguished. Social robots are part of the service robots. According to this Report, in 2014 professional service robot sales arrived at 24,207 units, showing an increase of 11.5% compared to 2013. But service robots for personal and domestic use arrived at 4.7 million units, showing an increase of 28% compared to 2013. Disabled assistance robots have taken off in 2014, when a total of 4,416 robots were sold with an increase of 542% in respect to 2013 when only 699 units were sold.

However, the bulk of sales occurred in the sector of robots for domestic tasks: 3.3 million of units were sold, including vacuum cleaning, lawn-mowing, window cleaning and other types of. In the entertainment sector, there are increasingly more sophisticated low-priced toy robots, but also high-quality products such as those proposed by the LEGO Mindstorms program, offering software environments that reach actually into high-tech robotics. These digits tell us that the domestic material needs are those more urgent to respond to and that there is a huge space for market development in the domestic sphere. Also, the projections for the period 2015–2018 reported by IFR show that 35 million of service robots for personal use are expected to be sold. By contrast, the sales of robot companions/assistants/humanoids

are projected to be only 8,100 units in the same period. In reality, these social robots started to arrive to research laboratories and university only in 2004, but so far there have not been significant sales of robots as human companions to perform typical everyday tasks.

All these processes converge on bringing to light what I call the new phenomenon of "ubiquitous social roboting". The new research on social robotics, such as those presented and discussed in this volume, are timely and necessary to strengthen this phenomenon by developing further and in the right direction (from a human perspective) the robotification of society [12].

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