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## Robotics handbook explores past, present and future

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**The dream to create machines that are skilled and intelligent is now becoming part of our world's striking reality, according to robotics expert Bruno Siciliano.**

Together with Oussama Khatib, who is a Professor of Computer Science at Stanford University, Siciliano has edited and launched a "Handbook of Robotics" that aims to make the increasingly complex field of robotics more accessible to engineers, doctors, computer scientists and designers.

Siciliano, who is a Professor of Control and Robotics at the University of Naples, Italy, as well as the President of the IEEE Robotics and Automation Society, spoke with iTNews about the book and its topics that range from the foundations to the social and ethical implications of robotics.

### Who is your target audience for the "Handbook of Robotics"?

The handbook was conceived to provide a valuable resource not only for robotics experts, but also for newcomers to this expanding field [such as] engineers, medical doctors, computer scientists, and designers.

### Why do we need such a handbook?

The undertaking of the project was motivated by the rapid growth of the field.

With the ever increasing amount of publications in journals, conference proceedings and monographs, it is difficult for those involved in robotics, particularly those who are just entering the field, to stay abreast of its wide range of developments.

This task is made even more arduous by the very multidisciplinary nature of robotics.

### How prevalent are robots in everyday life?

Robots today are making a considerable impact on many aspects of modern life, from industrial manufacturing to healthcare, transportation, and exploration of the deep space and sea. Tomorrow, robots will be as pervasive and personal as today's personal computers.

### What are the potentials of robots in the near future and how will this compare with robots of today?

In the 1990s, research was boosted by the need to resort to robots to address human safety in hazardous environments (field robotics), or to enhance the human operator ability and reduce his/her fatigue (human augmentation), or else by the desire to develop products with wide potential markets aimed at improving the quality of life (service robotics).

A common denominator of such application scenarios was the need to operate in a scarcely structured environment which ultimately requires increased abilities and a higher degree of autonomy.

By the dawn of the new millennium, robotics has undergone a major transformation in scope and dimensions.



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This expansion has been brought about by the maturity of the field and the advances in its related technologies. From a largely dominant industrial focus, robotics has been rapidly expanding into the challenges of the human world (human-centered and life-like robotics).

The new generation of robots is expected to safely and dependably co-habitat with humans in homes, workplaces, and communities, providing support in services, entertainment, education, healthcare, manufacturing, and assistance.

**What is the global landscape like for robotics currently?**

Even though the first industrial robots were designed and built in the 1960s in the USA, during the course of the following decades they have matured elsewhere.

Mostly due to the needs of their automotive industry, combined with high costs of labour, both Europe and Japan have taken over global technological leadership in industrial robotics in the past decades. In the US, most of robotics research is currently funded through military, space and security programs.

In Japan, robot manufacturers can rely on public opinion that robots are widely accepted by society. They are seen as useful helpers (co-workers to their human counterparts) and not as job-killers, they have a strong home market with the highest density of robots, cover a larger spectrum of robots, and are typically part of huge vertically integrated industrial conglomerates that can build up massive R&D and commercial power.

In Europe, by contrast, the robotics industry is strong, but still quite fragmented and dispersed. Industry observers agree on the following global trends in the industry: due to saturation in the classical (automotive) markets, all major manufacturers will need to identify new areas to maintain growth and (ii) the rapid development in technology areas that are the basis for robotics – mechatronics, computers, sensors, programming, human interfaces – bears huge potential for totally new application scenarios.

Clearly, these developments may also result in a dramatic re-distribution of the market share of robot manufacturers in future application scenarios.

**Will robotics ever become an issue for policy makers? How so?**

Robotics is rapidly becoming one of the leading fields of science and technology, so that very soon humanity is going to coexist with a totally new class of technological artefacts: robots. It will be an event rich in ethical, social and economic problems.

It is the first time in history that humanity is approaching the challenge to replicate an intelligent and autonomous entity. This compels the scientific community to examine closely the very concept of intelligence – in humans, animals, and of the mechanical – from a cybernetic standpoint.

In fact, complex concepts like autonomy, learning, consciousness, evaluation, free will, decision making, freedom, emotions, and many others shall be analysed, taking into account that the same concept shall not have, in humans, animals, and machines, the same reality and semantic meaning.

From this standpoint, it can be seen as natural and necessary that robotics drew on several other disciplines, like Logic, Linguistics, Neuroscience, Psychology, Biology, Physiology, Philosophy, Literature, Natural History, Anthropology, Art, Design. Robotics de facto unifies the so called two cultures, Science and Humanities. The effort to design Roboethics should take care of this specificity.

**What are Roboethics?**

Roboethics is an applied ethics whose objective is to develop scientific, cultural, and technical tools that can be shared by different social groups and believes. These tools aim to promote and encourage the development of Robotics for the advancement of human society and individuals, and to help preventing its misuse against humankind.

This means that experts shall view robotics as a whole - in spite of the current early stage which recalls a melting pot – so they can achieve the vision of the robotics' future.

**When do you expect robots to be an unavoidable part of life? What needs to be achieved before this happens?**

The dream to create machines that are skilled and intelligent has been part of humanity from the beginning of time. This dream is now becoming part of our world's striking reality.

Reaching for the human frontier, robotics is vigorously engaged in the growing challenges of new emerging domains. Interacting, exploring, and working with humans, the new generation of robots will increasingly touch people and their lives.

The credible prospect of practical robots among humans is the result of the scientific endeavour of a half a century of robotic developments that established robotics as a modern scientific discipline.

Today, new communities of users and developers are forming, with growing connections to the core of robotics research. A strategic goal for the robotics community is one of outreach and scientific cooperation with these communities. Future developments and expected growth of the field will largely depend on the research community's abilities to achieve this objective.

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