On the Ethics of Research and Practice in Robotics and Automation

By Raja Chatila

Research in robotics and automation (R&A) has reached an unprecedented stage of maturity.

Enabled by increased computing speed and memory storage, the miniaturization of sensors and actuators, new materials, and, most importantly, research results in R&A at large, we can see today that robots and systems are capable of achieving impressive operational functions in perception, motion planning, motion control, manipulation, human–robot interaction, and so on, in a variety of situations. Full autonomous operation is possible in some cases. Of course, a great amount of research is still necessary to understand many underlying principles, in decision making, control, perception, or learning, and to achieve operation in open-ended situations.

These robots have now come out of the labs. New applications are booming in many sectors: transport, services, defense, manufacturing, agriculture, construction, medicine, and health. Many others are yet to come.

This wealth of applications has made R&A very visible to governments, the media, and the general public worldwide. Questions on ethical, legal, and societal issues in the use of robots have emerged and are becoming more meaningful to scientists and engineers as well as the general public. Statements are made, by specialists and nonspecialists alike, about the consequences on jobs and the ethical use of robots but also about robots and artificial intelligence (AI) "taking over the world." And when it comes to autonomy, additional questions are raised, mainly about self-driving cars or certain types of military usage of robots, e.g., autonomous lethal weapons.

Many of these questions are undoubtedly legitimate, even if they are often based on misconceptions about robots and their actual capabilities and about the state of the art in R&A and AI.

Scientists and engineers engaged in robotics research have at least a moral responsibility about the outcome of their work and sometimes also about the misconceptions within the public because of some of their statements. The R&A community started to reflect on the question of the ethical implications of robotic technology and of autonomous robots more than ten years ago, more precisely, in 2002, within a research atelier funded by the European Robotics Research Network (EURON). The first workshop was organized by Gianmarco Veruggio and Fiorella Operto on 30–31 January 2004, in Villa Nobel, San Remo, Italy. The same year, the IEEE Robotics and Automation Society established a technical committee on "roboethics." Robot ethics is today an interdisciplinary research area at the intersection of applied ethics, robotics, and AI. The European Union (EU) funded several projects in the past ten years on this issue, and, recently, Robolaw, the conclusions of which were presented before representatives of the EU Parliament. In some countries, official ethics committees on robotics research have been formed [e.g., the French Advisory Commission for the Ethics of Research in Information Sciences and Technologies (CERNA) in France, which addresses more broadly digital sciences and technologies].

But what exactly is the ethics of research in our area? Like in other areas, it is to reflect, since the early stage of research and as applications and technologies get closer to actual usage, on the consequences of this research and these developments on our human societies and to consequently make appropriate decisions and take appropriate measures measures according to our moral standing.

Similarly to physics, our domain raises many questions about the use of technologies developed from theories and about the machines designed after them. And similarly to biology, R&A raises profound questions on the very nature of human beings. The list of these questions is long. Just to mention a few: Should robots be allowed to autonomously make decisions that could knowingly endanger human lives? What are the consequences of robots expressing emotions with people who

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could be psychologically vulnerable, immature, or diminished, especially people or children who have no technological background? Can robots improve or reduce human dignity? What are the consequences of building robots that mimic or replicate animals, or, more importantly, human beings, in appearance and behavior? What could be the consequences of human augmentation by means of robotic devices? These last two questions raise debates on human identity. Another question pertains to the status of robots, especially whether they should be classified as akin to living beings, in human society.
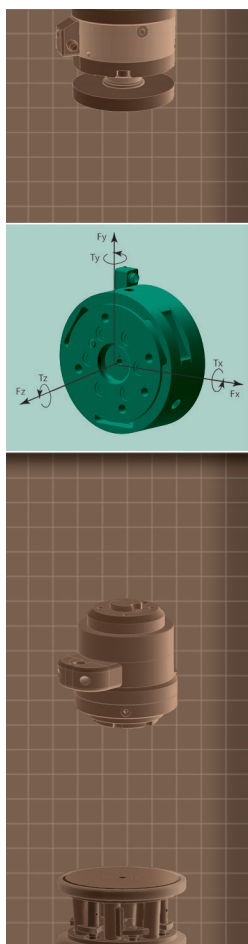
In addition to these questions, there are many others related to legal aspects, such as the accountability and responsibility of robots, privacy, and intimacy of humans interacting with them.

It is our responsibility as researchers, engineers, and practitioners to address these questions individually and as a community and to provide answers. Our Society also has its share of this responsibility. This is why a new Standing Committee on Ethics of Robotics and Automation Research and Practice has been introduced in the latest revision of our bylaws and voted by the Administrative Committee in May 2015, to organize reflections and to contribute opinions and recommendations on this major issue.

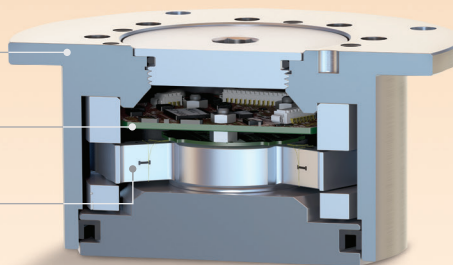By doing this, we will be advancing technology for the benefit of humanity.

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