A Brave New Robotic World

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ABSTRACT (ENGLISH)

Alves-Oliveira reviews The Heart and the Chip: Our Bright Future with Robots by Daniela Rus and Gregory Mone.

FULL TEXT

A Brave New Robotic World THE HEART AND THE CHIP: Our Bright Future with Robots. Daniela Rus and Gregory Mone. 272 pp. W. W. Norton, 2024. $29.99.

Daniela Rus, a roboticist and computer scientist at Massachusetts Institute of Technology (MIT), and writer Gregory Mone take readers into the world of robotic technology in their new book, The Heart and the Chip: Our Bright Future with Robots. The subtitle speaks to the authors' optimism about robotic technology and their book explores the great potential that robots have to benefit society, if created and used with good intentions. However, the authors are careful to note the following: "Of course, the very idea of what is good or bad, in terms of how a robot is used, depends on where you sit." Rus and Mone go on to explore these complexities throughout the book.

In the introduction, Rus writes, "I build robots-their bodies and brains. When I tell people what I do for a living, they generally have one of two reactions." Those reactions are either anxiety about robots taking over the world or excitement about what robots may be able do. These very different reactions can be seen as an expression of opinions about not just the potential harmful effects, but also about the benefits that robots can bring to society. Rus and Mone argue that if we can mitigate the potentially negative effects, the positives about robots can lead to unprecedented societal progress. Throughout the book, the authors dissect the robotics field and define what robots are and what they can do for us, hoping to shift readers' perspectives from popularized notions of robots to a more nuanced, well-rounded perspective of what robots really are.

The book is divided into three sections: "Dreams," "Reality," and "Responsibility." In the "Dreams" section, Rus and Mone imagine the possibility of robots that could extend our abilities or even do things for us. Inspired by the comic book character Iron Man, the authors speculate about what it would be like to have a wearable, fullbody robot that could fit invisibly under an existing outfit. This robot could enhance a person's strength, such as in the case of an older person who has lost physical strength with age. These types of robots are called exoskeletons. A central concept of the book that is reiterated in this section is that scientists should fuse the unique assets that humans have with robotic technology. This human-robot partnership would demonstrate the interplay that needs to exist for robots to become relevant in society.

In the "Reality" section, Rus and Mone describe the challenges that robots face in sensing the world, planning their behaviors, and then acting. One of the major ways robots know how to do things is by learning from data. Data is limited, however, and programmed solutions can cover only a finite number of possibilities. Thus, the actions that robots can take are limited to their data or programs.

To go beyond this limitation, robotics researchers envision a future in which robots can learn from their previous experiences and create solutions for situations they have not yet seen. To achieve this goal, robots would need to assess their environments and decide on a plan, without having to be programmed for every step. To illustrate this concept, the book presents several learning methods that roboticists have been working on. One approach is called reinforcement learning, in which robots learn what actions lead to better results than other actions and plan accordingly. But robots can be slow to learn, and computational power is expensive. Also, reinforcement learning

may create what is called a black box-if robots become able to learn on their own without exact programming instructions, roboticists may not know what a robot has learned or whether that knowledge will be applied to every situation. So, if something goes wrong, we would not be able to explain why. Another important challenge is bias, since a robot is only as good as the data from which it learned: If the data carries bias, the robot will learn that bias as well.

In the section titled "Responsibility," Rus and Mone dive deeper into various possible futures of coexisting with robots. One scenario is our current reality. Right now, robots learn from data and most of the time, roboticists do not exactly know how, resulting in roboticists not always knowing why the robot is doing what it is doing. In other words, it can be hard-sometimes impossible--to trace back all the steps a robot took in their learning in order to explain their behavior. Thus, we risk producing a generation of robots whose creators cannot identify or explain when a problem arises in a robot program. In the long run, the result may be issues of trust in robot systems.

The most promising scenario that Rus and Mone speculate about is the development of robots as tools that can empower people. The authors argue that such a lofty goal is possible only through interdisciplinary collaboration-where engineers, social scientists, lawyers, and other professionals come together to design robots that people want to be around. The authors list 11 qualities that robots and AI systems should have to ensure they are working for the greater good. Those qualities include safety protocols toward humans; guaranteed security with regard to personal data and robust security protocols; that robots should have the ability to be assistive while allowing the human to have the final decision in any action; and the qualities of being affordable, equitable, sustainable, and certified by a regulatory body before deployment.

Rus and Mone also share how important it is for roboticists to repurpose technological advances from one robot application to another. For example, consider autonomous cars. Rus and Mone write, "We asked ourselves what would happen if we transformed our autonomous driving technology into a wearable, lightweight system. In short, what if we took our robotic car technology and used it on a person?" This question was the motivation for Rus and her lab team to pursue groundbreaking work to develop technology for people who are blind or have low vision. If we can equip cars to see better and make decisions autonomously, then we can certainly repurpose these technologies to amplify sensing capabilities for people who need them most, right? To achieve this goal, Rus and her team connected with blind people and people with low vision during their research. This turned out to be an essential part of ensuring the utility and acceptance of the technology. As they built a wearable prototype that would guide people in navigating spaces such as restaurants and parks, the roboticists wondered how this system should communicate with its users. Initially, the system was designed to provide verbal commands, similar to how Siri or Alexa communicate. But the participants provided feedback that they liked to hear the space around them, so the scientists changed the communication into haptic feedback (that is, touch or vibration) that indicated where obstacles were. In this way, and many more, robots may be able to transform accessibility and amplify ways we connect with the world and with each other.

The Heart and the Chip is an ambitious book, but it succeeds on a variety of levels. Not only does it detail the history of robotics through personal stories, pop sci-fi, and research, but the authors also share their dreams and hopes for an exciting future, all while staying grounded in the current state of robotic technology.

Rus and Mone envision positive near-future directions in robotics while also addressing potential challenges and dangers, as well as the fears and unknowns about our future with robots. This book champions the vision that robots can transform societies if they are created with good intentions-what the authors have called "putIting] a heart in the chip."

Patricia Alves-Oliveira is an assistant professor in robotics at the University of Michigan. She designs social robots that empower and enhance human health. Her interdisciplinary work unifies the fields of robotics, design, and psychology.

Sidebar

This human-robot partnership would demonstrate the interplay that needs to exist for robots to become relevant in society.