Engineering species

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Robo Sapiens. Evolution of a New Species

by Peter Menzel and Faith D'Aluisio
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These are exciting times for biologists. Multiple genome projects and incredible advances in our understanding of biological systems on a molecular level could soon help us to understand human intelligence and ultimately provide us with the answer to the question 'What is life?' But for more than half a century, researchers from a completely different field have also been searching for this elusive answer using non-biological systems. The work of computer scientists and engineers around the world, who aim to create artificial intelligence (AI) and build robots that mimic biological systems, is becoming increasingly relevant to our daily lives. Indeed, it would be worthwhile for biologists to take a look at these developments, especially those that intersect with biological research. *Robo sapiens*, written by the American photojournalist Peter Menzel and his wife Faith D'Aluisio, also a science journalist, presents a fascinating overview of these developments without challenging the non-specialist with technical details.

In 1920, would the Czech writer Karel Capek have foreseen such creatures presented in this book when he invented the term 'robot' for a play that was first performed 3 years later? At that time, robots were simply the product of his fantastical imagination and no further consideration was given to their realisation. Today, the Merriam-Webster Collegiate Dictionary defines robot as 'a mechanism guided by automatic control'. But as this definition can also be applied to living systems, we are now at the heart of the discussion surrounding artificial life and intelligence that has been occupying and fascinating computer scientists, engineers and biologists as well as legions of science fiction writers for decades. To what extent can we build machines to replace us in performing increasingly complex tasks? Will such systems ultimately be able to behave intelligently by making decisions on their own? Will they even be able to have emotions? And are such developments beneficial or detrimental to the future of humankind?

When building an artificial system that is to behave intelligently, one first has to define intelligence. Robot builders still refer to the British mathematician Alan Turing who stated in the 1940s that a machine is intelligent if there is no discernible difference between its answers in a conversation and those of an intelligent person. But it was not until more than 10 years later that John McCarthy and Marvin Minsky installed the first laboratory devoted to research on artificial intelligence at the MIT. Since then, this field has split into two factions: 'weak AI' believes that machines can simulate human cognition down to the smallest detail but cannot experience mental states, whereas 'strong AI' believes that machines will become self-aware one day.

Is this a frightening thought? Is it too fantastic? Menzel and D'Aluisio's book cannot and does not claim to provide an answer—indeed, nobody can—but it presents results, thoughts, options and dreams that show what has been achieved and what might be possible. In six chapters—electric dreams, robo

sapiens, bio logical, remote possibilities, work mates and serious fun—they present current stages of an ongoing 'evolution' towards a new *Robo sapiens* species. Similar to biological evolution, we can see variation, selection and finally adaptation to tasks defined by engineers. The question asked, but not answered, is whether machines will be able to define these goals themselves one day and thus take their evolution into their own claws. Indeed, it makes one slightly uneasy to be left with the impression that nothing can be excluded in principle.

The authors put a lot of flesh on the metal bones of a broad diversity of robots. Each robot species is introduced with a catchy title. 'Claw and order', for instance, describes Joe Ayers' use of neurobiological studies on lobster locomotion to develop an underwater mine-searching robot. 'The full story' presents Robert Full from Berkeley and his biomechanics-based approach to multi-legged walking machines. If it were not for the space limitations of a book review, the list of fascinating machines could go on for pages. Each species is presented in an easy-to-read schema that is adopted from animal and plant taxonomy. An entertaining and informative text by Faith D'Aluisio precedes an interview with the creator of each of the robots concerned. Peter Menzel's brief personal comments complete each section.

And then there are the photos. These brilliant pictures make *Robo sapiens* a coffee-table book, a pleasure to browse through even for those who are not particularly interested in robots and AI. The book is not a scientific volume and it does not claim to be one. Instead it solves, in a very elegant and fascinating way, the problem of informing a broad readership about developments which may affect any one of us sooner than we think.

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