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Turning robots into assistants for people: Alin Albu-Schäffer

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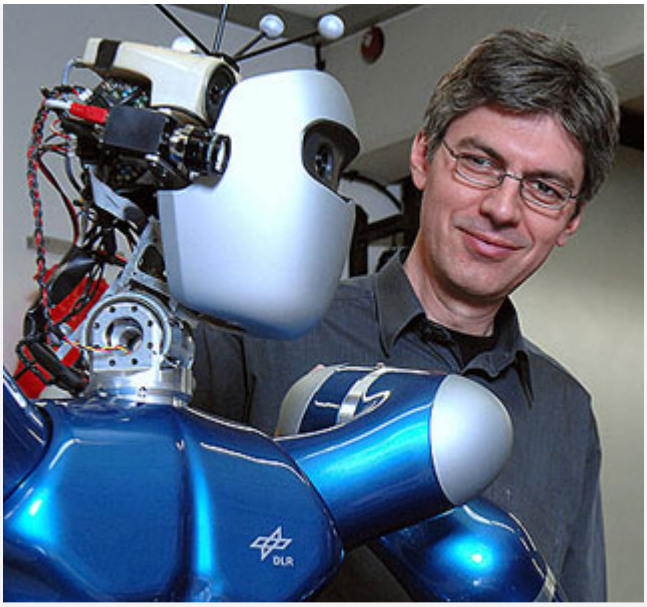


Always had a soft spot for robots: Alin Albu-Schäffer

By Manuela Braun

In Walt Disney`s comic book "Donald Duck", Gyro Gearloose has a little helper - an electric bulb with two legs - always at his side to serve him. Although Alin Albu-Schäffer has yet to come up with a walking light bulb like that - a presence that is always close by, ready to accept instructions and to assist people - his research work is clearly guided by a similar vision. Albu-Schäffer is a Department Head at the Robotics and Mechatronics Center (Robotik- und Mechatronikzentrum) of the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) and is involved in the development of robots for use in space, industry and medicine.

"The barriers between robots and humans must be lifted"

One of Alin Albu-Schäffer's visions, which he is developing with his team, stands one storey below his sparsely furnished office on the first floor. The size of a human being with two camera eyes on its head, gigantic, multi-fingered hands and rollers to move around on Ð Justin the robot looks massive. Albu-Schäffer places his hand gently on the blue metallic casing of the robot. As though remote-controlled, the gigantic robot arm with its ball joints smoothly follows the movements of the 41-year old scientist. Innumerable sensors on the body detect the engineer's touch and help Justin to adapt with silky smoothness to his movements. This is clearly an example of where the human being dictates what happens next. "The barriers between robots and people must be lifted," says Albu-Schäffer. He envisages a future where human beings and robots can work as a team, without any barriers of anxiety separating them. "I view the robot as a helper wherever possible: in the factory, at home, in medicine or in space." In his view, robots can contribute precision and repeatability, while human beings can contribute flexibility and creativity.

The fascination with robotics

Albu-Schäffer grew up in a German-speaking region of Romania. He has been working for DLR since 1995, first while studying for his doctorate, then as a researcher and, since June 2009, as the head of the Mechatronic Components and Systems Department (Mechatronische Komponenten und Systeme). His professional career, which started with studies at the Technical University in the Romanian city of Timisoara with a focus on robotics, is single-minded. "A fascination for robotics is something you get as a child. Science fiction literature and films then of course continue that journey for you." No surprise, then, that it is cult science fiction author Isaac Asimov whom Albu-Schäffer chooses to quote. "A robot may not injure a human being or, through inaction, allow a human being to come to harm," were the words Asimov used back in 1942 - one of his three Laws of Robotics, first expressed in the short story 'Runaround' - a a law that Alin Albu-Schäffer abides by in his research. "Robots used to be very cumbersome, highly dangerous and also blind. They did not notice if a human being was nearby and had to be separated from people by protective sensors or barriers. The robots we are building are specifically intended for cooperation between human beings and robots."

Competitive puzzle solving with the robot arm

Focal areas, from the industrial robots to medical technology

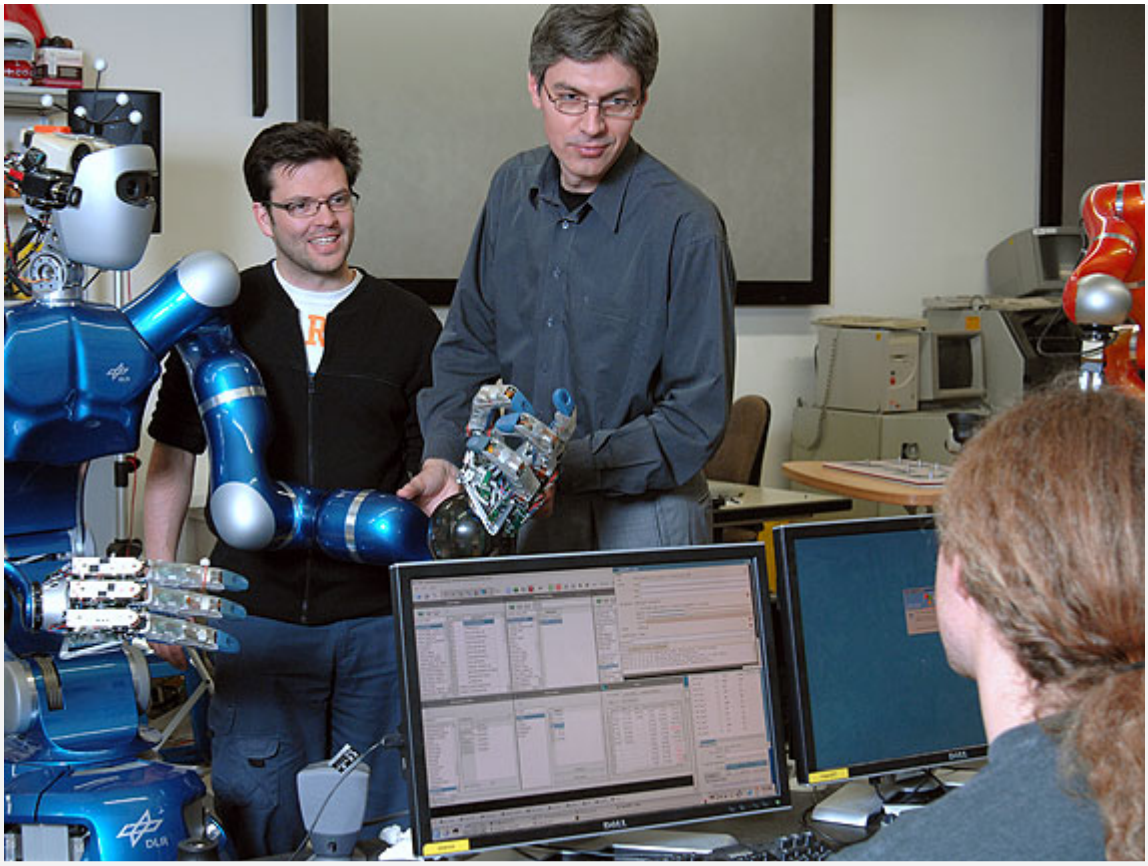
While Justin follows the commands of his operator, his rollers move him around and his arms also move. With his camera eyes, Justin can see the team of researchers around him. Alin Albu-Schäffer is relaxed when standing next to it. Later, on a computer, he demonstrates with films the extent to which the researchers in the Robotics and Mechatronics Center have confidence in 'their' robots. One co-worker sits in front of a robot arm that stops its forward motion as soon as it makes contact with the human. A child sits side by side with a robot arm solving puzzles, with the robot proving only slightly inferior to this bright child's mind at this difficult task.

Albu-Schäffer starts the next film and you can see just how enthusiastic he is about the Institute's successes. The researchers have documented the results of their work at regular intervals. Here, a robot arm catches a ball, here Justin screws on a container and serves tea. Whenever, for example, Justin reaches for something with his arm, engineers have done a great deal of work in the background. Alin Albu-Schäffer field is that of control engineering. Once it becomes apparent which tasks are to be performed by the robot, the engineer provides the commands that allow the hardware to perform those tasks. "To transfer a human movement to a robot, you first have to be able to describe that movement mathematically." Do you have to be a very logical person for that to happen? Albu-Schäffer smiles, "I hope that I am." Alongside all that mathematics, the creativity of the researchers is certainly not lacking. "It makes a difference whether one is creating industrial robots for a production environment or running research projects, where the concepts can be bolder. The ideas we try out in the latter case are a little more adventurous. I get a great deal of pleasure out of both fields." Albu-Schäffer's field of focus is very broad. Human-robot interactions are as much part of the process as medical technology, lightweight arms for industrial manufacturing or Justin the robonaut.

Controlling a robot in space by hand

Robot arms are already working in space, and Albu-Schäffer has himself helped to control one from here on Earth. Robotic Component Verification on the ISS, ROCVISS, is located on the exterior of the International Space Station. "That was something very special, to control a robot in space from here on Earth, and to feel the forces with which it moved along a specially-shaped contour and exerted pressure on its surroundings." ROCVISS not only receives signals, it also transmits back to Earth. Albu-Schäffer says he is unable to pick out one single highlight from his work. "Because it's been so varied." In all this work though, he is a team player above all. "Electrical engineering, mechanical engineering, computer science, physics, mathematics - we work in a large interdisciplinary team. That is what makes robotics what it is." Recently, Albu-Schäffer started to coordinate an EU project in which collaboration with

neuroscientists has an important role to play. "New things often originate through the meeting of two areas which have different kinds of knowledge."



Teamwork in the lab at the Robotic and Mechatronics Center

Vision for the future: household robots and space robonauts

Albu-Schäffer and his colleagues have a their own vision of the future: robonauts that travel through space on a satellite, visiting other satellites and repairing them; robots that take soil samples from the surface of Mars and build habitats to enable us to send human beings to the Red Planet; machines capable of moving on legs across rough terrain on faraway planets; and service robots in the home, an everyday feature of many science fiction films. "Naturally, I would love to have such a robot, but the tasks are very complex and it would be very expensive." As a research institution, we need to be able to undertake projects where the results may not be commercially viable for another 15 years. "I remain as convinced as ever that robotics is the most exciting field I could possibly be engaged in."

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