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INTERVIEW

Looking Back on 20 Years of RoboCup

Interview with Minoru Asada, Co-Founder of RoboCup

Alexander Ferrein[1] · **Gerald Steinbauer**[2]

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Minoru Asada received his B.E. (1977), M.E. (1979), and Ph.D. (1982) in Control Engineering from Osaka University, Osaka, Japan. From 1982 to 1988, he was a Research Associate of Control Engineering at Osaka University (Toyonaka, Japan). In April 1989, he became an Associate Professor of Mechanical Engineering for Computer-Controlled Machinery at Osaka University (Suita, Japan). In April 1995, he became a full Professor of Mechanical Engineering for Computer-Controlled Machinery at Osaka University. Since April 1997, he has been a Professor at the Department of Adaptive Machine Systems at Osaka University (Suita, Japan). Since 2013, he has been the director of the division of cognitive neuroscience robotics, the Institute for Academic Initiatives (IAI), Osaka University. Also, in 1986 and 1987, Mr. Asada was a visiting researcher at the Center for Automation Research, University of Maryland (College Park, Maryland). In 2005, he was elected to serve as the Research Director of the JST ERATO (Exploratory Research for Advanced Technology) ASADA Synergistic Intelligence Project by the Japan Science and Technology Agency and he continued to serve as the Research Director until the Project was completed in 2012. In 2012, the Japan Society for Promotion of Science (JSPS) named him to serve as the Research Leader for the Specially Promoted Research Project (Tokusui) on Constructive Developmental Science Based on Understanding the Process From Neuro-Dynamics to Social Interaction. He has been the Founding Vice President of the RoboCup Federation since 1998 and served as the President during 2002 and 2008. He was elected as a fellow of the IEEE for Contributions to Robot Learning and Applications in 2005.

KI: Mr. Asada, what was your personal biggest moment regarding RoboCup in the last 20 years?

The first RoboCup in 1997, 19 years ago. Everything was a first experience, the organisation, the media. It was very exciting. Even though the number of teams was just 30 or 35 it was the beginning of a history.

KI: How many leagues existed at that time?

Only three: the Small-size League (SSL) with four teams, the Middle-Size League (MSL) with five teams, and the rest were 2D Simulation (SL) teams. It was very exciting and actually very small sized. The SSL field was as large as a ping-pong table, the MSL field had a size of four ping-pong tables. The SL were just a number of computers with the 2D simulation. That were the beginnings. At the first RoboCup, nothing much has happened. One robot was standing like a statue, another one was hitting the wall all the time. The media asked: when did the

✉ Alexander Ferrein
ferrein@fh-aachen.de

Gerald Steinbauer
steinbauer@ist.tugraz.at

[1] Mobile Autonomous Systems and Cognitive Robotics Institute, FH Aachen University of Applied Sciences, Eupener Straße 70, 52066 Aachen, Germany

[2] Institute for Software Technology, Graz University of Technology, Inffeldgasse 16b/2, 8010 Graz, Austria

game start? I said: Well, it already started! From there it became much bigger than we had expected.

KI: Did you ever expect to sit here in Germany 20 years later at such a big event? Were you worried after the 1st RoboCup where not much was working?

I expected that this could become a big event. I could not imagine how rapidly it was growing. Actually, one of our dreams was to host the RoboCup in a baseball stadium once. We did this in Fukuoka in 2002.

And yes, we had some worries. I thought, with that with many teams participating, the performance could get worse. The opposite happened! One idea in the SL was to open the sources so that many new teams could look at the sources, at past games and the used strategies. That was and is the idea of RoboCup. The game itself is competition, but after the game, RoboCup is cooperation. That is the key of RoboCup. The games and the competition is very motivating and exciting. The teams share their experiences and how difficult it is to realise and to control a robot. There is a very strong connection. Other than at a scientific conference, the exchange in RoboCup is much deeper. The treasure of RoboCup is the human resources and the human interconnections.

KI: Seen from a research perspective, what is the essence of RoboCup?

Before RoboCup, each researcher had their own task, ensured the performance and wrote a paper. No one could verify the task and the performance of someone's solution. As an academic, you need to publish scientific papers in journals and conferences for getting promoted. But robotics is not just a theoretical discipline, actually, the robot should work in any situation and any environment. In 'just' writing or reading a paper, this is hard to achieve. Therefore the idea is to be open to the public. And we should realise that in robotics we should work together. This includes not simply the competition or cooperation, but also a new research perspective.

KI: So, it is a kind of benchmark problem?

Yes, but it is not only about the benchmark, also the audience is of importance. We had to show in front of a general audience how this technology can be applied. Of course, research is of importance, but more important is to show the realisation and the implementation to the society. In industry projects, things are designed, manufactured and sold to the market. In case of RoboCup, we get immediate feedback from the audience and from the participants. So, it is not only about research, but also towards social implementation.

KI: Some say that RoboCup is not about serious research. What do you hold against?

Before starting RoboCup, my group focused on reinforcement learning (RL), and at that time there were very few applications of RL to real robots. Therefore, we could find many research topics in applying RL to real robot situations such as vision-based RL and multi-robot RL. These research issues could have been difficult to find without RoboCup. Nowadays, my research topic is a bit further away from the RoboCup. It is "cognitive developmental robotics". But this is also born from my RoboCup experience. Towards the final goal, the research issues are endless. Perception (vision, auditory, tactile and so on) is still far away from human performance. The robot's actions need to improve as well. Cognition is another aspect to be addressed more. So, very fundamental research issues were and will be addressed continuously towards the final goal.

Again, RoboCup is not only about research and engineering, but also about human resources. After graduation, students go to the industry and make 'real' things. In that case, the experience in RoboCup is very useful. With the experience in RoboCup, my students can decide to do many different things. RoboCup is a very good experience for the students.

KI: The next question is about the vision of RoboCup. With self-driving cars and Go-playing agents today, do you think the vision of RoboCup is still valid or is there a need to adapt it?

RoboCup is a kind of a landmark project. Rather than achieving the 2050 goal, the process is of importance: to build a humanoid that can play against a human. For instance, we need soft skin and flexible actuators. These technologies have to be developed and applied. It is a very ambitious goal, through the process we expect some technology to spin off; these can then be applied to other fields. However, achieving the final goal in one generation is too ambitious. Therefore, we created RoboCupJunior aiming at handing over our dream to the next generation. So it is important to share the goal and to build a strong community. So the final goal is still valid.

KI: Soccer does not have a 'real purpose' such as building a self-driving car or building a transport robot. Do you think that an open problem such as building soccer robots gives you more freedom in research?

Actually, the final goal is to build a humanoid. This is an ideal research goal as the research issues constantly develop; for instance, developing soft skin, vision, sensors, motor control. The current technology does not yet have

the required performance, for instance, running, jumping, playing headers as I explained already. For soccer, there is no immediate application, but the main goal is a real great challenge and we can find a number of research issues along the way.

"'RoboCup is not only a community to show some cutting-edge technology; more fundamentally it is about human resources."'

KI: RoboCup has always had a strong connection between robotics and AI. It seems, today, real breakthroughs are coming from companies like Google, Boston Dynamics or others. Do you think that real cutting-edge research and technology is coming out of RoboCup community? How can we reconnect RoboCup with this kind of cutting-edge technology and why is the innovation happening at Google? Is it just a matter of money and manpower?

The first answer is that we provide the human resources for Google and others. The students share their RoboCup experiences. The first one is sharing the research and technology experience, the second one is the social communication. They grow up in different countries with different backgrounds and learn that they can share these kind of experiences. So, the human resource connections are reaching far. RoboCup is not only a community to show some cutting-edge technology; more fundamentally it is about human resources. The first generation of RoboCup Junior participants graduated from universities and will enter research or industry and take their RoboCup experience with them.

Money is one aspect. Look at Boston Dynamics. They received a lot of money from the DARPA and provided innovation. It is not so easy to provide this kind of innovation when participating in RoboCup. But when the participants enter a new working environment, they might develop some brilliant ideas.

KI: What is the impact after 20 years of RoboCup?

As I mentioned already, the performances at the beginning was very poor, but this encouraged many researchers to enter. Being open to the public and the participants has been working all the time: we got positive feedback to improve the technologies very quickly and to find new research issues. Actually, the number of papers on multi-robot cooperation increased after RoboCup. RoboCup Rescue robots worked in NYC in 2001 and are working in Fukushima since 2011. The DARPA robot challenge is inspired by the methods of RoboCup. Thus, RoboCup has continuously giving impacts to our society.

KI: What is the relation to other competitions. Is there is a race among the competitions for funding, publicity etc. Think of DARPA or Eurathlon which are very similar to, say, RoboCup Rescue; even the same people participate. Does this race between competitions have a positive influence on RoboCup?

RoboCup inspired other societies. They are not simple copies. They have their own policies. We do not to intend to unify the competitions and allow for different styles of competitions. It is ok, if the same people enter different competitions. When they participate in RoboCup, they share the RoboCup spirit. Hopefully, we can share the technology developed in the competition with others. Some competitions are closer to the RoboCup, and there we can share a lot.

KI: So, having prize money as DARPA and others would not be a role model for RoboCup? How does the Amazon Picking challenge, which we had this year, fit into the idea of an open community with no prize money?

That is, indeed, a question in our community. We think about travel support or research support, not simply about prize money. We actually give out such grants.

The picking challenge and the RoboCup are independent from each other. We have our own policy. My personal opinion is that among the variations of competitions, there will be a natural selection as time goes on. There might be other competitions that are now popular and attract many people. But if the idea is poor, they will not continue. The RoboCup still exists, we have a strong idea and spirit, therefore we will survive.

KI: How do you see the diversity in the leagues, what can RoboCup contribute with the new applied leagues (Rescue, @Home, Industrial)? Does the diversity dilute the grand vision?

This is also an issue. Some like to extend, others not so much. For instance, RoboCup@Home is the league that keeps growing and growing; we should keep the diversity. But also, we should develop some policy about that: why would we take this league and not another one? We need criteria for the decision.

In the beginning of a new league, the performance is poor. Think of the first RoboCup or the beginning of the Nao league. We need some time to grow in performance. That is the idea of RoboCup. Some teams are on soccer, some on rescue. But at RoboCup, we are all together at the same place at the same time and exchange experiences and share technologies and ideas.