

WORLD SERIES EVENTS ON ARTIFICIAL INTELLIGENCE

Event 9 Report

AI & Robotics for a Smart Society 5.0



REPUBLIC OF SLOVENIA
EMBASSY TOKYO



REPUBLIC OF SLOVENIA
MINISTRY OF FOREIGN AFFAIRS
OF THE REPUBLIC OF SLOVENIA



Report: AI & Robotics for a Smart Society 5.0



Tokyo, Japan

11 November 2021 at 18:45 GMT+9

This event was hosted by the Slovenian Embassy in Tokyo (Japan) and is part of the World Series Events on AI. The Ministry of Foreign Affairs of the Republic of Slovenia, the Slovenian Presidency, and the International Research Center Artificial Intelligence (IRCAI) have joined forces to organize 13 events in close cooperation with Slovenian embassies and other permanent representatives in 12 countries around the world.

The aim of this effort has been to set an active agenda for AI during the Slovenian Presidency and to provide a basis for continuing and promoting bilateral discussions in the field of AI and sustainable development beyond the Presidency.

Read the full transcript of the event [here](#).

Abstract

As artificial intelligence is increasingly being applied in the vast world of robotics, robots are continuously being endowed with new enriching features, including significant improvements in terms of efficiency and acuity, and increased cognitive abilities. Although robots are still far away from building a more extended relationship with a human going beyond one-off conversations in designated contexts, a rising number of laboratories are starting to come up with innovations that are seriously blurring the boundaries between artificial agents and humans – including the two laboratories from Japan and Slovenia that got to present their innovations during this event.

The agenda of this event features speeches by policymakers highlighting the benefits of a cooperation between the two countries in the field of AI and robotics, real-life use case presentations by the two laboratories, and an invitation by John-Shawe Taylor (Director at IRCAI) to transform any areas of common interest in the field of AI into a partnership aimed at gearing humanity towards a sustainable and human-centered Society 5.0.

The following speakers have been invited to the event:

- **H.E. Dr. Ana Polak Petrič** (Ambassador of the Republic of Slovenia to Japan)
- **Mark Boris Andrijanič** (Minister for Digital Transformation of the Republic of Slovenia)
- **Dr. Hiroshi Ishiguro** (Distinguished Professor at Intelligent Robotics Laboratory at Osaka University)
- **Dr. Maša Jazbec** (Head of DDT Lab)
- **Prof. Dr. John Shawe-Taylor** (Director at IRCAI)



Introduction: Are we heading towards a cyberphysical system?

Throughout the past decades, robots have already been taking on vital roles in a wide range of contexts and solving important global challenges: As such, factories are employing robots to protect workers from mundane or dangerous tasks. In conflict-torn areas, robots are being used to defuse bombs. In healthcare, robots are helping substitute defective body parts with synthetic organs such as prosthetic limbs.

Yet, researchers are continuously seeking to improve robotics to the next level, endowing robots with abilities beyond our expectations. By applying artificial intelligence to their development, roboticists have enabled various sectors to make significant progress in terms of efficiency and acuity: The automotive industry, for example, can now adapt robot welding to the smallest micro-level tolerances. Meanwhile, robots in healthcare are aided by AI to conduct nanosized medical interventions, allowing a precise targeting of diseases and genetics. Thereby, with increasing research being done in the field of human-robot interaction, more and more sectors are getting acquainted with collaborative robots (also known as *cobots*) – robots that are intended to work alongside humans: In industrial applications, cobots are responding in real-time to the movement of human workers, while in brick-and-mortar stores, such robots can serve as sales assistants.

However, as Ishiguro's and DDT Lab's robots are progressively learning to interact with humans, cyberphysical systems are becoming less and less of a distant reality: The boundaries between physical space and cyberspace are, indeed, slowly starting to blur. Although robots are still far from assuming a proper social role and establishing a genuine relationship with humans, we might already have to ask ourselves some questions: How will humans

relate to each other in a society including robots? How will humans interact in the future? To which degree can robots and humans merge?

Learning from two use cases of AI in robotics

While many robots can handle one-off conversations in designated settings, developing a more extended relationship with human (including verbal and non-verbal language) remains a challenge for roboticists. Yet, Dr. Hiroshi Ishiguro decided to take up the gauntlet: Aiming to create an “avatar symbiotic society” within the next 30 years, Ishiguro presents a few robots his laboratory has developed in the past few years, in an attempt to acquaint robotics with the intricacy of human communication. He starts off by presenting “Geminoid”, an android copy of himself, that observes and reproduces his own voice and head movements, with the aim of studying what it means to be human. Jokingly, Ishiguro mentions that he might as well stop visiting countries for his business meetings: “I can send this robot instead”, he says. Next, he introduces us to “*Telenoid*”, a robot that can transmit a person's voice and mimic their face and head motion. “*Telenoid* gives off a more neutral appearance and is void of personality”, he notes. Meanwhile, “*ERICA*” is what Ishiguro believes to be “the most advanced human-like avatar in the world”: Understanding natural language, *ERICA* has a synthesized human-like voice and displays a variety of facial expressions.



Figure 1: Ishiguro’s Telenoid serving as an “avatar for elderlies” (Source: Dr. Hiroshi Ishiguro)

Ishiguro’s most recent robots learn to incorporate non-verbal aspects of communication as well - and besides merely answering questions, they can occasionally also ask the conversation participants (humans or other robots) a question or seek their approval. Thereby, Ishiguro emphasizes that incorporating such robots into societies (i.e. creating an avatar symbiotic society) would be highly beneficial for various communities. In the light of COVID-19 pandemic, he notes that Telenoids could come in handy as tutors in pupil’s homes, as doctors treating patients in isolated areas or as assistants in a nursing home. In a symbiotic society, Ishiguro claims: “Anyone, including the elderly and people with disabilities, will be able to freely participate in various activities beyond ordinary people while expanding their physical, cognitive and perceptual abilities”.

While Ishiguro’s robots are intended to take on various roles (such as giving

medical treatment, tutoring school pupils, etc.), DDT Lab’s NeuroYaski has one main role: Painting humans’ thoughts. As part of the laboratory’s research in brain-computer interfaces (BCI) and creative human-robot interactions, NeuroYaski “combines breakthrough interface technology with industrial robotics”, as formulated by Dr. Maša Jazbec (Head of DDT Lab). The brain-computer interface technology is thereby supported by industrial robotic art from Japanese manufacturer Yaskawa.

DDT Lab’s Head of Programming, Žan Rajšek, explains that the programme can be divided into three parts: First, various types of painting strokes have been programmed into NeuroYaski’s robotic arm. A BCI program then allowed the team to select the designated stroke from a pre-made graphical interface. Finally, the strokes are sent to the robotic arm through DDT’s Python program, making the robotic arm draw on the canvas.

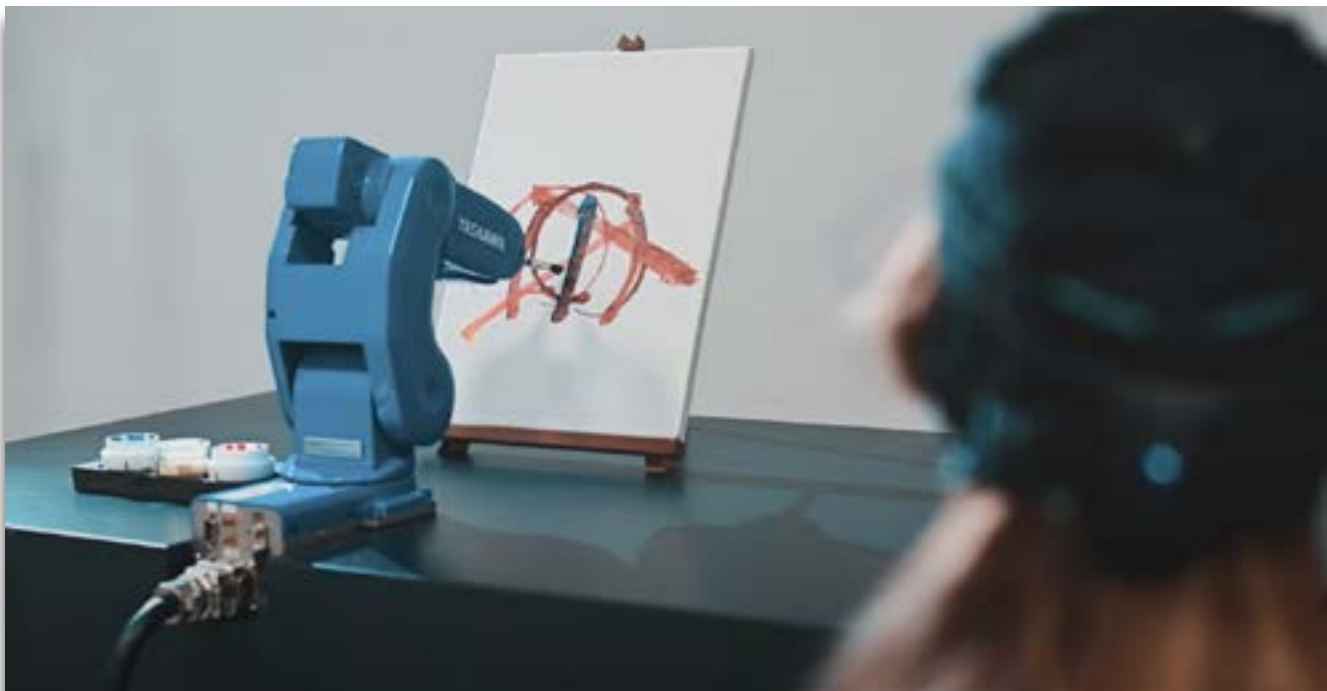


Figure 2: DDT Lab’s *NeuroYaski* “drawing people’s thoughts” on a canvas (Source: DDT Lab)

Collaboration: The key to a smart society

Having heard from Ishiguro’s ambitions to create an “avatar symbiotic society”, Japan’s STI (Science, Technology and Innovation) policy is also aiming for a transition towards a cyberphysical system: Besides their ability to tailor services to citizens to their needs, Japan’s Society 5.0 blueprint clearly points to the opportunities robotics can bring in overcoming the challenges posed by Japan’s recent demographic evolutions: To tackle population ageing, for example, the government actively supports the research, development and deployment of robots assisting in nursing homes or robots standing by to replace retiring craftspeople. As rural areas are being progressively depopulated, autonomous vehicles are being developed, amongst others with the aim of supplying vital goods to the concerned areas. Thereby, the Society 5.0 project is a joint effort by a wide range of stakeholders: While the government’s political agenda has put a central focus on such technologies, Japan’s AI roadmap, for example, is the result of a close collaboration with business representatives, too: Using the

United Nations’ Sustainable Development Goals (SDGs) as a framework, corporations are stimulated to proactively contribute to Japan’s transition towards a sustainable, inclusive and human-centered smart society.

In her speech, the Slovenian Ambassador to Japan (H.E. Dr. Ana Polak Petrič) remarks that Slovenians have in fact admired Japan for its technological advancements already for a long time: “We all watched TV which were all produced in Japan. We were listening to music on our Sony Walkmans. And, of course, every photo made at that time was done with a Japanese camera”. The Slovenian Minister for Digital Transformation, however, accentuates that Slovenia is also having big ambitions in the field: Having established a National Strategic Council for Digitalization and a Government Office for Digital Transformation in the past year, Slovenia is aiming to become “one of the five most digitally advanced European countries by 2026”. To make sure that the country’s transition towards a smart society does not cause a digital divide, the country is about to launch a national digital skilling programme, which will include, amongst others, the training of essential digital skills and modern computer equipment to the elderly.

Quotes

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“I remember how we admired Japan for its technological advancement and wealth: We all watched TV which were produced in Japan. We were listening to music on our Sony Walkmans. And, of course, every photo made at that time was done with a Japanese camera.”

Dr. Ana Polak Petrič, Ambassador of the Republic of Slovenia to Japan

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“In a couple of months, we are launching the largest digital skilling programme in our country’s history. Our goal is to bridge the digital divide by providing our elderly and other vulnerable groups with essential digital skills as well as modern computer equipment.”

Mark Boris Andrijanič, Minister for Digital Transformation of the Republic of Slovenia

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“Anyone will be able to work and study anytime, anywhere, minimize commuting to work, and have plenty of free time. This is the symbiotic society we want to realize.”

Dr. Hiroshi Ishiguro, Distinguished Professor at Intelligent Robotics Laboratory at Osaka University

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“We are presenting cutting-edge technology, scientific advancements and interdisciplinary arts to a broader audience”

Dr. Maša Jazbec, Head of DDT Lab

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“Japan and Slovenia have a long tradition of collaboration, and also a long tradition of working in the area of artificial intelligence. These streams are potentially convergent around the theme of Society 5.0”

Prof. Dr. John Shawe-Taylor, Director at IRCAI