

# Workshop on Portable Androids and their Applications



JST CREST | Patient@home | SOSU Nord | Future Lab

# Workshop on Portable Androids and their Applications

## 2 March 2015

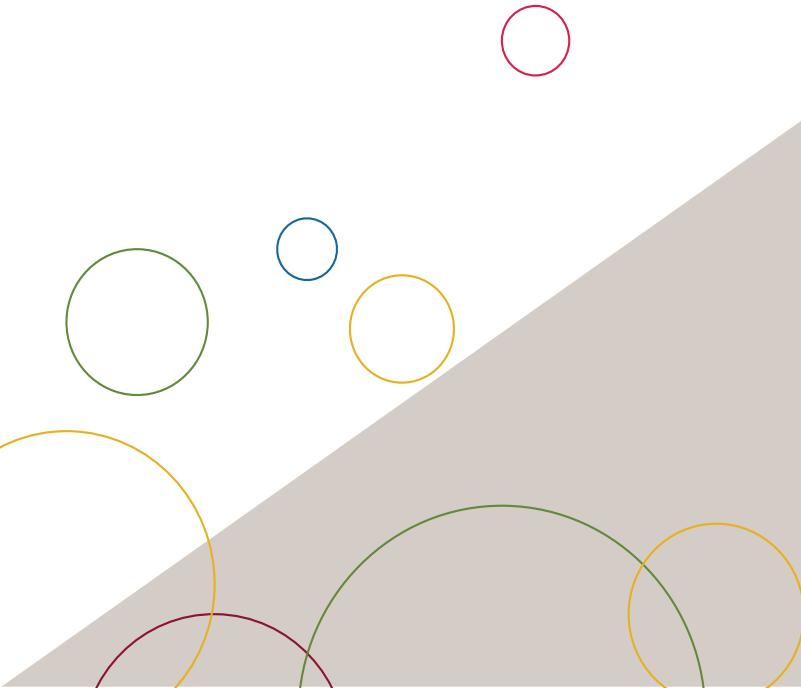
People are versatile, and thus research must be approached from versatile fields. Today researchers from fields including engineering, psychology, philosophy, communications and social care will present their findings and thoughts on portable androids and their applications. We pursued the possibility that teleoperated androids will be a future cellphone-type device and will fill a gap between people and provide opportunities to interact socially with others over distances.

Topics such as appearance, embodiment, motion, speech and perception have been investigated from all these perspectives, and we are intrigued as well as surprised by the results.

This workshop, we consist of four sessions, focussing on An Overview Of Our Work, The Development And Evaluation Of Portable Androids, Portable Androids For Aged Citizens and Portable Androids For Enhancing And Discovering Human Experience. As we value discussion, we invite you to participate in the following debates and help refine the future applications of androids. In addition to this, SOSU Nords FutureLab will be open during the entire workshop, and demonstrations of technologies, robots and research infrastructure is available.

Welcome to the workshop!

Anja Jørgensen, Hiroshi Ishiguro & Uffe Kock Wiil



# Welcome



Prof. Hiroshi Ishiguro  
ATR & University of Osaka

## A new style of communication with Teleoperated Androids

At ATR Hiroshi Ishiguro Laboratory, Osaka University, SOSU Nord, and collaborators in Japan and Denmark, we have been working together to develop new information media which minimally express humanlike appearance and convey our presence to remote locations. They will provide a new communication style beyond the current telephone communication; a user can talk with his/her partner in the remote place while feeling as if they are facing each other. Our work has been supported by JST CREST program "Studies on cellphone-type tele-operated androids transmitting human presence," (PI: Hiroshi Ishiguro). This workshop is also the final international workshop of the project and we will report all the results, from their scientific foundations to where these media can be applied in our life.



Prof. Uffe Kock Will  
University of Southern Denmark

## The future is here?

Using robots for healthcare sounds futuristic to many people. As principle investigator and project manager I am proud that Patient@home hosts a "futuristic" activity involving teleoperated androids. The activity has many important characteristics: it is interdisciplinary (involving people from engineering, social science, and health science); it is international (involving people from Japan and Denmark); and not least it involves testing in real-life settings in Denmark. Patient@home aims to introduce 40 new products and services to market within its life time (2012-2018). The teleoperated android activity has the potential to become a successful product and make high impact in (Danish) healthcare in the near future. Hence, it is fair to say that the future is (almost) here.



Ph.d. Anja Jørgensen  
Director, SOSU Nord

## A new world for the brave

At SOSU Nord, we aim to research applications of all technologies with relation the future health and welfare sector. We investigate broad and narrow issues related to both the recipient and the implications that these applications have on the work-setting. As a leading Danish vocational educational institution, SOSU Nord FutureLab focuses on researching real world applications for these technologies, in cooperation with our large network of both private and public partners and institutions in the region. Robots are, in a health and welfare context, still a thing of the future, but with this event on 'Portable Androids and Their Applications' we look forward to bringing robots to life, debating their applications and the future of health and welfare.

# Program

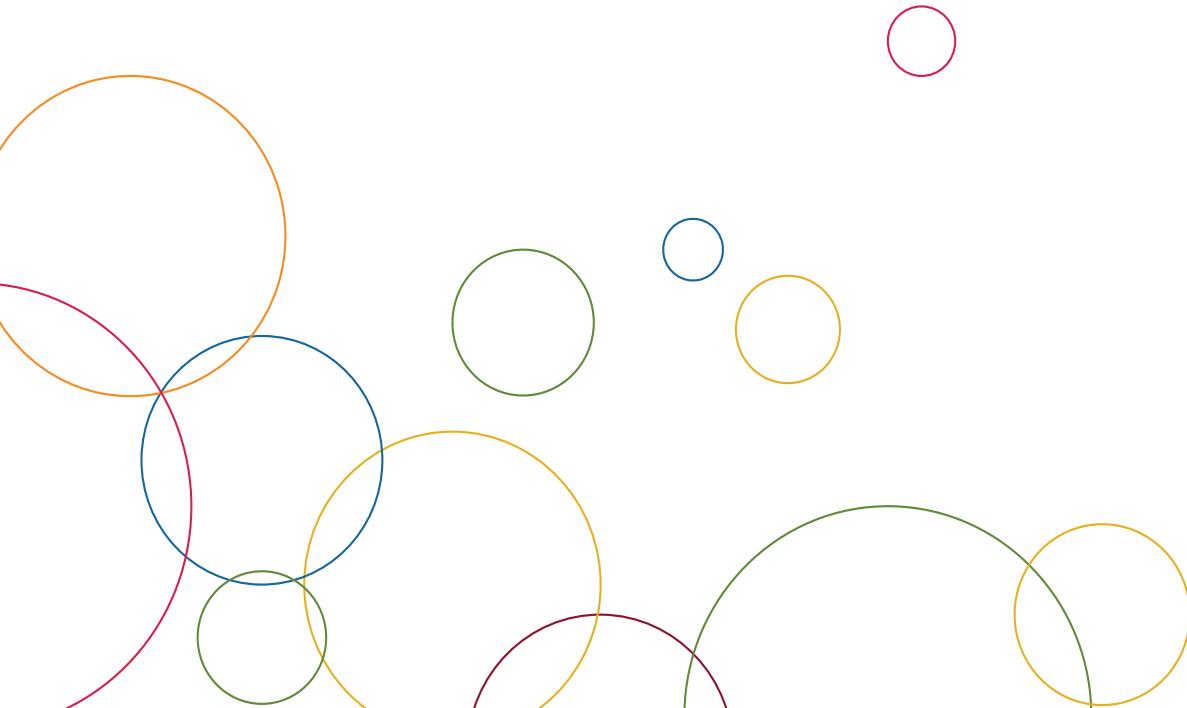
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### Session 1: Opening and project overviews

10:00 - 10:10	<b>Greeting, Introduction on Future Lab activities</b> Anja Jørgensen (Director of SOSU Nord, Denmark)
10:10 - 10:25	<b>Workshop overview</b> Hiroshi Ishiguro (ATR Research Fellow / Distinguished Professor; University of Osaka, Japan)
10:25 - 10:35	<b>Denmark-Japan cooperation</b> Seishi Suei (Ambassador of Japan to Denmark)
10:35 - 10:45	<b>Overview of JST/CREST project</b> Toyoaki Nishida (Professor, Kyoto University, Japan)
10:45 - 10:55	<b>Overview of Patient@home project</b> Uffe Kock Wiil (Professor, University of Southern Denmark, Denmark)

### Session 2: Development and evaluation of portable androids

11:10 - 11:25	<b>Development of portable tele-operated androids based on a concept of minimal human design</b> Takashi Minato (Researcher, ATR, Japan)
11:25 - 11:40	<b>Facial image processing for tele-presence robots</b> Yoshio Iwai (Professor, Tottori University, Japan)
11:40 - 11:55	<b>Speech-driven motion generation technologies for tele-presence robots</b> Carlos Toshinori Ishi (Group Leader, ATR, Japan)
11:55 - 12:10	<b>Unpacking avatars: appearance, motion, embodiment, and teleoperation</b> Hideyuki Nakanishi (Associate Professor, Osaka University, Japan)
12:10 - 12:25	<b>Discussion for Session 2</b>



# Program

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## Session 3: Portable androids for aged citizens

13:30 - 13:45	<b>Portable android “Telenoid” for aged citizens: overview and results in Japan</b> Shuichi Nishio (Principal Researcher, ATR, Japan)
13:45 - 14:00	<b>Introducing new technologies in the healthcare sector. Acceptance factors of Telenoid in different settings</b> Barbara Klein (Professor, Frankfurt University of Applied Sciences, Germany)
14:00 - 14:15	<b>DTI testing Telenoid for people with dementia and developmental disorders</b> Lone Gaedt (Senior Consultant, Danish Technological Institute, Denmark)
14:15 - 14:30	<b>Humanoid robots in dementia-care: Investigating if Telenoid alleviates symptoms of dementia</b> Jens Dinesen Strandbech (Ph.d Student & Project Lead, SOSU Nord, Denmark)
14:30 - 14:45	<b>Cost-effectiveness analysis of Telenoid / Hugvie</b> Byung-Kwang Yoo (Associate Professor, University of California, Davis, USA)
14:45 - 15:00	<b>Discussion for Session 3</b>
15:00 - 15:45	<b>Coffee break / Teleoperated android demonstrations</b>

## Session 4: Portable androids for enhancing and discovering human experience

15:45 - 16:00	<b>Facilitating communication by a robotic communication medium</b> Takashi Minato (Researcher, ATR, Japan)
16:00 - 16:15	<b>A philosophical inquiry into android robotics</b> Marco Nørskov (Assistant Professor, Aarhus University, Denmark)
16:15 - 16:30	<b>Stress reduction of Hugvie and its application to education</b> Hidenobu Sumioka (Group Leader, ATR, Japan)
16:30 - 16:45	<b>Hugvie cross-cultural effect, what happens if genders get mixed</b> Ryuji Yamazaki (Researcher, ATR, Japan)
16:45 - 17:00	<b>Discussion for Session 4</b>



# Session I: Opening and project overviews

Can teleoperated android robots redefine the way we communicate with each other in the network society? Telecommunications technologies have broadened our opportunities to interact socially with others, and robotics has opened a new frontier for innovation and development of communication media. The JST CREST project has developed portable androids and is in their applications cooperating with SOSU Nord and Patient@home with forward-looking projects of welfare technology. This session describes the novel humanoid robotic approach, while figuring out where we stand today in the evolution of communication media and their services.

## Speakers

**Anja Jørgensen**  
Director of SOSU Nord, Denmark



Anja Jørgensen is the director of SOSU Nord. She received a Ph.d. from the Department of Social Sciences at The University Of Aalborg in 2008 focusing on the development of vocational education. Having published in numerous scientific journals she now focuses on the continuous educational development at one of the highest profiled Social and Health colleges in Denmark.

**Hiroshi Ishiguro**  
ATR Research Fellow & Distinguished Professor, University of Osaka, Japan



Hiroshi Ishiguro received the D.Eng. degree from Osaka University in 1991. He has worked at Yamanashi University, Osaka University, Kyoto University, University of California, and Wakayama University, before he became a Professor at Osaka University in 2002. He is now a Professor at the Department of Systems Innovation, Osaka University, and a director at ATR Hiroshi Ishiguro Laboratories.

**Seishi Suei**  
Ambassador of Japan to Denmark



Seishi Suei majored law at University of Tokyo. After graduating in 1977 he entered the NPA (National Police Agency). In 2007 he was appointed Director-General of the Traffic Bureau of the NPA. In September 2013 he assumed office of Ambassador of Japan to Denmark.

**Toyoaki Nishida**  
Professor, Kyoto University, Japan



Toyoaki Nishida is Professor at Graduate School of Informatics, Kyoto University. His research centers on artificial intelligence and human computer interaction. He has been appointed the research supervisor for the JST-CREST research area on Creation of Human-Harmonized Information Technology for Convivial Society, since January 2014.

**Uffe Kock Wiil**  
Professor, University of Southern Denmark, Denmark



Uffe Kock Wiil received his M.Sc. (1990) and Ph.D. (1993) degrees from Aalborg University. He is a professor in software engineering at the University of Southern Denmark (since 2004). His primary research interests are health informatics (clinical decision support systems; patient empowerment) and security informatics (analysis, and visualization of crime-related data).

## Session 2: Development and evaluation of portable androids

With the portable teleoperated androids such as the Telenoid, the JST CREST project proposes a minimal human representation that allows any person to transfer their own presence to a distant location, anywhere and at any time. The androids have the flexibility to look like anybody and embody the project's intent to keep only the key features involved in the communication for representing humans. This session specifies the design concept, functionalities and basic evaluation of the androids.

### Speakers



**Takashi Minato**  
Researcher, ATR, Japan

Takashi Minato was a researcher of CREST, JST, since 2001 and obtained Ph.D. degree in engineering from Osaka University in 2004. He was an assistant professor of Osaka University since 2002. He worked as a researcher for ERATO, JST, since 2006. He has currently been working as a researcher in ATR Hiroshi Ishiguro Laboratories since 2011.



**Yoshio Iwai**  
Professor, Tottori University, Japan

Yoshio Iwai graduated from Osaka University in 1992 and completed the doctoral programs in 1997. He was then appointed a research associate at the university, subsequently becoming an associate professor. From 2004 to 2005, he was a visiting researcher at the Cambridge University. He is currently a professor in the Graduate School of Engineering at Tottori University.



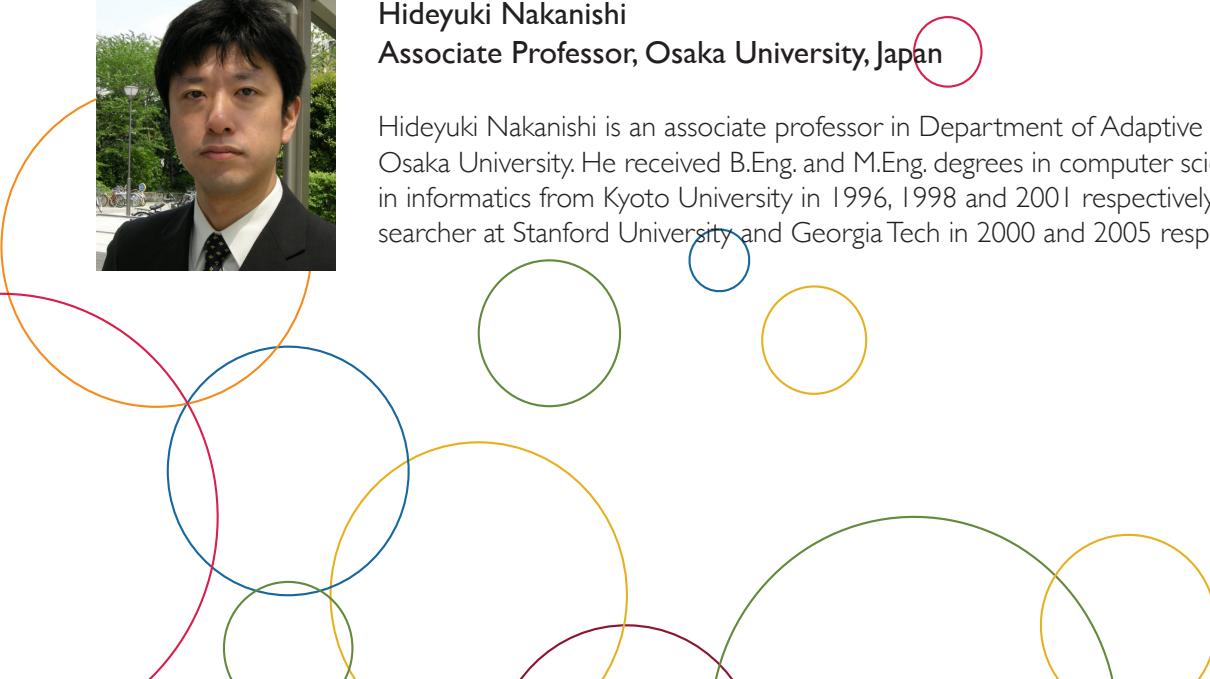
**Carlos Toshinori Ishi**  
Group Leader, ATR, Japan

Carlos T. Ishi received the PhD degree in engineering from The University of Tokyo (Japan) in 2001. He worked at the JST/CREST Expressive Speech Processing Project from 2002 to 2004. He joined ATR Intelligent Robotics and Communication Labs. from Jan. 2005, and is currently the leader of the Sound Environment Intelligence Group, since Apr. 2013.



**Hideyuki Nakanishi**  
Associate Professor, Osaka University, Japan

Hideyuki Nakanishi is an associate professor in Department of Adaptive Machine Systems at Osaka University. He received B.Eng. and M.Eng. degrees in computer science, and a Ph.D. degree in informatics from Kyoto University in 1996, 1998 and 2001 respectively. He was a visiting researcher at Stanford University and Georgia Tech in 2000 and 2005 respectively.



# Session 3: Portable androids for aged citizens

The study on the portable androids explores their applications in field experiments in which people interact with one another by their mediation. With the focus on the social aspects of androids that may facilitate human communications, the Telenoid has been applied to dementia care in order to observe the elderly's natural reactions to the robot and to develop service models and new communication media. This session reports the results from Japan and Denmark, and discusses the androids' potential for aged citizens of different nationalities.

## Speakers

**Shuichi Nishio**

**Principal Researcher, ATR, Japan**

Shuichi Nishio received his M. Sc. in computer science from Kyoto University in 1994, D. Eng from Osaka University in 2010 and is currently a Senior Researcher at the Advanced Telecommunications Research Institute International (ATR) in Kyoto, Japan.



**Barbara Klein**

**Professor, Frankfurt University of Applied Sciences, Germany**

Barbara Klein is professor and researcher at Frankfurt University of Applied Sciences in Germany and Visiting Professor at Northumbria University in Newcastle in England. Her work focusses on acceptance and application fields of assistive technologies and robotics in the healthcare sector.

She is the coordinator of the Independent Living Center in her university.



**Lone Gaedt**

**Senior Consultant, Danish Technological Institute, Denmark**

For more than 30 years Ms. Lone Gaedt, physiotherapist and M.Ed., has been working with physical and cognitive disabilities, including psychological and social aspects, -the last 10 years focusing on testing and evaluating technologies for people with different disabilities and their caregivers, e.g. social robots and devices for eating, toilet, transfer, washing etc.



**Jens Dinesen Strandbech**

**Ph.d. Student & Project Lead, SOSU Nord**

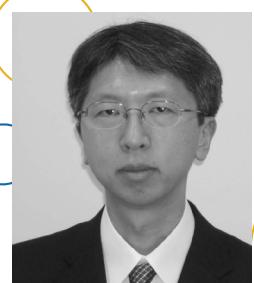
Jens Dinesen Strandbech is a Ph.d. student at SOSU Nord FutureLab specialising in Telenoid research. He investigates if and how the Telenoid alleviates symptoms of dementia using qualitative and quantitative data, focussing on dementia-evaluation tools and interaction analysis. In addition, he investigates the roll of humanoid robots in the health and welfare system of the future.



**Byung-Kwang Yoo**

**Associate Professor, University of California, Davis, USA**

Byung-Kwang (BK) Yoo, MD, MS., PhD (Health Economics), Associate Professor in Dept. of Public Health Sciences, University of California Davis, U.S.A. His research interests include telehealth, healthcare workforce, and, international comparison of healthcare systems. He has previously worked at Harvard University, Johns Hopkins University, and Stanford University.



# Session 4: Portable androids for enhancing and discovering human experience

As new human-harmonized communication media, android robots are developed with the hope of them becoming part of our daily life. Technologies are not just neutral instruments, but are inherently embedded in cultural contexts and even consequently could transform us. The possibilities and limitations of all these types of robots can potentially change our society and the human-robot interaction might affect the very way in which we engage with each other and who/what that 'other' might be. Robotics challenges our core conceptions of what we are and how we should be. This session aims to explore and expand the contribution of scientific analyses to reflection on human self-discovering through androids.

## Speakers



**Takashi Minato**  
Researcher, ATR, Japan

Takashi Minato was a researcher of CREST, JST, since 2001 and obtained Ph.D. degree in engineering from Osaka University in 2004. He was an assistant professor of Osaka University since 2002. He worked as a researcher for ERATO, JST, since 2006. He has currently been working as a researcher in ATR Hiroshi Ishiguro Laboratories since 2011.



**Marco Nørskov**  
Assistant Professor, Aarhus University, Denmark

Marco Nørskov received his PhD degree in Philosophy in 2011. He is currently an Assistant Professor at the Department of Culture and Society at Aarhus University and cooperate researcher at the Hiroshi Ishiguro Laboratories. His research is focused on intercultural philosophy of technology with a special interest in HRI, Japanese philosophy and phenomenology.



**Hidenobu Sumioka**  
Group Leader, ATR, Japan

Hidenobu Sumioka received the Ph.D. degrees in engineering from Osaka University, Osaka, Japan, in 2008. From April 2009, he was a researcher at AI Lab. directed by Prof. Rolf Pfeifer. Currently, he is the leader of Presence Media Research Group in Hiroshi Ishiguro Laboratories, ATR. His research interests include human--robot interaction and its hormonal evaluation.



**Ryuji Yamazaki**  
Researcher, ATR, Japan

Ryuji Yamazaki received his M.A. degree in Philosophy from Chuo University in 2004, Ph.D. in Knowledge Science from the Japan Advanced Institute of Science and Technology in 2010, and is a Researcher at ATR. His current research interests are android science, dementia care, cross-generational communication, intercultural philosophy of technology and phenomenology.



**Hiroshi Ishiguro**  
ATR Research Fellow & Distinguished Professor, University of Osaka, Japan

Hiroshi Ishiguro received the D.Eng. degree from Osaka University in 1991. He has worked at Yamanashi University, Osaka University, Kyoto University, University of California, and Wakayama University, before he became a Professor at Osaka University in 2002. He is now a Professor at the Department of Systems Innovation, Osaka University, and a director at ATR Hiroshi Ishiguro Laboratories.

# CREST

Studies on cellphone-type tele-operated androids transmitting human presence



We can talk with a remote person while seeing her if we use a cellphone with videophone and handsfree device; however, it is nothing but a videoconference and we don't feel as if the cellphone were the person we are speaking to. This study creates new human-harmonized information media that everyone can easily use and feel as if she were facing with a conversation partner, by endowing a cellphone with human shape.

The project leader (Ishiguro) has been engaged in the research and development of tele-operated android "Geminoid" in advance of the world. The important finding in the study is that a person operating Geminoid feels its body is her own body and another person facing the operated Geminoid also feels it is possessed by the operator. Additionally, we have found that this phenomenon appears even when the operator is different from the original person (person after who Geminoid is modelled).

This study aims at developing new communication media (that is to say portable Geminoid) that allows for the transmission of human presence from anywhere at any time by downsizing Geminoid into a cellphone scale. A user's presence is transmitted to a remote place and a remote person can feel as if she were really talking face-to-face with the user. It will be new information media that will change our society as well as existing personal computers and cellphones.

The portable android adopts a minimal design of Geminoid, that is, it is designed according to minimum requirements to express humanlike appearance and motion, which are revealed in our past studies. This design has the minimum appearance that can be recognized that it is man at first glance but cannot be distinguished from men, women, senior people, and babies. This study develops the sensing and motion capabilities and the design of portable android through cognitive psychological experiments, while explores its potential as new human-harmonized communication media through a social experiment.

Since October 2010, the project has been studying the essential factors to transmit human's presence, developing the portable androids such as Telenoid, Elroid, and Hugvie, and exploring their applications in field experiments in Japan and foreign countries such as Denmark, in order for developing new communication media of portable androids. In this workshop, the project will report the achievements of studies in four years.



# Patient@home

Patient@home is Denmark's largest welfare-technological research and innovation initiative with focus on new technologies and services aimed at especially rehabilitation and monitoring activities within the Danish public health sector.



Through interdisciplinary and public-private project collaboration between health professionals, patients, private enterprises and research institutions, Patient@home is developing a number of new welfare-technology products and services that will contribute actively to the reduction of both the number and duration of admissions to Danish hospitals.

## Aim

The goal is, during the life of the project, to develop 40 new products and services that will support the health sector's growing need for better and faster rehabilitation, more outpatient treatments and hospitalizations of patients in their own homes. The development of technologies for these purposes will minimize the pressure on, not least, hospital financial and human resources as well as increase patients' active involvement and motivation to take responsibility for their own health.

In addition, the technologies will ensure that healthcare professionals throughout the sector can get both valid and consistent data for the assessment of the individual patient's need for treatment. Furthermore, Patient@home gives Danish enterprises access to the latest knowledge, laboratories and real-life testing facilities, so that they can get the best starting point for building strong international market positions in terms of innovative and intelligent welfare technologies and services.

## Collaboration ensures relevance and impact

The project's major focus on close collaborations with health professionals, patients, private enterprises and research institutions ensures relevance and impact of the developed products and services. This form of cooperation is a guarantee that all products and services are designed in accordance with the users' needs and acceptance, and that all results are based on the latest research results as well as on the companies' and especially the hospitals' development and business plans.

## Why Patient@home?

Denmark's demographic and general health status is changing. Experts suggest that due to a changing age structure in the coming years the number of patients needing care and treatment will increase - especially the number of Danish citizens above the age of 64 is rising, while the labour force available is decreasing. Furthermore, the amount of Danish citizens with chronic diseases as diabetes and heart/vascular diseases is also increasing - and the picture is the same in many other parts of the world. This development puts a lot of pressure on the health sector, which, if continuing using the current methods and procedures, will have to deal with a soaring number of tasks with less staff at hand, as well as a need for more beds and thus far more resources.

Welfare technology can specifically support patients and reduce pressures on the health sector in three different areas: (1) before hospitalization or outpatient treatments at the hospital - observation, for example, of the citizen's physical condition; (2) during treatment in preparation for discharge from the hospital to the patient's home; (3) after early discharge or outpatient care - continuous observation, for example, of health as well as support in terms of rehabilitation. The effects of technological support may be successful pre-hospital treatments that reduce or even prevent hospitalizations. At the same time accelerated patient courses may shorten the time of hospitalisations; in addition, good and targeted treatments in the patients' own homes can help minimize the number of readmissions. Focusing on treatment, care, observation and rehabilitation in the patients' own homes, Patient@home aims to support and develop new welfare technologies to boost both pre-hospital treatments and early discharges.

# SOSU Nord

SOSU Nord is one of the largest social and health colleges in Denmark. The college's primary activity is to train healthcare support staff for the social and health sector and we aspire to create an open and creative environment, characterized by cooperation and flexibility. We also aspire to promote values such as respect, reliability, trust, openness, participation, responsibility, tolerance, regard for differences, individuality and a high level of information and communication.

Our aim is to ensure that people are trained to work in and develop the social and health sector and the educator sector. We want to create a highly qualitative training environment, where students can acquire a high level of vocational competences, matching the different training programs. We are dynamic and enterprising workplace, closely interacting with surrounding companies, local, regional and national government as well as the EU.

Besides a number of subdivisions SOSU Nord have two main departments – in Hjørring and Aalborg. The Aalborg department where you are now was inaugurated November 2014. This new and modern building is placed on the former grounds of a railway station. Today the location is still a center of traffic in Aalborg, but furthermore an educational center, where different competencies meet and the directions for the future are debated and laid out.

SOSU Nord applies problem-based-learning (PBL) philosophy in its teaching. This allows our students to apply theory in practice, and use technologies in practice before graduation. Simply put, we feel it is necessary to use the technologies of the future, to become an active part of the future workforce.

The pupils' questions and problems form the basis of learning, and this becomes an active and responsible process where knowledge and practical experience are in focus. The training is widely based on group work combined with class teaching where the teacher becomes an initiator and provides theoretical introductions, presenting problem-oriented themes.



# SOSU Nord Future Lab

SOSU Nord Future Lab is the vocational research department of SOSU Nord, The Social and Health Education College of the Northern part of Denmark. By establishing Future Lab, SOSU Nord seeks to add a human look to tomorrow's technologies, in the areas of care, support, educational theory and pedagogy.

Future lab places SOSU Nord in the lead ensuring that new health and welfare technologies have a human perspective added to the design and research process. Future Lab is a centre where new technology can be presented to interested parties, and where collaborators may be invited to perform tests, analyse experiences and implementation of the technology. In addition to this, we have a large network of both private and public partners and institutions in the region. This allows us to quickly test new technologies, 'in-house' or in e.g. eldercare facilities, dementia facilities, rehabilitation centres or kindergartens and other forms of specialised pedagogical work fields.

SOSU Nord contributes to the creation of a user-driven process of innovation, where local authorities, regional health authorities can cooperate with both the present and future workforces involved in using the technologies of the future. This allows us to include a crucial ethical perspective to the design-process.

With the establishment of Future Lab, SOSU Nord desires to ensure that the workforce of tomorrow are able to handle the technologies of tomorrow. While accepting this, we also acknowledge that there is a need for further research into both the applications of these technologies, and the requirements, responsibilities and results they bring with them.

Welcome in the Lab

Bent Fuglsbjerg  
Head of Department  
FutureLab, SOSU Nord



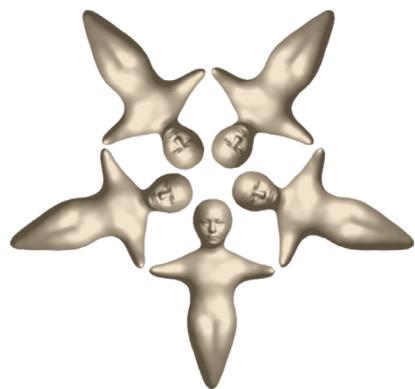


# Japan-Denmark Cooperation

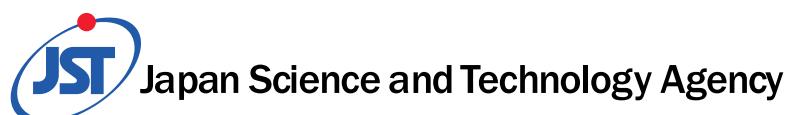
In March 2014, Danish Prime Minister Helle Thorning-Schmidt visited Japan and had a summit meeting with Japanese Prime Minister Shinzo Abe.

They released "Joint Statement on the Establishment of a Strategic Partnership for Growth and Innovation Between the Government of Japan and the Government of the Kingdom of Denmark" for further bilateral cooperation. The two leaders decided to establish concrete cooperation within welfare technology, including robots and assistive technologies, with the aim of developing better treatment and care for citizens within the welfare sector. The two leaders further confirmed their commitment to strengthen cooperation between Japanese and Danish authorities, businesses and research institutions, and to explore possibilities for enhanced cooperation in the welfare sector.

/The Danish embassy in Japan



In cooperation with





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