Essi Heimovaara-Kotonen
Toni Pekkola (Eds.)

Teleprecence robotics

Towards higher quality wellness services

European Union
European Social Fund

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Jamk University of Applied Sciences

Telepresence robotics

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CONTENTS

CHAPTER 4 PROCUREMENT AND DEPLOYMENT OF TELEPRESENCE ROBOTICS IN A WELLNESS BUSINESS

CHAPTER 5 PILOTING TELEPRESENCE ROBOTICS IN THE WORKING WITH ROBOTS PROJECT

CHAPTER 6 TIPS FOR THE DEPLOYMENT OF ROBOTICS IN THE WELLNESS SECTOR

SUMMARY

Essi Heimovaara-Kotonen & Toni Pekkola (Eds.)
Telepresence robotics. Towards higher quality wellness services.
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The use of robotics is becoming more common – this is so also in the wellness sector. This provides new opportunities for improving the efficiency and diversification of operations, improving well-being at work, and providing means and tools for both rehabilitation and remote guidance. One of the forms of robotics used in the wellness sector is telepresence robotics. It enables guidance and communication independent of time and place. Making use of telepresence robotics can lead us towards higher quality wellness services.

Successful robotics deployment requires time, familiarization, commitment, and willingness to introduce new technology. The introduction of robotics is a major change that requires management. Regarding related change management, it is generally referred to as digital transformation management, which is closely linked to the acceptance of technology and the different maturity levels of robotics implementation, joint development and inclusion, and future-oriented thinking.

Four SMEs in the wellness sector in Central Finland were able to experiment with telepresence robotics in an agile manner in the Working with robots project (ESF) implemented by Jamk. The telepresence robotics pilots were implemented using a fast-track operating model which meant that the changes were reacted to quickly. Several different pilot experiments were carried out in the project. The preliminary experiences and results are very promising.

In companies planning to implement robotics, it should be noted that positive experiences of robotics have a positive impact on attitudes. Achieving the benefits of deployment requires the development of operating models and processes for the entire work community. Jamk is happy to participate in this work.

Key words: wellness robotics, telepresence robotics, digital transformation, inclusion, well-being at work

1 INTRODUCTION

Tapio Mäkelä, Henna-Riikka Markkio, Essi Heimovaara-Kotonen & Toni Pekkola

Since the 1990s, we have been hoping for a solution to both the shortage of nurses in health care and, in general, help for the care of older people. A technology-oriented vision according to which social welfare and health care services are produced by robots or are technology-assisted, despite their advances, has not been realised even though undeniable advances have been made in Japan, among other places. Due to the demographic structure, the number of workforce in Japan is the first of the OECD countries to decrease. Thus, the development and utilisation of robotics is no longer a matter of reducing costs alone and improving the efficiency of actions, but rather of maintaining the service structure and business operations in general. Robotics and automation are no longer an option in Japan, but a necessity. (Watson & Wright 2018.) Finland is also facing major demographic changes. The growing number of older people in relation to the number of working people requires new technological solutions that are humanely and economically sustainable also in the Finnish health care and social services sector. An entirely separate issue is how the customers or personnel of care services perceive robots and how their perspective and ethical issues are taken into account when robotising care services.

According to studies, nursing bots currently offer mainly instrumental assistance in the health care and social services. There is no multifunctional nursing robot that mainly replaces humans, nor is there such technology in sight. (Van Aerschot & Parviainen 2020.) However, significant progress has been made in recent years, and new solutions in such areas as rehabilitation robotics and health care logistics robotics have functioned as key drivers. So, the situation is changing. The expected breakthrough in the utilisation of robots may occur in the current decade in institutional environments where robots can significantly reduce the amount of mechanical routine work carried out by humans. This would free up nurses' time for encountering customers as well as make the shortage of experts in the field easier in general. In other words, both the customer and the nurse would benefit from the increase in robotics.

There are many possibilities for using wellbeing robotics. Working with Robots project funded by the European Social Fund and Jamk University of Applied Sciences has made it possible to experiment with various ways of using and utilising telepresence robotics in daily life together with companies. Pilot trials have been carried out in services aimed at special groups. The experiences have been very diverse. This publication presents some new, alternative ways of utilising telepresence robotics in authentic care environments. The operating environment and the processes required of companies to successfully implement and utilise robotics will also be highlighted.

Also read the Ohjelmistorobotiikka – kohti rutiinitehtävien automatisointia publication, produced in the Working with Robots project.

Chapter 2

Wellness robotics

2 WELLNESS ROBOTICS

Toni Pekkola, Tapio Mäkelä & Essi Heimovaara-Kotonen

2.1 ROBOTICS AS A PHENOMENON

The etymology of robotics refers to the Czech language and the word robota, which originally refers to a worker or a serf. For the first time, machines or robots serving people were depicted in Karel Capek's play in 1920. However, the credit for the name robot lies with the writer's brother Josef. With numerous translations, the play became popular, and the concept was expanded to other languages. (Rossum's Universal Robots 2020.)

Despite its long history, robots and robotics have no single accepted definition.

As a rule, the word robot refers to computer-controlled workpieces or tools. According to the Merriam Webster encyclopedia (2021), a robot is a human-shaped machine that performs mechanical actions. According to Niku (2011, 3) 'a robot is a device designed and intended for use on a computer or a similar device. It is also able to perform various programme-based tasks simply by changing the program." This definition is also unsatisfactory as it does not take into account the new office automation, i.e., software robotics (Robotic Process Automation, RPA). The idea of rapidly increasing software robotics is to automate the (mass) routines of office work. The difference from traditional robotics is that such robotic technology lacks the physical and mechanical structure contained in the traditional definition of robotics. (Pekkola, Mäkelä, Vehmaskoski & Minkkinen 2020, 10–11.)

In Finland, smart robotics and automation are defined as follows in the Government Resolution (VN 2016):

> *A smart robot is able to learn, is interactive and autonomous, and it utilises sensors, motor activities, networking, and artificial intelligence in its actions. A robot is often perceived as a physical object in general language, such as a service or industrial robot, but in a broad sense robotics also covers software robots and smart machines.*

Because of the overlap of concepts, the term robotics is often used when referring to both smart robotics and automation, except when one wants to emphasise the special features of technologies. In other words, robotics is in its simplest form a robot system. According to the definition of ISO-8373 (ISO 2012) standard, which was updated in 2012, robotics also means science and action related to the engineering, manufacture, and utilisation of robots. Similarly, the term robotization is used when referring to the spread of smart robotics in automation. (Ministry of Transport and Communications 2016, 9.)

> **At its simplest, robotics is a robot system built from equipment and competence that can work together with robots.**

According to the International Federation of Robotics (IFR), robots can be distinguished according to the purpose for which they are used. The main categories are industrial robotics and service robotics. In this case, service robotics – broadly understood – is robotics whose application area covers work other than traditional factory work. However, the method or area of use does not necessarily indicate whether the robots themselves are fundamentally different from each other. (Turja & Särkikoski 2018.)

Using artificial intelligence in robotics

Robots were originally built to perform simple tasks, but today they are designed to be smarter by using artificial intelligence and data analytics (AI). There are two types of artificial intelligence: weak and strong. Weak AI refers to a machine that uses software to investigate or solve certain problems. It does not reach awareness, but is mainly a problem solver in a certain area of application. Strong artificial intelligence refers to a hypothetical machine whose behavior is at least as skillful and flexible as that of humans. Regarding strong artificial intelligence, the development is still far from genuinely strong artificial intelligence. (Ailisto 2018.)

With regard to robotics, the taxonomy, or classification system, is still very wavering. It is generally felt that service, social and care robotics have been separated from industrial robotics over the decades. Wellness robotics is still finding its footing in the field of robotics. Sometimes it is defined as a separate entity alongside traditional robotics, often as part of service robotics. (Alho, Neittaanmäki, Hänninen & Tammilehto 2018, 4.)

The health care and social services sector utilises technology that aims to promote human good, such as care, rehabilitation, or independent coping.

However, the robotics of social welfare and health care services is still evolving. The utilisation of robots in welfare services is limited, but technological development will lead to new applications for robots. The next chapter aims to place robotics in the wellness sector as part of the broad field of robotics.

2.2 ROBOTICS IN THE WELLNESS SECTOR, I.E. WELLNESS ROBOTICS

As has already been mentioned above, there is no single generally accepted classification system for robots. A common practice is to roughly divide robots into industrial and service robots according to their intended use. Service robotics, which includes wellness sector robotics, is widely understood as robotics, the scope of which covers all but factory work. According to Kaivo-oja (2015), service robots are collaborative robotics because they work in the same environment with people and they are designed to help, support and partner people.

The International Federation of Robotics IFR, classifies service robots for private and professional use and, depending on their intended use, further into more detailed classes. Private robots include various self-care robots that assist in eating, hygiene or cleaning the home, as well as robots used to assist with the care of older people and people with disabilities, transport, home safety and monitoring. Professional robots include various medical robots, pharmacy robots or logistics robots. (Alho et al. 2018, 4.)

Robots used in the wellness sector can also be classified in several different ways. Robots and the Future of Wellbeing Services, which drew up the Robotics Roadmap for Finland – the ROSE consortium divides the robots used in welfare and health services into medical robots, institutional robots and personal assisting and nursing robots (table 1). (Kyrki, Coco, Hennala, Laitinen, Lehto, Melkas, Niemelä & Pekkarinen 2015, 3). The ROSE consortium further divides nursing robot applications into four areas: support for nursing staff, rehabilitation and prostheses, personal physical assistance, and personal cognitive/social assistance. (Hennala, Koistinen, Kyrki, Kämäräinen, Laitinen, Lanne, Lehtinen, Leminen, Melkas, Niemelä, Parviainen, Pekkarinen, Pieters, Pirhonen, Ruohomäki, Särkikoski, Tuisku, Tuominen, Turja & Van Aerschot 2017, 10).

TABLE 1. Examples of robots used in the wellness sector

Robotics area	**Example of application**
medical robots	robot surgery: surgical robots
institution environment robots	hospital pharmacy
	hospital logistics, such as transport of samples and laundry
personal assistive robots	physical assistance: eating, moving, cleaning, hygiene, carrying objects
	cognitive and social assistance: partner robots, telepresence robots, reminders
care robots	rehabilitation devices, prostheses, exoskeletons
	nursing staff support: automation of recording, ERP systems, remote consultation

In the Robotics in health care report commissioned by Business Finland (Frost & Sullivan 2020), the health and wellbeing robotics ecosystem is considered to consist of medical robots, health care service robots and care robots, such as:

1 Medical robots

- Surgical robots
- Diagnostic systems

2 Health care service robots

- Dosage and distribution of medicines
- Cleaning and disinfection
- Telepresence and remote monitoring
- Automatic auxiliary bots (transport of food, samples and laundry)

3 Nursing robots

- Social robots
- Assistant robots
- Prostheses and exoskeletons

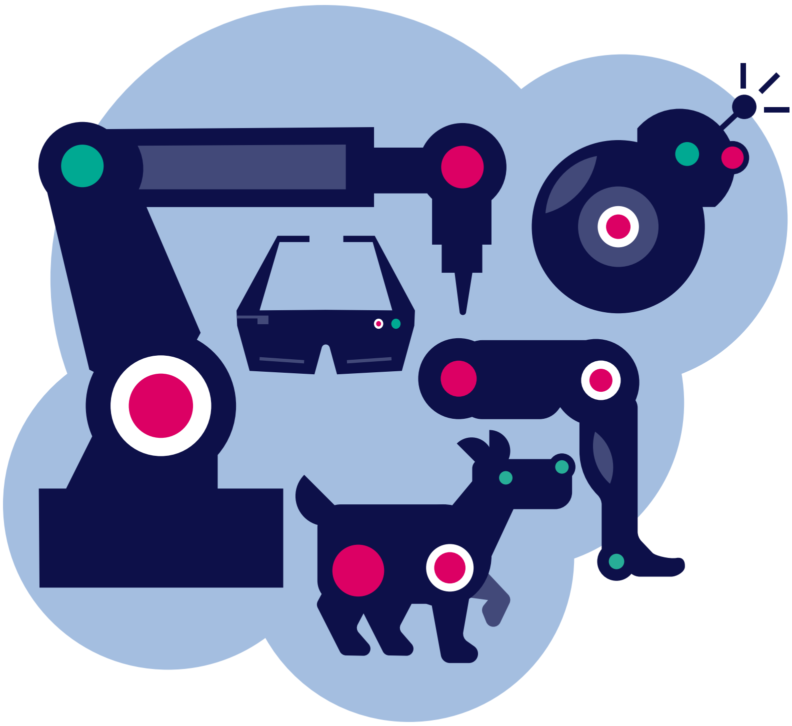
The different robots used in health care and the wellness sector are discussed in more detail in the following chapters.

2.2.1 THE VARIOUS ROBOTS OF THE WELLNESS SERVICES

The use of robotics in health care has increased, albeit slowly. Robots have gradually become part of the everyday life of hospitals. Operation, logistics and rehabilitation robots have been pioneers. In addition, solutions in robotics have been sought especially for care services for older people through various projects, research projects and experiments. It is believed that service robots will bring new opportunities for wellbeing and health services both because of increased productivity and through the development of service quality. New business opportunities can also be seen. (Kyrki et al. 2015, 2.)

> In addition to service robotics, software robotics has been identified as having a major impact on health sector processes. They will affect almost all actions in the field and contribute to solving future challenges identified in the health care and social services sector. (Alho et al. 2018, 5.)

The range of robots used in wellbeing services is already wide in Finland. For example, rehabilitation utilises robots from soft animal robots to large walking rehabilitation robots used to support physiotherapy. (Melkas 2018, 25.) Robotics also offers many opportunities to support living at home and the work of professionals (Niemelä & Sachinopoulou 2019, 4). Telepresence robotics and medication robots have been developed to support living at home. Various nursing robots are available to assist in nursing, which can perform treatment procedures and collect and transport medical supplies and medicines as well as various social robots. (Kangasniemi, Pietilä & Häggman-Laitila 2016, 40.)



2.2.2 MEDICAL AND HEALTH CARE SERVICE ROBOTS

Hospitals and other health care organisations and pharmacies have been using robotics for a long time, which is usually not visible to customers. All Finnish university hospitals and many other hospitals already have surgical robots. In many hospitals, logistics tasks, such as the transportation of medicines, food doses, linen, and waste, are also carried out by logistics robots helping the personnel. (Juopperi 2018.) Disinfection robots that utilise UV light have also been introduced in operating rooms (new UV robots are introduced in Finland to combat COVID-19 in 2020).

The medicines of more than 50,000 Finns are mechanically dispensed by robots.

In the pharmaceutical warehouses of many hospital pharmacies, collection storage robots are used, and in wards, smart medicine cabinets are used to store and manage medicines. Smart medicine cabinets increase the safety of the distribution of medicines, speed up the discovery of medicines and prevent abuse. (Kemppainen 2018.) Through pharmacies, more than 50,000 Finns already receive their medicines by machine dispensing robots. The objective of dose delivery robots is to save nurses' working hours, prevent mistakes in dispensing and reduce medicine losses. (Leikola, Rantanen & Airaksinen 2018.)

Pharmacies also have pharmacy robots or storage machines (Image 1). The robot optimally sorts the medicine orders sent to the pharmacy, and when the customer purchases the medicine, the mechanical assistant delivers the order to the prescription desk. Robots improve the efficiency of pharmacy operations, improve patient safety as the number of human mistakes is minimised, and free personnel to provide medicine advice while the robot picks up the medicine. (Leikola et al. 2018)

Image 1. Pharmacy robots are used for sorting and collecting medicines (Image: Toni Pekkola)

Medication dosing robots are also used in home use as personal aids. They ensure that medicines are taken at the right time and in the right doses. The robot reminds the customer of taking the medicine and the information about taking or not taking it is automatically sent to a party agreed upon in advance – either the care organisation or a family member. It is also possible to send various reminder messages through some medicine dosing robots. There are also separate reminders for home use. (Taipale 2019.)

Health care units also use telepresence robots. They are robots located in a different location from where they are controlled. Telepresence robotics can be used, for example, by a doctor to perform a round or by a nurse to consult a specialist who is in another location. In a pandemic, there may be a need for remote presence due to restrictions even if you are in the same building. Home care customers can also use telepresence robots. In this case, the nursing staff can contact the telepresence robot if necessary or as agreed, talk to the customer, or guide them. Telepresence robots can also be used for communication between the customer and their relatives. (Turja & Porokuokka 2020.) Telepresence robotics and its uses in the wellness sector are discussed in more detail in the chapter Telepresence Robotics.

2.2.3 CARE BOTS

In addition to medical and health care service robots, nursing robots are also used in hospital environments and rehabilitation institutions. One form of application for nursing robots is rehabilitation robots, such as robotised walking rehabilitation robots (Image 2). Compared to traditional manual physiotherapy, robotics improves rehabilitation by enabling larger numbers of repetitions and steps. The walking rehabilitation robot is suitable for practical training of walking skills and, for example, walking exercises with customers with neurological conditions. Robotics can also be used to monitor the progress of rehabilitation and increase the meaningfulness of practical training by means of gamification. (Pennanen 2020.)

Image 2. The Lokomat robot is used in walking rehabilitation. Image: Essi Heimovaara-Kotonen)

> The exoskeleton, or external support spine, is an external, anatomical structure that supports and protects the body of the organism and increases human strength, enabling various movements. Sometimes it is also called wearable robotics.

In addition to walking robots, external skeletons or exoskeletons, robotised prostheses (Image 3) and upper limb rehabilitation robots are used in rehabilitation. Typical of the abovementioned robots is that they enable a higher number of repetitions and enhance rehabilitation or act as a support or substitute for impaired body function. In particular, robots benefit people with reduced functional capacity, such as those suffering from neurological diseases. Exoskeletons can also be utilised in the workplace to support good ergonomics and to reduce the need for the use of force by workers. (Alho et al. 2018, 13; Turja, Saurio, Katila, Hennala, Pekkarinen & Melkas 2020.)

Image 3. Robotised prostheses included in nursing robots can be used to support rehabilitation. Image: Thisisengineering/Pexels)

Social or companion robots that support emotional, cognitive and social functional capacity have been utilised, especially among the elderly, but also among autistic people and children. They are a form of nursing robots, and several types have been available on the market over the years. The most widely used social robot in Finland is the seal robot Paro (Image 4). It is used as a therapy device especially for people with memory disorders. Some robot cats are also used. According to studies, working with robotic pets can improve mood, lower the threshold for interaction and alleviate anxiety (Leng, Liu, Zhang, Hu, Zhou, Li, Yin & Chen 2019).

Image 4. The Paro robot seal is a social robot that is used, for example, as a therapy device for people with memory disorders. Image: Toni Pekkola)

Humanoid robots resembling human characters (e.g., Zora and Pepper, Image 5) are also used in nursing to some extent. These robots are capable of simple dialogue with humans. However, this always requires either pre-programming or realtime guidance (Niemelä & Turja 2019). In particular, Zora has been developed for the use of the care sector. It has sensors, a speech synthesiser, speakers, and a camera for responding, seeing, and hearing. Zora can walk, dance, and wave his hands, and it can be used, for example, to control exercise sessions, tell stories or play games. Due to its small size (about 50 cm), it can be held in your lap like a child. (Kangasniemi et al. 2016, 45.)

Image 5. The Pepper robot resembles a human figure. (Image: Alex Knight/Pexels)

2.3 VISIONS FOR THE FUTURE OF ROBOTICS IN THE WELLNESS SECTOR

The wellness sector and the related social and health care services are constantly developing. One of the major visible changes is digitalisation and, consequently, new technologies, which will become more widely available in these fields as well. As a result, the utilisation of robotics in the wellness sector has become more common. One way to assess the utilisation of robotics is to use Gartner's hype cycle graph.

Gartner is an international market research company. The company publishes annual hype cycle graphs assessing the maturity of technologies. This is a current state review – not a prophecy of the future. The purpose of a fivestep graph drawn in the form of a curve is to help the reader assess the maturity, adoption and relevance of the technologies and applications presented in solving business challenges and identifying new opportunities. In other words, the graph gives an idea of how technology or application develops over time and provides a view of successful implementation. The graph is divided into five sections:

1. Innovation Trigger or identifying potential technologies. A potential technological breakthrough whose commercial usability has not yet been verified.

2. Peak of Inflated expectations. Early publicity and success stories or failures. Technology is either abandoned or developed.

3. The Trough of Disillusionment, i.e., facing challenges. Interest in the new technology is weakened as experiments and implementations fail. Manufacturers aim to improve the suitability of technology to the satisfaction of early adopters.

4. Slope of Enlightment. Several examples of how technology can be utilised have emerged on the market. Understanding of the opportunities offered by technology has also increased.

5. Plateau of Productivity, i.e., even productivity. General deployment will increase, and mass production will begin. The requirements related to products have been specified in more detail, they are used more extensively, and they are verifiably topical.

The hype curve also shows the predicted time for technologies to reach the steady productivity stage in the market or to disappear from the market before they reach steady productivity. Some technologies disappear or drop from development at different stages of the life cycle. (Gartner Hype Cycle 2021.)

Gartner's hype cycle for healthcare providers (Craft & Jones 2020) highlights platforms that utilise artificial intelligence and digital solutions and virtual assistants as emerging technologies and innovations (Figure 1). In practice, this means digitalisation of services and more efficient utilisation of data. When examined from the perspective of robotics, robots intended for the care of the elderly have already exceeded the stage describing the initial expectations. On the other hand, emerging technologies also include applications that can be thought to utilise robotics, for example through virtual assistants.

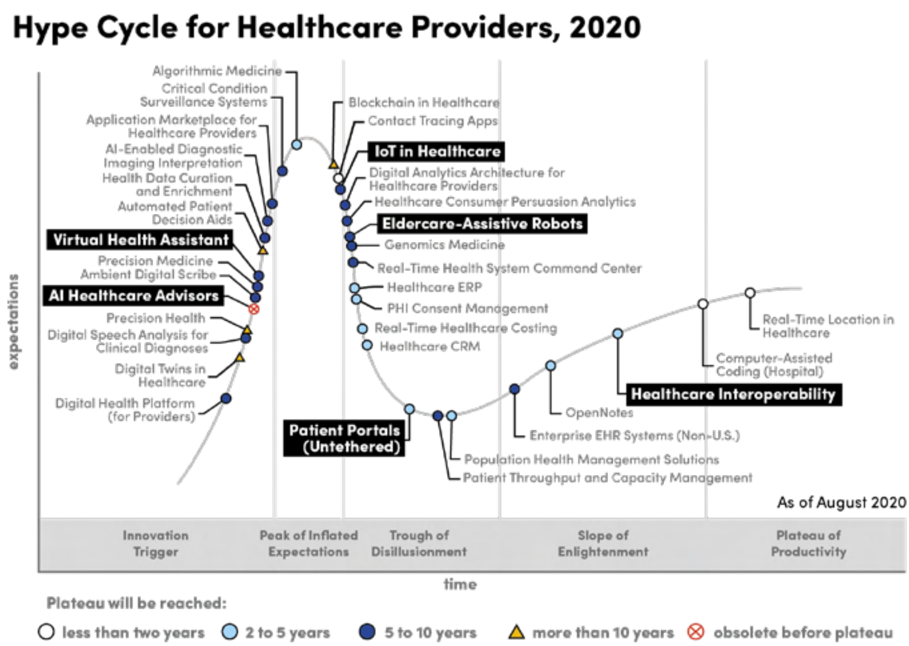


Figure 1. Gartner's hype cycle for healthcare providers (adapted by Craft & Jones 2020).

The report commissioned by Business Finland by Frost & Sullivan (2020) examines robotics in health and wellbeing services and assesses the maturity of various technologies in terms of their market opportunities. The report divides robots into three categories: medical robots, health care service robots and care robots. The report shows that the potential of robotics has been identified, but its costs and complexity slow down deployment. One interesting feature of the report is the possibilities of robotics to prevent social isolation of people with chronic illnesses and disabilities. This solution can be provided by personal robot assistants, interactive robots and telepresence robotics. However, according to the report, Finland's strength in robotics lies in industrial robotics, and as a result, there might be opportunities for developing robotics in, for example, healthcare distribution robots, such as autonomous robots. On the other hand, assisting robots, diagnostics, prostheses, exoskeletons and social robots can also offer Finnish companies a market share, as well as robots utilising machine vision and data analytics.

In an article published in 2018, Cresswell, Cunningham-Burley and Sheikh discussed the challenges and future trends of healthcare robotics. They suggest that robotics can significantly improve safety, quality, and efficiency in healthcare. However, the challenges include the interest and attitudes of customers and patients, the appearance and expectations and concerns of robots, the organisation of work, and new ethical and legal issues. (Cresswell et al. 2018)

Opportunities and threats related to the development of robotics have also been identified in, for example, scientific literature and films. They have started to develop ideas and visions further, and humanoid robots are representations or manifestations of hopes, fears and social norms presented by means of technology. On the other hand, when we look at robotics and its manifestation, new questions are constantly emerging that have not yet been clearly answered. Social robotics and its manifestation are a good example of this, as it is also necessary to consider whether technology can be social and how it includes ethical aspects. (Penny 2018.)

2.3.1 UTILISATION OF ROBOTS IN THE FUTURE

The future visions and fiction of robotics have long presented the merger of human and technology (convergence) in various ways (Dufva 2020). Early examples of this in popular culture include RoboCop and the Six Million Dollar Man. In these examples, human performance is strengthened through technologies. The development work has already produced exoskeletons, for example, which at least make work lighter and support rehabilitation processes. Many intelligent solutions have also been introduced in prostheses. Technologies begin to integrate with people or use the body. An example of this are bone conductor headphones, which are already available, and which transmit sound to the inner ear through the cranial bones. This means that the sounds of the environment will not be silenced, and for example jogging while listening to music is safer.

While technology is introduced on or even under the skin, the environment is also going through changes. Data connections are constantly evolving and reaching us all. As technology develops, the requirements will also increase. People want services regardless of time and place. This also applies to services provided or utilised by the health and wellness sectors – robotics will become more common in everyday life. In addition to assisting robots in home chores, various service robots will become available.

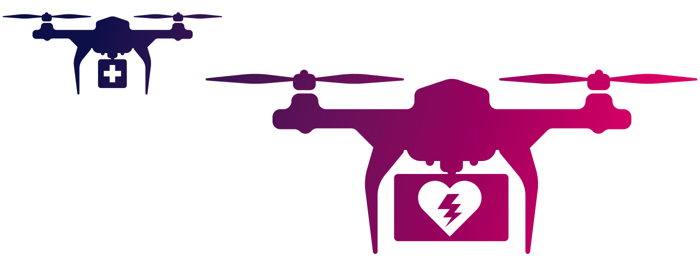
In the future, you may also come across robotics at a doctor's office, if indeed you still need to physically go there. Machine vision applications are being developed for the health care industry, and with the help of these applications as well as other sensor technologies, artificial intelligence will draw conclusions and evaluate the need for treatment. Personal health data and its collection help to anticipate future illnesses and target the need for treatment even before the first symptoms occur. Doctors, nurses and other health care and social service professionals already use video conferencing technologies in remote appointments (Image 6).

Image 6. Remote appointments with doctors or nurses are already common today. (Image: Tima Miroshnichenko/Pexels)

Various virtual assistants help with daily actions and, if necessary, also manage social contacts through them. Telepresence robotics makes it possible for the elderly and unwell people to authentically participate in social situations, whether in a family circle or a wider context. Technologies are already in use to enable remote presence and enable interaction with the robot's surroundings either through video or an avatar. Various hologram technologies have already been developed; for example, in the 2017 French presidential elections, one candidate appeared at two events at the same time.

In the future, work, working and working methods will change. Already, the aim of robotics is to replace heavy, dirty, and other wise unpleasant work tasks. In the future, the customer will be increasingly in focus. Mobile robotics and autonomous transport robots deliver supplies and products to where they are needed. An example of this is the transport of a defibrillator by ambulance drone to a patient suffering from cardiac disorders in a trial in larger cities (BBC 2017). Another example is a drone transport experiment carried out in the Swedish Vesterbåtten area in autumn 2021, in which the necessary medical equipment was delivered faster and at lower costs at long distances. County Administrator Helene Hellmark Knutsson (2021) states that sampling by drone transports makes it easier for doctors and nurses to target the treatment to those who genuinely need it. (Oddasat 2021.)

Telepresence robotics makes it possible for the elderly, unwell people or relatives to authentically participate in social situations, whether in a family circle or a wider context.



Impacts of the COVID-19 pandemic on the use of robotics

he COVID-19 pandemic, which began in 2020, showed that companies and individuals have started to utilise technological solutions and robots to overcome the challenges posed by exceptional circumstances. The interests of robots have risen beyond human limitations, as a robot cannot develop COVID-19. Telepresence robotics makes it possible, for example, for already overloaded nursing professionals to work safely at least to some extent without endangering their own health. (Shen, Guo, Long, Mateos, Ding, Xiu, Hellman, King, Chen, Zhang, Tan 2020.) There will certainly be more demand for such innovation in the future.

On the other hand, the aforementioned issues are only visions of the future. Time ultimately shows what kinds of technological solutions and robotics will be used and what the schedule will be.

2.3.2 ETHICS OF ROBOTICS

The development of digitalisation and the continuous change in the operating environment raise ethical issues related to working in the health care and social services. Nursing robotics produces ethical issues from a variety of perspectives and at several levels, from interaction between individuals to societal, even global issues. (Sihvo & Koski 2020, 19, 32.) Among other things, the ROSE project has studied ethical and social issues that arise when dealing with people and robots. These include issues related to privacy, human encounters and human dignity as well as the conditions under which care robotics development is carried out. Equality and nondiscrimination are also subject to ethical review; will robots only help those who can afford it or those who cannot afford it in the future (Rantanen 2018). The general concern associated with nursing robots is related to loneliness and fear that robots are intended to replace human nurses and human interaction (Kyrki, Coco, Hennala, Laitinen, Lehto, Melkas, Niemelä & Pekkarinen 2015, 5).

Ethical issues should also be examined from the perspective of the opportunities offered by robotics, for example, how robotics can increase the customer's opportunities for selfdetermination and participation (Peiponen 2018). Responsibility issues are also central to ethical review. The authority to decide on the actions and treatment of robots will always remain with the health care professional and the patient (Kangasniemi & Andersson 2016). Some ethical issues related to robotics in the health care and social services have been highlighted in Figure 2.

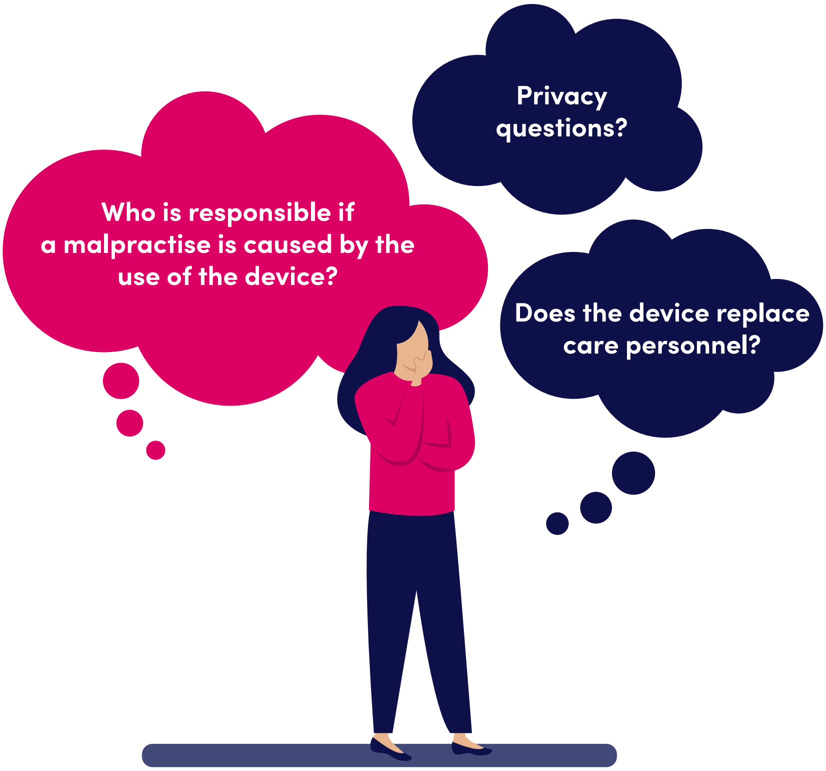


Figure 2. Ethical issues related to robotics in the health care and social services sector.

The digitalising work in the social welfare and health care sector is guided by legislation, national strategies and programmes, various national and international ethical guidelines and sectorspecific guidelines. To support the identification and evaluation of ethical issues related to digitalisation, a checklist has been developed, which can be used to assess ethical perspectives and issues in accordance with the principles of the technology or service in question. (Sihvo & Koski 2020, 196–198.)

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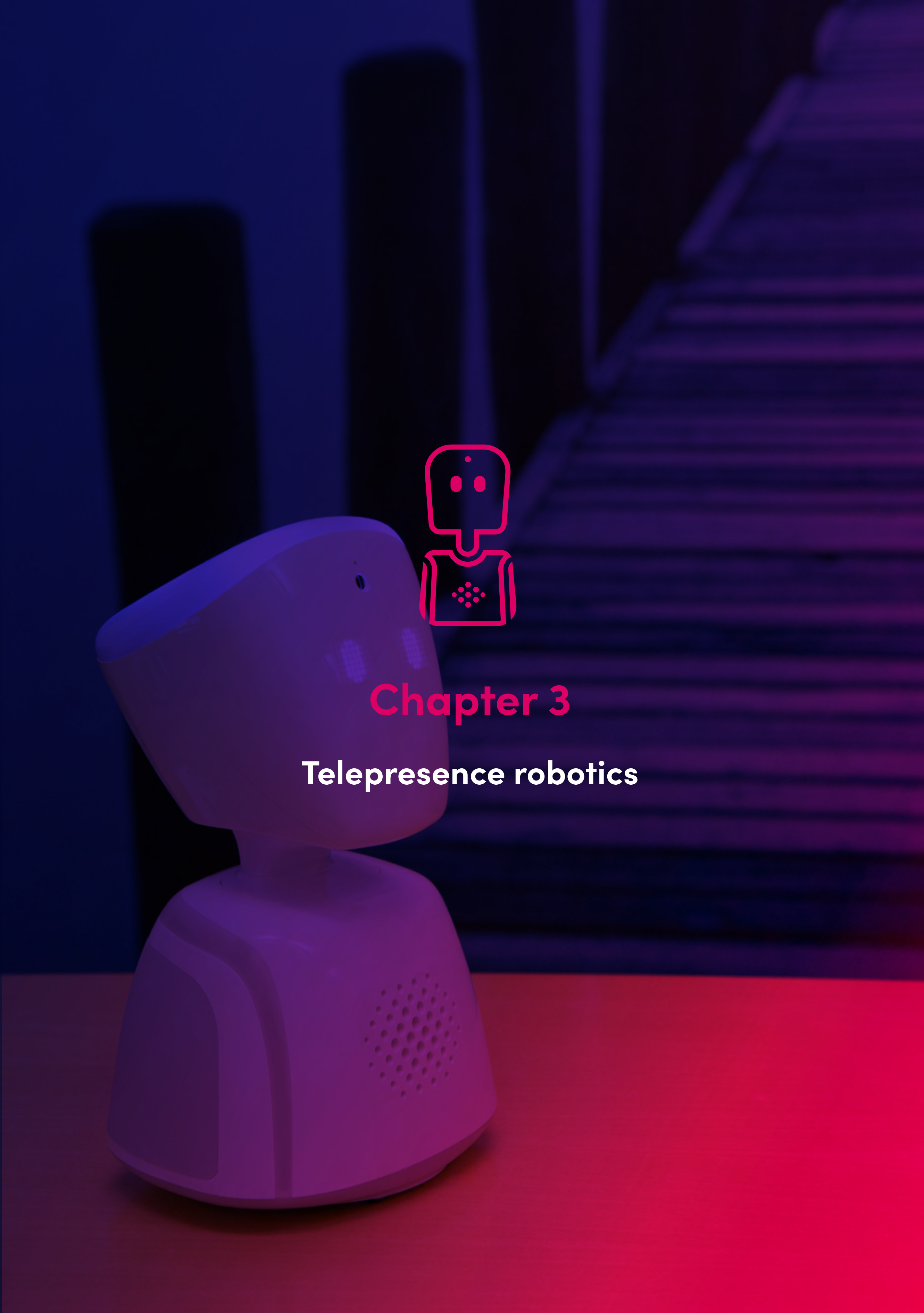

Chapter 3

Telepresence robotics

3 TELEPRESENCE ROBOTICS

Toni Pekkola, Essi Heimovaara-Kotonen & Tapio Mäkelä

3.1 BACKGROUND AND DEFINITION OF TELEPRESENCE ROBOTICS

A telepresence robot is a robot whose special feature is not only two-way image and sound transmission, but also mobility with remote control. The telepresence robot is placed in a different location from where it is controlled. The telepresence robot is controlled remotely either near or far by a human operator. Telepresence robotics allows the user to see another space through the camera and therefore feel physically present regardless of where they actually are. (IJsselsteijn 2006.)

Telepresence robotics, also referred to as remote presence, is robotics originally developed for surveillance and communication purposes. The first studies on the use of the wellbeing sector can be found in the 1970s. At that time, two-way video communication was used in intensive care for consulting purposes and it was thought to have many advantages compared to telephone consultation. In the 1980s, the same researchers applied remote connection to consultations in various hospital environments. Despite the promising results, remote presence was not yet ready for wider distribution, partly due to high costs. (Chung, Grathwohl, Poropatich, Wolf & Holcomb 2007.)

For the first time, the word telepresence robotics, in the form in which it is understood today, came up in Canada in 2007 when Boissy, Corriviau, Michaud, Labonté and Royer examined the suitability of telepresence robotics for home care. The experiment revealed potential, as robotics was seen to improve the quality of treatment for customers with multiple illnesses. (A/M 2007.)

In recent years, telepresence robots have been a major factor in development work, and solutions have been sought for rapidly increasing numbers of older people and supporting living at home. Cooke, Drummond, Jones, Moyle, O'Dwyer and Sung (2014) investigated the suitability of telepresence robotics for communicating between a person with a memory disorder and their loved ones. The study found that telepresence robotics helped customers keep in touch with their relatives and brought content and joy to their lives. (A/M 2014, 1.)

According to the definition of Sherman and Craig (2019), remote presence utilises technology closely related to virtual technology. In remote presence, equipment and sensors, such as video cameras and microphones, replace the participants' corresponding senses. The participant can see and hear the perspective the robotbrings to the environment using sensors on the remote device. The user can interact and even impact a remote environment through actions that are repeated at a remote location. Remote presence differs from augmented and virtual reality by representing the physical world, unlike a fully computer-generated world. (A/M 2019.)

A telepresence robot enables the user of the robot to experience being present in another location.

In simple terms, a telepresence robot places its user in a remote location in some way. The telepresence robot is controlled with a computer, tablet, or smartphone. The robot itself usually has a video camera, a display, speakers, and a microphone that allows a person interacting with the robot to see and hear the robot's remote user/operator. Similarly, the operator can see and hear the person who is in the same space as the robot. Some telepresence robots use a tablet or phone connected to a robot, while others have built-in video and audio equipment. (What is a Telepresence Robot and what can they do? 2021.) A robot also needs network connection to play audio and video and control the robot.

Telepresence should not be confused with a related term remote control. The difference between these can be illustrated, for example, by controlling a radio-controlled plane. In telepresence, the user (operator) sees the environment and interacts with it as they would if they were physically present. In the case of remote control, the pilot is usually on the ground and monitors remotely through direct vision how the plane performs the specified control commands. In order to turn this into remote presence, the pilot should be placed in the plane using cameras or other similar devices. (Sherman & Craig 2019.)

> At best, telepresence robotics enable social awareness of the environment. For example, when we sit at a workstation, we are aware of what is happening around us: we hear conversations and talk that take place nearby, we see passing people. In practice, therefore, we share the physical environment with other actors. (Kuniavsky 2010.)

Telepresence robotics are usually also associated with some degree of mobility in the operating environment. Some robots provide a view of the fixed object assigned to the robot, for example, if the robot can be rotated 360 degrees on its own platform. Some robots also have a platform that enables the robot to move around in its surroundings, for example by wheels or tracks. As robots have evolved, they have also become increasingly autonomous. In practice, this means that the operator determines the end point to which the device will go, and the robot will move there independently. (Lekach 2019.)

Technological development has also highlighted the potential of virtual reality and augmented and mixed reality in remote presence. For example, the objective of the Mesh platform presented by Microsoft is to bring people into various environments, be they virtual or augmented reality. (Warren 2021.) At the moment, in addition to remote consulting appointments, consulting nursing staff and various specialists, various telepresence robots that enable participation have also been introduced in housing services, daytime activities and teaching.

3.2 APPLICATION EXAMPLES OF TELEPRESENCE ROBOTICS

Telepresence robotics can be utilised in many situations and with many different target groups. This chapter describes some examples of telepresence robotics applications regardless of the sector. The aim is also to inspire ideas about new uses in the wellbeing sector.

TELEPRESENCE ROBOT IN TEACHING SITUATION – CASE AV1

In a study conducted in Denmark, the AV1 robot by No Isolation (Image 7) was utilised in children who underwent cancer treatment at the same time. The objective of robots was to maintain the children's social and school-related contacts. The study found that the following factors influence the use of the appliance: social factors, technical characteristics, learning, environmental factors, and user expectations. (Weibel, Nielsen, Topperzer, Hammer, Wagn Møller, Schmiegelow & Larsen 2020.)

Image 7. AV1 robot (Image: Viivi Kaartinen)

TELEPRESENCE ROBOT GUIDING A CUSTOMER – CASE SIFROBOT

Telepresence robots can be utilised in various service tasks where people cannot always be in the same space with a customer. For example, the SIFROBOT telepresence robot is activated when a person approaches within two metres of the device. It can turn and tilt its head. The device is remotely controlled and contains a video chip and face recognition software. Applications may include a lobby servant, shopping centre guide, fair presenter, and hospital patient instructor. (Telepresence Robots 2021.)

TELEPRESENCE IN MEDICINE – CASE RP-7

Already in 2007, Chung, Grathwohl, Poropatich, Wolf and Holcomb investigated how telepresence robots have been used in medicine. There has been a known shortage of personnel resources in nursing, and the research focused on using robotics in these conditions. The ward rounds of the personnel participating in the treatment had been carried out in one experiment using a telepresence robot. Through telepresence robotics, the specialist was able to consult another specialist or even instruct the customer. Robots were also used to guide medical students. The RP-7 robot was used as a physician's eyes, ears, and avatar in the physical environment. The physician themself participated in the patient's examination and instructions from their workstation through a PC and a network connection. (Chung ym. 2007.) Since then, robotics and connections have developed enormously, and today telepresence robotics is widely applied in various areas of medicine, for example in surgery.

TELEPRESENCE ROBOT AS A MEDIATOR OF CULTURE AND ART – CASE ARTBOT

The arts and culture sector produces experiences and services for people. However, there are situations (e.g. illnesses and disabilities) that prevent the experience of art and culture through participation in events. However, experiencing art and culture is important, as it increases wellbeing and promotes health (Kulttuuri lisää hyvinvointia 2021). Van Delden and Bruijnes (2017) investigated how a museum visit can be made through a telepresence robot. Participation in a museum visit through a robot enabled a more interactive experience than simply using a video link. As a result of the experiment, a crowdfunding campaign was launched to purchase a robot for the Seattle Art Museum. Another cultural experiment involved the researchers replacing an actor in a play with a telepresence robot. (Van Delden & Bruijnes 2017.) A telepresence robot can also be used in other experience services, such as sports or culture.

A TELEPRESENCE ROBOT AT HOME – CASE GIRAFF

One application environment for the telepresence robot is the home. At least in 2019, the City of Jyväskylä's home care experimented with a technology that enables remote care with the Swedish Giraff telepresence robot. Customers used the appliance independently in their own homes. A nurse was able to contact the unit and operate it remotely in the customer's home. If necessary, the customer was able to reject the incoming video call to the robot. The robot allowed the nurse to check whether the customer had eaten or taken their medication. Social interaction through the robot has also been experimented with, for example, to ease the feeling of loneliness or insecurity. (Solanterä 2020.)

TELEPRESENCE ROBOT ETHICS AND LEGISLATION – CASET SHOPBOT, BEERBOT JA THEFTBOT

There are various reasons and situations why people cannot be present in certain environments. As an interesting experiment, telepresence robotics has been tested in a grocery store to make purchases. The experiments included, among other things, buying age-restricted beverage products and stealing products. The experiment considered ethical perspectives and the reactions of customer service personnel to such new situations. In the event of a purchase (and theft), a robot without a separate gripper installed needed help either from the shop staff or other customers. The trials raised a few questions about responsibilities, ethical review and data protection issues. (Van Delden & Bruijnes 2017.)

3.3 TELEPRESENCE ROBOTICS APPLICATIONS AND OPPORTUNITIES IN THE WELLNESS SECTOR

The use of information and communications technology (ICT) in social and health care services has rapidly become more common. Although telepresence robotics has a relatively long history of use in industrial and business services within the framework of the telepresentation concept, the situation is different for health and care services. In health care, remote consultation has been used for a long time, but the actual telepresence robotics is only in the early stages of piloting and commissioning in social welfare and health care services. Therefore, it is not yet possible to draw far-reaching conclusions. The situation is changing. The Working with Robots project and the studies and reviews that will be launched will enable systematic and comprehensive collection of information on user experiences related to telepresence robotics and its impacts in work communities in the near future.

The introduction of telepresence robotics in hospitals and care services has been accelerated by the pandemic caused by the COVID-19 virus. The use of technology is also based on the recruitment status of nursing professionals. Since the 1990s, additional resources have been requested for robots in hospitals, supported living facilities and private homes, as there is a shortage or scarcity of trained nursing staff in industrialised countries. In Finland, this discussion refers to the number of people in relation to the number of clients. With the reform of the Act on the Care Services for Older Persons (2020), by 2030, more than 30,000 new nursing professionals will be needed in the care of older people alone as a result of retirement and tighter staffing levels (State of services for older people THL 2020). When the separation of indirect and immediate client work is added to the reform, the nursing staff will need new solutions to support their daily work, from organisation structures to the reformulation of work processes and wider utilisation of technology.

It is generally believed that robots can be used to solve issues related to resource shortages in the next few years. However, research and statistics do not unambiguously support this belief, as they indicate that nursing bots mainly provide instrumental assistance for nursing. However, experimental use of various robots has become more common in institutional environments, where routines are clear and operating methods repeated. (Van Aerschot & Parviainen 2020.) In hospitals and care units, it is possible to significantly lighten, substitute and complement nursing with various robotics and automation applications. (Kangasniemi & Andersson 2016, 37). With the COVID-19 pandemic, user trials related to location-independent remote services have become more common. For example, the Ava telepresence robot was able to control the risk of infection in the hospital, as the robot made it possible to carry out tasks related to patient examination, monitoring, or treatment by video (Frost & Sullivan 2020).

Video connections can be utilised in home care and informal care for older people. They are useful when serving various target groups, such as residents of sparsely populated areas, people with acute illnesses or people with reduced mobility. The difference compared to a traditional telephone is that seeing the customer helps the professional assess the situation. As elderly people increasingly live in their own homes and need external help several times a day, video connections also reduce the family's concern regardless of where they live. (Harjumaa, Ervasti, Pussinen, Similä & Wallin 2017.)

There are several applications for telepresence robotics in the wellbeing sector (Figure 3). It can be utilised in services for, for example, elderly people, persons with disabilities, health, rehabilitation, and social services as well as early childhood education and care. For example, the COVID-19 pandemic showed how easily the feeling of loneliness and social isolation can increase for older people. The impact of the restrictive measures was reflected in, for example, the narrowing of freedom of choice and the further reduction of pleasure, hobbies, and social contacts. Some service providers started examining new ways of maintaining social contacts: for example, various meeting containers appeared in the yards of some elderly care units. Individual telepresence robotics experiments were also launched. One of the more extensive examples of this is the piloting of telepresence robotics in companies providing services for the disabled and older people in Central Finland.

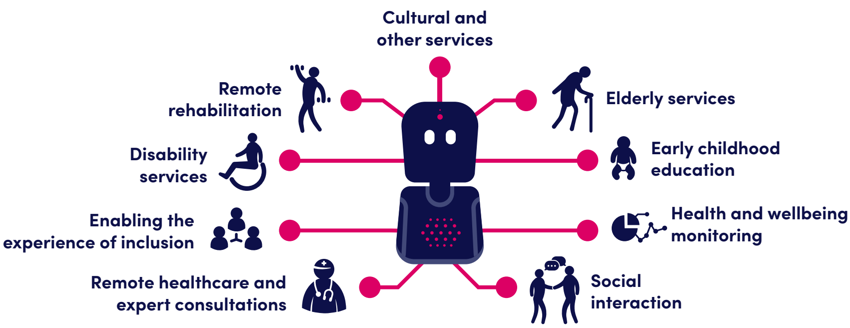

Figure 3. Applying telepresence robotics in the wellness sector

Applications for telepresence robotics may include service production, provision of remote services, maintenance of social contacts, consultations, entertainment use as well as education. The beneficiaries in these cases are both customers and personnel. For more information about usage examples, see chapter: Piloting telepresence robotics in the Working with Robots project (p. 78).

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Chapter 4

Procurement and deployment of telepresence robotics in a wellness business

4 PROCUREMENT AND DEPLOYMENT OF TELEPRESENCE ROBOTICS IN A WELLNESS BUSINESS

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4.1 PROCUREMENT

The idea of acquiring telepresence robotics is usually preceded by a observed or perceived need that initiates the procurement planning process. The starting point for the procurement is what the need is and how robotics can respond to it. The driving force can be detected or identified by the actual customer, care/ nursing staff or organisation management. In this publication, the actual customer refers to an individual who is the recipient and user of the services of a company or organisation providing welfare services. The need for procurement may also result from a changed operating environment or societal situation. Examples of this include favouring home care for the elderly instead of institutional housing, or a global pandemic. The sector may also require procurement as either a competitive advantage in separating itself from other operators or from a legislative perspective.

> The need to acquire telepresence robotics may arise either from the customer's or nursing staff's observation, due to a changed operating environment or social situation, or due to the preconditions of the sector.

The objective of the needs assessment is to determine the customer's current situation, possible problems, future prospects, and the expectations and target group related to the service or product. The needs assessment is an important step in the procurement process, and it is carried out in close cooperation with the customer/ end user, based on the customer's objectives and needs. Information on needs can be collected, for example, through surveys or by interviewing a limited group of people in the target group. Observing the actions of operators and customers also provides information on what kind of solution would be beneficial for the care or nursing staff and/or the customer. Other possible sources of information include general practices and standards in the field, legislation, decrees and recommendations. (Santanen 2017.)

When investing in telepresence robotics, it is advisable to conduct searches and choices that lead to a potential investment decision. After identifying the need, the next step is finding a suitable device or solution. The selection process consists of three steps:

- Search
- Selection
- Decision-making

In the search step the need has already been identified. The procurement manual of the City of Kerava (2019) describes the search step as follows:

> *Before publishing a request for proposal, a market consultation/technical dialogue should be conducted, which can be carried out in writing or in the form of meetings. In the market survey, all parties can discuss the options for implementing the procurement, possible new solutions and products and services already available and, for example, the contract terms and conditions related to the procurement. It is a good idea to clarify to the suppliers/service providers participating in the dialogue at the very beginning that the dialogue is about a survey related to the preparation of the tendering process, not negotiations on tenders.*

Although the above example is a public operator, this can also be applied elsewhere. Through dialogue with equipment suppliers, it can be verified that the solution in question is suitable for utilisation in the identified need, operating environment and target groups.

During the search phase, the available solutions and potential equipment suppliers are identified. After this, the selection can be made. In addition to costs, the selection is influenced by a price-quality ratio, which can be assessed based on the following qualitative criteria in the procurement manual of the City of Kerava (2019). These criteria include:

- Technical merits
- Aesthetic and functional characteristics
- Accessibility
- User requirements
- Operating costs and cost effectiveness
- Aftersales service, maintenance, and technical support
- Delivery date or delivery/ implementation time
- Other terms of delivery if any
- The competence and experience of the personnel of the supplier organisation and the organisation of the personnel
- Environmental friendliness (definitions in line with sustainable development).

EVALUATION OF THE BENEFITS AND DISADVANTAGES OF TELEPRESENCE ROBOTICS

The content of the evaluation of the benefits and disadvantages related to telepresence robotics is challenged by the limited documented experiences. Telepresence robotics has been discussed in VTT's study Ikääntyminen ja teknologia (2017). The publication of Savonia University of Applied Science's Hyvinrobo (2020) publication presents user experiences of the AV1 telepresence robot, which was also piloted in this project. Ethical issues in the social welfare and health care sector in the age of digitalisation and artificial intelligence have been discussed, for example, in the Karelia University of Applied Sciences' publication Eettinen toimintamalli – – osaamista tulevaisuuden koulutukseen ja sote-alan työhön (2020). (Hallamaa, Leikas, Malkavaara, Vesterinen 2020.)

The framework for the evaluation of telepresence robotics should be considered in that the explaining power of the traditional evaluation approach may be limited in the evaluation of the benefits and disadvantages of robots. A social phenomenon is always complex, especially when people want to understand the views of various operators or the relationships and dynamics between them. The phenomenon being assessed also involves different interests and the relationship between the actors is not symmetrical. From the viewpoint of evaluation, the best framework is multifaceted evaluation, the idea of which is to take different views and opinions into account and to receive feedback from different directions: the customer, the user and the organisation. The attached Figure (Figure 4) contains views often linked to telepresence robotics from a different perspective.

Views related to the implementation of telepresence robotics

	Pros	Cons
Customer	Reduce the feeling of loneliness by enabling social contacts (flexible and real-time connection with relatives/care staff) Ease-of- use	Lack of information about the supplier of the device Challenges in using the device (introduction and training) and in communication
User (Employee)	Reduction of overlapping work Streamlining of work processes	Challenges related to the technology and technical know-how Demands to change thinking and working culture
Organization	Efficiency of work processes and the easing of customer encounters Possibility to participate in meetings flexibly	The needs develop faster than the number of devices The one-time investments can be considerable

Figure 4. Views related to telepresence robotics (adapted by Hallamaa et al. 2020; Harjumaa et al. 2020; Kinnunen & Väisänen 2020)

Although technology aims to bring solutions to make everyday life and work easier, it does not always offer the best opportunities or suit its intended purpose. The use of technology involves technical problems and usability challenges. It is therefore important to identify what kind of technology is available and to be able to utilise it where applicable. We also need so-called technology literacy from professionals who work as users.

To examine the limitations or possibilities of introducing and utilising robotics for the customer, it is necessary to first determine who or which party the customer is. As mentioned above, a customer refers to an individual who accepts and utilises the services of a company or organisation providing welfare services. Even in this case, some options remain: actual customer

> **Opportunities for telepresence robotics include supporting and maintaining social interaction and increasing the sense of participation and experiences.**

and family member. From the perspective of individual customers, either of these factors may be prejudices or assumptions that are shaped by previous experiences, competence and functional limitations. The possibilities of telepresence robotics for this target group include supporting and maintaining social interaction and increasing the sense of participation and enriching experiences. For relatives, telepresence robotics provides an opportunity to participate in the daily life of their loved ones and in interaction with the service provider.

4.1.1 COSTS: DIRECT AND INDIRECT

For its part, robotics is able to respond to the challenge posed by the increasing costs of health care (Nevala 2021). Of course, the purchase of robotics, like other technologies, also generates costs. These costs can be divided into variable, fixed, direct and indirect costs.

Variable costs increase or decrease as actions or activity rates change. In terms of technology, these include energy consumption and maintenance of machinery, equipment, etc. Fixed costs, on the other hand, remain constant and are not dependent on fluctuations in action or activity rate. Typical fixed costs include interest and depreciation of capital tied up by machinery, equipment and machinery, salary costs of management and employees, basic electricity charges and, for example, ICT and office supplies costs. (Tenhunen 2013.)

Variable and fixed costs, on the other hand, are divided into direct and indirect costs when you want to examine costs per product or performance. Direct costs are usually variable, and their link to the product is clear. Indirect costs, on the other hand, cannot be allocated directly to a product or service, even if they are necessary for the action. Indirect costs are usually fixed but may also include variable costs, such as supplies and additives, which cannot always be allocated to a product or service. Direct costs are easy to allocate to the product, but the matching principle must be taken into account; in other words, only the costs incurred by the object of calculation must be taken into account. In accordance with this principle, the costs of a product or service may be calculated only as a proportion of the costs of the undertaking. (Tenhunen 2013.)

When purchasing robots, the costs of physical equipment are often determined. However, the total cost includes many other factors such as programming, testing, installation, commissioning, and training. In addition, the use and maintenance of the devices also incur their own costs. As robotisation is not intended to incur costs, on the contrary, to bring cost savings or allocate existing personnel resources to essential tasks, there is always reason to consider investment whole when planning investments. The Robotti tuli töihin – Working with Robots project estimated the costs as follows (Figure 5):

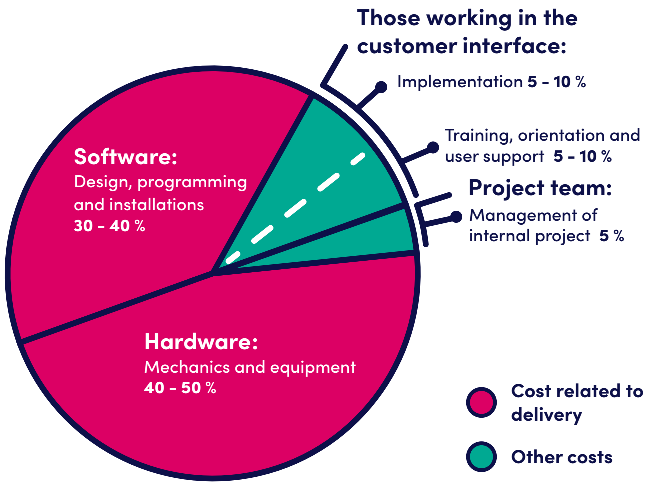

Figure 5. Observations of the Robotti tuli töihin project on the cost structure of the robot investment

The investment therefore includes hardware and software. Increasing user competence and commissioning will also result in additional costs. After the actual commissioning, the equipment will generate various variable costs in addition to any fixed operating costs. Applications are usually subject to monthly pricing. It should also be noted that robotics is available at different prices and that there are also significant differences in their usability. These affect not only the hardware and software but also the total costs – especially in cases where the acquired robotics are found more difficult to implement. The aforementioned cost model presents the observations made in the Robotti tuli töihin project and includes the factors that should be taken into account when investing in robotics.

However, costs are not the only factor on which the procurement of telepresence robotics must be based. Other factors to be considered include availability, user experiences, reliability of equipment, intended target groups of equipment, availability of product and supplies, price, novelty value, company values in relation to procurement (e.g., accountability), security, product warranty, and connection to product support, equipment manufacturer or importer.

4.1.2 LEGISLATION AND STRATEGIES RELATED TO THE SECTOR

Decrees and laws related to telepresence robotics and its usability in services for the elderly and services for the disabled are still in early stages. The topic is still so new for the authorities that there are no clear answers or guidelines for usability. Some guidelines are available from Valvira's guidelines on remote health care services for patients and general decrees. However, these are open to interpretation.

Read Valvira's instructions: https://www.valvira.fi/web/en/healthcare/ private-health-care-licences/telemedicine-services

The quality recommendations for work with the elderly (2020) do not give a clear opinion on robotics, but for the first time, the recommendations take into account the opportunities offered by digitalisation and new technologies to support and safeguard wellbeing (Quality recommendation to guarantee a good quality of life and improved services for older persons 2020–2023, 2020). The importance of digitalisation has also been taken into account in several strategies and programme packages concerning the sector. According to the Ministry of Social Affairs and Health's policy (2016), people are the most important factors in the development of digitalisation. Among other things, digitalisation aims to improve the quality of services regardless of the party in the customer's role: citizen, authority, company, or community (Figure 6) (Digitalisaatio 2016).

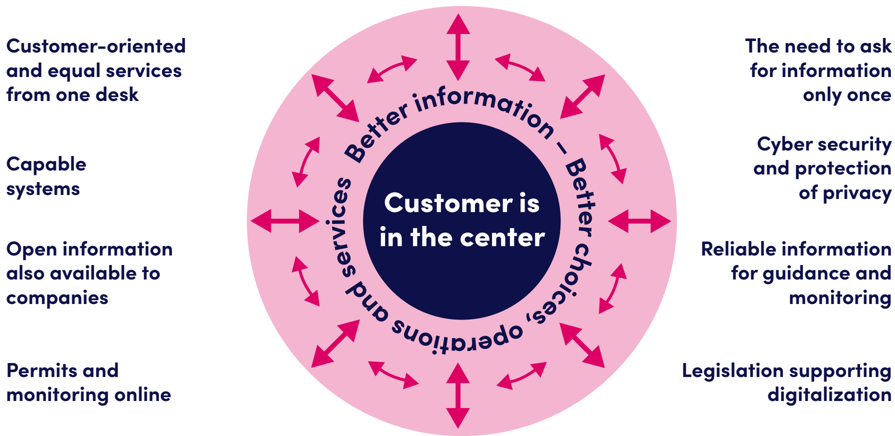

Figure 6. Vision of digitalisation in the administrative branch of the Ministry of Social Affairs and Health until 2025 (adapted from Digitalisaatio 2016)

The Ministry of Social Affairs and Health is responsible for leading the national Wellbeing and Health Sector's Artificial Intelligence and Robotics Programme (Hyteairo) (2021) in its early stages. The Hyteairo programme supports and accelerates the utilisation of artificial intelligence and robotics. One of its objectives is to investigate and remove obstacles and create preconditions for the development and use of artificial intelligence and robotics in the wellbeing sector. (Hyteairo 2021.)

In addition to strategies, there are also legal factors that must be taken into account in telepresence robotics. For example, the Act on the Care Services for Older Persons defines social and health services and social participation as follows:

> *Social and health care services that safeguard long-term care must be implemented in a way that enables older people to feel that their lives are safe, meaningful and valuable, and that they can maintain social interaction and participate in meaningful actions that promote and maintain well-being, health and functional capacity. (L 980/2012.)*

Similar definitions can also be found in the Act on services and support provided on the basis of disability, such as: "The services and support measures needed by persons with disabilities are organised in such a way as to support their independent coping." and: "Daytime activities for persons with disabilities include actions that support independent living and promote social interaction organised outside the home." (L 380/1987.)

In these legal texts, telepresence robotics is not mentioned as a term, but there are similarities in the content, for example in terms of social interaction and opportunities to participate.

The Ministry of Social Affairs and Health publication Teknologia ja etiikka sosiaali- ja terveysalan hoidossa ja hoivassa (Technology and ethics in the care of health care and social services, in Finnish) (2010) summarises the purpose of technology in this sector as follows:

> *Technology must ensure a good life from the perspective of health, social participation and personal autonomy. Both users and employees must be taken into account in the ethical reflection of technology. These refer to the content and operating methods of care and services and their impacts on the lives of service users and the working conditions of personnel. The effects of technology on the situation of the most vulnerable person or group must be considered from the perspective of ethics.*

The same publication also highlights ETENE's statement on the utilisation of technology:

> *In social welfare and health care, technology supports good life, human dignity, self-determination, participation, and human care. The necessary technology is equally, fairly and easily available, and only with the informed consent of the user. The use of the technology is agreed upon with the user when preparing the service plan. The plan requires a comprehensive examination of the user's needs and life situation. Technology must be naturally suited to people's everyday lives, the harmful effects, and risks of using it are assessed, and the user is guided and supported according to needs. Social welfare and health care information systems are reliable and secure, and their use respects and protects the privacy of customers and patients. People can check their information and professionals can help them interpret the information and research results if necessary. At best, technical monitoring enables an independent and safe life. Its use is agreed upon together. The use does not violate human privacy or restrict human contacts. The development, evaluation, procurement, and utilisation of technology require diverse expertise and collaboration. Personnel must be trained. Uniform national recommendations are needed. (Teknologia ja etiikka sosiaali- ja terveysalan hoidossa ja hoivassa 2010.)*

4.2 RECOMMENDED PRACTICES FOR IMPLEMENTATION AND ORIENTATION

Acquisitions and investments are necessary to ensure the continuity and development of a company's actions. In robotics investments, the company must pay particular attention to the planning and preparation of the procurement, taking into account the commitment of the personnel, the different possibilities of implementation, as well as the lifecycle of the equipment. The preparation of investments typically involves plenty of preliminary studies and co-operation with various stakeholder groups. This sub-chapter focuses on the role of personnel in robotics procurement. In other respects, the topic has been discussed in the sub-chapter: Procurement (p. 52). The purpose of this section is to present perspectives on which and what kinds of issues should be taken into account when committing personnel to the procurement and deployment of robotics so that the investment would serve its users efficiently and comprehensively.

Although a good work community is both profitable and productive and supports wellbeing at work, in reality, organisations are constantly changing. Only by developing its actions and competence an organisation can achieve its objectives and maintain its competitiveness in a constantly changing environment. In this sense, change is always both a risk and an opportunity. Working life research emphasises the importance of a culture that supports participation. The logic goes roughly like this: participation increases the possibilities of exerting influence and feeling of managing one's own work, which in turn affects wellbeing at work, which is relative to productivity.

Participation increases opportunities for exerting influence and feeling of managing one's own work. This in turn affects wellbeing at work, which is relative to productivity.

Engaging personnel poses various challenges. One of the biggest challenges is whether the organisation's management has understood engagement correctly. Relying on the general view that everyone needs to be empowered can lead to an undesirable outcome. This means that functional work processes are changed even if the outcome is no better from the perspective of action or wellbeing. However, it is important that work and work processes are planned together at the workplace. As a group, employees can influence how the work should be carried out. (Joensuu 2019.) The difficulty is that employees are not in any way a cohesive group, but the motivation, interests and competence of individuals can vary greatly; how to locate those in the group whose competence and work input would make the most effective use of planning? In general, it pays to engage staff, as a combination of efforts creates cumulative action that benefits the entire organisation.

Participation is a general concept for participating in actions. This means that employees are committed to the organisation and its objectives. The concept of participation is suitable for many uses, but its analytical ability is poor. Participation is usually considered a starting point for exerting influence. In an organisation, participation can be achieved in very different ways. Participation is also different, depending on the individual's motives, objectives and forms of participation. Participation may require your own activity and initiative (activity), or you may end up in it without your own interest and ambition (passivity). This means that the content, significance and results of participation vary. (See e.g. Siisiäinen 2010.)

As regards robotics procurement, there are baseline options for implementation planning. The first is goal-oriented action, where the objectives set are achieved through detailed planning of predefined actions. When defining objectives and actions, the views of the management and the expertise of specialists are used. Management and managers are not very interested in the views or opinions of the personnel. This can be described as top-down development. The basic idea is good advance planning, and the challenge is that decisions made by a limited group do not easily commit people to making decisions. Another option is practical, participatory planning, in which the procurement or its implementation is presented to the personnel for comments already at the planning stage. In this case, the development process is guided – or influenced – by the needs and wishes of the users, working methods and their ideas. New ideas are tested locally and with light resources. This model is described as bottom-up development and can be used to utilise the competence available within to the personnel and to commit the employees to the new operating model. This is the case in theory; in practice, however, a significant proportion of the new ideas seem to come from a relatively small number of participants. Who are these ”change agents”? Where do they come from? How to identify key persons in the development work?

The concept of participation can be grouped into four sub-types, which can be used to specify the various forms of participation and their differences and impacts on planning and development. The participants' activity and passivity, which are the extremes of group dynamics, can be taken as the starting point.

The cross-tabulation of these two variables and the source of motivation/ commitment (internal/ external) produces four sub-types of participation (applying Siisiäinen 2014, 29–46). The four types of participation are:

Internal – Active = Genuine/Unconditional Commitment
Internal – Inactive = Adaptive Participation
External – Active = Participation, commitment to joint decisions
External – Passive = Participation, superficial commitment.

This four-square table is a simple, rough but commonly used analysis or grouping tool that serves group analysis. The result of the grouping is a four-square table in accordance with Figure 7, which can be used as the starting point for the examination, even though in practice, the type formats presented here also appear almost without exception in mixed form.

Source or reason of motivation and commitment	Level or form of commitment: ACTIVE	Level or form of commitment: PASSIVE
INTERNAL	Genuine/ Unconditional Commitment	Adaptive Participation
EXTERNAL	Participation, commitment to joint decisions	Participation, superficial commitment

Figure 7. Four fields of participation (Siisiäinen 2014, 32)

Although Genuine Commitment (Participation) (Internal – Active) is only one theoretical type of participation, in practice a large proportion of participatory development work and new ideas are based on the input of this group. It is a group in which the employee consciously decides, with sufficient information, to participate in actions that implement their interests. This group often combines experience, professional skills and personal interest in development work. This also involves good interaction skills and a functional social network. Team members are ”natural agents of change” in different ways: innovative, sometimes inspiring, and often creative. However, they may not be very effective in turning their ideas into practice. (Adapted, ibid. 33–36.)

New ideas and operating models are mostly put into practice by employees in the Adaptive Participation category (internal – passive). This form of participation is the most common. Members of the group are less likely to be initiators, but they are professionals with the ability and professional skills to change, reinvent or apply change proposals as functional practices in their own professional field. (Adapted, ibid. 36–37.)

For those belonging to the Participation, commitment to joint decision category (external – active), the most important motivating force for participation is their own interest. If it is missing, the source of motivation is external. In this case, the interest in participation is based on an external factor, such as group pressure, position in the organisation or a supervisor’s order. To some extent, such participation is useful; it serves at least as a source of information to be shared, but it is difficult to identify genuine commitment. The person may take initiative, but they do not want to implement or even commit to the perspectives they have presented. In some cases, participation may take the form of indifferent, retractable behaviour without clear statements. Passive resistance may also occur. (Adapted, ibid. 37–40.)

It is difficult for employees with an external source of motivation to demonstrate a particular development interest. Participation is often based on the fact that the workplace organisation enables participation, and the employee feels that it is an obligation or even a necessity. Participation may also be based on a role or position in an organisation that requires participation. Activity and interest vary with the theme under discussion. The key source of activity is how closely the issue to be addressed is related to their work tasks. The group is also heterogeneous in that it includes supervisors, specialists and manual labourers. This category includes members of the Participation, but superficial engagement types (external – passive). (Adapted, ibid. 37–40.)

According to the current view, organisations should pay attention to the development of management and the involvement of personnel. Successful jobs create innovations, growth, and new jobs. Both the national Working Life 2020 project (2013–2019) and the previous OSUVA project (2015) demonstrated the importance of co-development in working life. Work can be reformed when the reformation is well managed and implemented as part of everyday work. Development models that emphasise participation in different ways have thus gained a strong position in new working life development thinking, such as service design or LEAN models.

> Instead of involving general personnel, the company could consider who has a genuine interest, the ability and/or skill in participating in the planning and implementation of robotics procurement. It is also advisable to consider which stage of the process would make the most efficient use of the work input and competence of these people.

4.2.1 CHANGE MANAGEMENT FOR DIGITALISATION

The TEE model presented in this chapter has previously been presented in the Robo-Countryside – robotiikan mahdollisuudet maaseudulla (2020) publication. The model has since been tested in the Working with Robots project and the conclusions and justifications have been supplemented.

All organisations strive to succeed, although each organisation determines success in its own way. Management development is a common goal for success. As summarised by Hamel (2006), management innovations have brought more benefits to companies over the past 100 years than any other innovation.

It has long been believed that competent and motivated personnel are one of the key success factors of all types of organisations. According to Markkula (2011, 69), Argyris (1990) considered participatory management to be the most effective management method, as the participatory operating model increases people's commitment to work and the work community, offering them the opportunity to implement themselves in their work. The challenge was, and still remains, that the potential committed to the personnel is often minimised by adhering to traditional hierarchical management thinking, as the inclusion process is always initiated by the organisation. Participation brings added value to all activities of the organisation. When management and participation are integrated so that the significance of both is emphasised, participation can be utilised diversely in the organisation.

A well-planned and implemented engagement process increases the organisation's personnel's understanding of their own actions and operating environment.

In recent years, digital transformation has signalled the development of organisations. This refers to the process of changing the business processes, actions, and structures of companies. The phenomenon is based on the digital transformation of society caused by information technology. Business and services have been reformed and developed by utilising information technology, artificial intelligence, and robotics applications. This is also one of the major challenges of change. Transformation does not refer to any change; it means a deep change. Processes, people and technology should be transferred to a new era. In a borderless, digitalising world, management itself must also be reformed – partly because traditional change management methods and tools have been developed at a time when change has been simpler. In other words, traditional change management approaches and tools are not as such suitable for managing digital change. (Vitica 2020.)

Digitalisation, robotics, and artificial intelligence with their applications offer a unique opportunity for the wellness sector to renew its actions. In the wellness sector it means, among other things, that the interface between current services and new technology is growing, expanding, and deepening. As a result, existing services can be produced or made more efficient in a new way, and completely new service production methods or service packages can be created. In essence, the digital health and social services reform aims to save costs while maintaining the quality of current services.

Implementing digitalisation into the organisation always requires management. Digital change often leads to a situation where overlapping structures are created. The operation is functional, but money is also spent on running overlapping actions. Good transformation management creates order for a confused situation. It is necessary to review and examine existing processes, systems, job descriptions and tasks in relation to the technology to be adopted. To succeed, the changes require good planning, abandoning overlapping practices, reviewing job descriptions, and learning from old operating models.

Planning alone will not achieve the desired result. Digital transformation requires a clear vision of the future, clarifying the objective and communicating them to the personnel – in other words, a strategy. Time is also a limited resource; the sooner the operating environment changes, the more important it is for management to spend enough time ensuring the organisation's continuous ability to renew and to secure competence. However, the biggest task is to carry out the change and overcome the resistance to change. Strong leadership is needed alongside project management. The organisational culture must adapt to the change and become supportive of it. It must therefore be avoided what one of the most important leadership thinkers of modern times, Peter Drucker, is said to have summarised as follows: "Culture has strategy and structure for breakfast".

So how can all this be accomplished? How do you change the mindset of employees? A participatory operating model (TEE model) supports the planning process and harnesses the development of competence linked to the employees. At the same time, it commits to change. Information (T for Tieto in Finnish) on the technology to be deployed is the basis for the change. Information can influence attitudes, but new information usually requires verbalising expertise and changing the information so that it can be understood by the recipients. Influencing culture requires not only clear content but also an objective and the use of various information channels. But what or who can act as the driver of the change and support information? The true agents of change are the users of technology, i.e., Forerunners (E for Edelläkävijät in Finnish) and those who accept the technology through Examples (E for Esimerkki in Finnish). Robotics is becoming more common through users. In the first phase, it will be introduced by a small number of early adopters who are willing to experiment and reform. Robotics will reach the majority when there are plenty of users, and when new technologies start becoming part of everyday life, actions and the operating environment. Finally, robotics will end up in the public awareness and in common use, i.e., will gain approval, only if early experiences are good and information about them has spread efficiently (Figure 8). (Mäkelä, Pekkola & Tuovinen 2020, 41–42; Rogers 2003, 247–251.)

Figure 8. TEE Model

4.2.2 ACCEPTANCE OF TECHNOLOGY AND THE SIGNIFICANCE OF ATTITUDES

The technology approval models presented in this chapter have previously been presented in the publication RoboCountryside – Robotiikan mahdollisuudet maaseudulla (2020) and they are also presented in the ”sister publication” Software robotics – towards routine task automation (2022).

The introduction of new technologies and robotics raises ideas and also raises concerns in the organisation. Everyone has their own views that are shaped by previous experiences or assumptions about the technological solutions to be adopted. The introduction of technology may even raise doubts or fears about the permanence of one's own work. In particular, the automation of routine work as IT and robotics evolve may be seen as a threat, even if they also create new work tasks. However, changes in work do not happen overnight and can be influenced. (Lintulahti 2019.)

The adoption and use of technology is influenced by the approval of the technology. It has been under investigation for decades. Based on the studies, several different approval models have been built, which can also be applied to the introduction of robotics in work communities. These models show factors that affect the approval and use of the technology. Perhaps one of the most well-known and used approval models is the TAM (Technology Acceptance Model) published by Davis in 1985 (Venkatesh, Morris, Davis & Davis 2003). According to the model (Figure 9), the essential aspects of technology approval are perceived benefits and ease of use as well as the intended use and actual use resulting from them. Even though ease of use is considered to play an important role in approving technology, the benefits of said technology or software will eventually be prioritised over time and use in terms of significance. In addition, ease of use is not considered to increase the use of technology if users do not find it useful. (Davis, Bagozzi & Warshaw 1989.)

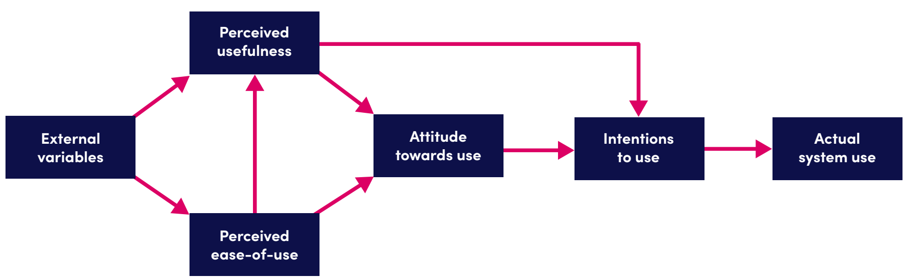

Figure 9. TAM model (adapted from Davis et al. 1989)

The intended uses of the technology are also influenced by factors other than the perceived benefits and ease of use mentioned above. Social factors, the operating environment and factors that enable use also play a role. Also, individual factors such as age, sex, experience and volunteering should not be forgotten. The UTAUT – Unified Theory of Acceptance and Use of Technology (Figure 10) has since been developed based on the TAM Model and other technology acceptance models.

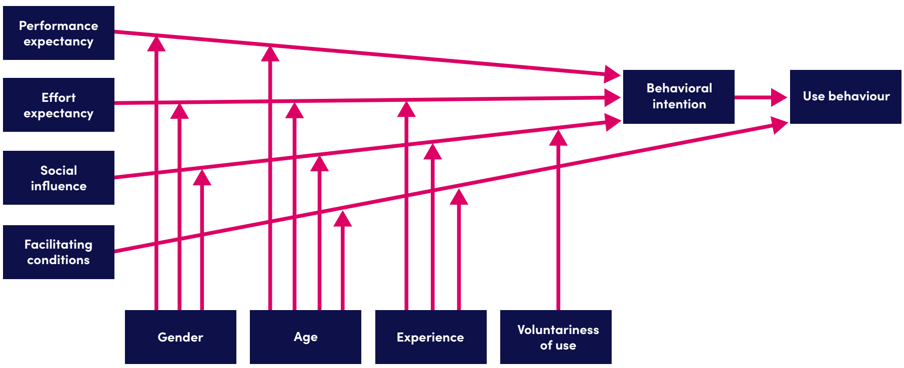

Figure 10. UTAUT model (adapted by Venkatesh et al. 2003)

Similarly, to the TAM model, the UTAUT model includes the intention to use the technology as the main factor influencing its use, which is partly influenced by individual and social factors as well as environmental factors and factors enabling its use. In the model, performance expectations describe how they think the technology will improve their personal performance. Expectations of ease of use describe the expectations related to the implementation of the technology. In addition to experience, the user's age and sex have been found to have a significant impact. The social impact describes the user's assessment of the impact of their social connections – for example, how people close to them or otherwise relevant to them think that new technology should be used. Enabling conditions, on the other hand, describe, for example, the support of the organisation's structures and technical systems for using technology. In this respect, age and experience have been found to be particularly important. All of the above-mentioned factors related to the intended use and use are therefore influenced by the social factors presented together at the bottom of Figure 10. These social factors include sex, age, experience and voluntary use. (Venkatesh et al. 2003)

4.2.3 INTRODUCTION AND IMPLEMENTATION OF ROBOTICS

As is common with any new ways of working, the successful implementation of robotics within an organisation requires awareness and commitment from the entire work community to the introduction of the new operating method. The task of the management is to support the change process and ensure the resources required for the change. This is a critical factor. (Sarala 2000.)

Successful deployment of robots in wellness services requires that personnel accept robotics as part of their daily work tasks and learn to utilise them as part of their work (Turja, Taipale, Kaakinen & Oksanen 2020). The responses to the Tuisku, Pekkarinen, Hennala and Melkas (2017) survey revealed that wellness sector professionals want more researched information on the advantages and disadvantages of robotics in order to be able to accept them as part of the treatment process. Personal track records of robotics and user trials also make attitudes more robotic-friendly and increase the readiness to introduce robotics as part of their own work (Turja et al. 2020).

The establishment of robotics as part of the work processes also requires that the personnel are able to use the robotics application sufficiently well. A prerequisite for a successful implementation process is efficient and sufficiently long orientation, which the employer must make possible. (Tuisku et al. 2017) Training several employees or an entire team as robotics users promotes the establishment of the work community as a common operating method. This also enables peer support and joint development work within the work community. (Lemminkäinen 2003, 153.) There are also good experiences of establishing various developer groups, which include not only users but also supervisors. The developer group plays an important role in the implementation of the robot at the organisational and community level and in providing information on the existence and possibilities of using the robot. (Hennala, Parjanen, Saurio, Pekkarinen, Laakso & Melkas 2021, 55.)

According to studies, new tools and methods should be implemented as soon as possible after the commissioning training. This ensures the training is fresh in the users’ memories, which in turn makes implementation easier. The Chard (2004) study revealed that the more the implementation is postponed, the more difficult it is to start using it later. It is therefore important to start using the robot in the company/organisation as soon as possible after receiving the orientation.

When introducing new robotics, it is good to name one of the personnel as a so-called administrator or key user. They act as the robot competence support contact and are in charge of the implementation within their organisation and as a coordinator in connection with the implementation. In the future, they will be responsible for the orientation of new employees and support others. The key user's tasks also include coordinating further development and liaising with the robotics supplier. (Manual for deploying remote services 2015, 42–43, 52; Hennala et al. 2021, 59.) In a large organisation, the key user may also be assisted by pro-development and technology-friendly robotic agents. Their task is to support their colleagues and the organisation in changing situations and operational development. The change agent takes the changes forward, particularly by setting an example. (Hennala et al. 2021, 55.)

Four tips for successful robotics deployment

- Remember to involve personnel
- Change requires leadership – remember to communicate about change
- Take into account the personnel's attitudes and the significance of the organisational culture in the change
- Don't forget induction

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Chapter 5

Piloting telepresence robotics in the Working with Robots project

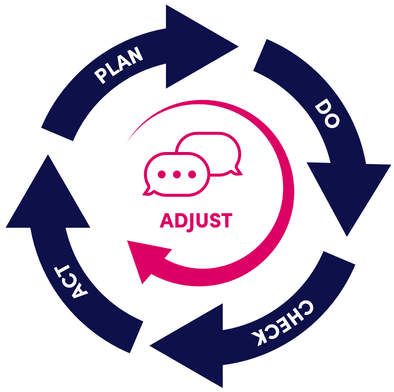
5 PILOTING TELEPRESENCE ROBOTICS IN WORKING WITH ROBOTS PROJECT

Tapio Mäkelä, Toni Pekkola, Essi Heimovaara-Kotonen & Henna-Riikka Markkio

In the Working with Robots project, companies producing wellbeing services in Central Finland piloted telepresence robotics solutions to support their services. The companies involved mainly work with the elderly and services for the disabled. Although some of the participating companies had already been aware of the need for robotics before joining the project, for some, the need for robotics became clearer though increased awareness and experience. The COVID-19 pandemic contributed to the need to find new solutions and technologies for communication between different parties. In particular, the need for remote presence and support for social contacts and increasing interaction methods were emphasised as a result of the restrictions imposed by the pandemic.

5.1 THE FAST TRACK OPERATING MODEL UTILISED IN THE PROJECT

The Working with Robots project developed a development path that favours rapid experiments, or the Fast Track operating model (Figure 11) for the introduction of telepresence robotics. The model was developed to adapt the PDCA model of Deming's quality circle, which aims at problem-solving and continuous improvement of action (MSC 2020). The starting point for the Fast Track operating model was that the pilot tests of telepresence robotics were not allowed to increase the workload in companies and that the device testing could be carried out safely. The Fast Track model focuses on agile action adaptation and continuous dialogue and sparring with both participating companies and equipment manufacturers. The model consists of five steps:



- Plan
- Do
- Check
- Act and
- Adjust

Figure 11. Working with Robots project Fast Track model in telepresence robotics piloting

In the Plan stage, the starting point was to identify the need. During the COVID-19 pandemic, the decline in social contacts between customers of the services for the elderly and the disabled emerged in the public debate due to general and unit-specific restrictions. The need for telepresence robotics emerged strongly in company discussions regarding companies providing wellness services in the Central Finland region. In order to identify the needs, a survey on the current state of robotics was also prepared for the companies participating in the project. The survey was intended to examine not only the robotics already in use by the company but also whether the companies have intentions or plans to introduce robotics in the future. The survey also included questions about the respondents' know-how, needs, attitudes and expectations regarding robotics. In addition to the so-called hard issues, i.e., robotics and equipment, the current state survey focused on softer issues, such as experiences related to company management and participation.

The results of the current status mapping were discussed in the workshops of the Do phase, which also discussed what kind of telepresence robotics is available and what it can be utilised for. During the workshops, participants were familiarised with the telepresence robots (AV1 and Komp, Image 8) acquired for the pilots of the Working with Robots project, and their use. The workshops reviewed the implementation and schedule of the pilots and discussed the uses where the participating companies could try telepresence robotics. The implementation phase also included the actual delivery of telepresence robotics to companies and more detailed orientation to the equipment. According to the original plan, the Komp device trial was intended to last 3–6 weeks, but for practical reasons (COVID-19 restrictions and precautions), the trial period was slightly over six months, depending on the company.

Image 8. Robots selected for the pilots of the Working with Robots project. On the left, Komp and on the right, AV1. (Image: Toni Pekkola)

As the pilots progressed, an interim survey was conducted to clarify the pilot plan. In addition, the participants were interviewed via the devices selected for the pilots and Teams. During the interviews, the topics of the pilots were specified for the second trial round of telepresence robotics. The Komp device was upgraded to a new device version for a second trial period of 2 to 3 weeks. Intermediate surveys, including interviews and device updates, were a key part of the Check phase in accordance with the Fast Track model, which progresses to the next phase in accordance with the principle of continuous evaluation.

In the Act phase, companies were able to make a second trial round with updated Komp versions. At this stage, it was essential to make adjustments based on the experiences of the previous experiment in order to maximise the benefits of the entire pilot. From the point of view of the companies, the Act phase is used to make decisions on making the experiment permanent and, for example, purchasing the necessary hardware/software for companies.

The Adjustphase of the Fast Track model is a continuous adaptation of robotics experimentation and also includes fine tuning. This included a dialogue with both companies and the equipment manufacturer. Where necessary, the companies also received more detailed sparring from Project Specialists to support their experiments.

5.2 COMPANIES INVOLVED IN PILOTING

Four Central Finnish housing services and companies producing daytime activities for special groups participated in the Working with Robots project. The companies participating in the pilots had identified the need to utilise new technologies and robotics, for example through previous development projects and webinars and events on the topic. Questions and technology related to robotics had also been discussed at events organised by interest groups in the field. In addition, the COVID-19 pandemic accelerated the need to find solutions that enable social interaction and to support the staff in this challenging period. In summary, the companies participating in the project had an interest in care robotics, but there was little structured information and minimal previous user experiences. Although each participating company had similar starting points for development needs, each company also had its own individual needs and ideas for using robotics in its daily actions.

KARPALOKODIT

Karpalokodit by Karstulan Hyvinvointipalvelusäätiö offers supported housing in three different units for people with disabilities and intellectual disabilities. Each unit is unique and forms its own community. In the Karpalokodit residences, residents can live an independent and personal life in a home-like and safe environment. Karpalokodit values individuals and communality and places particular emphasis on the culture of caring. Caring is visible in all their actions. (Karpalokodit 2021.)

JYVÄSSEUDUN HOIVAPALVELUT

Jyvässeudun Hoivapalvelut Oy is a social enterprise that produces services for the elderly. It is owned by the Jyväskylän Hoivapalveluyhdistys. The values of the association are humanity and love, which guide their actions. The care services have a total of five supported housing homes in Jyväskylä and Muurame. The services mainly comprise enhanced housing services for older people, but the range of services also includes home and nutritional services. The piloting of the Working with Robots project mainly focused on services related to enhanced housing. These services are intended for people who need 24-hour care and attention. (Jyväskylän hoivapalvelut 2021.)

TAITOLA HOIVAPALVELUT

Taitola Hoivapalvelut Oy organises daytime activity for special groups at Äänesseutu and Jyväskylä offices as well as online and, from October 2021, also in the Eksote operating area in South Karelia. The objective of Taitola is to produce high-quality content for everyday life through physical activity, manual skills and performing arts. One form of action is recreational groups that take place three times a week, and camp activities around Finland. Virtual enrichment activities are produced for the YouTube channel. All content produced for the channel is free of charge. Taitola cooperates with companies and organisations that are prepared to include people from special groups in practical training and later in a more permanent employment relationship. (Taitola 2021.)

KESKI-SUOMEN VAMMAISPALVELUSÄÄTIÖ

The purpose of the Keski-Suomen vammaispalvelusäätiö vices and services based on individual contracts. The purpose of the foundation is to promote the living conditions of people in need of special support as equal members of society and to develop service systems to meet their needs. The values guiding the actions include reliability, respect for human dignity and development. (Keski-Suomen vammaispalvelusäätiö 2021.)

5.3 DEVICE MAPPING AND PROCUREMENT

The project carried out a device mapping of the available devices. The study was carried out based on information received from equipment manufacturers and retailers, online device descriptions and public price information. In addition, user experiences from networks of universities of applied sciences and universities, private users, device manufacturers, as well as national and international publications were examined. Equipment selection took into account usability, user track records, reliability of equipment, planned target groups, availability, price, novelty value, data security and the possibility of cooperation with the equipment manufacturer. From the perspective of data protection, the mobility of the equipment was excluded from the features, but the degree of automation had to be determined for the equipment. The selection table below (Table 2) was used in the device comparison. The table also presents some examples of the observations made in the comparison for the supplier selected for the project.

TABLE 2. Device comparison table

Manufacturer	**Product information**	**Price**	**Pros and cons**	**Other comments**
Contact information and other necessary information	Product name and model	Price and possible additional costs (see chapter Procurement)	E.g. usability, reliability, mobility	E.g. additional features, peripherals, usage restrictions, materials

The suitability of the technology selected based on the company contact (equipment manufacturer) and other available material was assessed as good. Direct contact with the manufacturer and the importer was considered an advantage. The online video presentation and materials were provided directly by the manufacturer. The price comparison showed that the device was not the most expensive choice and usability did support the choice. The procurement was based on an estimated price-quality ratio. Another criterion for procurement was effective cooperation with the manufacturer in terms of pilot use. In addition, there were only individual pieces of equipment on the Finnish market, which brought novelty value to the experiment. Good experiences and examples of equipment use had already been gained in other parts of the world.

Based on the device mapping, No Isolation's Komp and AV1 (Figure 9) were selected as the devices to be piloted. After more detailed enquiries, the availability of equipment and in-use support were also assessed as good. The device manufacturer also provided orientation to the selected devices.

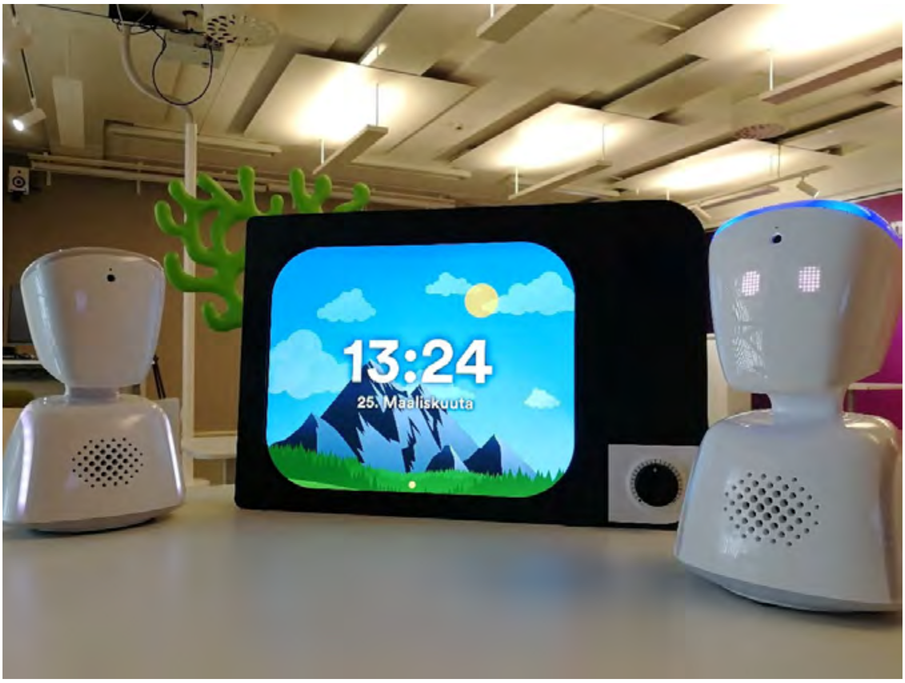


Image 9. Based on the device mapping, AV1 and Komp were selected as the devices to be piloted in the Working with Robots project. (Image: Toni Pekkola)

AV1

AV1 is a telepresence robot whose purpose is to enable participation and interaction with a person who, for example, cannot participate in a group situation due to an illness. AV1 uses the microphone, speaker and camera built into the robot (Figure 12). The robot also has two motors that enable it to rotate 360 degrees for maximum good video and audio connectivity. The device connects with an application available for mobile devices: smartphones and tablet computers. AV1 uses both wireless network connection and mobile data, which makes it possible to take the robot out, for example. The durable exterior, long battery life and light total weight also provide easy mobility. (No Isolation 2021.)

A robot placed in the environment remotely transmits video to the mobile device of the participant, either the phone or a the tablet. A remote participant can ask for a permission to speak and speak through a robot by controlling the robot using a mobile device. The user can express their emotional states to others using the robot's expressions. AV1 plays audio in bi-directional mode, but video only in one-way mode. (No Isolation 2021.)

AV1 was originally developed as a physical avatar for one person. It offers, for example, children and young people who are away from school and physical social contacts for a long time due to illness or reduced immunity the opportunity to be present in classroom education and to communicate with friends. The AV1 robot is best suited for this kind of use.

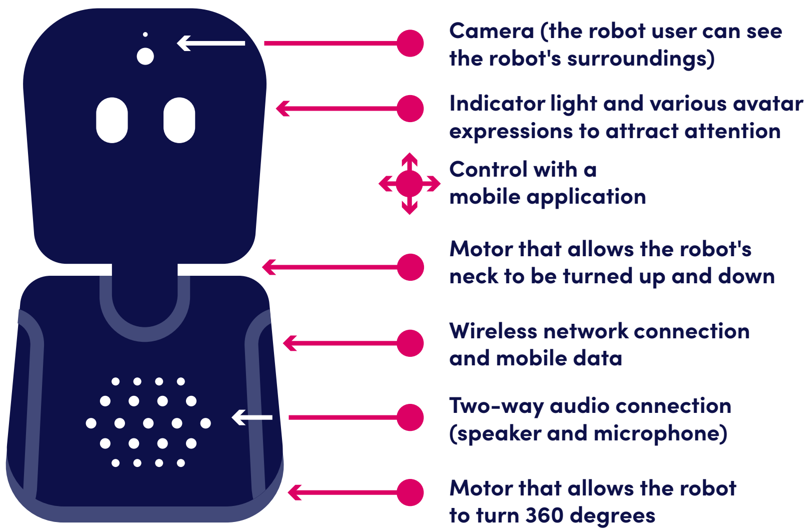


Figure 12. AV1 robot features

KOMP

Komp is a mobile device for receiving messages, images and video calls over a private network from separately invited users, such as friends and family. They need the Komp app, which is available for both iOS and Android devices, to use the device. A browser-based PRO application is available for professionals, such as nursing workers, and in addition to the above, it offers various maintenance, reminder, and calendar functions. (No Isolation 2021.)

Komp is designed to be very easy to use. It does not require IDs or passwords and does not need to be updated or downloaded. It looks like an old-fashioned TV and consists of a large, separate screen with only one turn switch (Figure 13). In addition to receiving pictures, messages and video calls, you can also see the time, date, and weather status on the Komp screen. In addition, reminders related to facilitating the daily rhythm can be pre-programmed, for example, for agreed appointments or taking a medicine. (No Isolation 2021.)

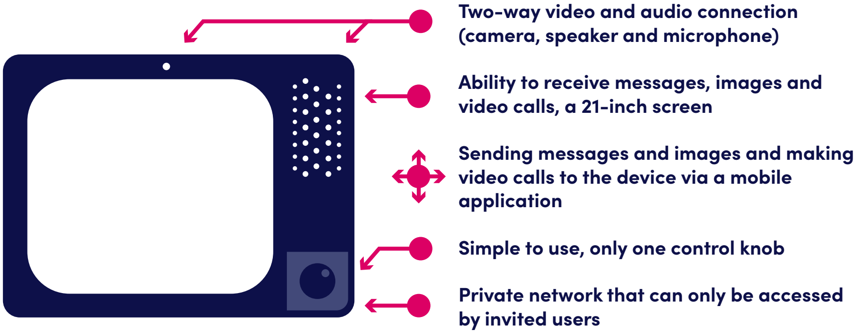


Figure 13. Komp device features

The user of Komp can determine when they can be reached by turning the device on or off and by controlling who they want to invite to their closed social network. In order to ensure data security, the Komp application allows the user to choose how long images are stored. Video calls cannot be recorded, and video streaming is protected, i.e. no other Komp user or application user can access streamed content. (No Isolation 2021.)

5.4 THE PROGRESS OF PILOTING

The first phase of telepresence robotics (approximately 6 months) was piloted in target companies as part of the Fast Track operating model. At the end of the first phase, the equipment supplier, No Isolation, delivered the updated Komp devices for the project and the two AV1 robots involved in the pilot were transferred to new companies.

For piloting, the Jamk project team familiarised itself with the properties of the Komp and AV1 devices, after which the devices were prepared and delivered to companies. In connection with the delivery, equipment orientation was arranged for the persons participating in the pilot. At the same time, the company's key users were defined for the devices and software. The orientation was also prepared to be implemented remotely, but eventually all orientation was carried out on-site, either at the company's or Jamk's premises. In one orientation, some of the personnel participated remotely and tested telepresence robots immediately.

During the pilot period, support services were produced for companies in cooperation with the equipment manufacturer. At the same time, companies were also offered opportunities to exchange ideas in terms of the use and utilisation of equipment. The answers to the additional questions received from the companies were clarified with the equipment manufacturer and, if necessary, with the relevant authority (such as the Regional State Administrative Agency and the Office of the Data Protection Ombudsman). Development ideas from companies were also brought to the information of the equipment manufacturer.

The experiences of users were collected in individual or pair interviews. The interviewees were provided with themes that were discussed in advance and on which the discussion was based. 1–2 employees from each company participated in the interviews.

There were four interview themes:

- What is the need for robotics in your company?
- How have you utilised the robotics that were tested during the project?
- What kinds of experiences and views have you formed of robotics?
- How do you experience the potential of robotics for the future in your field?

The interviews were examined, documented, and analysed in joint workshops of Jamk's School of Health and Social Studies Project Specialists. The results were used to analyse, among other things, the opportunities offered by remote presence technologies to diversify the working methods of nursing staff and to support the interaction on the one hand between staff and customers, and on the other hand customers and family members.

After the completion of the first phase piloting, the equipment supplier delivered the Komp devices updated for the project as agreed and the AV1 robots involved in the pilot were transferred to new companies. The feature updates for comp devices concerned the accuracy/dimensions of the display, the microphone (wider range) and the carrying handle, which allows for easier and safer movement. The device was also improved to be more stable on a platform. The upgrade did not significantly change the use or usability of the device.

At the end of the pilot phase, a final evaluation by the companies will be carried out using the Webropol survey. Where applicable, the survey repeats the questions in the initial survey to assess the overall change. The analyses and summaries of the surveys (in Finnish) will be published on Jamk's blog platform by the end of March 2022.

5.5 PILOT TOPICS AND PRELIMINARY EXPERIENCES

At the beginning of the piloting, the participating companies were presented with various opportunities to experiment with telepresence robotics as part of their own operations. These included information on robotics and the evaluation of pilot sites, contact with family and friends, service provider connection to customers or personnel, cultural services, own service production and device management. In the end, however, companies, personnel and customers themselves defined device trials according to their interests, needs and opportunities. This chapter describes the experiences of telepresence robotics that have been gained in the project by the time of this publication. A more thorough and comprehensive analysis will be summarised in the blog article published in spring 2022 when the interview and observation material produced by the second pilot phase has been analysed.

EXPRIENCES OF USING KOMP

The main purpose of the Komp device in the company's device pilots was to use a video call connection between the customer and their family member or loved one. The experiences and feedback from both residents and their relatives were positive throughout. The use of the device was found to be fairly or very easy. This was particularly facilitated by the automatic opening of the connection. The colour screen and image resolution also attracted a lot of praise. In addition to calls, the device was also used to view and share pictures (photographs), for which the large screens were considered to be particularly well suited. Komp does not have a touch screen; instead, the device is controlled by a single button. The elderly group of users thought this facilitated the use of the device.

The Komp device was also used in communication between the customer and the nursing staff within the housing unit. The remote connection was found to have positive impacts for both the customer and the personnel: The customer calmed down when they were able to connect with the nurse and, on the other hand, the nurse was able to guide the customer through visual and audio connections in simple daily activities, such as dressing and keeping to the schedule, without being physically present. Both customers as well as nurses and instructors seem to appreciate that the device displays the user's face, and the sound is transmitted in real time. This makes communication more immediate and, in its own way, more intimate than a normal phone can do.

If necessary, the customer living in the housing unit was able to use the device to talk to the nurse through a visual connection. With the help of the telepresence robot, the nurse could also ”move” in the customer's apartment and thus get an overall picture of the situation. This way, for example, the missing glasses were located and the nurses' working hours and steps were saved. This is particularly important in certain kinds of environments, such as in housing units that are ”decentralised”. The personnel could be in another building or on a different floor of the unit and still have visual and audio contact with the resident.

One of the final stages of the Komp piloting took place in the Christmas market (2021), where the residents of the supported housing unit were able to use Komp to monitor the market programme, sales point events and product sales as well as to experience the market atmosphere remotely through a COVID-19-safe connection. Telepresence robotics attracted interest in the market. Based on the experiment, several inquiries were received on how equipment could be made available for use and whether it is possible to participate in pilots also from outside Central Finland.

As a rule, telepresence robotics is designed for communication and participation. The most significant use is indeed the interaction and communication between customers and their families. In Karpalokodit, the phenomenon, which was observed in almost all pilot sites, was described as follows:

The piloting carried out during the COVID-19 pandemic made it possible for people who had lived relatively far away to keep in regular contact with the resident with Komp.

This trial use received positive feedback from both family members and the customer. The customer felt that the meeting felt more like a visit than in a situation where they only talk into a phone without a visual connection to the speaker. The user experiences gained from telepresence robotics – such as the ease of using and maintaining the equipment and communication – also increased the interaction between family members and residents. When the Komp device served as the first experience of a smart device for an older resident, after a hesitating start, a positive experience was accumulated over time through user experiences, and an interactive connection between the customer and sometimes very distant family members could be created and established.

Individual actions supporting social interaction were also implemented and participation in things like shared events, group guidance and band activities of the housing unit, was strengthened remotely. Various discussion groups were also organised using the Komp device. Taitola Hoivapalvelut care services also tested the implementation of interactive exercise sessions using the Komp device.

The personnel used the equipment for communication and expert consultation between the units and, for example, for the remote reception and consultation of a nurse. The use of a professional application intended for personnel during the pilot period was left for individual experiments, in which calendar reminders were used to support the resident's daily routine. As a rule, the staff's experiences of Komp were positive. The device enabled interactive participation and communication remotely. The device was easy to use and the user menu was clear, simple and easy to use.

The interviews also produced some corrective/critical feedback. Even though group guidance for elderly people with memory disorders through Komp was a successful experiment and a functional solution from the perspective of customers, the implementer felt that it was clumsy compared to the Teams platform. The answer mainly highlighted the alternative activities offered by Teams compared to Komp. The pilot experiences also highlighted the need to utilise commonly used plain images or the user's own images in connection with reminders. The project team actively cooperated with the device manufacturer and forwarded the development proposals to No

Isolation. In addition, other development proposals that emerged were submitted to No Isolation to improve the applicability and usability of the device.

From an ethical perspective, there was particular discussion on the feature where the visual connection could be opened automatically for clients with an intellectual disability. When the video connection is switched on, no user intervention is required; the connection will open automatically within a predetermined time. This feature has been developed to ensure ease of use. To open the video connection, the device must be turned on. The resident must understand that when the device is turned on, the connection can open. The user determines who can communicate via the device, as only invited users can send content and make video calls. If the recipient does not want to open the connection, Komp is switched off. When turned on again, photos and messages are once again displayed on the screen. To improve privacy, streaming is encrypted, and video calls are not recorded. (No Isolation 2021.)

EXPERIENCES OF USING AV1

The AV1 pilots focused on various outdoor activities, such as nature and city walks, where company customers were able to follow seasonal variations and see and experience familiar environments. AV1 enabled experiencing outdoor activities even during hot weather, when the weather was too hot many residents to go out. The fishing trip included in the preliminary plans was regrettably cancelled because the robot's water and spill resistance could not be guaranteed. The AV1 robot was also used experimentally in enrichment activities, which allowed the resident to participate in actions that interest them, such as band rehearsals, discussion groups or physical activity sessions, with the help of a telepresence robot. Unlike the original intended use, the AV1 robot was also tested under the guidance of several person groups, but its smooth utilisation would require streaming the mobile device's display to a larger display.

Except for one company, the AV1 robot was suitable for use in all wellness sector companies participating in the project. In this company, the personnel estimated the customers' functional capacity to be such that they do not benefit from the possibilities offered by the equipment.

5.6 SUMMED-UP OBSERVATIONS ON TELEPRESENCE ROBOTICS

The resource problems in nursing and the pandemic, which have both recently been much talked of in connection with nursing, were also strongly reflected in pilot companies during the robotics trial period. Limited amount of time and limited human resources slowed down the utilisation of robots and restricted experiments compared to the original plans. On the other hand, a longer pilot period supported the utilisation of robotics and encouraged those employees who initially had prejudices – and thoughts on robotics – to experiment with devices. Attitudes changed with personal experiences, and prejudices about the workload of introducing robotics proved to be wrong. Experiences showed that telepresence robotics could save both time and steps. This is an interesting observation, as care robotics has usually been examined (e.g., Venta, Honkatukia, Häkkinen, Kettunen, Niemelä, Airaksinen & Vainio 2018) from the perspective of acceptability and technical fitness. The perspectives related to effectiveness and efficiency have been rare.

When asked about the significance of the robotics experiment for the meaningfulness of work and wellbeing at work, the following answers were received:

”New ideas for my own work, a broader view of my personal network as a result of collaboration. New perspectives for guidance work.” (Taitola Hoivapalvelut Oy)

”There have been experiences of success and pleasure in the fact that the target group has had a visual connection with their relatives.” (Jyväskylän Hoivapalvelut)

”It has provided additional means for maintaining the residents’ social contacts and thus increased work motivation.” (Karpalokodit)

Nearly all of the interviewees highlighted the special situation caused by the pandemic, as it was necessary to restrict meetings between family and customers. In these special circumstances, communication and maintaining interactive relationships were exceptionally challenging. Telepresence robotics provided one effective tool for this challenge. Based on the user experiences gained during the project, it can be said that the experimental robotics were able to alleviate the feeling of loneliness, increase perceived wellbeing and thus support independent living. The interviewees also believed that using remote presence devices reduced the exposure of staff and customers – or at least lowered the exposure risk.

Robotics experiments in companies strengthened the previous understanding that the introduction of new technology requires an allocated time resource and a designated person in charge. In practice, it would be good if the responsibility for commissioning and induction and support of other personnel had been shared between several people or an entire team. In this way, possible absences or acute work tasks would not cause a break in the introduction, experiment or utilisation of robotics. This also enables better peer support and the development of robotics fromthe starting points of the work community. However, brainstorming new applications requires that the personnel are able to use the robotics application sufficiently well and feel that feel confident using it. The following development proposal was made by the Keski-Suomen vammaispalvelusäätiö disability services foundation:

The family members should be provided with their own training. -- Some employees also need more support in using the device.

It was also found necessary for the expert team to communicate regularly with companies and provide ideas and inputs for the utilisation of robots for various purposes. Without this, use is easily narrowed, and the existence of various features and opportunities is forgotten.

These experiences reinforce the acceptance of the introduction of robotics in accordance with the TEE model (see chapter Change management for digitalisation). Marketta Niemelä (2021), VTT's leading Researcher, has also stated: ”Professionals must be able to experiment with solutions and identify their benefits”.

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Chapter 6

Tips for the deployment of robotics in the wellness sector

6 TIPS FOR THE DEPLOYMENT OF ROBOTICS IN THE WELLNESS SECTOR

Essi Heimovaara-Kotonen, Tapio Mäkelä & Toni Pekkola

Since the early 2010s, health care organisations that have become accustomed to a shortage of doctors have also had to get used to the shortage of nurses. In addition, almost one third of practical nurses and nurses will retire by 2030 (KEVA 2016). Since the 1990s, robots have been thought to offer solutions to the resource problem of nursing. Each home was thought to have a multi-purpose robot that was envisioned as an assistant, safety guarantor and even a companion. A lot of money has been invested in such research and development of nursing robots around the world, but so far, the results have been quite modest. The technology required for a multifunctional care robot intended for human substitution does not exist and is not in sight. Instead of homes, robots are more useful in an institutional environment, where routines are clear and repeated. In institutions, robots can reduce the amount of mechanical routine human work, which would free up nurses' time to interact with customers. (Van Aerschot & Parviainen 2020.)

Robotics also has impacts on the wellbeing of nursing staff. According to the reports, various robotised tools and robots make it easier to carry out certain work phases or work tasks. The Working with Robots project has revealed that nurses expect support and assistance from the new technology for the mental and physical workload of the work, which is not fully or automatically realised even though savings related to time use and steps were reported. In connection with the pilots, the importance of orientation and support during the implementation of robotics was also emphasised. The best results are achieved when both nursing staff and customers participate in the deployment of robots and the accumulated experiences are widely shared (Figure 14).

It is good to get the nursing staff to participate in the development related to the introduction of robotics.

Positive robotics experiences affect attitudes. The personnel must be able to realize the benefits themselves through successful experiments.

Negative experiences slow down the introduction and acceptance of robotics. The technology must be sufficiently ready for deployment, easy to use and secure.

Investing in robotics requires piloting in order to identify the positive welfare, personnel and cost effects.

Figure 14. The results of the Working with Robots project are consistent with the observations made by Niemelä (2021)

The use of robots in social welfare and health care will expand in the next few years as digitalisation progresses. Service robots are already used fairly routinely in both logistics and support services. Similarly, the utilisation of rehabilitation robots is relatively advanced, and technology offers completely new opportunities for maintaining and restoring functional capacity.

”The health care service system has its own world with strict rules – a robot cannot just walk in there.”
(Niemelä 2021)

Although increasing robotics already makes it possible to improve the efficiency of welfare services, the most important ones are the new operating methods developed by work communities. The introduction of digitalisation, robotics or new technologies alone will not result in good services, more satisfied customers, or more functional work communities. Technology is developing rapidly. Experiments and user studies show that achieving benefits requires the personnel to develop existing operating models and processes so that the innovations created by new technologies can be utilised cost-effectively in work communities. Only the application of new technology together with new operating methods can bring the desired benefits. (Kunta-alalla seurataan työn murrosta 2019.)

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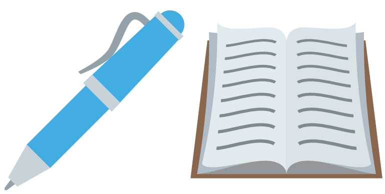

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The utilization of robotics in the wellness sector (social and healthcare sector) gives many opportunities for the development of operations, for the participation of the personnel and customers of nursing facilities, and for the streamlining of work processes. The successful introduction of robotics requires time, familiarization, and experimentations.

This publication describes wellness robotics in general and goes deeper into the implementation of telepresence robotics in the wellness sector. The publication presents telepresence robotics pilot experiments in SMEs in Central Finland, implemented in the Working with robots (ESF) project. The results of the experiments are promising – both company personnel and customers have experienced successes and developed new ideas for everyday life.

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