

# Care robotics

Orientation pathways for users and the society

Helinä Melkas, Christine Gustafsson, Lea Hennala, Satu Pekkarinen, Outi Tuisku,  
Kirsten Thommes, Julia A. Hoppe, Rose-Marie Johansson-Pajala



#### AUTHORS:

Helinä Melkas, Christine Gustafsson, Lea Hennala,  
Satu Pekkarinen, Outi Tuisku, Kirsten Thommes,  
Julia A. Hoppe, Rose-Marie Johansson-Pajala

#### GRAPHIC DESIGN AND ILLUSTRATIONS:

Vinkeä Design Oy, Petri Hurme

#### CHARACTER DEVELOPMENT:

Pilvi Veijanen

Lappeenranta-Lahti University of Technology LUT  
LUT Scientific and Expertise Publications  
Tutkimusraportit – Research Reports 106

ISBN 978-952-335-499-9 (PDF)  
ISSN-L 2243-3376, ISSN 2243-3376

Lahti, Finland, 2020



JPI MYBL is supported by J-Age II. J-Age II is funded by Horizon 2020, the EU Framework Programme for Research and Innovation, under Grant Agreement nr 643850.



# Foreword

Are you interested in the topic of care robots? What is your link to the topic—are you an interested citizen, a potential user, a relative, a care professional, a care manager, an educator, or a decision-maker at the local or national level? Do you, perhaps, represent a technology company or an interest organisation? Dialogue concerning care robotics is essential at the different levels of the society, from individuals through to the wider societal level. Everyone benefits from good care robot orientation.

This guide serves different kinds of readers—anyone who is interested in care robots. In particular, it is helpful for care organisations, professional caregivers, and decision-makers at different societal levels,

in vocational and continuing education, and for individuals' use.

Its aim is to 'wake people up': to visualise, raise questions, and provoke thought, rather than give precise answers. Its aim is to identify essentials, offer tips, and encourage and support people in care robot orientation activities—as providers or receivers—but also in finding out more about care robots and participating in general discussions about their use.

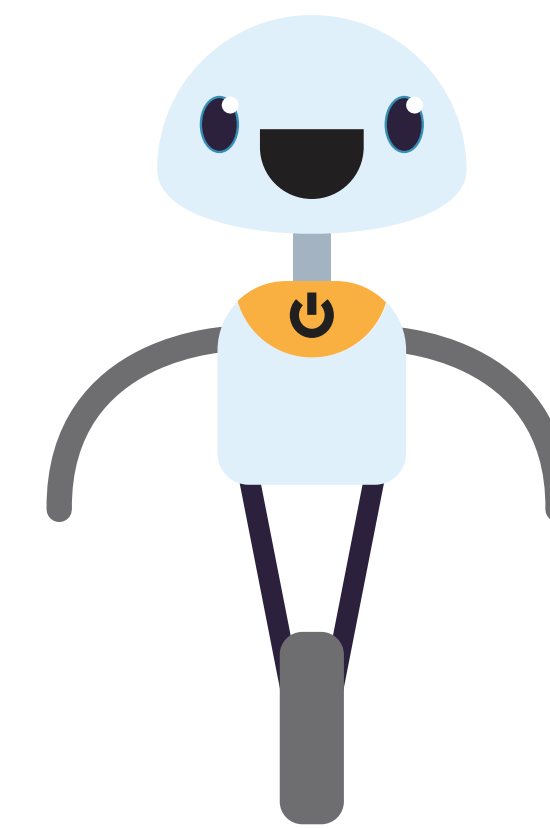
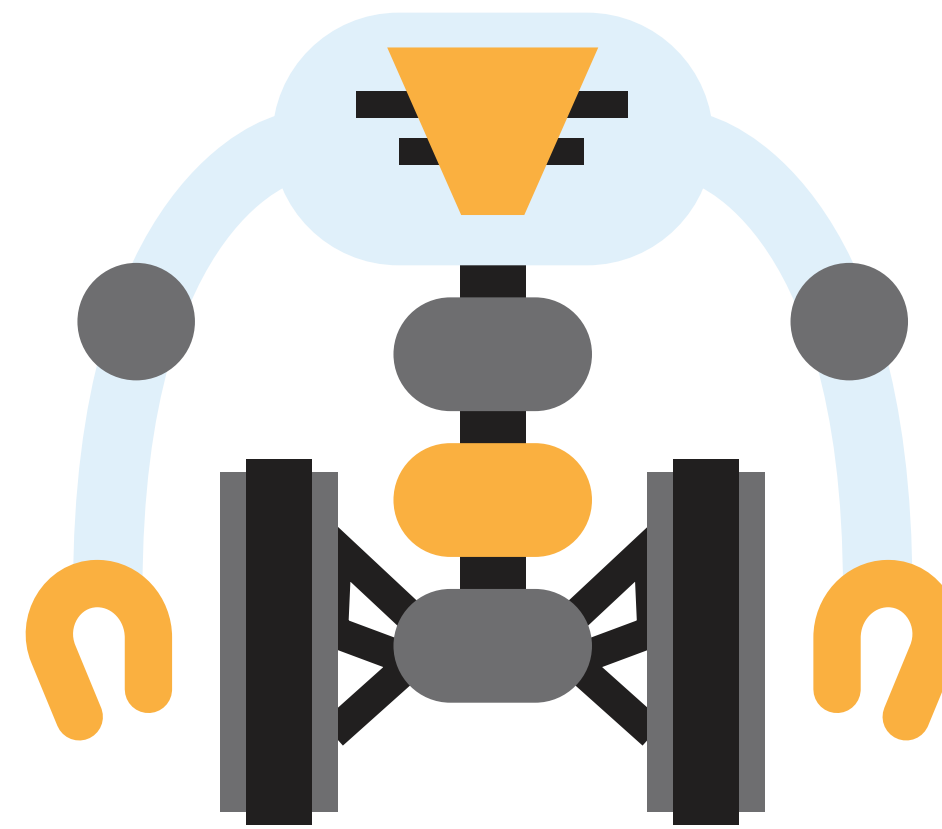
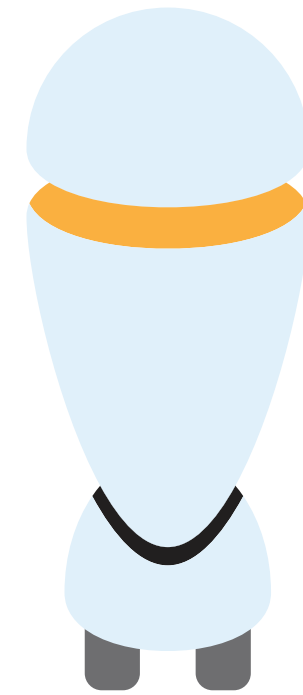
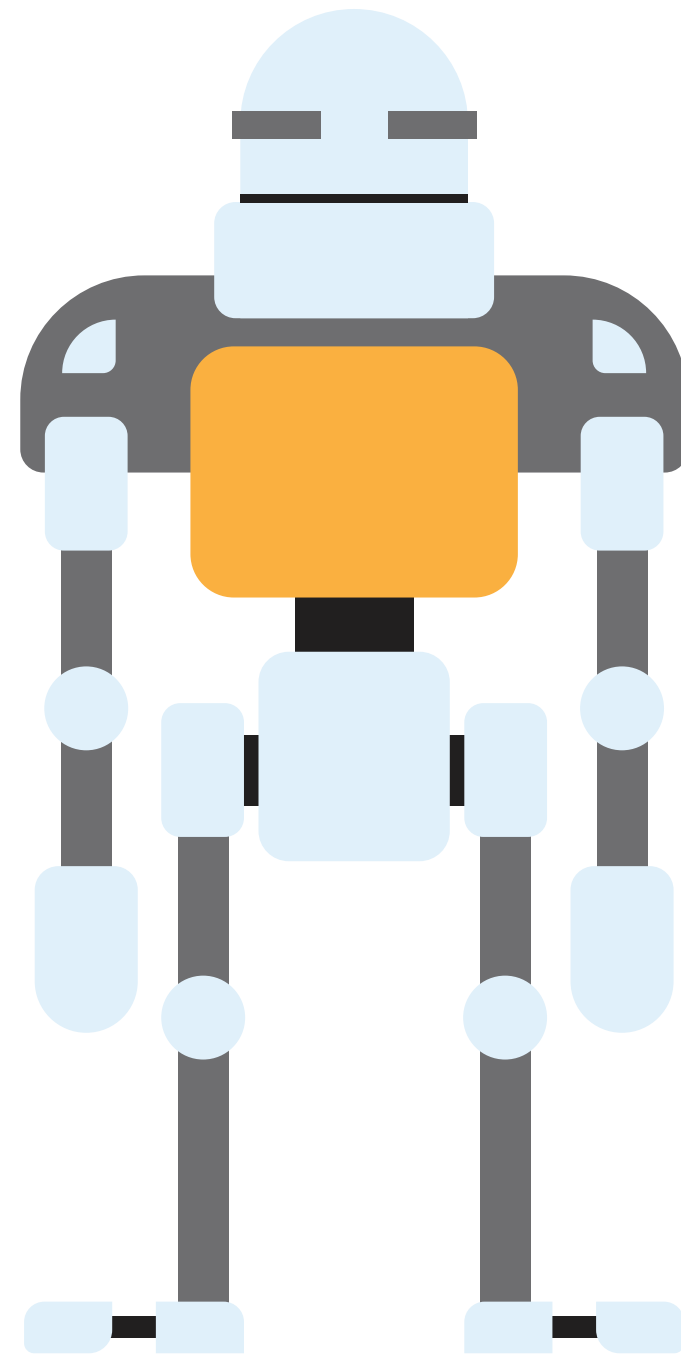
We also hope that it will increase familiarity with care robots among people who are still unacquainted with them. We hope that each reader will locate the sections that are most relevant for her/his needs and interests.

*See the animation  
associated with the guide.*

The guide was prepared in an international research project called ORIENT, which focused on orientation for the use of care robots in welfare services for older adults. The guide is based on scientific articles and unpublished material produced by the project, and more than 130 user and societal-level interviews conducted in Finland, Sweden, and Germany. The guide uses numerous interview quotations to represent the voices of the users and various stakeholders.

In Lahti, Finland; Eskilstuna, Sweden; and Paderborn, Germany, March 2020

*The authors*



# Introduction

Robots can be utilised in industries and services. Service robots are utilised by service providers or individual consumers, while care robots are service robots that are primarily utilised in welfare and care

services. Their tasks are quite similar,<sup>1</sup> so the line between the two is not easy to draw. Service robots utilised in care services help, for example, to monitor health behaviour, assist older adults and their

<sup>1</sup> Okamura et al. 2010

*We perceive care robot orientation as the continuous co-creative process of introduction to technology use and its familiarisation, involving the learning of multi-faceted knowledge and skills for effective use.*

relatives and professional caregivers in daily tasks or rehabilitation, or provide cognitive or emotional support, such as companionship.<sup>2</sup> Care robots are machines that operate partly or fully autonomously.<sup>3,4</sup>

Robot technology develops rapidly to support new tasks and roles, so *the role of care robot orientation will become an increasingly important societal issue*. In order to understand the use of robots in care, it is necessary to understand and value the orientation process for the different stakeholders involved. We perceive *care robot orientation as the continuous co-creative process of introduction to technology*

*use and its familiarisation, involving the learning of multi-faceted knowledge and skills for effective use.*

Care robot orientation is essential in society. When knowledge about care robots and their use is lacking, it is difficult to know what to ask for or to seek information about; therefore, care robot orientation must have a firm basis in trustworthy knowledge and information and must respect individuals' wishes. Special ethical responsibilities arise when dealing with individuals who have reduced decision-making ability, such as those with cognitive impairment. Society often stereotypes older adults as technology users, through age-based assumptions, as passive

<sup>2</sup> Wu et al. 2012

<sup>3</sup> Glende et al. 2016

<sup>4</sup> Goeldner et al. 2015



recipients,<sup>5</sup> so it is essential to understand and take into account the diversity of users.<sup>6</sup>

The most significant factor that motivates an individual is the benefit that she/he obtains from using a certain type of technology. The impacts of different types of technology use are often indirect and difficult to identify and the skill levels of individuals vary. Technical care devices do not exist in a vacuum: behind the technology, there is the user with her/his values, the living (or working) environment, and related service activities.<sup>7</sup> Technology brought into care services is not a separate ‘island’: systems thinking<sup>8</sup>

is vital for identifying important questions, making informed choices, and recognising their impacts.

The need for care robot orientation does not only concern end users, older adults living in their homes or in assisted living settings, and their relatives. Professional caregivers also face challenges in the new social and physical environments characterised partly by care robots. They have a central role to play in listening to older clients’ needs and guiding them. Care robot use is not yet common among professional caregivers, and robots are still largely in the development phase.

*Care robot orientation  
is essential in society.*

5 Östlund et al. 2015

6 Flandorfer 2012

7 Melkas 2011

8 For example Midgley 2011

*New technologies,  
such as care robots,  
contribute to broader  
societal changes.*

Implementing care robots requires changes in work practices and in collaboration between organisations, as well as in the knowledge and skill levels of personnel. If there are shortcomings in the orientation and implementation phases, the introduction of such technologies may lead to fatigue, loss of work motivation, and additional costs.

However, the introduction of technology in elderly care has been highly valued by professional caregivers, who wish to participate in technology development.<sup>9</sup> They may see it as an important ethical issue not to exclude older adults with, for example, dementia from technology use, but to offer technology support for increased wellbeing.

9 Gustafsson 2015

Importantly, care robot orientation is essential for decision-makers and a variety of other societal stakeholders. New technologies, such as care robots, contribute to broader societal changes, involving constant ‘negotiations’ with user preferences and thinking models, policies, infrastructures, markets, and science.<sup>10, 11, 12</sup> Innovation in structures, mindsets, and practices that involve stakeholders from different sectors, domains, and levels is also important.<sup>13</sup>

This guide focuses on *orientation pathways for (present or potential) care robot users and various societal stakeholders*. We wish to promote orientation activities as vital for all. It is obvious that different dimensions are needed depending on the context and the people

10 Pekkarinen & Melkas 2019  
11 Akrich, Callon & Latour 2002  
12 Geels 2004  
13 Loorbach et al. 2009

concerned. This is what we mean by *pathways*: seeing the importance of orientation at the level of people and the society; finding one's own appropriate way of implementing it; and 'waking up' to systems thinking and listening to the needs of users.

We emphasise the importance of taking into account the perspectives of older clients, their relatives, caregivers, care service managers, and care organisations, but also the many different kinds of societal level stakeholders; for example, public services and administration, the non-profit sector, business and industry, education, interest organisations, and the media.

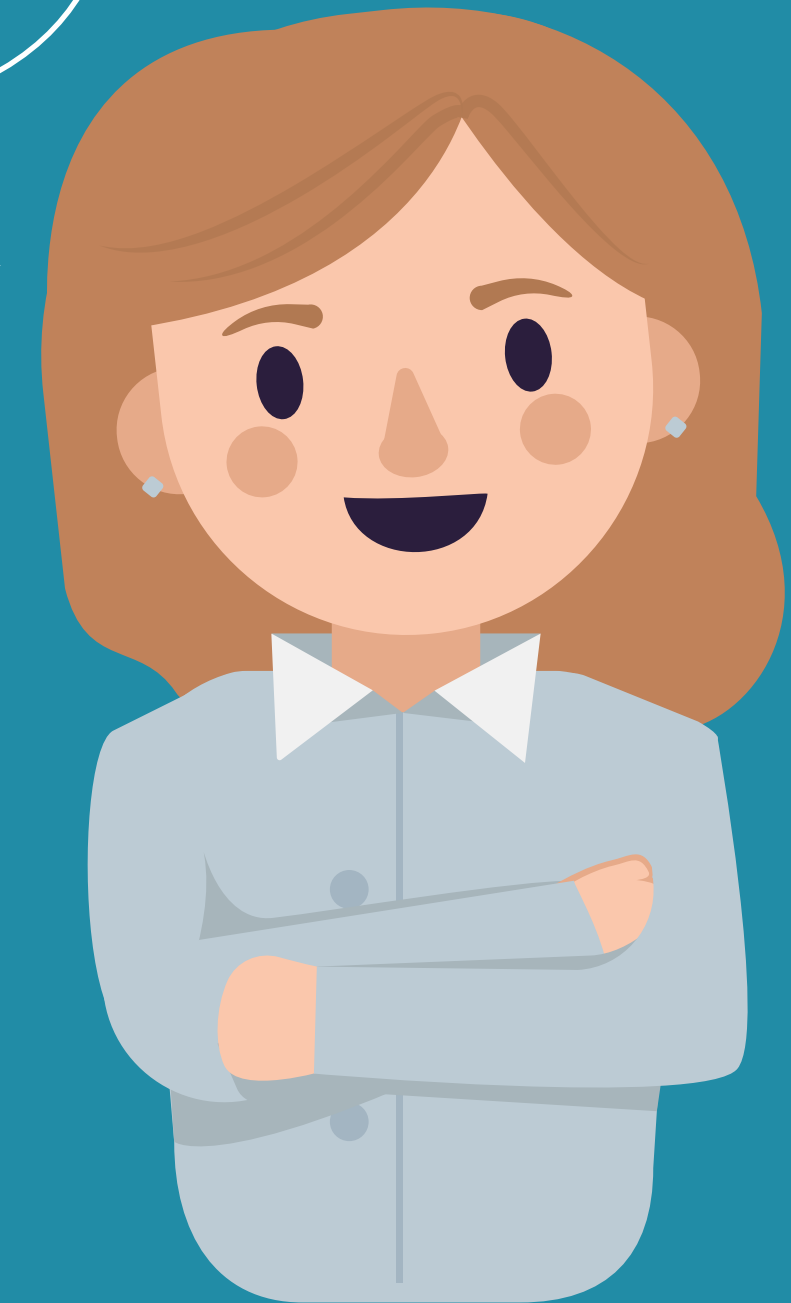
This guide maps the *why*, *what*, *who*, and *how* aspects of care robot orientation. This will provide a foundation for the creation or refinement of orientation practices at the user (micro), organisational and community (meso), or wider societal (macro) levels, depending on the context. The four essential aspects of care robot orientation are thus:

1. *What* is care robot orientation?
2. *Why* is it necessary?
3. *Who* needs it and *who* should deliver it?
4. *How* should it be delivered?

*We wish to promote orientation activities as vital for all.*



Do you want to read more  
about the project behind this  
guide? Check *Epilogue*!



The guide was prepared in an international research project called ORIENT, which focused on orientation for the use of care robots in welfare services for older adults. The guide is based on scientific articles<sup>14, 15</sup> and unpublished material<sup>16</sup> produced by the project, and interviews with different stakeholders in Finland, Sweden, and Germany. The researchers interviewed 20–30 people in each country at the micro level (older adults, relatives, professional caregivers, and care service managers). Roughly 10 people were interviewed in each country at both the meso level (public sector service organisations, robotics companies, interest organisations for professional caregivers, interest organisations for end users, and educational organisations) and the macro level (political decision-makers, research institutes, insurance organisations, funding organisations, and the media). Altogether, the researchers conducted more than 130 interviews, using similar questions, across the three countries. Information about future publications will be available at [www.robotorientation.eu](http://www.robotorientation.eu).

<sup>14</sup> Johansson-Pajala et al. 2020

<sup>15</sup> Hoppe et al. 2020

<sup>16</sup> For example Pekkarinen et al. [forthcoming]

# The big picture

*An overview of the crucial issues relating to care robot orientation at the different levels of society.*

This guide gives an overview of the crucial issues relating to care robot orientation at the different levels of society, but does not focus on individual robots and their implementation, or isolated experiments in robotics use.

Different societal levels imply the central role of different kinds of stakeholders in the care robot discussion and orientation. At the micro level, the relevant stakeholders are older adults, relatives, professional caregivers, and care service managers.

At the organisational and wider societal (meso and macro) levels, the relevant stakeholders include care organisations in the public, private, and non-profit sectors; municipalities; technology companies; interest organisations for professional caregivers; interest organisations for end users (older adults); educational organisations; political and other decision-makers; funding organisations; research organisations; interest organisations in the field of service robotics; the insurance sector; and the media.

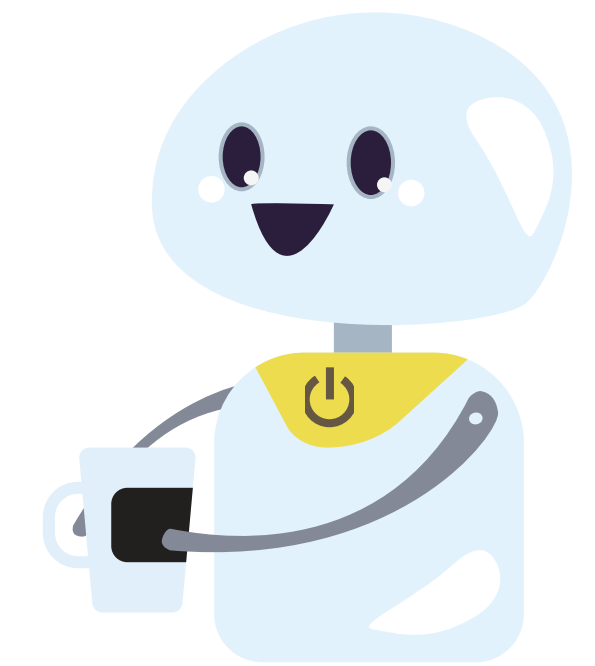


Figure 1. Examples of stakeholders at different levels and examples of their tasks associated with care robot orientation.

Examples of relevant stakeholders:

Examples of tasks associated with care robot orientation:

Political decision-makers  
Funding organisations  
Research institutes  
Media

Make informed decisions  
Provide funding  
Monitor and evaluate  
Develop and manage systems  
Report and communicate

Wider societal  
(macro) level

Care organisations  
Educational organisations  
Companies

Make informed decisions  
Provide funding  
Monitor and evaluate  
Develop services  
Deliver and manage services

Organisational/  
community  
(meso) level

Older adults  
Professional caregivers  
Care service managers

Use care robots  
Provide care services  
Manage and facilitate care work

User (micro) level

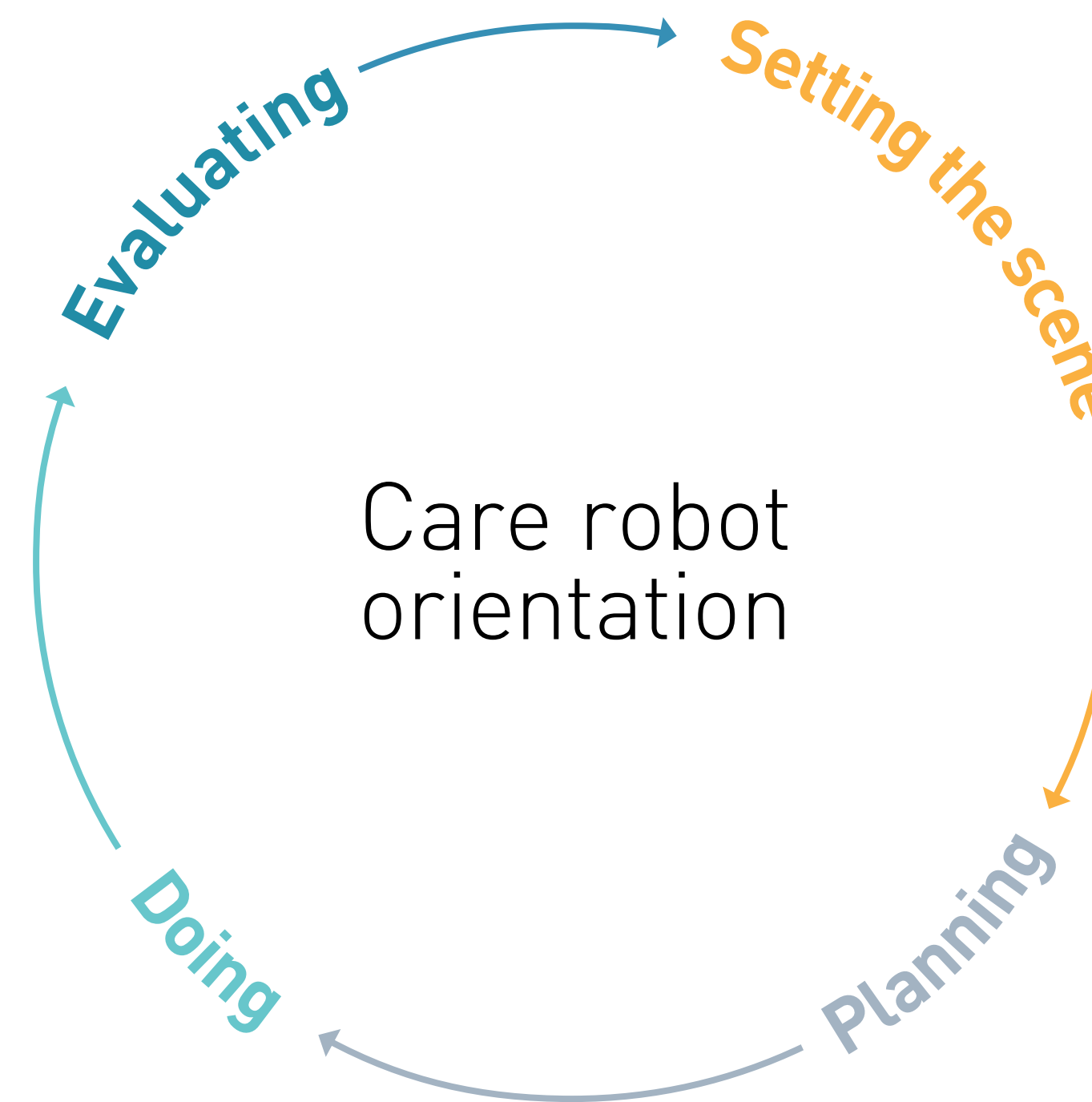
Figure 1 shows the levels, examples of stakeholders, and their tasks.

Care robot orientation—as a continuous co-creative process of introduction to technology use and its familiarisation, involving the learning of multi-faceted knowledge and skills for effective use—contains several phases (Figure 2). The stakeholders and their tasks may differ depending on the phase.

Since care robots are very diverse, different robots may require different aspects to be emphasised. For people with different illnesses, different kinds of

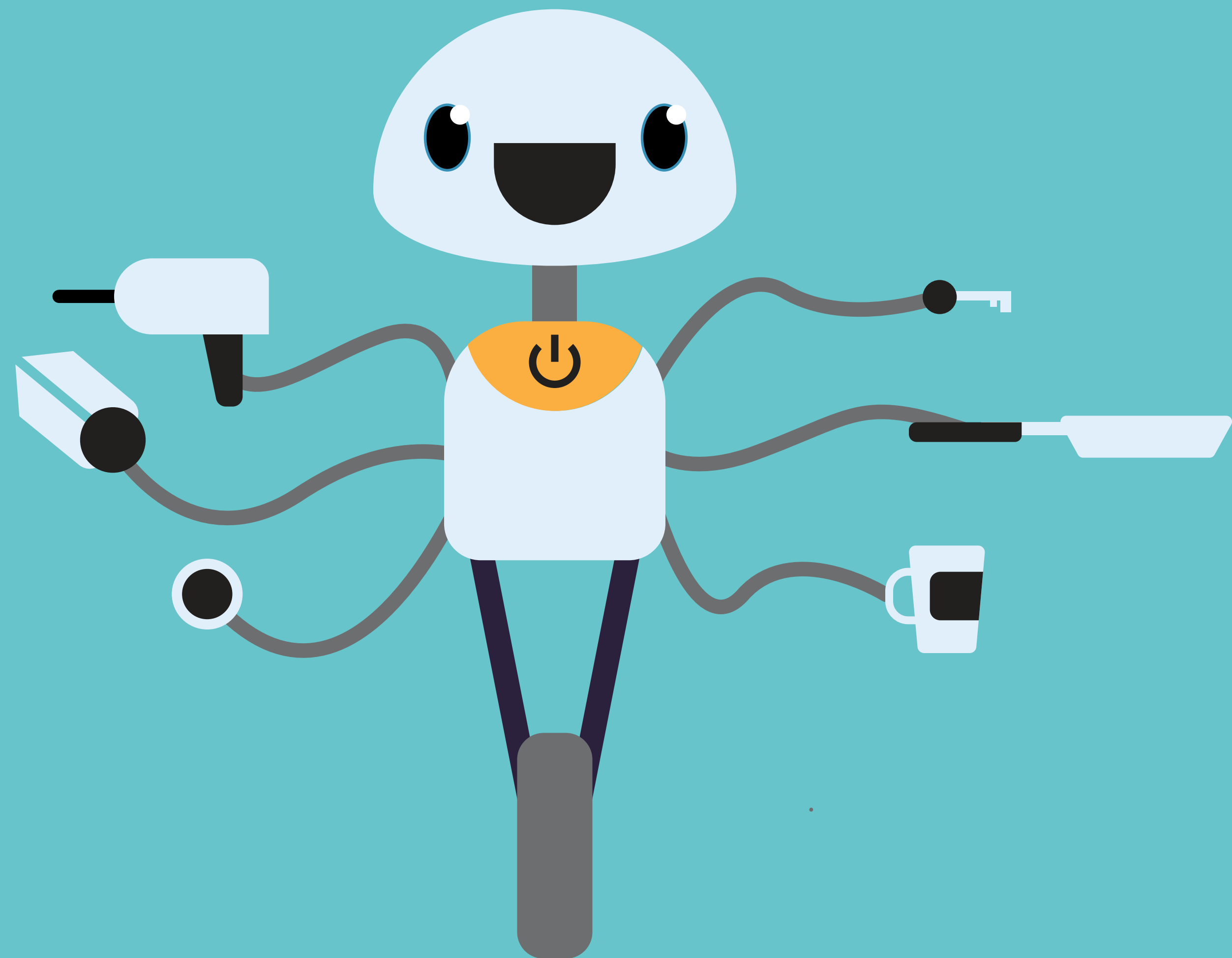
*Since care robots are very diverse, different robots may require different aspects to be emphasised.*

Figure 2.  
Care robot orientation.



orientation may also be necessary. In this guide, our main messages are:

1. Listen to the users' voices—place people at the core.
2. Facilitate people and organisations' informed choices.
3. Cherish societal stakeholders' orientation towards building multi-faceted knowledge, discussion, and collaboration.





# Care robot orientation: why, what, who, how?

## Why?

In the following, we map the why, what, who, and how aspects of care robot orientation. In so doing, we represent the voices of various stakeholders with quotations from our interviews.

Knowledge dissemination is a key factor favouring interaction and information sharing between the stakeholders who are involved in caring and care robot management. At best, care robot orientation provides knowledge, skills, and competence to support informed choices and decisions.

Exploring the field of welfare technology, specifically care robots, generates many questions regarding the meaning, content, and means of delivery of care robot orientation. The issue is important because of the rapid increase in the digitalisation and development of welfare technology. A deeper knowledge of

the orientation process for involved stakeholders is vital for realising the advantages of robot technology, on the one hand, while at the same time considering and addressing stakeholders' barriers when robot technology is introduced into care services.

While this guide does not provide direct responses to all kinds of situations, robots, and people, it advances:

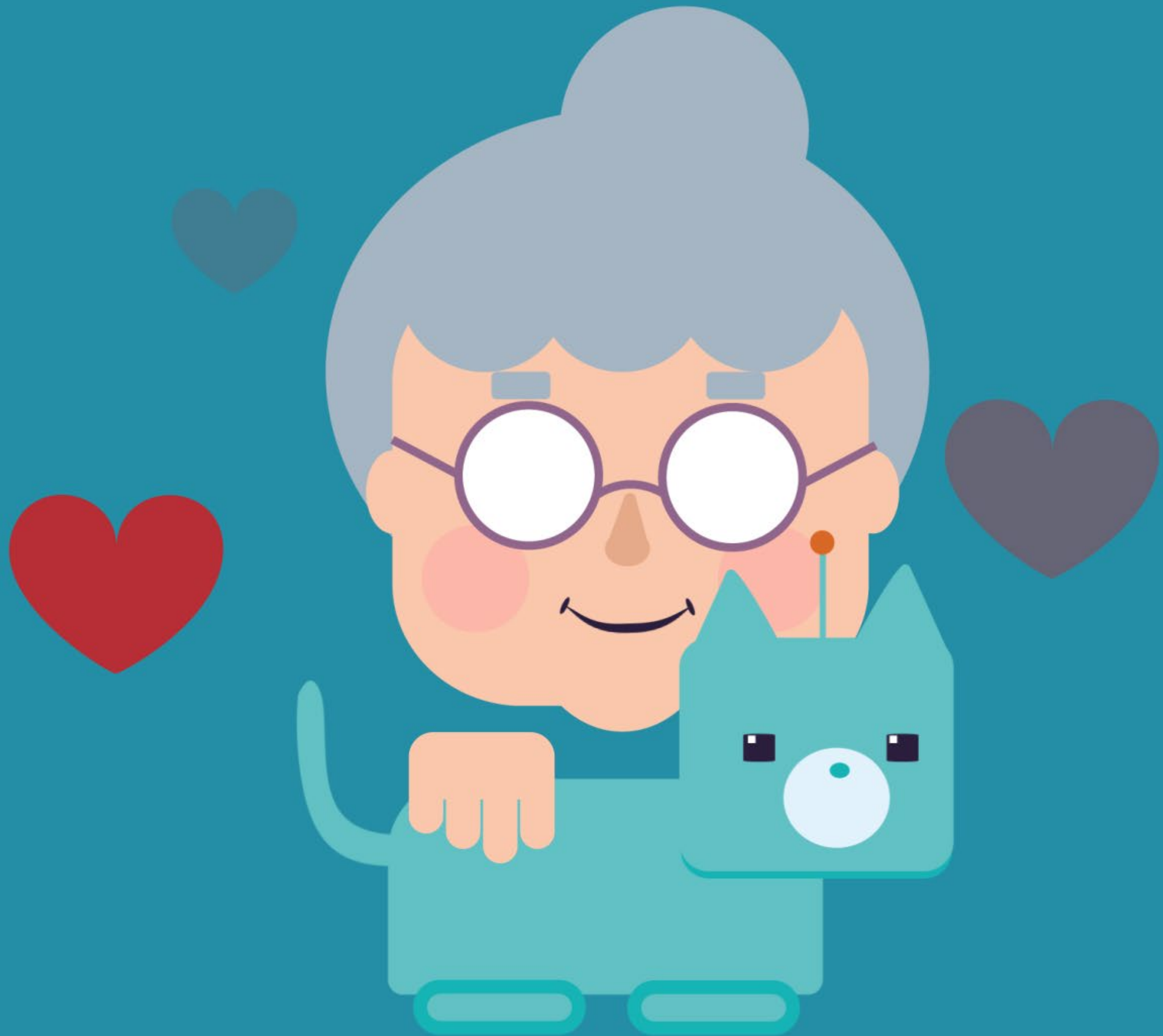
- » Understanding about *the importance of orientation and its different levels and aspects* in the introduction and implementation of care robots
- » Awareness of the *necessary resources* for proper orientation of the professional care-

givers towards working with robots, and of the role of technology in care work and services

- » Knowledge of *the use of care robots as a broad-based, systemic issue* requiring collaboration between different societal levels, policies and sectors.

Good-quality care robot orientation is vital for *overcoming pitfalls in care robot use* to support older adults' wellbeing, advancing the *user-friendly and effective use* of care robots, and enabling users and other stakeholders to benefit from the *new opportunities* provided by care robots.

- » More context-related, user-oriented orientation methods relating to care robots are needed – for older adults, professional caregivers, and other stakeholders.
- » Through better orientation, the use of robots will become more understandable and meaningful.
- » Reduction of the gap between technology and older adults may reduce their digital exclusion.
- » Provision of information in an understandable and meaningful way may contribute to the increased agency and autonomy of older adults.






# What?

To reiterate, we understand care robot orientation, in this guide, as the continuous co-creative process of introduction to technology use and familiarisation, involving the learning of multi-faceted knowledge and skills for effective use.

To introduce care robots and enable familiarisation with them, basic information is essential, including an exploration of their fundamental dimensions:

- ***what* care robotics is (the definition)**
- **how care robots can be used**
- **the possible benefits of using them**
- **an understanding of the contexts in which care robot use can be beneficial.**

When exploring and accepting something new, it is fundamental to have a basic understanding of what that something is or could be. In situations where this understanding is lacking, it is problematic to know what to ask and to contextualise possible use in everyday life. By contrast, when such basic knowledge as this exists, it is possible to discuss other aspects and considerations of the subject.


More specifically, the *what* aspect consists of five categories presented in the following text, together with quotations from the interviews conducted in Finland (  ), Sweden (  ), and Germany (  ):

- » basic knowledge needs
- » processing of care robot information
- » ethical issues
- » funding considerations
- » different living conditions.

**Basic knowledge needs**

**Lack of knowledge and experience**

There is an evident lack of knowledge and experience regarding care robots in the field of social and health care and in society. When knowledge is lacking, it is difficult to know what to ask for or where to look for information.

 *Probably, when it becomes more topical and relevant to myself that ‘now you need to get one’, I would know how to ask for the information. But since I don’t think*

*I need it now, I don’t even know what to ask for or what kind of information I would need. (Older adult)*

This issue deserves and requires discussion at many levels; discussing it only at the individual level, when a need arises, is not sufficient.

**Core definitions**

Initially, the term welfare technology, care robots specifically, should be defined to reduce stakeholders’ fear and prejudice and overcome unjustified scepticism, but also to make overenthusiastic visions more realistic.



” Probably, when it becomes more topical and relevant to myself that ‘now you need to get one’, I would know how to ask for the information. But since I don’t think I need it now, I don’t even know what to ask for or what kind of information I would need.

” *When robotics are discussed, I think it [the term] can be misunderstood badly ... When the concepts become clearer, and what each of them means, there won't, perhaps, be this confusion, suspicion, or prejudice towards it. (Interest organisation for end users)*

Understanding and conceptualising care robot use in daily life and work, and in society, is essential, so answers are required for various questions about them: what kind of care robots are available, what features do they have, and what tasks can they perform? These questions relate to the support care robots can

provide for professional caregivers, older adults and their relatives, and other users, currently and in the future, regarding their possible areas of use.

” *I see that a positive vision essentially means that different stakeholders—and, you could even say, the general public—understand what robotics is and what it is not; what it is used for and what it is not used for ... A negative vision is probably that this technology is brought to the field without anyone except technology developers really knowing what the technology is and why, or for what purpose, it is brought into use. (Research institute)*

## Concrete examples

In addition to general information, concrete examples are important regarding the benefits of care robots in relation to individuals' specific needs. These examples should be linked with various disabilities, illnesses, or other situations in which care robots can be supportive.

” *You should emphasise the benefits ... Through the benefits, people will understand. If you just say 'We're doing this', there will be resistance, but if you start from the benefits ... (Relative)*

” I remember a video that I saw, in which a robot hand helped a person to eat. I felt that it was very impressive, because having a meal is so extremely intimate, and it has a huge meaning for the person, of course, if s/he can eat with the help of the robot, instead of being dependent on another person’s professional skills and mindset and the hastiness of work. (Research institute)

The contrary aspect, when care robot use might not be suitable, should also be discussed.

” I have a hard time seeing it [care robot technology] being used in dementia care ... This is a big concern I have, because they need so much care, conversation, and body language. (Care service manager)

In addition, there may be concerns regarding practical issues relating to how to manage and handle a care robot, or lack of space in the housing.

Various pilot studies have provided concrete examples, but one shortcoming is that the experience, knowledge, and skills originating from them have not spread. Mechanisms for accumulating a joint knowledge base for the common good are vital.

” If pilot studies or other practical actions are implemented, then, of course, they should be openly discussed. (Media)

### Different backgrounds

The need for basic knowledge should be seen in the light of potential users having different levels of knowledge, understanding, and reasoning. This depends partly on whether they have care needs in their daily lives or not.

” I will have to experience it [the robot] before I become ill and can probably no longer make my own decisions. (Older adult)

The other stakeholders in the society also need basic knowledge, especially multi-disciplinary knowledge: experts in robotics need basic knowledge of care, for example, or there may be unrealistic expectations of what kind of knowledge is sufficient.

Care robot use is an example of digital transformation, where the issues essentially concern users.

Understanding and conceptualising care robot use in daily life and work, and in society, is essential.

” I believe that it [the level of knowledge of those involved] is certainly in need of improvement. There is not even a marginal level of knowledge of technical details, for example, right? (Educational organisation)

Care robot use is an example of digital transformation, where the issues essentially concern users, not merely the technology itself.

” More information, and more varied information, is needed, about why they [care robots] are needed or used. We have to know a lot more, just because it’s very easy to get incredible misunderstandings. (Care service manager)

Processing care robot information

Conceptualising and contextualising

Care robot orientation is not just about passively receiving information; it is also necessary to conceptualise the information—once acquired—in different scenarios that relate to a person’s own process of understanding. This involves processing the information and turning it into practical ‘know-what’ and ‘know-how’ about care robots.

From a managerial and professional perspective, it is also a process of putting the knowledge into an authentic context for practical application; for example, needs

relating to facilities, service structures, technology demands and training, and changed work routines. An understanding of the organisational changes that the implementation of new technology involves needs to be increased.

” *It is about organisational innovation as well: organisational changes. If you put in a new technical gadget or new system, you will need to change the organisation, and you will need to make a risk assessment of how the working environment will be affected, what the consequences and time-plan should be, what education is necessary, and how we should organise the work in a different way. (Interest organisation for care professionals)*

On the other hand, common areas for collaboration and sharing experiences are fundamental.

” *Systematise experiences, share experiences, create common areas for collaboration. (Interest organisation for care professionals)*

### True need?

The specific needs of the potential users should guide the use of care robots, and legal and safety issues must be considered. What happens if mistakes or injuries occur, caused by a care robot? What about data security and integrity? These issues raise many questions that merit discussion during orientation.

*Processing the information and turning it into practical ‘know-what’ and ‘know-how’ about care robots is needed.*



” It is about organisational innovation as well: organisational changes. If you put in a new technical gadget or new system, you will need to change the organisation, and you will need to make a risk assessment of how the working environment will be affected, what the consequences and time-plan should be, what education is necessary, and how we should organise the work in a different way.

*“There’s always the question, whether it’s robotics or any other kind of technology ... what problem this solves, and on the other hand, what problem does it not solve.”*

- ” There’s always the question, whether it’s robotics or any other kind of technology ... what problem this solves, and on the other hand, what problem does it not solve. (Care service manager)
- ” About the legal aspects and data protection, that’s probably a story I can’t influence; probably a political decision will be necessary or courts will have to decide what the robot may and may not do. (Older adult)
- ” What happens if the robot makes a mistake; for example, delivers the wrong medicine? Who is liable? Actually, it is obviously the caregivers in the case that

*they provide the wrong medicine. But if the robot gives a wrong drug, who is liable then? (Older adult)*

- ” Safety always comes first, and there must be sufficient research knowledge that a particular robot can be used for a particular purpose. (Insurance)

### Unveiling the drivers

It is challenging to overcome prejudice and the common suspicion that the general driver of welfare technology use is short-term cost savings, especially if the societal discussion does not change.

*Ethical orientation  
relating to care robots  
is a significant issue.*

” We must not forget to give information and explanations, to both older adults and relatives, regarding the purpose ... I think that is very important, because I think that they instantly believe that the purpose of new innovations is to reduce staff and make cut-backs, perhaps causing things to deteriorate. (Care service manager)

Effective communication about the reasons and intentions behind the use of care robots is vital. When major suspicions are resolved and responsible care emphasised, a more open-minded attitude is likely to be fostered.

” If the robots are introduced properly (transparently with a lot of information) and caregivers can see the benefits, rather than obstacles, challenges, and limitations [they will be accepted]. So if they [the users] recognise the benefits of the technology, how it might relieve them, and that it comes with few or no risks (or, if there are risks, how to handle them), all with as much transparency as possible, then I can well imagine that acceptance will be easy. (Educational organisation)

## **Ethical issues**

### **Ethical orientation: a must**

Ethical orientation relating to care robots is a significant issue. A main ethical concern is the importance of using care robots carefully and competently, based on ethical values. For meeting these requirements, ethical guidelines, legislation, and professional competencies are essential. Service, support, and technological functions should be aligned with ethics.

” I would depart from this: ethical rules should always be in mind and written down, and people must commit to them ... so that robotics serve the right purposes and good aims ... And who are the ones determining the rules? That is also important. Starting from legislation

*and different supervisory bodies, these issues must be considered. (Interest organisation for end users)*

### Responsible communication about intentions

Responsible communication should foster understanding and trust that the intention behind using care robots is not to replace human caregivers, but to assist professional caregivers. The discussion on this issue is often shallow, exacerbating suspicions among various groups.

” If a certain robot was to be introduced in one care unit and we [professional caregivers] were supposed to focus on the social part, one might think that we

*would get more time for that [the social part]. But then the effect would be that they would remove staff, probably ... I would not want them to replace staff, but they will do that. (Professional caregiver)*

” At present, [the discussion] concentrates more on whether robots can care for people or not, and as, in my opinion, it is quite clear that humans can never be replaced, I am frustrated. Are we really concentrating on this now, when there are so many other things that should be discussed? (Political decision-maker)

### Compulsory use of robots?

The need for sensitivity in introducing care robots is emphasised, since care robots should not be forced on people.

” In the end, the user decides how far he or she wants to get involved with technology or whether he or she chooses the classic way of human care. (Older adult)

” All technology should be a servant to humans, useful for humans. It is a frightening future image that human life could become dehumanised through technology. There are so many older adults alone, and technology doesn't help in, and relieve, a situation where a human needs another human. (Media)



On the other hand, some discussions focus on whether the use of care robots should be compulsory, or will become so in the future. Such discussions usually relate to staff shortages and funding issues.

” Here’s how care is done, this is a help we offer you ... whether it is cameras or a timer for the stove, there are a lot of such things ... It’s nothing strange. (Older adult)

Valuing older adults’ capabilities

It is vital not to underestimate older adults’ capabilities to know what is best for them.

” In some ways, older individuals are treated as though they have dementia or something: as though they have a cognitive impairment and do not understand their own situation ... like ‘I know better, I give you this because then you will feel good’. I mean, I know myself and what I feel good about, regardless of whether I am 75 or 95, so it is in some ways like a kind of ‘dummi-fication’; some people think you lose your intelligence when you get older. (Robotics company)

Realism behind statements

An ethical issue at the societal level is the existing exaggerated opinion of what technology is capable of doing. Some politicians and other decision-makers

may believe that robots and other kinds of welfare technology will solve the problem of population ageing. Robots are not yet flexible enough to operate in many different environments and do everything that users want them to. The orientation should acknowledge that fact and maintain realistic views.

” We, who are working on robotics, know that if we are to develop a robot that picks up glasses ... it should cope with all kinds of glasses, it should cope with all kinds of surfaces they fall on, it should cope with all kinds of lighting conditions, but then we are talking about a device costing one and a half, two million [Swedish krona] today. Robots are not good



*at being flexible in an environment and we are far from reaching that point. (Robotics company)*

Procurement challenges

Knowledge of, for instance, the procurement challenges and requirements for technical solutions is, however, gradually increasing. It requires time and a consideration of basic things.

”Of course, in terms of the use potential, you can’t base it only on salespeople. There’s always a question: whether it’s robotics or any other kind of technology, it should answer the simple question of ‘what problem does this solve?’ ... and, on the other hand, what problem does it not solve? (Care service manager)

Funding considerations

Different welfare systems:  
who pays—what are the values?

Potential robot users may be well aware of the impending demographic challenges, the shortage of professional caregivers and financial resources, and the fact that action is required, such as an increased use of welfare technology; however, the issue of who should pay for robots raises many questions.

Funding considerations call for awareness and discussions about the welfare system. These systems differ across countries, so this issue is largely beyond the scope of this guide. Depending on the context, it is, however, something that can and should be discussed

within orientation. Older adults and their relatives may wonder who pays for the devices.

- ”As a starting point, it’s the municipalities’ business to pay for it, if the robot is absolutely necessary. (Older adult)
- ”If you have a lot of money, you buy your own robot. (Older adult)
- ”Is this a commodity, or is this our common right? Will this mean that those who have the opportunity ... intellectually, or economically in terms of resources ... they can choose this, but all the others who do not have that, how do we handle them? ... We are becoming a very divided society. (Older adult)

*Funding considerations  
call for awareness  
and discussions about  
the welfare system.*

Societal stakeholders often have a role to play in the value discussion concerning funding. This relates to ethical considerations, and challenges in determining where the responsibilities of the welfare system end and something becomes individuals' responsibility.

”Of course it's always the one who benefits the most that should be the biggest payer. In many cases, we're talking about society. (Relative)

When pondering funding, careful analyses should underpin discussions, be conducted with a consideration of the particular country's welfare system, and have a firm footing in the fundamentals of care and respect for human values.

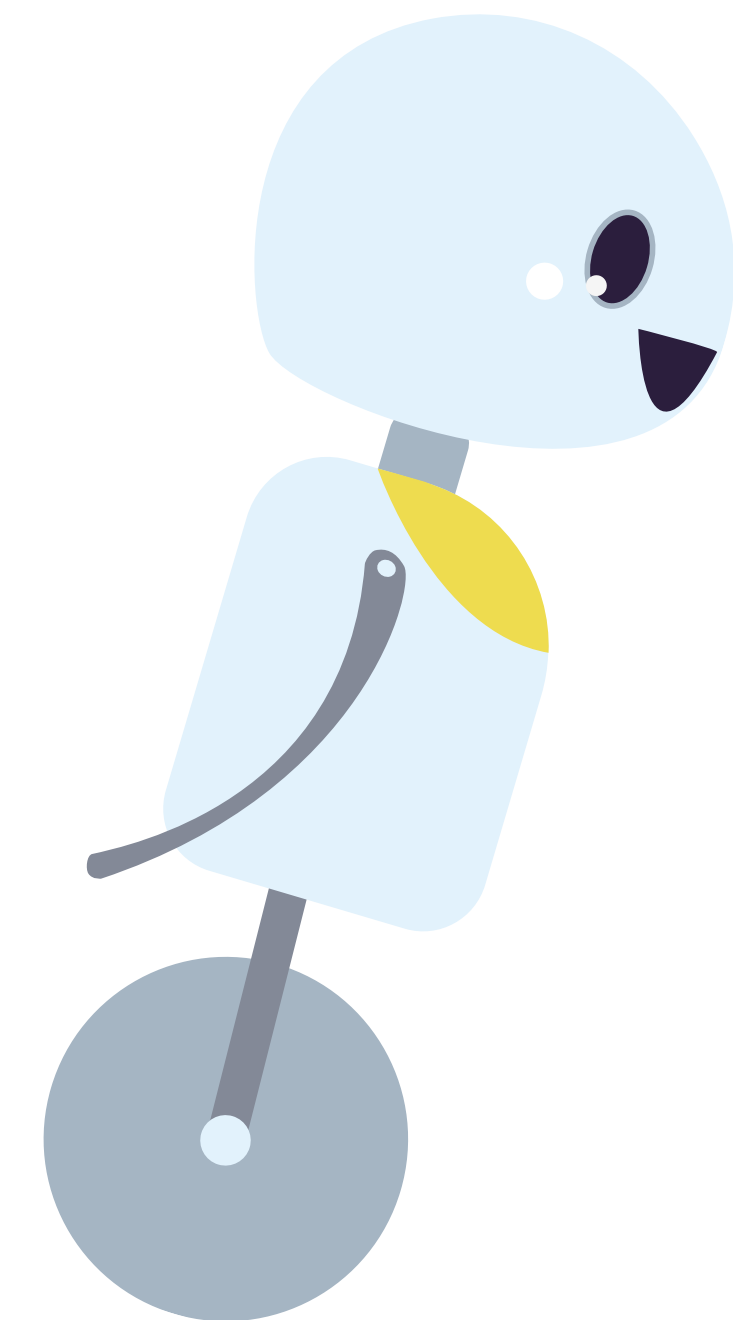
”I could imagine that the health insurance company would be happy to make it available free of charge, because it would keep labour costs as cheap as possible. That's probably how it's going to happen. (Care service manager)

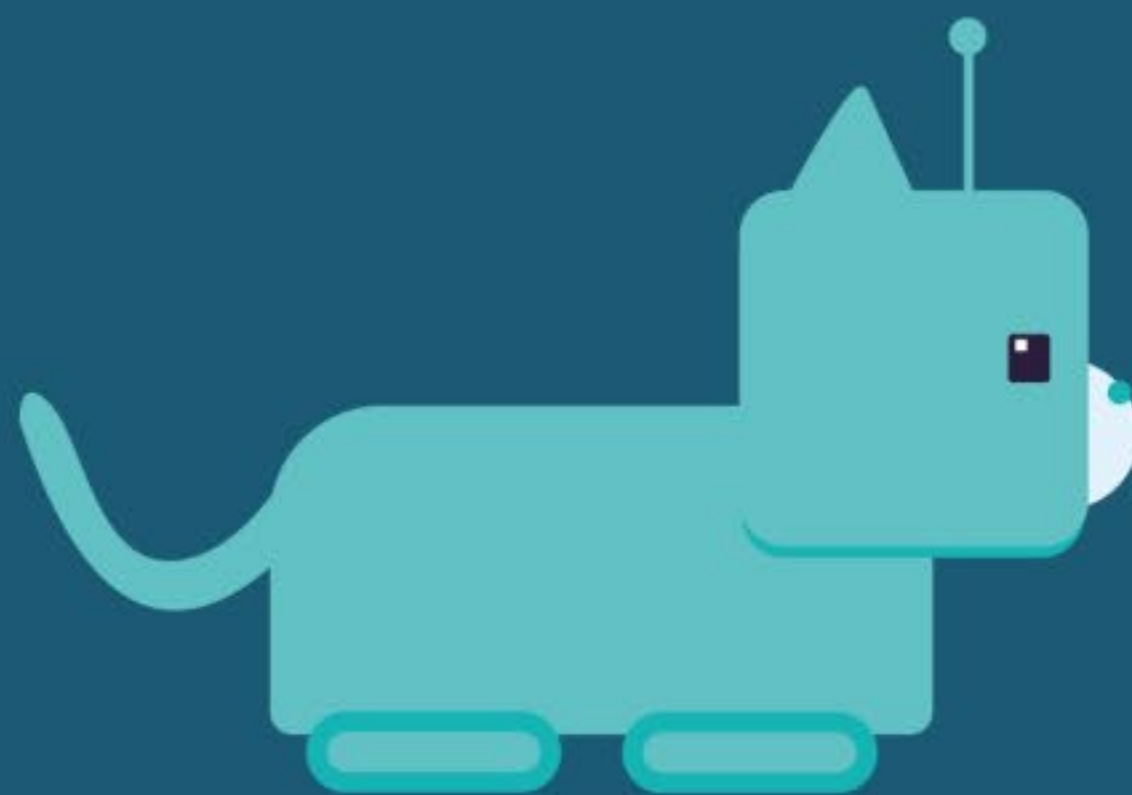
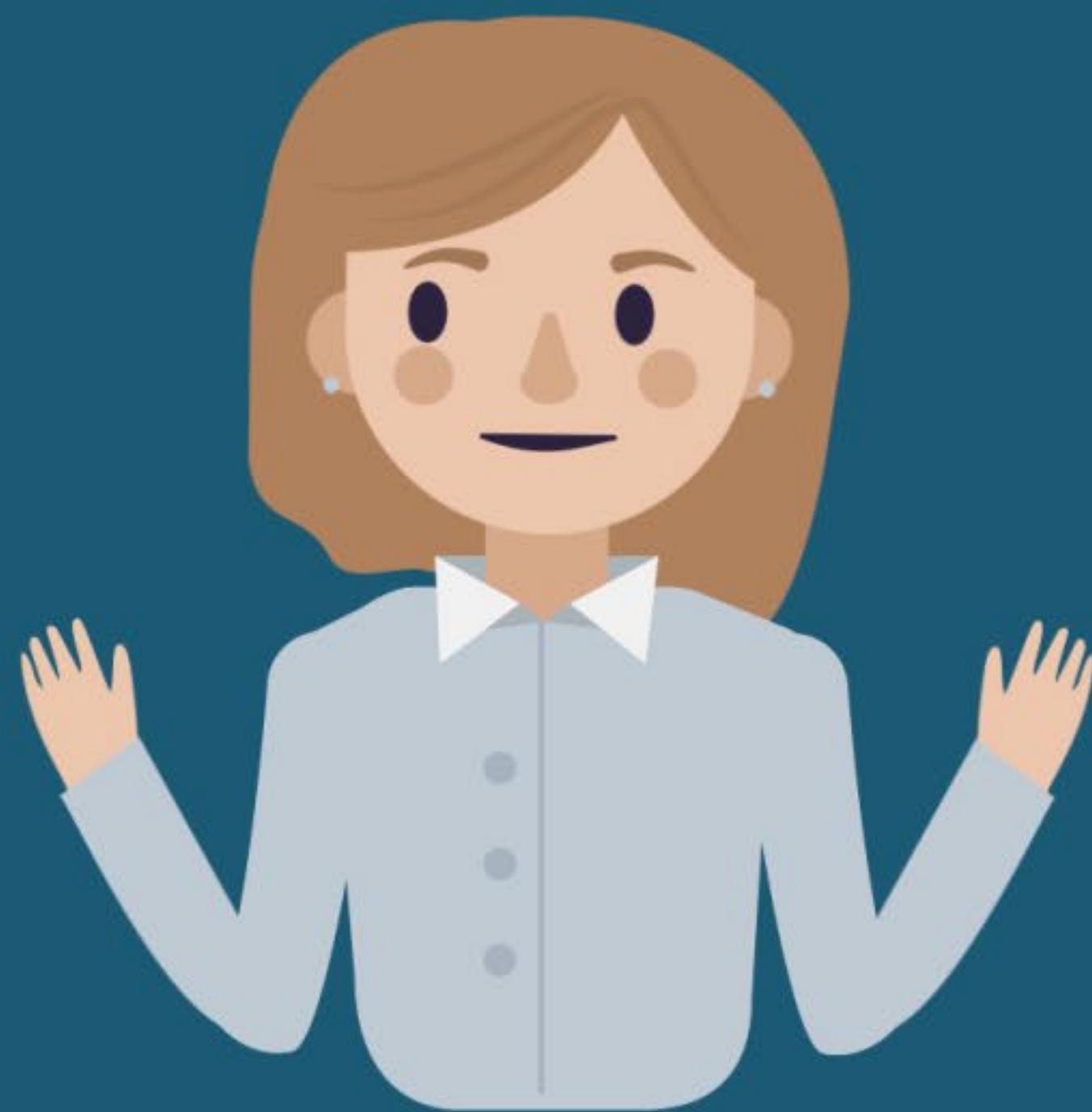
”As we still try to be a welfare society, I would think that [funding] is a societal responsibility. Only in that way is it possible to guarantee equality. If a particular robot produces higher-quality rehabilitation, for example, that should be possible for all Finns and not just the one who happens to live in that social and healthcare district. (Interest organisation for care professionals)

***Different living conditions***

The meaning of care robotics in a person's private life and in care services may be different depending on the environment. Opportunities may differ, and on the other hand, different knowledge and skills may be necessary. Such differences relate to living in the countryside versus in towns and cities, as well as the variety of housing arrangements among older adults.

” *As odd as it may be, in principle, robotics and such technology may further improve the living conditions in the countryside. As a matter of fact, it is nowadays easier to pilot new digital services in the countryside than anywhere else. And in the countryside, as surprising as it seems to many, various digital issues are pretty much at the top [of the agenda]. (Media)*







# Who?

Who should give and receive care robot orientation? An obvious main target group includes those with needs that robots can support in daily life: older adults with care needs, but also relatives and professional caregivers.

The groups of professional caregivers and care service managers require increased knowledge of care robot opportunities in their caring practice, but also

for addressing their responsibility to give orientation to other groups of people.

Various stakeholders have an important role to play in the societal discussion regarding care robots. They are often in need of care robot orientation, but may also have a role to play as orientation givers. An example is educational organisations. They require new knowledge and wider understanding of care robotics in order to educate others and, thus, provide knowledge.

There is a need for at least basic technological skills if the technology is not to remain underutilised. It is not necessary to have a very deep and specific knowledge of artificial intelligence, but skills for communicating across the disciplines are important. In particular, there is a huge need for knowledge relating to the actual supply of technology and to user experiences and benefits. Systemic understanding about care robots and their impact on care work should be promoted.

*Who should give  
and receive care  
robot orientation?*





*Skills for  
communicating  
across the disciplines  
are important.*

*From a broader  
perspective, knowledge  
building should be  
addressed early,  
and in stages.*

” *The one who uses the robot most, the client, s/he must have the knowledge and understanding, and then, of course, the relative. If there is a home-care professional, s/he must know and understand, and all the personnel, but ... if we talk about this from a wider perspective, not just about orientation to [robot] use, those who make decisions have to understand the benefits. (Interest organisation for care professionals)*

In the following, the guide will discuss the receivers and providers of orientation.

### **Receivers of orientation**

#### **Early knowledge building**

People with care needs are the primary target group, followed by their relatives, often acting as informal caregivers. People with care needs may feel that one is most likely to benefit from care robot orientation when there is an actual need for care robots. From a broader perspective, knowledge building should be addressed early, and in stages.

At the societal level, early knowledge building in different professions and networks would help to overcome the discussion of care robots in ‘silos’ and promote systemic understanding.

” *The discussion is ‘siloed’. It is discussion on digitalisation, sometimes on digital hype, and people forget that innovation is social innovation ... In many care processes, technology has not speeded up or alleviated professionals’ work, but it has sometimes doubled or tripled the work. Then we do this ... ‘developing a bicycle for a horse’, instead of thinking about how to redesign the whole process based on the technology that we have. (Political decision-maker)*

### Identifying different roles

Professional caregivers are an important target group, given their responsibility for providing care robot information. Positive attitudes among the pro-

fessional caregivers are crucial for the successful introduction and use of care robots. Different groups of professional caregivers are expected to provide orientation to others, but may not possess sufficient competence and resources for this given responsibility, either in their own or other potential users’ view.

” *In a nursing home, there should be health care professionals who have the knowledge ... I don’t know if they do, but that is how it should be. (Relative)*

Professional caregivers require an increased level of knowledge for this task and there may even be a need for a new specialist profession in this area.

*Different groups of professional caregivers are expected to provide orientation to others.*

Leaders of change

Care service managers are leaders of the process of change; they provide information, and facilitate the development of skills and work processes. They are the ones who have to deal with upcoming problems and difficulties in the implementation of care robots, including motivating and supporting all the involved parties.

” What is most difficult, I think, experience wise, is to keep the motivation up and running with our professional caregivers, because you very easily fall back to what has gone before. (Care service manager)

In addition to the potential users, there is a demand for more general societal care robot orientation. At

the individual level, this could change attitudes, especially when considering a person’s individual care needs and the possibilities for staying independent in the private home.

” I would let it [a robot] immediately into my apartment, if it was necessary; if I could postpone a move into assisted living for several more years. (Older adult)

Providers of orientation

Caregivers as providers

From the perspective of older adults, the information should come from professional caregivers. When care

needs arise, involved professionals should suggest appropriate care and give related care robot orientation.

” Yes, but everyone has contact with the health service; if you are ill, then you have that contact, and that contact should be the one who gives the information. (Relative)

To be able to accomplish this, professional caregivers need greater knowledge in the area, and sufficient time for the task. Care robot orientation should also be part of preventive care activities and rehabilitation. Knowledge about the integration of care robots into care, and how the professionals can assist vulnerable older adults in the selection and use of care robots,

Professional caregivers  
need greater  
knowledge in the  
area, and sufficient  
time for the task.

is lacking. Care robot orientation should be placed higher on the agenda of professional caregivers in elderly care.

Family, friends and peers’ support

Family, friends, and peers may discuss care robots in daily conversation and offer practical support. The information becomes more credible if the people themselves have experience of using the robot.

” Maybe it’s peer aid, peer support, peer information on every level, so that users can tell future users, or the older adults who have been helped by care robots, can tell about their, hopefully good, experiences and ... reduce distrust and fear. (Relative)

Multidisciplinary collaboration

Orientation provided by technical experts in collaboration with professional caregivers elicits multiple views, which may be an optimal strategy.

” So, I could even imagine that a new profession would emerge; for example, medical engineering, technology, and nursing—combining these in one occupation. (Older adult)

Official, reliable sources sought

Several stakeholders have a role to play in the provision of orientation. Official sources (governmental, regional, and local authorities) should have the task of providing care robot orientation as part of the national welfare technology information.



” Maybe it’s peer aid, peer support,  
peer information on every level, so  
that users can tell future users,  
or the older adults who have been  
helped by care robots, can tell about  
their, hopefully good, experiences  
and ... reduce distrust and fear.

*The risk of bias emphasises the need for multi-disciplinary and multi-sector collaboration and broad discussion about care robotics.*

” Someone should start a coordination centre, a centre of excellence in robotics, that would really have the expertise in the technology [robotics] and communicating in general about it ... Training and communication would really boost the implementation of technology. (Political decision-maker)

Research and educational institutions are regarded as reliable sources of care robot orientation, but manufacturers and suppliers of welfare technology and care robots also have an important role to play. The risk of bias is a concern, emphasising the need for multi-disciplinary and multi-sector collaboration and broad discussion about care robotics.

” I don’t immediately trust anything that I get from a salesperson. Of course, they just want to sell the product. (Care service manager)

Media and community information

Media and the society as a whole—the general public—are important stakeholders. There are many possible communication channels, including the internet and social media, television, newspapers, and advertising. Other information channels have been suggested, such as information in shops, pharmacies, at fairs, and in independent advice centres for robots.

” *Make it exciting; show that it is pleasurable and that I can see it on different social media, I can see it in stores, I can see it in movies, and see that celebrities have small robots. I think it is difficult to just introduce it in elderly care; instead, we have to make sure that this technology is visible and used by others also [not just older adults]. (Older adult)*

It may be possible to deliver care robot orientation as community information in different places and situations; in/by centres for older adults, different care settings, thematic days arranged by seniors, centres for relatives, and retirement organisations. Field

trips and information-dissemination through human interaction are highlighted as important arenas.

” *I always think it would be nice if there was an external person who wouldn't want to sell me this robot and just tell me how great the device could be, but who could really give honest information about the advantages and disadvantages. (Relative)*

National differences involve different stakeholders. Depending on the welfare system, healthcare insurance companies may also play a central role in providing information as part of general care robot orientation.

*Care robot orientation can be delivered as community information in different places and situations.*

*“...but who could really give honest information about the advantages and disadvantages.”*

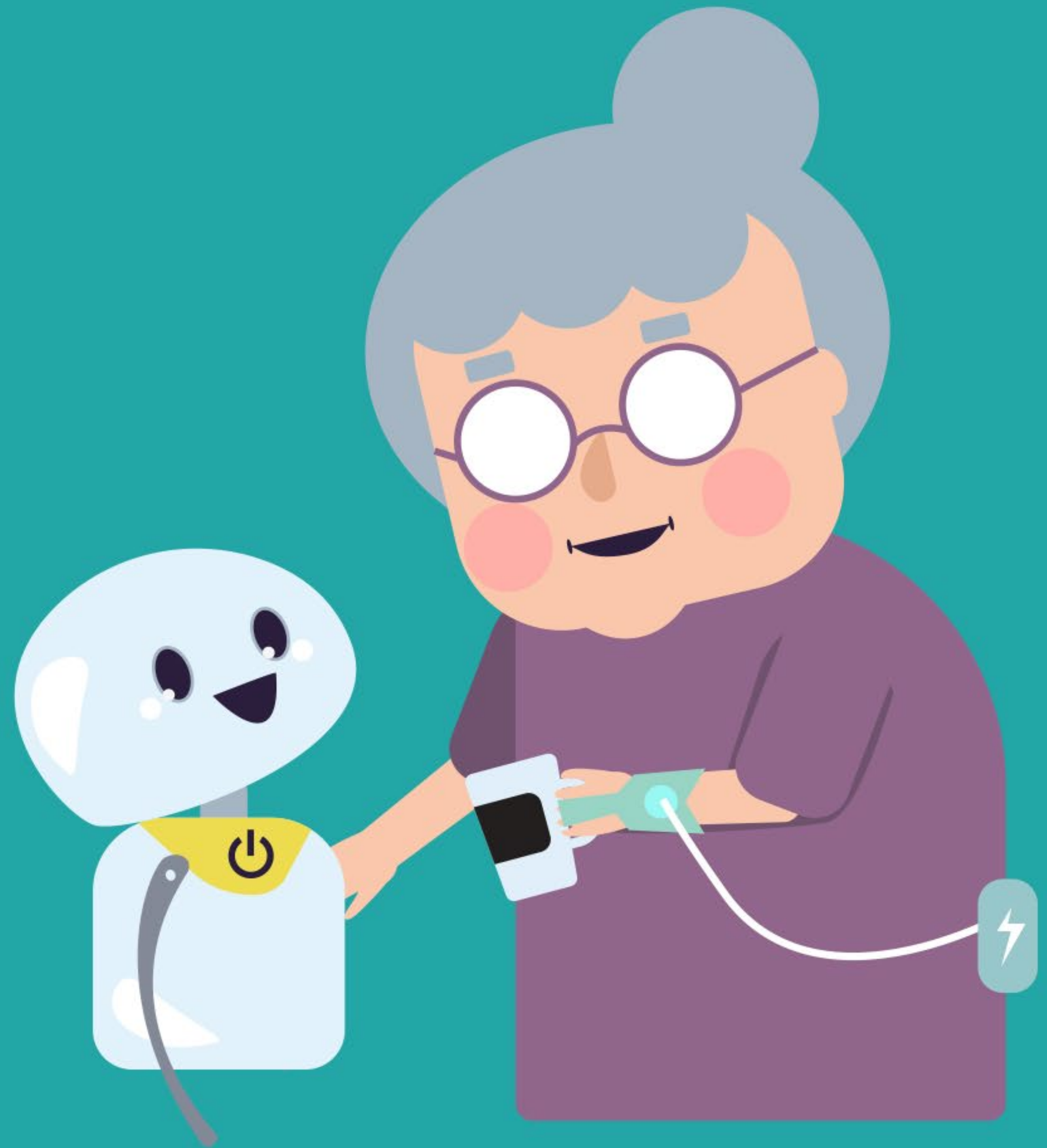
### Orientation by intermediaries

Public sector service organisations, robotics companies, interest organisations (trade unions) for social and healthcare professionals, interest organisations for end users, and educational organisations may be intermediaries at the interface between, for instance, end users and decision-makers. They are in contact with the practice, but also active in networking and operating in the context of broader societal issues. This is important to keep in mind regarding their orientation role.

“From my profession’s perspective, making examples visible, finding out about what models exist, how they are used abroad, or in our country, and research

*results—my task is to forward such knowledge to our member organisations, so that they can choose. They should have as new and state-of-the-art knowledge as possible on how robots can be used, how they will develop, and where they could be used. (Interest organisation for end users)*

“Of course, educational organisations have done good work, but from the point of view of quick dissemination of information and networking, it has been important to bring up these issues in seminars and other events where service providers and others network. (Interest organisation for end users)





# How?

## *Different strategies, different timings*

Very different orientation strategies are necessary, from providing targeted information to individuals to engaging in general governmental campaigns in society. Regarding the question ‘when?’, the most beneficial learning is likely to occur at the user level when someone—at home or work—has actual needs that can be solved by welfare technology in the form of care robots. However, other time-related aspects include providing care robot orientation well in advance of such a need, even to young people in schools.

This advance provision also concerns the level of the various societal stakeholders. Regarding question ‘when?’, the response at the societal level is ‘now’. The digital transformation is ongoing, pilot studies are underway, robot technologies are developing rapidly, and the active management of change is imperative.

The **how** aspect consists of (1) activities and (2) time aspects.

*Care robot orientation  
needs to be provided  
well in advance.*

*The information must be adapted to the receivers and their circumstances, regardless of the target group.*

### **Types of activities**

At present, potential users and other people receive little care robot orientation.

” You have to search for yourself ... the channels that exist ... if you are curious and interested ... (Relative)

Easy opportunities to see different kinds of robots should be arranged, for the general public and various professionals, also those whose work does not relate directly to care.

” Encounters are important. I have been to a few events for the general public, and there were people from small children to older adults, the whole spectrum; everyone came to see the robot. There should be more

*events where robots can be seen, so that people can assess them for themselves. (Interest organisation for end users)*

### **Tailored orientation**

Care robot orientation activities, at an individual or group level, involve introducing the technology and giving information in a positive manner. The information must be adapted to the receivers and their circumstances, regardless of the target group.

” For us older adults, when technology is taught, it should be taught in such a way that people really get it. (Older adult)

Continuous orientation  
is important.

” *It is quite frightening if there is a device at home that you cannot control; that starts to live its own life. So, the orientation must be quite detailed and clear. (Interest organisation for end users)*

If care robots are appropriate and meaningful for the task, the orientation must be clear, descriptive, and motivate the user. Overcoming initial assumptions that robot use is only about saving money in care services is key, but possible fears should also be addressed.

Long-term, continuous orientation

It is important to provide understandable examples of care robot use and robots’ impacts. If possible, learning should be increased by using the didactics

of ‘learning by doing’ and hands-on opportunities. Orientation activities at the user level are likely to be more effective in safe and relaxed environments that facilitate joint learning. Allowing mistakes, and having a sufficiently long duration for the piloting of any devices, are crucial. Preferably, care robot orientation should be provided in the environment and circumstances where the care robot will be used.

Continuous orientation is important, particularly for professional caregivers, due to staff turnover; it should utilise various practical methods, from individual and group orientations to support by video conferencing. These activities must be tailored to individual contexts in order to avoid losing important opportunities for learning.

Orientation activities at the user level are likely to be more effective in safe and relaxed environments that facilitate joint learning. Allowing mistakes, and having a sufficiently long duration for the piloting of any devices, are crucial.

” *The person who sells the robot comes and introduces it, and it takes half an hour. Then we have refreshments—and that’s it! Afterwards, the boss says: ‘Well, you were already trained, so you must be stupid if you didn’t learn’. (Interest organisation for care professionals)*

### **Time aspects: when?**

#### **The appropriate situation**

Another important aspect of the delivery of orientation is that it should be conducted at the time when it is beneficial and most likely to be effective. It is essential to give information when it is relevant to a changed life or work situation that care robots could perhaps aid or solve. When actually in the situation, asking the right questions is easier.

However, there is an incentive to offer orientation, at a more general level, as common information to raise people’s awareness of the possibilities provided by care robots. Improvements in such orientation at the user level would have positive effects in preparing for the day when individuals, relatives, and/or professional caregivers have the need for, or are facing, care robot implementation. In relation to older adults, orientation should be given before they become too old and frail to make their own decisions.

” *Technology needs to be introduced earlier in life, before people become affected by old age and illness. (Older adult)*

However, many people lack interest, since they believe that care robot use lies in the far future and does not

*Another important aspect of the delivery of orientation is that it should be conducted at the time when it is beneficial and most likely to be effective.*



concern them yet; thus, care robot orientation may be most effective for people who are motivated by individual curiosity or interest in the issue.

In a care organisation, all the robot users should be involved, and it is important to ‘prepare the ground’ before purchasing and introducing the robot.

” *If you have already purchased [the robot], that is the worst mistake to make. (Interest organisation for end users)*

Providing orientation on the phenomenon of care robotics and its role in the organisation in question can precede the introduction of the robot itself.

### A generational issue

Another time-related aspect is the generational issue. The young people of today will be better prepared than the older generation and will probably not consider care robots to be anything strange. To enable people to get used to the technology, it should be introduced and discussed in schools at an early stage of education.

” *I think that even the next generations, those that have integrated technology, robotics, and artificial intelligence in their professional lives, want robots for their care in the future, too. (Care service manager)*

However, this time-related aspect might have an ‘expiration date’, due to rapid technology development. The use of care robots is expected to become a natural part of future care.

*It is vital to adopt an increasingly nuanced approach to old age and individual older adults.*

” I think, later, it will be like, one care unit realises ... ‘We don’t have staff, so we have to introduce it’ [care robots]. I think, when the technology exists, then there will probably be ‘intelligent homes’ that can explain to someone with dementia ... that ‘now we will do this and that’. (Professional caregiver)

The need for a nuanced approach

Ageing will always, even in the future, involve various physical changes that should not be overlooked. It is vital to adopt an increasingly nuanced approach to old age and individual older adults in order to achieve the meaningful use of care robots, but also welfare technology more generally.

” Actually, our diversity increases; it doesn’t decrease. Among older adults, there is a spectrum of life experiences, education, preferences, health conditions, experienced health, and all; it is huge. It implies the need for modularity and applicability. Maybe there cannot ever be an ideal solution. [We must ask] ‘What serves whom?’, otherwise the risk increases that we will do completely the wrong things, because it is so difficult to understand. I don’t even understand what it is like to be 94 or what it really means when your back is hurting when you walk. (Political decision-maker)

Ageing also affects professional caregivers in workplaces.

” What we highlight here, when we hear: ‘But I will soon retire’, we definitely think that ‘It is part of the work tasks, so let’s learn about it then’. We try to promote a positive attitude here, and the employer has a right to demand it, but then the employer has to offer the opportunities and education for that [robot use]. Everyone has responsibilities. (Interest organisation for care professionals)

At the societal level, the time-related aspects are different. They relate, for example, to the integration of care robot orientation into the education of future care professionals, early in their studies. Importantly, this advance and continuous provision also concerns the various societal stakeholders.

” In basic education, at all levels of social and health care, education on care robotics should always be integrated as basic knowledge. There may be some special courses where it is discussed nowadays, but

*it is not a separate issue: it must be integrated into everything that is taught. If the Swedish language is taught, then the relevant concepts in Swedish are taught, and if care work is taught, or care for some particular illnesses, then the opportunities [of robotics] there or in that illness should be taught. Of course, the same goes for those who come for continuing education later on. (Interest organisation for care professionals)*

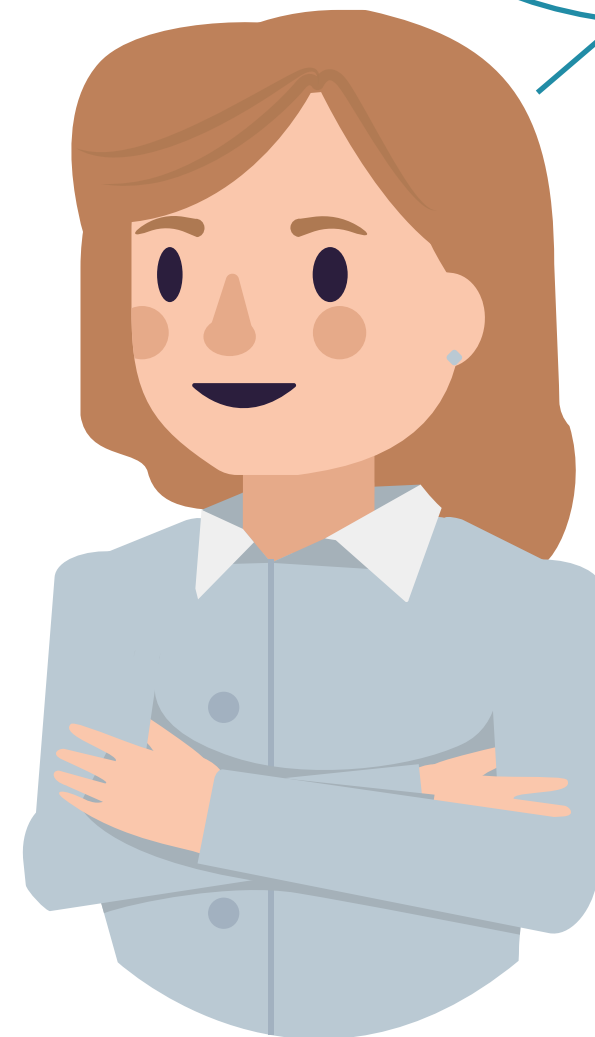
# Wrap-up

What are the main  
messages at the  
user level?



Listen to the users' voices—  
place people at the core.

Facilitate people  
and organisations'  
informed choices.



What about the level of  
societal stakeholders?



Cherish societal stakeholders'  
orientation towards building  
multi-faceted knowledge,  
discussion, and collaboration.



*There is a great need  
to adopt innovative  
pathways for  
orientation regarding  
care robot use.*

Orientation is one way to increase knowledge and provide practical, user-centred learning in order to improve the acceptance of care robots and promote inclusive technology use. In line with increasing digitalisation, orientation’s role in different contexts is becoming more important, but this is often overlooked in practice.

Various obstacles to the acceptance of care robots, and deficiencies in their use, have been identified in pilot studies and early implementation efforts. Technology providers may organise initial training for care organisations, but those trainers may have lit-

tle experience of the care sector. The specific needs of an individual care organisation—or an individual employee—may therefore be neglected. The ways in which individual people learn new things also differ.

Older adults, again, are largely on their own, especially if they ‘age in place’ and have not moved into institutional living. Their relatives may also feel ignorant and helpless when facing the ‘jungle’ of various technologies, wondering what is suitable for whom and for what purposes. The novelty of care robots exacerbates these problems. A further challenge is the successful combination of different



welfare technologies, which is an avenue for future development that should be (but is not yet) addressed with users.

*There is a great need to adopt innovative pathways for orientation regarding care robot use*, taking into account the needs of older adults, their relatives, professional caregivers, and care service organisations. The societal level should be taken into account, as appropriate; public administration and the non-profit sector, businesses and industry, and

all the other stakeholders in the society that have been discussed in this guide.

Care robot orientation is necessary for:

- » the private use of robots, for both potential and present users
- » the relatives of private users
- » the use in care work
- » decision-making and service development at different levels

- » education
- » interest organisations and companies
- » media, funding organisations, researchers in different fields, and the insurance sector
- » other stakeholders, depending on the national welfare system.

The variety of robots itself generates further needs; for example, for robot use in care work, orientation must be tailored to the receivers, but also to the type of robot in question, as the sphere of robotic devices is wide.

For different groups, different dimensions of orientation may be necessary, depending on the receiver, the provider, and the context. For some, general orientation (mainly responding to the ‘what’ question) may be sufficient, whereas others might require experience-based orientation from their peers, orientation as part of education, technically-focused orientation, orientation tailored to managerial or administrative issues, or orientation for collaboration in the field of care robotics (between organisations, networks, etc.).

If the issue of orientation continues to be overlooked, it is likely that the benefits of robot use will not be realised and investments will be wasted.

” *I do not think that we are sufficiently prepared for what is coming. (Interest organisation for care professionals)*

*If the issue of orientation continues to be overlooked, it is likely that the benefits of robot use will not be realised.*

By adopting a user-centred approach, the design of care robots' functions can better match the end users' needs and wishes, and this, of course, applies to all potential users.

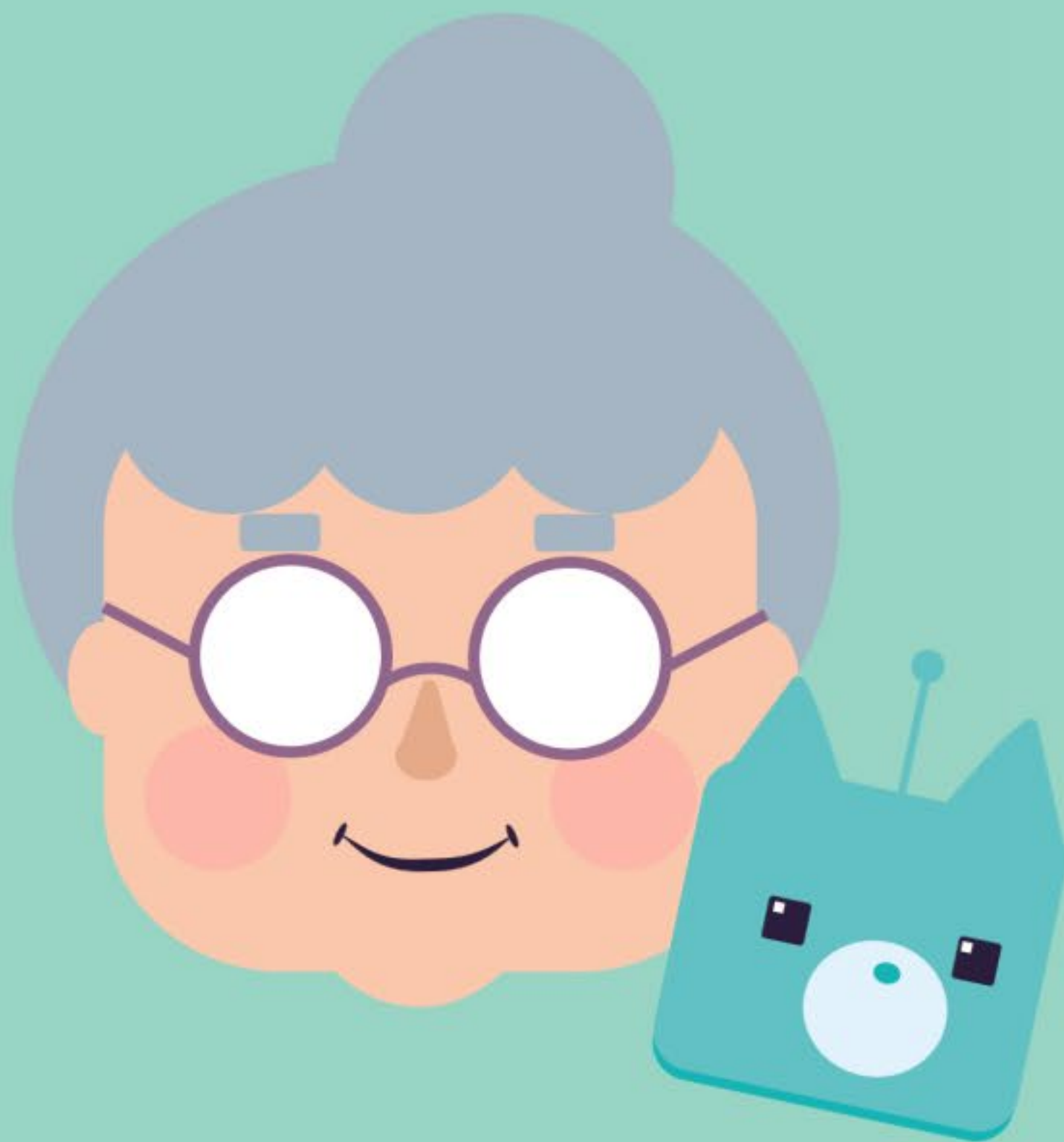
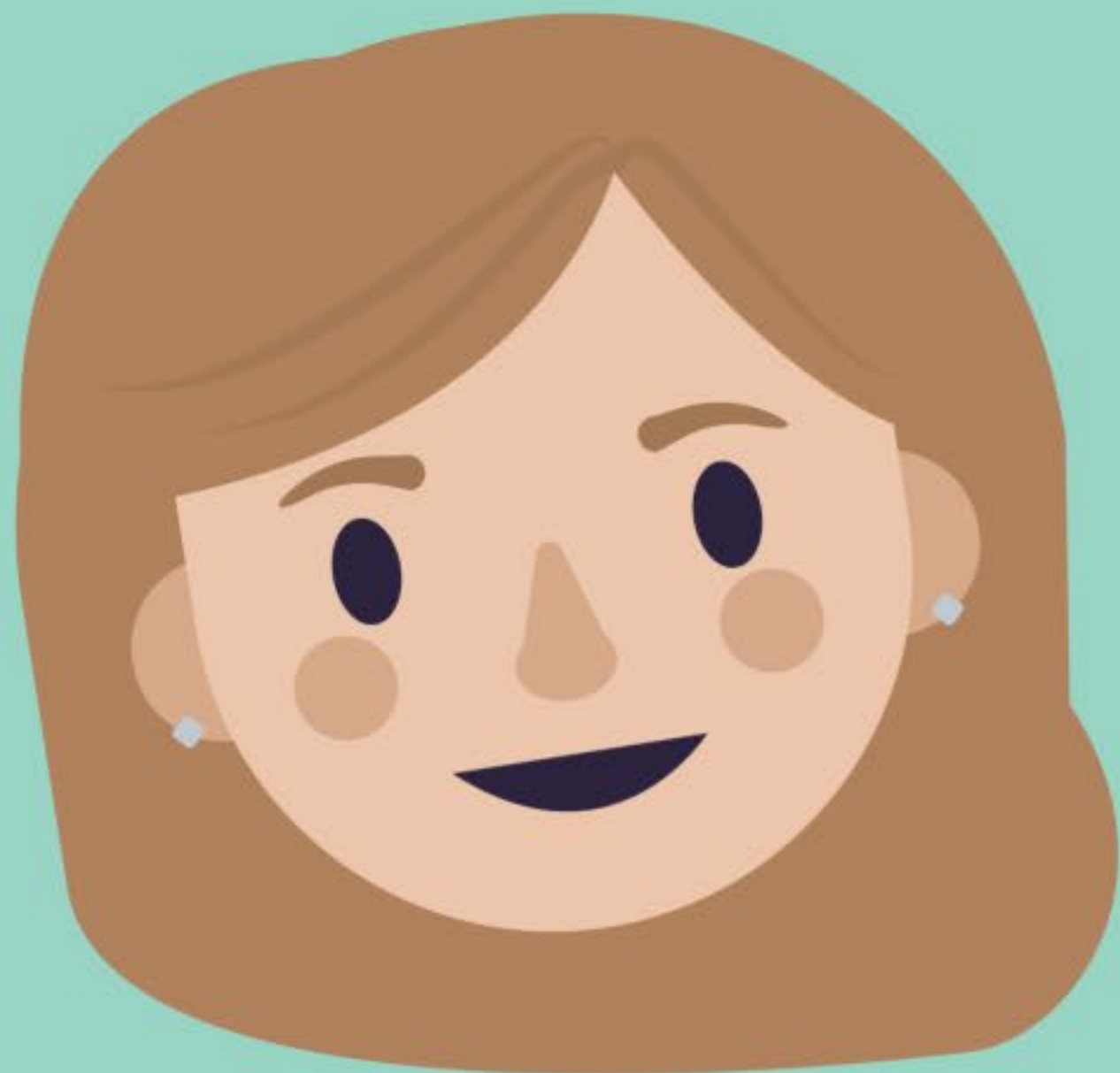
*So far, the wider societal level of care robot orientation has been overlooked.*

It is important that all the concerned potential users receive care robot orientation. Older adults need to be able to voice their needs, expectations, and wishes personally, without others appointing themselves their spokespersons. Nor should care robot orientation rely on the prevailing stereotypical perceptions regarding older adults. By adopting a user-centred approach, the design of care robots' functions can better match the end users' needs and wishes, and this, of course, applies to all potential users. A user-centred approach should characterise the whole care robot orientation process, from design

to implementation and follow-up, instead of emphasising technical ambitions.

Orientation should not stop when care robot technology has been introduced and the essential skills have been learned. As a process, orientation should continue in the care services, in one way or another, all the time. When considering the necessary skills, the relevant questions concern the role and usefulness of robot technology in the care services: what are the aims of using it? The aims may remain unclear to many stakeholders.

So far, the wider societal level of care robot orientation has been overlooked. The demands and prerequisites differ from those of the user level, although they share certain similar characteristics. Consequently, a prudent long-term strategy is needed, involving all the stakeholders, including both the user and societal stakeholder levels, to be able to provide solid and well-founded care robot orientation.





# Checklist

## ***Test your care robot orientation (role: giver/ receiver/ both)***

If you can respond to these questions, you are a potential (future) care robot orientation expert, from your own perspective. This guide has not ended up in your hands by accident. 😊

Thank you for reading!

- ☐ Do you think that you should receive *or* give care robot orientation to someone?
- ☐ Why is it necessary—what is the specific case?
- ☐ What is the basic information that you would need to know *or* tell others?
- ☐ Who should be your target group *or* who should give the orientation to you?
- ☐ How should you give it *or* receive it?
- ☐ How would you know whether you have succeeded? How would you measure that? What could change, and how?

# Epilogue

## **Use of care robots in welfare services: new models for effective orientation (ORIENT, 2018–2020)**

This guide was prepared in an international research project called ORIENT. The two-year project focused on orientation for the use of care robots in welfare services for older adults. The use of care robots is still in its early stages. The project defined orientation as *the continuous co-creative process of introduction to technology use and its familiarisation, involving the learning of multi-faceted knowledge and skills for effective use*.

Within ORIENT, we studied how robots should be introduced, how to plan their use, what kind of support and information the various stakeholders need (older clients, relatives, professional caregivers, service organisations, and a variety of other stakeholders at the societal level), and how these can be taken care of. ORIENT thus aimed to smooth the co-creation of care robot technology and service innovation by identifying and characterising best practices for orientation. The needs of older clients and their relatives are a priority for us. The project also linked care robot orientation to the framework of sociotech-

nical transition, whereby new technologies are seen to contribute to broader societal changes.

Our results showed that increasingly context-related, user-centred orientation methods relating to care robots are necessary, for older adults, professional caregivers, and many other stakeholders – also at the societal level. With our work, we wish to increase understanding of the importance of orientation and its different aspects in the introduction and implementation of care robots. Based on our results, there should be better resources for proper orientation

of professional caregivers who expect to work with care robots. New knowledge is also desirable concerning the use of care robots as a broad-based, systemic issue requiring collaboration between different policies and sectors in the society.

ORIENT was conducted in 2018–2020 by Lappeenranta-Lahti University of Technology LUT, Finland (coordinator); Mälardalen University, Sweden; and Paderborn University, Germany. ORIENT was part of

the Joint Programming Initiative—‘More Years, Better Lives’ (JPI MYBL). The national funders within the JPI MYBL framework were the Academy of Finland (award no. 318837); the Swedish Research Council for Health, Working Life and Welfare (FORTE; award no. 2017-02300); and the Federal Ministry of Education and Research, Germany (award no. 16SV7954).

We gratefully acknowledge the support of JPI MYBL and its representatives, as well as the national

funders. We cordially thank all the informants who generously shared their experiences and thoughts about care robots and welfare technology with us. Thanks are also due to the other national and international collaboration partners of the project.

*[www.robotorientation.eu](http://www.robotorientation.eu)*

# References

Okamura, A.M., Mataric, M.J. & Christensen, H.I. (2010). Medical and health-care robotics. *IEEE Robotics & Automation Magazine*, 17(3), 26–37.

Wu, Y., Fassert, C. & Rigaud, A. S. (2012). Designing robots for the elderly: Appearance issue and beyond. *Archives of Gerontology & Geriatrics*, 54(1), 121–126.

Glende, S., Conrad, I., Krezdorn, L., Klemcke, S. & Krätzel, C. (2016). Increasing the acceptance of assistive robots for older people through marketing strategies based on stakeholders needs. *International Journal of Social Robotics* 8, 355–369.

Goeldner, M., Herstatt, C. & Tietze, F. (2015). The emergence of care robotics — A patent and publication analysis. *Technological Forecasting & Social Change*, 92, 115–131.

Östlund, B., Olander, E., Jonsson, O. & Frennert, S. (2015). STS-inspired design to meet the challenges of modern aging. Welfare technology as a tool to promote user driven innovations or another way to keep References hostage? *Technological Forecasting and Social Change*, 93, 82–90.

Flandorfer, P. (2012). Population Ageing and Socially Assistive Robots for Elderly Persons: The Importance of Sociodemographic

Factors for User Acceptance. *International Journal of Population Research*, article ID 829835.

Melkas, H. (2011). Effective Gerontechnology Use in Elderly Care Work: From Potholes to Innovation Opportunities. In: Kohlbacher, F. & Herstatt, C. (eds.), *The Silver Market Phenomenon: Marketing and Innovation in the Aging Society*. Second (revised) edition, p. 435–449, Springer, Berlin & Heidelberg.

Midgley, G. (ed.) (2011). *Systems thinking*. SAGE Publications.

Gustafsson, C. (2015). Utveckling och implementering av välfärdsteknologi inom demensvård. *Palliativ Omsorg*, 4(32), 26–30. (In Swedish; Development and implementation of welfare technology in dementia care.)

Pekkarinen, S. & Melkas, H. (2019). Welfare state transition in the making: Focus on the niche-regime interaction in Finnish elderly care services. *Technological Forecasting & Social Change*, 145, 240–253.

Akrich, M., Callon M. & Latour B. (2002). The key to success in innovation, Part II: The art of choosing good spokespersons. *International Journal of Innovation Management*, 6(2), 207–225.

Geels, F.W. (2004). From sectoral systems of innovation to socio-technical systems. Insights about dynamics and change from sociology and institutional theory. *Research Policy*, 33(6/7), 897–920.

Loorbach, D., van Bakel, J., Whiteman, G. & Rotmans, J., (2009). Business strategies for transitions to sustainable systems. *Business Strategy and the Environment*, 19(2), 133–146.

Johansson-Pajala, R.-M., Thommes, K., Hoppe, J., Tuisku, O., Hennala, L., Pekkarinen, S., Melkas, H. & Gustafsson, C. (2020). Care Robot Orientation: What, Who and How? Potential Users’ Perceptions. *International Journal of Social Robotics*. 10.1007/s12369-020-00619-y.

Hoppe, J., Johansson-Pajala, R.-M., Gustafsson, C., Melkas, H., Tuisku, O., Pekkarinen, S., Hennala, L. & Thommes, K. (2020). Assistive robots in care: Expectations and perceptions of older people. In: *Aging between participation and simulation - Ethical dimensions of socially assistive technologies in elderly care*. De Gruyter. (Forthcoming in May 2020.)

Pekkarinen, S., Hennala, L., Tuisku, O., Gustafsson, C., Johansson-Pajala, R.-M., Thommes, K., Hoppe, J.A. & Melkas, H. (forthcoming). Embedding care robots into society and practice: Socio-technical considerations. Journal manuscript in review.