Chapter 2
Orientational Knowledge in the Adoption and Use of Robots in Care Services

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Elderly care faces a gigantic shift in technology. Health and welfare technology are expected to help people live independent and healthy lives with retained integrity (Kapadia, Ariani, Li, & Ray, 2015). They are also expected to contribute to the effectiveness and efficiency of elderly care and meeting individual needs (Malanowski, 2008). The demographic challenge of the ageing population also means that fewer people are working. Health and welfare technology could play a significant role in supporting care professionals. The elderly care sector is undergoing structural transformation, and the introduction of health and welfare technology has clear potential to contribute to its development. In many countries, scenarios for elderly care with severe staff shortages and cutdowns are already a reality. One way to drive improvements is to focus on the intersection of the two phenomena—the transformation caused by the shift in technology and the demographic challenge—and the potential they create (Niemelä et al., 2021). Robots have gained more cognitive functions and improved safety, which makes it possible to use them to provide new types of services, including in elderly care (Holland et al., 2021; Preum et al., 2021). The European Union has also advanced the use of robots in providing care services. Yet despite care robots' potential to advance health and welfare, the centrality of ethical, social, and legal issues hampers application (e.g., Seibt, Hakli, & Nørskov, 2014; Melkas, Hennala, Pekkarinen, & Kyrki, 2020b), requiring changes at individual, service, and societal levels, and their interfaces.

A lack of knowledge is a big challenge in the use of robots in care (e.g., Johansson-Pajala et al., 2020). Johansson-Pajala et al. (2020) investigated various stakeholders (older adults, relatives, professional caregivers, and care service managers) and found that many lack knowledge of general matters, such as what a care robot is, what it can

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do, and what is available on the market. Detailed information is also needed concerning care robots' benefits for individuals' specific needs (Johansson-Pajala et al., 2020). Those introducing, using, and assessing care robots must therefore give priority to a nuanced understanding of knowledge. In this chapter, we present a compilation of our recent micro-, meso-, and macro-level studies on care robots and elaborate on the relation between robot technology and knowledge, proposing a focus on *orientation to care robot use* as a continuous co-creative process of introduction to technology use and its familiarization, including learning of multi-faceted knowledge and skills for its effective use (see also Johansson-Pajala et al., 2020; Melkas et al., 2020a). This perspective can be regarded as complementing existing technology acceptance and diffusion models [e.g., Technology Acceptance Model (TAM): Davis, 1986, 1989; Theory of Reasoned Action (TRA): Fishbein & Ajzen, 1975; Diffusion of Innovations (DIT): Rogers, 2003; Unified Theory of Acceptance and Use of Technology (UTAUT): Venkatesh, Morris, Davis, & Davis, 2003], whose creators have focused on different stages of technology adoption, familiarity with technology, use intention, adoption, and post-adoption (Khaksar, Khoslar, Singaraju, & Slade, 2021). We also focus on the *process of how* the adoption, acceptance, and meaningful use of care robots can be facilitated with the help of knowledge.

We base our approach on the view that new ways should be created for increasing knowledge related to care robot use, taking into account the needs of older customers, their relatives, caregivers, and care service organizations. They must not overlook societal-level actors, including business and industry, public administration and the non-profit sector, the media, and other stakeholders in the related innovation ecosystem (Pekkarinen, Tuisku, Hennala, & Melkas, 2019). We focus our research synopsis on the micro-, meso-, and macro levels related to care robot use, aiming also at unveiling a more systemic view of its related knowledge. On the basis of multi-level robot studies and a long background in welfare technology research, we propose shifting the focus from mere training—provision of information—to a more comprehensive understanding of processes and actions towards knowledge building in this area. The transformation caused by the shift in technology requires such novel understanding as a prerequisite for reaping the benefits of care robot use.

Background

Researchers have defined care robots as partly or fully autonomous machines that perform care-related activities for people with physical and/or mental disabilities related to age and/or health restrictions (Goeldner, Herstatt, & Tietze, 2015). These robots may simplify the daily activities of older adults and/or people with disabilities or improve their quality of life by enhancing their autonomy (Herstatt, Kohlbacher, & Bauer, 2011) and providing protection (Goeldner et al., 2015). Wu, Fassert, and Rigaud (2012) categorized care robots as monitoring robots (helping to observe health behaviours), assistive robots (offering support for older adults and their caregivers in daily tasks), and socially assistive robots (providing companionship). Care robots may assist, for example, assistant nurses in their daily tasks (Melkas et al., 2020b). Cresswell, Cunningham-Burley, and Sheikh (2018) presented another categorization of care robots, including service robots (e.g., stock control, cleaning, delivery, sterilization), surgical robots, telepresence robots (e.g., screens on wheels), companion robots, cognitive therapy robots, robotic limbs and exoskeletons, and humanoids. Niemelä et al. (2021) categorized robotic applications and services according to their use contexts and purposes.

Researchers express doubts about the technological readiness of care robots and the lack of concrete usage scenarios for everyday nursing practice (Maibaum, Bischof, Hergesell, & Lipp, 2021). Several challenges exist concerning the organizational culture, practice, and structure of care robots, hence leading to problems with integration (Arentshorst & Peine, 2018; see also Pekkarinen et al., 2020) when efforts are made to use more of them. In general, the acceptance and impacts of digital technologies on customers in elderly care and personnel affect the possibilities of embedding technological innovations into care (e.g., Goeldner et al., 2015; Melkas et al., 2020b). The way in which older customers are involved in the emerging area of care robot use may be essential for their wellbeing and opportunities to learn technology and participate in society throughout the different stages of later life. Despite the recognition that technical aids could promote, sustain, and improve the wellbeing of older people (e.g., Herstatt et al., 2011; Kanoh et al., 2011), usable indicators for good solutions are lacking (Taipale, 2014).

Researchers have previously shown that implementers could have eliminated or relieved most of the negative effects of welfare technology use by means of good orientation, based on foresight information and assessment (Raappana, Rauma, & Melkas, 2007). Users lacking an appropriate level of skills and knowledge struggle with feelings of insufficiency and incapacity, easily leading to lowered motivation and distress. These may mitigate the intended impacts on wellbeing. The most significant factor related to the introduction of technology that motivates an individual is the benefit they get from its use. The different impacts of technology use are often indirect and difficult to identify (Melkas et al., 2020b). Each person's skill level differs, and a technical device in care is not born and used in a vacuum: Behind the technology there stands a user with their own values; the living (or working) environment; and related service activities (Melkas, 2011). Technologies are still typically brought into care services as separate "islands," and the systemic view is missing (Pekkarinen et al., 2020).

Regarding the relationship between knowledge and technology, Jones III (2017) conducted a systematic review on knowledge sharing and technological innovation management and found that three factors are paramount to knowledge sharing: (a) trust, (b) technological training, and (c) good communication. Managers should focus on implementing practices with which they can emphasize these factors in their teams and/or organizations. Teo, Wang, Wei, Sia, and Lee (2006, p. 276) found that for technology assimilation, organizational learning is important in leveraging technological advantages and developing "learning capacities to increase a team's ability to understand and leverage new technologies." Training is important in understanding technologies and sharing knowledge and insights about a technology within a team or organization. Seufert, Guggemos, and Sailer (2021) specified the concept of technology-related knowledge, skills, and attitudes (KSA). Although they focused on teachers, these points are not likely to depend on the profession but are more generally connected to the relationship between knowledge and technology at the micro- (and perhaps also the meso-) level. The creators of the will, skill, and tool model also imply that attitudes are predictors of the actual use of technology (Knezek & Christensen, 2016).

Researchers have devoted far less attention to the relationship between knowledge and technology at the societal level (understood in this chapter as the macro level), especially from a human-oriented perspective. Considering the specific type of technology—robots—the term "robot knowledge" or "robotics knowledge," for example, has gained quite technical interpretations. Suto and Sakamoto (2014) defined "robot literacy" as the ability to have appropriate relationships with intelligent robots, a kind of media literacy because robots can transmit the designers' intentions to the users. Our research approach is broader, including what could be called "societal robot literacy" (societal awareness raising; Pekkarinen et al., 2020).

In this research synopsis, we focus on the relationship between knowledge and robot technology at the micro, meso, and macro levels from the perspective of end users (older persons living in their homes or in assisted living settings and their relatives), care service personnel and organizations, and society. As end users, older people using technology are often viewed stereotypically or represented by assumptions or static identities without cultural and historical constructions (Östlund, Olander, Jonsson, & Frennert, 2015). In this narrow portrayal, old age is strongly related to illness, frailty, lost competences, and costly care. When such images underlie innovation processes, the resulting technology design—for example, of care robots—may implicitly or explicitly position older users only as frail, ill, or in need of care (Neven, 2010), reinforcing the stereotypical and homogenous sociocultural imagery of older people, translated into key design decisions (Oudshoorn, Neven, & Stienstra, 2016). When designers incorporate user diversity at all, they have most often focused only on age and gender differences (Flandorfer, 2012).

Moreover, an imbalance often exists between perceptions of older people's technology needs and knowledge about their actual needs. According to Östlund et al. (2015), the role of older people in digital agendas may simply be to legitimize development for fictive users rather than real ones. Old age is seen as a homogeneous stage in life, yet it covers decades and includes several phases. Society needs a paradigm shift and proactive technology that meets the real needs and demands of actual older people today (see Östlund et al., 2015; Gustafsson, 2015). The structure of elderly care also diverges from some other service processes: Not only is the client involved, but informal caregivers, such as relatives, often provide an essential part of the care (Johansson-Pajala et al., 2020).

From the point of view of work life, workers with low technology skills, in particular, face challenges in the new social and physical environment characterized partly by robots. They have a central role to play in listening to older customers' needs, guiding them, and promoting their wellbeing (Tuisku et al., 2022). Technology implementation requires changes in work practices and collaboration among organizations, as well as in the knowledge and skill levels of personnel. Because organizational decision-makers do not commonly consider technology and care services as connected, the introduction of technologies such as care robots may lead to fatigue, loss of work motivation, additional costs, unwillingness to use the technology, and a decrease of well-being at work, sometimes even resulting in the premature loss of the experience and professional skills of older workers (e.g., Venkatesh & Davis 2000; Brougham & Haar, 2018). Yet professional caregivers have highly valued the introduction of technology into elderly care. According to Gustafsson (2015), in dementia care—which is considered "low-tech" care—professional caregivers consider it highly valuable for older people to be part of technology development. Caregivers suggest that not excluding older people with dementia but offering them technology support for increased wellbeing is an important ethical aspect.

Importantly, we consider knowledge about care robot technology 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 (Pekkarinen & Melkas, 2019; Akrich, Callon, Latour, & Monaghan, 2002; Geels, 2004). This makes innovation in structures, mindsets, and practices that involve stakeholders from different sectors, domains, and levels important (Loorbach, van Bakel, Whiteman, & Rotmans, 2010).

We thus propose focusing on knowledge as a key issue for care robot use. We wish to contribute to finding appropriate and effective forms of increasing knowledge, and to providing practical, user-centered learning to promote inclusive technology implementation and use. Although the role of knowledge in different contexts becomes more important with increasing digitalization, researchers of knowledge and technology use have often worked quite generally, or only at one or (at most) two levels (of the micro, meso, and macro). They seem to have largely overlooked practical knowledge-building efforts in care robot-related research, even though earlier researchers identified various obstacles to acceptance of care robots and shortcomings in their use. Sharkey and Sharkey (2012), for example, noted that the use of robots in elderly care brings various ethical problems: the loss of human contact; the feeling of objectivation; a loss of control, privacy, and liberty; deception and infantilization; and the question of whether older people should be allowed to control the robot. Customers 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 in the face of the jungle of various technologies, wondering what is suitable and for what purposes (see Johansson-Pajala et al., 2020). The novelty of care robots exacerbates these problems. Producers of appliances and systems often organize initial training for care organizations, but such training is provided by trainers who do not work in the care sector, and the specific needs of an individual care organization—let alone an individual employee—are rarely taken into account (Melkas, 2013).

The variety of concepts related in one way or another to knowledge and technology may obscure the essentials. The concepts of acceptance, adoption, assimilation, or introduction, familiarization, domestication, and embedding may be well-known, but the existence of multiple terms may blur the overall picture. By contrast, *training* is very commonly used. Questions remain: How much and what kind of training is needed, and for whom? However, we focus this research synopsis on a broader matter—the advancement of an increasingly systemic and multi-level perspective on knowledge building—with which we expand the relatively narrow focus of training towards a more comprehensive and interactive *process* and *action* focus.

Methods and Materials

In this chapter, we present a synopsis of our recent research on care robot use published since 2019, referring to individual research contributions and findings where appropriate. We carried out this research as part of the ROSE and ORIENT projects, which we implemented together with colleagues from other Finnish universities, Sweden, and Germany. ORIENT ("Use of Care Robots in Welfare Services: New Models for Effective Orientation, 2018–2020") was an international research project that belonged to the JPI "More Years, Better Lives," centered on the use of care robots in welfare services for older adults. Within ORIENT, we studied how robots should be introduced, how to plan their use, what kind of support and information the various stakeholders need, and how these can be taken care of. We also linked our research to the framework of sociotechnical transition, whereby new technologies are seen as contributing to broader societal changes. ROSE ("Robots and the Future of Welfare Services") was a 6-year multidisciplinary research project funded by the Strategic Research Council (SRC) established within the Academy of Finland. The project's objective was to study the current and expected technical opportunities and applications of robotics in welfare services, particularly in care services for older people. We conducted our research at three levels: individual (micro), organizational (meso), and societal (macro).

In the field studies, surveys, and interview studies that we have carried out in recent years, we have focused on gaining understanding of end users'—older adults, their relatives, and care professionals alike—needs, perceptions, and experiences of robots in care, and various challenges faced when taking robots into use or raising awareness about their potential. In other studies, we have focused on gaining an understanding of organizational and societal levels. Several of our studies were connected to the long-term actual implementation of robots in authentic care or related environments. The findings from these studies are thus often based on the participants' first-hand experience of robots in their everyday lives and work in the context of care for older people. We utilize our theoretical background to draw on inputs from innovation research, inter alia.

Knowledge-Related Needs at Different Levels

Micro- and Meso-level Studies

Implementation of a humanoid robot in public elderly care services

The Zora robot is a 57 centimetre-tall humanoid-type care robot (see Fig. 2.1). It can be used for rehabilitation and recreational assistance with exercise; it can also play music, perform dances, tell stories, and play interactive memory and guessing games. Softbank Robotics produces this Nao-type robot with software developed for application in the healthcare field.[1] In regards to elderly care, Huisman and Kort (2019) and Kort and Huisman (2017) have concluded from studies conducted in long-term facilities that the Zora robot can positively influence both clients and staff. They found the potential for offering alternative means of pleasure and entertainment and rehabilitation for older clients, but the long-term care facilities are still exploring the most suitable target groups for Zora use (Kort & Huisman, 2017). Researchers studying acceptance and attitudes towards care robots have often used only pictures or audio-video material to, for example, elicit respondents' opinions of care robots (van Aerschot & Parviainen, 2020). When actual care robots are used

Fig. 2.1 The Zora robot. Source: Photo by Satu Pekkarinen

[1] For more detailed information, see www.zorarobotics.be

in research settings, researchers have mainly conducted short-term trials and pilot projects (Andtfolk, Nyholm, Eide, & Fagerström, 2021). We conducted longitudinal multi-perspective research on the implementation of Zora in 2015–2019. Our research consisted of a field study of the implementation phase and follow-up interviews after three years of use of the first Zora utilized for public elderly care services in Finland.[2]

From our field study results in the implementation phase (Melkas et al., 2020b), we concluded that the robot's presence stimulated the clients to exercise and interact. The care workers perceived the clients' well-being as both a motivation to learn how to use robots and a justification for negative views. The robot's use was associated with multiple impacts with positive, negative, and neutral dimensions. These included impacts on interaction, physical activity, emotional and sensory experiences, self-esteem and dignity, and service received for clients; and impacts on the work atmosphere, meaningfulness of work content, workload, professional development, competences, and experience of work ethics for care personnel. Impacts on care personnel were related, for example, to the need for orientation, problems with time usage, and overall attitudes towards the novelty and renewing of care service. The caregivers highlighted the importance of knowing the clients and their needs well in advance when planning to use the robot. They emphasized that ample time for training and orientation for all personnel was needed. Orientation (referring to training and learning) related to care robots should comprise not only an explanation of technical issues, but also cover issues related to time usage and task division. The managers also recognized the need for orientation, a major issue that requires emphasis and skillful handling: "I asked the importer to give training when I saw the fear, distress, and diffidence about the robot" (an instructor).

The use of the Zora robot affected the integrity of the entire workplace community in our study, as there were some tensions between robot users and non-users, and between "puttering about robot use" (as others perceived it) and "real care work." Many of the identified impacts were related to how the robot fit into the service processes. Workflow integration was challenging. Thus, although Zora has the potential to be part of care services and multifaceted rehabilitative functions, the need for careful systemic planning became clear. The robot's use must be well planned, with an understanding that the robot's usefulness varies and may increase over time. Realizing a robot's full potential may depend on providing staff with a proper orientation, usage time, and clear motives for use. Organizational leadership commitment may increase benefits for the clients and personnel in the establishment phase (e.g., from the viewpoint of meaningfulness of work). However, such

[2] The data on the implementation phase consisted of semi-participatory observation (27 sessions), focus group interviews of care workers, clients and social and healthcare students, and individual interviews of the management (49 interviews), as well as comments in the public media from January to April 2016. We further conducted seven follow-up interviews (care personnel from three units and managers) in the spring of 2019. We analyzed the data using the qualitative human impact assessment approach (Melkas, 2011) to identify the impacts of care-robot implementation on users, that is, care personnel and older clients.

benefits may remain negligible if the use is not well planned and led. An inadequate understanding of the purpose and meaningful tasks of the robot may lead to unrealistic expectations and unmet needs (Melkas et al., 2020b).

By thus studying the implementation phase, we unearthed the tricky relationship between knowledge and robot technology at the micro and meso levels. The impacts on care personnel were closely and in multiple ways related to knowledge-building needs, such as knowing about the device and its purpose and meaningful use for different kinds of clients; the workplace community's knowledge building about personnel's needs, time usage and task divisions; and addressing possible fears. We also reached insights into knowledge and clients. Clients should not be misled; the role of ethics is of key importance; and it is essential for the care personnel to explain to the clients what the robot is doing throughout the sessions, how clients can address and interact with it, and the role of the robot operator. As one caregiver said: "Elderly clients are grown-ups, even if they suffer from memory diseases. They are not stupid. The operator of the robot should tell them what is done and why."

Moreover, we studied the implementation phase using media analysis. Tuisku, Pekkarinen, Hennala, & Melkas (2019) examined the publicity surrounding the implementation of Zora. The aim was to discover opinions concerning the use of robots in elderly care as well as the arguments and justifications behind them. As the first Zora implementation in Finland in public elderly care services, the robot received much publicity, both regionally and nationally. From comments collected from online and print media, analyzed by means of interpretative content analysis, we learned that public opinion was mainly negative, but that the commentators apparently had little information about the robot and its tasks. There is clearly a need for more knowledge at the societal level for a better-informed discussion of how robots can be used in elderly care. Knowledge is also needed on how to involve the general public in this discussion in a constructive way.

Through our study on the long-term use of Zora (Pekkarinen, Hennala, & Tuisku, forthcoming), we showed that even though the care workers felt that the robot was a nice robotic "messenger" and that it brought new and interesting challenges to their work and recreation for clients, the robot-assisted service was not truly embedded in the daily services of the care units. This is due to factors such as changes in the organizational structures, and changes in personnel and tasks, which led to shortcomings in the provision of information and processes related to long-term robot use.

Exoskeleton trials

Wearable exoskeletons are increasingly being used in physically demanding jobs to support good ergonomics and augment muscular strength. Little is known about nurses' willingness and ability to use exoskeletons. Laevo Exoskeleton (see Fig. 2.2) is a wearable back support vest that, according to the manufacturer, alleviates lower back strain by 40–50%. Exoskeleton trials reported by Turja et al. (2020) were conducted during 2019 and 2020. Despite the low-tech nature of the equipment (see Fig. 2.2), researchers need trials to investigate the opportunities wearable technology

Fig. 2.2 Laevo. Source: Photo by Päivi Tommola. Reprinted with permission

provides for making care work physically less demanding. We tested Laevo exoskeletons in authentic care homes and home care environments in Finland. In the qualitative analysis, which we have summarized here, we investigated the social environment's impact on the intention to use exoskeletons.

Care workers (n = 8) used the exoskeleton individually for some days, up to 1 week. The participants were interviewed before and after the trial period, and they kept a diary on their use of the exoskeleton. In the pre-interviews, most nurses expected exoskeleton use to arouse interest and curiosity among patients and their relatives. Some thought the exoskeleton could cause aversion, especially if the nurses themselves expressed negative attitudes towards the exoskeleton or were unable to respond to questions about it. However, some suspected that the exoskeleton would not even draw the patients' attention, especially of those who suffered from memory disorders. These predictions proved to be quite accurate. The nurses reported that some patients assigned fairly negative attributions to the exoskeleton, such as calling it "a mess." This may be because the nurses' appearance while wearing the exoskeleton came across as clumsy and awkward. In post-interviews, the nurses revealed that the patients showed compassion towards those who "had to" use the exoskeleton.

In the pre-interviews, the nurses assumed that their colleagues would have quite mixed views about the exoskeletons. They expected that some colleagues would have a very negative opinion, merely because they did not know enough about the exoskeleton's usefulness. Some nurses anticipated that the trial period might cause colleagues to either ridicule the device or express interest in trying it out. Although the post-interviews supported these presumptions, the nurses also expressed that their colleagues questioned the exoskeleton's weight and pleasantness. The colleagues presumed that the discomfort would decrease the intention to use the exoskeleton, but the nurses themselves expressed being motivated to use it primarily because it would improve their ergonomics, and how this promise of positive health benefits would outweigh any possible drawbacks. We concluded that besides the functional characteristics of the device, many aspects of human-centered care work have to be taken into consideration when implementing exoskeletons in the care context. This indicates that new technology must be compatible with the ethical and social norms of care work (Turja et al., 2020).

As a result of the trials, the nurses did not believe that their colleagues or patients would much oppose use of the exoskeletons. They also thought that managers would be supportive. It is important to design new technologies and work methods together with professionals, utilizing their knowledge. Specific characteristics of geriatric care work either enhance or hinder the implementation of this new technology. The specific professional context and the cultural context of exoskeleton acceptance need to be emphasized. For example, ease of use has typically played a strong role in predicting intention to use technology (Heerink, Kröse, Evers, & Wielinga, 2010), but this did not appear as a prerequisite for accepting exoskeletons among Finnish nurses.

To summarize, the micro- and meso-level field studies showed, from the point of view of knowledge-related needs and knowledge building, that training and learning related to care robots must include more than an explanation of technical issues. They must also cover a wide variety of different issues, such as time usage and task divisions, with managerial involvement. The provision of information and thus knowledge building are needed to enable integrating robot-assisted services in the daily services of the care units. The benefits of use should also be clarified with regard to the characteristics of human-centered care work. Care personnel play a role in knowledge building towards their clients.

The role of assistant nurses in care robot use

Assistant nurses are an important part of care personnel. They support basic care and thus work at the grassroots level, closest to older adults with care needs. They form the largest professional group of Nordic social and health care (Ailasmaa, 2015). Yet researchers of technology use often overlook them (Glomsås, Knutsen, Fossum, & Halvorsen, 2020). According to our studies, understanding their perspectives and needs for knowledge seems essential for the implementation of care robots (Melkas et al., 2020b). With the increased use of technology, assistant nurses' tasks are also likely to include introducing new technology to older adults and supporting them in its use (Øyen, Sunde, Solheim, Moricz, & Ytrehus, 2018).

To understand the role of assistant nurses (and as part of their work communities) in robot technology use, and to contribute to future strategies for orientation to care robot use, Tuisku et al. (2022) examined assistant nurses' views of and need for receiving and giving orientation to care robot use in three European countries—Finland, Germany, and Sweden—using an online questionnaire developed based on earlier research (Johansson-Pajala et al., 2020). A total of 302 assistant nurses responded to the survey (Finland n = 117; Germany n = 73; Sweden n = 112).

According to the results, only 11.3% of assistant nurses had given orientation about care robot use to older adults or colleagues, but over 50% were willing to do so. Those with experience using care robots should take part in orientation. The most common information source regarding receiving orientation to care robot use was traditional media. Meanwhile, most nurses preferred to be introduced to care robot use through face-to-face interactions. In these introductions, they considered the most important pieces of information to be the benefits of a care robot (e.g., how it can assist caregivers). Respecting the different welfare systems per country, orientation to care robot use should be seen as part of care management and an issue that may affect future elderly care.

Assistant nurses are both receivers and providers of orientation to care robot use, and thus have the role of "mediators" of related knowledge. In this sense, they are indeed a critical group, as orientation to care robot use essentially relates to a mixture of practical and professional knowledge possessed by assistant nurses. Management should allow assistant nurses to get to know care robots by offering information and involving them in managerial discussion on how care robots can improve their work and facilitate older adults' meaningful and prolonged independent lives. Orientation to care robot use should be seen as part of care management and as an issue that may affect the whole organization (Tuisku et al., 2022).

As regards the relationship between robot technology and knowledge, we learned from surveying assistant nurses that it is important to understand them as both receivers and providers of orientation to care robot use, having the role of "mediators" of knowledge related to care robot use. Tailored orientation methods are needed to respond to the knowledge needs of assistant nurses, and orientation activities must form part of care management.

Multi-level Studies

Macro-level stakeholders' views of the care robotics innovation ecosystem

Societal actors and researchers still rarely discuss the societal and systemic levels related to the use of care robots, despite efforts to advance the use of robots in welfare services and various countries' initiatives to produce robotization strategies for those services. A wider and deeper understanding of the societal and systemic levels is missing, and ecosystem concepts could provide some assistance. Ecosystems are networks that gather complementary resources to co-create value (Moore, 1996) and involve cooperation, competition, and interdependence (Adner & Kapoor, 2010). Some scholars still regard the concept of the innovation ecosystem (Adner & Kapoor, 2010) as synonymous with the business ecosystem, whereas others differentiate the two (de Vasconcelos Gomes, Figueiredo Facin, Salerno, & Ikenami, 2018). De Vasconcelos Gomes et al. (2018) identified a dividing line: The business ecosystem relates mainly to value capture, whereas the innovation ecosystem relates mainly to value creation.

We conducted a study in which we focused on the dynamics of the emerging care robotics innovation ecosystem in Finnish welfare services (Pekkarinen et al., 2019; Tuisku, Pekkarinen, Hennala, & Melkas, 2017). As innovation ecosystems have both an evolutionary nature and aspects of purposeful design, we examined the relevant actors, their roles, the accelerators, and the barriers by conducting a survey among relevant stakeholders in the innovation ecosystem. The online survey was completed by a range of Finnish stakeholders (n = 250), including service actors (n = 148) and research and development actors (n = 102). We identified the care robotics innovation ecosystem as involving, on the one hand, service actors who are responsible for acquiring robots in welfare services (such as municipalities and hospital districts) and, on the other hand, research and development actors (decision-makers, development organizations, research institutes, and robot-related firms), whose tasks are related to the development work of robots, and from different perspectives. The service actors have more hands-on expertise in welfare services than the R&D actors. We prepared for the survey by carefully identifying the stakeholders in this emerging domain in Finland, then analyzed the two groups' responses using a pairwise t-test.

According to our results (Pekkarinen et al., 2019), the Finnish care robotics innovation ecosystem is still largely in its nascent stage. Essential stakeholders are missing or involved in many additional activities. Among the variety of stakeholders needed, the most important groups that should be involved are private persons who use robots in their homes, customers of services that utilize robots, and professionals who use robots. This concerns both the discussion and product and service development related to robots. The R&D actors, in particular, emphasized that private persons who use robots in their homes and customers of services that utilize robots should be involved in public discussion and development activities. The respondents also indicated the important role of researchers in public discussion—they are most likely to provide valid information based on empirical knowledge. The R&D actors seemed to think that more stakeholders needed to take part in the discussion than the service actors did. Overall, collaboration regarding the use of robots in welfare services remains rare. The R&D actors collaborated significantly more than the service actors. Service actors need to play a stronger role in the ecosystem.

Pilot studies with care robots have been loosely connected to the real aims of care (Pekkarinen et al., 2019). Robots should be integrated into other care technologies and into existing processes and information systems in care. We found the dynamics in the care robotics innovation ecosystem to be largely based on social and cultural issues. According to our results, three factors had the greatest effect on slowing down and hindering the introduction of robots: the care culture, resistance to change, and fear of robots. We found that Finland's piloting culture accelerates the introduction of robots and ecosystem growth in society, but that hindering factors such as fears and resistance have an impact. These hindering factors are largely attitudinal and are based on existing path dependencies rather than on technological limitations. Experimental projects in real-life contexts are seen as critical, as they bring together actors from various environments in shared networking and learning activities (Bugge, Coenen, Marques, & Morgan, 2017). However, as brought up in the context of the Zora study, a shortcoming in care robot research has been its conductors' focus on short-term trials and pilot projects (Andtfolk, Nyholm, Eide, &

Fagerström, 2021); longitudinal multi-perspective research has been lacking. Thus, a certain tension seems to exist in the culture of piloting (for a discussion, see the sub-section on impact assessment).

Defining ecosystem boundaries is generally challenging, and the ecosystem's and individual members' successes may even conflict. The creation of an "ecosystem mindset" is becoming important (see also Niemelä et al., 2021). Especially from a future-oriented perspective, ecosystem thinking may be developed with the help of education. In addition to increasing "hard" technical competences, education should cover issues related to the practical use of robots as well as work-life changes brought about by robot use. Those participating in the stakeholder survey highlighted: new abilities to process and analyze data; knowledge about data and cyber security, automation, and industrial management; understanding about social dimensions of robot technology, operational logic, and principles of robots as well as usability; skills in design of user interfaces and robotic devices; and knowledge about ethical issues and risks related to robotics. Educational institutions should build multidisciplinary programs that combine technical and welfare-related issues. Students of social and health care should gain certain technical competences, whereas those studying technology should gain competences in psychology and behavioral sciences. The survey respondents emphasized holistic understanding. Clearly, education can advance multi-sector and multi-professional skills and knowledge, as well as openness (Pekkarinen et al., 2019; Tuisku et al., 2017) and these competences are needed for future working life.

To summarize, regarding the relationship between robot technology and knowledge, the stakeholder survey showed that in the innovation ecosystem, users' knowledge—meaning here both private persons and care professionals—should be more visible in joint knowledge building. An ecosystem mindset is also related to joint knowledge building. Ecosystem knowledge can be advanced through education. Knowledge and competence needs that should be addressed in society and in workplaces are broad and diverse.

Multi-level perspectives on care robot use

Care robots in Finland: Overall findings

To unearth a multifaceted picture of the situation in Finland (for international studies, see Hoppe et al., 2020; Johansson-Pajala et al., 2020; Pekkarinen et al., 2020), we conducted multi-level interviews at the micro-, meso-, and macro levels. At the micro level, 18 individuals participated in the focus group interviews (older people, their relatives, professional caregivers, and care managers). At the meso level (organizational and community level), 12 individuals participated in semi-structured interviews (representatives of companies, interest organizations or associations of social and healthcare professionals, interest organizations or associations of end-users/citizens (older people), organizers or providers of public social and healthcare services, and educational institutions for educating professionals for social and healthcare or welfare technology fields). The macro-level (societal level) participants included 11 individuals in semi-structured interviews (representatives of political decision-makers, research institutes, insurance organizations, funding organizations, and the media).

Analyzing our results, we learned that "the door is open" for robot use in Finnish care for older adults. The conductors of various pilots have offered several glimpses of this, but there is an obvious lack of knowledge about the benefits of robot use and a lack of understanding of robots' tasks in services, their integration into clients' services, collaboration between various stakeholders, and competence in management and procurement. The interviewees emphasized the problem of "project-natured" pilots that lead to no permanent activities. On the one hand, inadequate, even skewed, information exists about the real opportunities of robot use in care for older adults; on the other hand, people have exaggerated expectations for, and fears of, the use of robots.

The attitudes of professional caregivers and clients towards robot technology varied in the study. Resistance was caused by the way in which robot use is marketed; marketing focuses only on economic concepts and underscores savings instead of quality of care. At all levels, interviewees strongly emphasized two issues: lack of knowledge and competence, and economic factors. At the micro level, they stressed several issues:

- Older adults need sufficient introduction to the robots, provided early on and individually, on each older adult's terms.
- Professional caregivers need sufficient resources for learning, which must be led, well organized, and supported by supervisors.
- Caregivers are occupied by the various ethical questions; older people's relatives recognize the caregivers' haste and hope that robots will increase the amount of human care.

The meso-level interviewees emphasized the following challenges: the one-off nature of pilots; levelling up of robots into the structure of the care system and vocational education; management and its support related, for example, to resistance to change; and a lack of shared national-level practices and guidelines. The macro-level interviewees highlighted the following challenges: uncertainty of the roles of different stakeholders, lack of a "knowledge concentration," and inadequacy of steering and funding mechanisms. Some interview quotations follow:

> 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 organization for end users)

> 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)

With these multi-level interviews, we confirmed the importance of integrating care robot-related issues into the education of future care professionals early in their studies. Basic education at all levels of social and health care should include education on care robotics. According to the interviewees, care robotics is not a separate issue to be discussed in some special courses—as it is nowadays—but 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. (Caregivers' interest organization)

The interviewees brought up good examples of educational pilots in vocational education—cross-disciplinary programs—but they noted that new occupations and occupational groups will emerge, which increases the need to understand each other's work and the big picture. As technology may become outdated, those designing basic education in social and health care should not settle for teaching the use of individual devices but should create capabilities to see and develop robot use as a wider topic.

Knowledge brokerage

Knowledge brokerage—the value of knowledge brokers, actors who "translate" diverse stakeholders' different "languages" for the common good—requires attention in robot use more generally and particularly in care robotics ecosystem development (Parjanen, Hennala, Pekkarinen, & Melkas, 2021; Pekkarinen et al., 2020). According to Burt (2004), brokerage (or brokering) could occur by making people on both sides of a structural hole aware of the other group's interests and difficulties, transferring best practices, drawing analogies between groups ostensibly irrelevant to one another, and synthesizing knowledge interests. We analyzed the multi-level interviews from this perspective to identify macro-, meso-, and micro-level brokerage needs, functions, and roles in care robotics innovation ecosystems and networks, as well as the kinds of knowledge that should be brokered at these different levels.

According to the results (Parjanen et al., 2021), emerging care robotics ecosystems and networks need brokerage functions to create operational conditions, bring disparate actors together, manage innovation processes, create learning possibilities, and share best practices. However, this brokerage must vary by level, indicating that the functions and roles of brokers and brokered knowledge may be emphasized differently. At the macro level, actors need system-level knowledge; at the meso level, they require knowledge related to innovation process management and user knowledge; and at the micro level, experimental and tacit knowledge takes precedence. Interest organizations of end users, for example, have an important role to play—they diffuse knowledge, as from the employees of the social and healthcare sectors or clients of care homes to the decision-making levels. The interviewees stated that it is essential for user knowledge to be collected by a neutral actor to better reveal the impacts of care robots. One broker or brokering organization typically has several roles, such as policy executor, creative actor, crosser of distances, shaper of organizations, and sniffer of the future (Parjanen, Melkas, & Uotila, 2011; Parjanen et al., 2021).

Socio-technical transition

Along with the ecosystem perspective, we have used the perspective of socio-technical transition in our research to focus on the societal level. In Pekkarinen et al. (2020), we tackled the socio-technical transition—a multi-level change with a reconfiguration of the social and technological elements of the system—of elderly care. Socio-technical transitions differ from technological transitions in that they include changes in user practices and institutional structures (e.g., regulatory and cultural) in addition to the emergence of new technologies (Markard, Raven, & Truffer, 2012). This is essential to consider, as a sector such as elderly care is traditionally seen as being based on human work and values. We examined the transition in the elderly care system and the conditions of embedding robots in welfare services and society in three European countries—Germany, Sweden, and Finland. We studied the ongoing change in elderly care services and the introduction of robotics in the field in terms of the multi-level perspective on transitions (e.g., Geels, 2002, 2004, 2005; Geels & Schot, 2007), a central framework facilitating the study of socio-technical transitions. With this approach, we highlighted the interdependence and mutual adjustments between technological, social, political, and cultural dimensions (Smith, Voss, & Grin, 2010; Bugge et al., 2017).

The interviewees represented the regime level in the transition framework; they acted as intermediaries at the interface between, for instance, end users and decision-makers, but also between the niche-level actors and landscape-level changes. In our qualitative study, we focused on the current situation in the use of robots in elderly care as well as advancing and hindering elements in integrating robots into society and elderly care practices. According to the results (Pekkarinen et al., 2020), there is a shift towards using robots in care, but remarkable inertia exists in both technological development and socio-institutional adaptation. Advancing and hindering elements in transition are both technical and social and increasingly interrelated, which those creating management and policy measures must consider to facilitate successful future transition pathways. The change in attitudes and embedding of robots into society are promoted, for instance, by raising relevant knowledge on robots at different levels.

We concluded (Pekkarinen et al., 2020) that the care currently provided solely by human caregivers seems to be shifting towards care provided through collaboration between human caregivers and technologies, but that the rules and practices for this work division are still unclear. There is almost mythical talk that “the robots are coming,” but when, how, and in which conditions, what it means in practice, and what their place will be in the care context are still largely undefined issues sparking discussion. In socio-technical terms, several “socio-technical negotiations” (see Akrich et al., 2002) seem to be ongoing within the regime. There is still no clear pathway to collaboration, and although there is much interest in robotics in elderly care, mainly due to economic pressures, attitudinal and other constraints exist. We listed three general-level socio-technical scenarios: (1) human-oriented care, in which robots assist just a little or in certain tasks, mainly on an experimental basis; (2) care produced jointly by humans and robots, with a smooth and well-defined division of labor; or (3) technology-oriented care, where humans act mainly as "interpreters" and "backup" (Pekkarinen et al., 2020). Although how different countries react to the transition remains to be seen, further research on the role of knowledge in socio-technical transitions is needed.

Impact Assessment and Co-creation at Different Levels

Continuous and early impact assessment (emphasized in the Zora study; Melkas et al., 2020b) is an essential element at all three levels. Importantly, care robot implementation research needs attention, as its conductors provide a longer-term view of robot integration challenges than those conducting pilot studies. Impact assessment—conducted on a continuous basis and early enough, not just as ex-post evaluation—may unveil invisible or seemingly irrelevant processes and stakeholders that should be considered in corrective actions when negative impacts are observed. Opportunities for implementation research have been slowly increasing in Finland (e.g., Melkas et al., 2020b). Piloting is often seen as a process that, at best, starts with the collection of information and ends with evaluation. Evaluators seek to discover factual information on, for example, users' experiences concerning the robot's benefits, challenges, and usability. When considering the innovation ecosystem perspective and, generally, the multi-level perspective, we have found that implementors should approach integrating robotics into welfare services as a co-creative piloting and implementation culture within the wide ecosystem, rather than as a process (Hennala et al., 2021). Actors in such a culture would emphasize the whole of care (the architecture, processes, actions, and ways of thinking) into which robots are being brought, at the different levels—micro, meso, and macro—and any interfaces between them.

The focus should be on paying close attention to what takes place and emerges during the pilots and implementation, particularly the kinds of dynamics that occur and who is truly involved in the co-creation (the users, notably). From the perspective of managing such a cross-cutting culture and the innovation ecosystem, it is essential to understand and utilize such focused knowledge by, for example, strengthening positive elements and weakening or eliminating the negative aspects identified in our studies. Management of a co-creative piloting and implementation culture is obviously demanding, as co-creation within the integration of robotics comprises not only direct interaction between diverse people, but also factors such as professional identities, managerial practices, "states of mind," feelings, responsibilities, and future horizons (Hennala et al., 2021).

Altogether, with our multi-level studies we confirmed numerous knowledge and knowledge building-related needs, such as a general lack of knowledge about the benefits of robot use and robots' tasks in services, their integration into clients' services, and collaboration between various stakeholders. Knowledge is also needed to build up competence in management and procurement, and to help address people's exaggerated expectations for, and fears towards, the use of robots. Knowledge needs to be nurtured early, such as during the education of future care professionals.

Knowledge brokers—actors who “translate” diverse stakeholders’ different “languages” for the common good and are aware of different types of knowledge—are essential, as is elaborating on relevant knowledge about robots at different levels to promote successful socio-technical transition and innovation ecosystem development. Some of these findings were already visible in our micro- and meso-level field studies, but a multi-level perspective is essential in this topic.

Discussion and Conclusions

With the different studies we presented in this chapter, we have focused on knowledge and knowledge building in many ways, whether regarding the question of clients of services utilizing care robots, their relatives, professional caregivers, or other groups or levels. The relationship between knowledge and technology is complicated and multifaceted, and we have discussed it by focusing on the use of care robots. We have offered a synopsis of our most recent care robot studies, conducted on the macro-, meso-, and micro levels. Technological change requires numerous changes in knowledge, yet the essential concept of knowledge may be handled in an aggregate way that hides much of its potential. Knowledge is not a stable or homogeneous issue; researchers have previously identified numerous types of knowledge. In future, researchers could also consider discerning different types of knowledge during the multi-level technological change affected by the emergence and implementation of robot technology. In the remainder of this chapter, we focus on our core concept related to knowledge and knowledge building: orientation to care robot use. We also propose practical orientation pathways on the basis of our research and a guide that we have written on this topic (Melkas et al., 2020a).

Orientation to Care Robot Use

By presenting a compilation of recent micro-, meso-, and macro-level studies on care robots, we have elaborated on the relationship between robot technology and knowledge and aimed at unveiling a more systemic view into the knowledge related to care robot use. We propose to shift the focus from mere training—provision of information—to a more comprehensive understanding of *processes and actions* towards knowledge building in this area as a prerequisite for reaping the benefits of care robot use. Various concepts related in one way or another to knowledge and technology may obscure the essentials—concepts such as acceptance, adoption, and assimilation or introduction, familiarization, domestication, and embedding. We also used multiple concepts in our research. Whereas previous researchers have discussed training, especially when new technology is adopted, the focus of our research synopsis is broader—advancement of an increasingly systemic and multilevel perspective on knowledge building—with the aim of expanding the relatively narrow focus of training towards a more comprehensive and interactive process and action focus.

We propose *orientation to care robot use* as a key issue in societies, workplaces, and homes, and define it as a continuous co-creative process of introduction to technology use and its familiarization, including learning of multi-faceted knowledge and skills for its effective use (see also Johansson-Pajala et al., 2020; Melkas et al., 2020a). With “co-creative process,” we are referring to collective action with differing roles and participants, and the importance of identifying opportunities and co-creating practical possibilities through a process of sharing knowledge in dialogue (Bergdahl, Ternestedt, Berterö, & Andershed, 2019). “Introduction to technology use and its familiarization” is related to user involvement among professionals in the implementation of technology in care services (Glomsås et al., 2020). “Learning of multi-faceted knowledge and skills for effective use” covers care professionals’ involvement, knowledge, and ownership, which researchers have shown to be important success factors in innovation processes in the workplace (Framke et al., 2019; Tuisku et al., 2022). We regard this perspective as complementing existing technology acceptance and diffusion models whose creators focus on the different stages of technology adoption (Khaksar et al., 2021). We focus on the processes and actions taking place, or needing to take place, on different levels; *how* adoption, acceptance, and meaningful use of care robots can be facilitated; and on understanding this process as inherently social action taking place among orientation givers and receivers, in addition to a more individual-level action (Tuisku et al., 2022; see also Melkas, 2013).

Referring to Venkatesh et al. (2003), our understanding of orientation is particularly related to the “facilitating conditions” construct. It is the action of orientating oneself or others. It should not be a one-time activity (when a device or solution is brought to use) but an ongoing process. We thus understand the construct as much more than (initial) training; as a process, it should also be able to “absorb” critical views and questioning attitudes. The word “orientation” itself does not have the self-evident positive nuance of “acceptance” or “adoption”; thus, it may be considered more neutral. Many studies stop at seeking to understand what affects the adoption of technology, for example, among care professionals, to provide new knowledge for introducing and implementing various technologies in care in the future. However, they fail to take into account the orientation-related “doing part.” Innovation scholars call the experience-based mode of learning and innovation the “doing, using, and interacting” (DUI) mode (Jensen, Johnson, Lorenz, & Lundvall, 2016). Our understanding of orientation resembles that kind of thinking (see also Tuisku et al., 2022). Learning “skills for effective use” (included in our definition) is at stake here.

The agency of multi-level actors from public, private, and non-governmental sectors is needed for developing orientation processes and actions in broad collaboration. Essentially, we claim that such an understanding of orientation to care robot use is a way of thinking, not only a question of practical processes and actions. For example, emphasizing the roles of orientation givers and receivers may renew one’s thinking, even about one’s own role, as dual roles may exist in practice (e.g., among care professionals or societal decision-makers). In other words, actors must understand the co-creative process (included in our definition of the concept); orientation to care robot use is neither mere training nor one-way knowledge transfer intervention. The relationship between knowledge and orientation is two-way. On the one hand, we believe that orientation is necessary for knowledge building; on the other hand, we include learning multi-faceted knowledge in (our definition of) orientation to care robot use. This relationship may differ partly depending on the level of detail and discussion's context.

Orientation Pathways

> 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)

We now turn to discussing orientation pathways in a more concrete sense. We have proposed the *why*, *what*, *who*, and *how* aspects of orientation to care robot use as a foundation for the creation or refinement of orientation practices at the user (micro-), organizational and community (meso-), and wider societal (macro-) levels, depending on the context (Johansson-Pajala et al., 2020; Melkas et al., 2020a). Different societal levels imply different kinds of stakeholders playing the central role in the care robot discussion and orientation (see the interviewees in section "Care robots in Finland: Overall findings", or Melkas et al., 2020a).

In Figure 2.3, we show the levels, some examples of stakeholders, and their tasks. The organizational and financial models, as well as patterns of necessary collaboration, depend on the country and other circumstances and prerequisites. Orientation to care robot use should contain several phases in a continuous way, and the stakeholders and their tasks may differ depending on the phase. Because care robots are very diverse, different robots may require emphasizing different aspects. The variety of robots available for a wide range of care tasks produces further knowledge needs. For people with different illnesses or diverse needs (e.g., people with disabilities), different kinds of orientations may also be necessary (Melkas et al., 2020a). In general, care services are a demanding application area for service robots, as many clients, such as the "oldest old," may be vulnerable and fragile.

Each aspect—*why*, *what*, *who*, and *how*—requires careful attention and planning (for further details, see Johansson-Pajala et al., 2020; Melkas et al., 2020a), and at the different levels, as we have implied with our research. Orientation is one way to increase knowledge and provide practical, user-centered learning to improve the acceptance of care robots and promote inclusive technology use. It needs to be seen as processes and actions taking place among orientation givers and receivers at different levels. Pilot study researchers and those engaged in early implementation efforts have identified various obstacles to the acceptance of care robots and deficiencies in their use. This knowledge needs to be put to use to tackle shortcomings

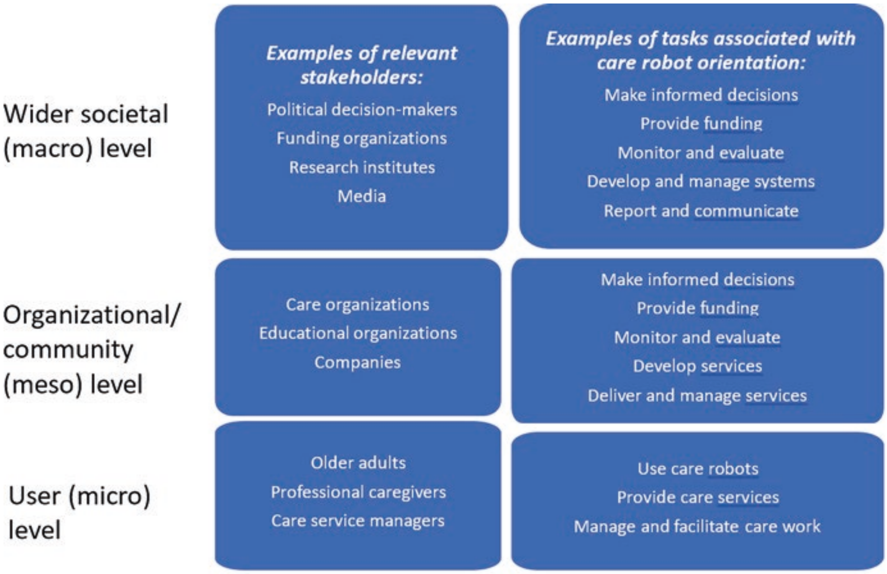

Fig. 2.3 Examples of stakeholders at different levels and examples of their tasks associated with care robot orientation. Source: Adapted from Melkas et al., 2020a, p. 33–42 . Copyright 2020 by Authors. Adapted with permission

in training by technology providers, overcome the neglect of care organizations, care professionals, clients, and their relatives' specific needs, and consider different ways in which individual people learn new things.

As for older people, care robots may potentially have an important impact on the quality of individuals' lives, their engagement with others, and their participation in wider society. Realization of this potential requires better understanding of the preconditions of care robots improving older people's life, contribution, and social engagement; practical information on how to deal with current and future shortcomings in care robot use; and policy development. Opportunities for learning about care robots must be provided for older people and those around them, as well as, systemically, for society at large, for the benefit of policy development (see also Fig. 2.4).

Orientation to care robot use is also necessary for both potential and present users. The variety of robots itself generates further needs. Different groups may require different dimensions of orientation, depending on the receiver, the provider, the type of robot, and the context. Some may find general orientation sufficient (mainly responding to the "what" question), whereas others may 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 organizations, networks, etc.). If actors continue to overlook such wider orientation, it is likely that the potential benefits of robot use will remain unrealized, and investments will be wasted.

Fig. 2.4 An illustration with key messages on orientation to care robot use from a guide by Melkas et al. (2020a). Source: Reprinted from Melkas et al., 2020a, p. 52. Copyright 2020 by Authors and Petri Hurme, Vinkeä Design Oy. Reprinted with permission

Older adults need to be able to voice their needs, expectations, and wishes personally without others appointing themselves their spokespersons. Nor should orientation rely on the prevailing stereotypical perceptions of older adults. The whole orientation process, from design to implementation and follow-up, should be characterized by a user-centered approach, not a focus on technical ambitions. Orientation should not stop when care robot technology has been introduced and essential skills have been learned. When considering the necessary skills, relevant questions also concern the role and usefulness of robot technology in care services—for example, what are the aims of using it? These aims may remain unclear to many stakeholders, especially in the hype that can sometimes be heard in care robot discussions.

So far, the wider societal level of orientation towards care robot use has been overlooked. The demands and prerequisites differ from those at the user level, although they share similar characteristics. Consequently, a prudent long-term strategy is needed, involving all stakeholders, including the user, organizational, and societal stakeholder levels, to provide a solid and well-founded orientation. This is what we mean with "pathways for orientation to care robot use": seeing the importance of orientation at the level of people and society, finding one's own appropriate way of implementing it, and internalizing systems thinking, including listening to the needs of diverse users.

> 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. This 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)

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