

Social Robots and Human Touch in Care: The Perceived Usefulness of Robot Assistance among Healthcare Professionals

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Touching in care work is inevitable, particularly in cases where clients depend on nurses in activities of daily living, such as bathing, dressing, lifting and assisting. When new technologies are involved in nurse–client relationships, the significance of human touch needs special attention. Stressing the importance of practitioners’ opinions on the usage of robots in care environments, we analyze care workers’ attitudes toward robot assistance in the care of older people and reflect on their ideas of the embodied relationship that care givers and care receivers have with technology. To examine nurses’ attitudes toward care robots we use survey data on professional care workers (n = 3800), including random samples of registered and practical nurses working primarily in elderly care. As the theoretical framework for analyzing the empirical data we apply two different conceptual approaches regarding human touch: nursing ethics and the phenomenological theory of embodiment. The empirical results suggest that the care workers are significantly more approving of robot assistance for lifting heavy materials compared to moving patients. Generally, the care workers have reservations about the idea of utilizing autonomous robots in tasks that typically involve human touch, such as assisting the elderly in the bathroom.

Keywords: Social robots; Care work; Human-Robot Interaction; Human touch, Care ethics

1 Introduction

Some critical voices have brought up concerns about care technologies and have suggested that they may create a risk of dehumanizing and depersonalizing care and objectifying care receivers by jeopardizing their individuality and subjectivity. For example, Barnard & Sandelowski (2001) have suggested that clinical and sterile environments characterized by standardization and strict regulation may fail to uphold and support human-centered care. In these kinds of environments with the highly palpable and audible presence of equipment, people may sometimes become treated as extensions of the machinery. However, many care workers, nurses and caregivers welcome tools, techniques, equipment and robots that can assist them in work tasks, especially in tele-care (Alaiad & Zhou, 2014). Hence, there seems to be some tension between the ideals of ‘touch-based’ care and ‘technology-driven’ care, or in other terms, ‘humanistic’ care and ‘technocratic’ care (Barnard & Sandelowski, 2001).

When new care robots are introduced in nurse–client relationships, the significance of human touch needs special attention. The new generation robots may be equipped with improved sensor

technology and artificial intelligence, both increasing the potential for interaction between robots and people. Care ethics are closely connected to professional touching and the physical presence of care workers with clients. The professional standards of nursing work include respectfulness, compassion, partnership, trustworthiness, competence and safety (NMC, 2015). There are concerns that the robotization of care may reduce human contact and increase feelings of objectification (Sharkey & Sharkey, 2012). Medical technologies have often been considered extensions of the nurse's body, but in the context of assisting robotics, the robot can be seen as a technological medium, a co-bot, operating between the care worker and the client. Turkle (2011) and van Wynsberghe (2013) claim that embodied practices in human care, even if technologically assisted, always require a reciprocal interaction between the care receiver and caregiver. If social robots assist in some of the tasks in human care, it is necessary to consider how to arrange mediating interdependencies within care relationships. van Wynsberghe (2013) suggests an approach with a value sensitive design, taking the ethical considerations as the first priority in the design process of care robots.

Stressing the importance of practitioners' opinions on the usage of care robots in care environments, we analyze care workers' attitudes toward robot assistance in care work and in services for older people more specifically. We then reflect on care workers' ideas about the embodied relationship care givers and care receivers have with technology. To examine nurses' attitudes toward care robots we use survey data on professional care workers (n = 3800) working primarily in the care of older people. The respondents were asked to evaluate how desirable different scenarios of using robot assistance in their work would be.

As the theoretical framework for analyzing the empirical data, we apply two different conceptual approaches regarding human touch. First, we rely on theoretical and practical discussions of touch in nursing ethics and nursing science (Routasalo & Isola, 1996; Twigg et al., 2011). Based on the traditional distinction between instrumental touch and expressive touch, we consider the role of professional touch in nursing practices. Second, we draw on a philosophical theory of human touch and embodiment to illuminate the human-robot interaction in care work. From the perspective of Maurice Merleau-Ponty's (1968) phenomenology, a living being cannot touch without being touched. This implies that touching and being touched are inherently connected among humans and animals. Identifying the significance of touch associated with the use of robots in care for older people, the phenomenological view of touch is a necessary first step toward ethical discussions on social robots and their impression of touch. The phenomenological approach can address senior persons' intimacy, individuality, autonomy, and rights to touch and be touched. However, this does not necessarily mean that the touch of social robots could not have significance in human care.

In analyzing the empirical results of our survey data, we will address the meaning of affective touch as regards both functional touch and expressive touch in care work. To concretize the empirical findings, we reflect on two types of social robots that seem relevant and timely for discussing touch in robotizing care work in the future. First, we discuss what kind of affective touch the robotic therapy animals may provide for older patients. We consider how the previous

empirical results concerning the use of the Paro seal robot resonate with the views of the respondents regarding affective touch in care work. Second, we reflect on how activities that require more (e.g. bathing, feeding, lifting, dressing) or less (demonstrating light exercises) functional touch are intended to be assisted by care robots. New generation robots are expected to be well-suited to lifting and carrying or other tasks, for example, feeding and bathing physically impaired persons. The use of these kinds of robots still remains marginal, both in care-giving facilities and home care but new robots are being developed. For instance, the robot named RIBA is intended to overcome its current limitations with added power and functionality. In the future, robots are also expected to interact with people. These typically humanoid robots are often doll-like in appearance and have the functionality of a preprogrammed puppet. In services for older people, these social robots are used for mere entertainment or, when steered by the professionals, for patients' cognitive, emotional or physical activation.

2 The Importance of Touching in Care of Older People

In traditional cognitive psychology, touch and haptic sensation refer to a sensory mode in which the body senses pressure, temperature and pain, as well as itself through proprioceptive, vestibular and kinesthetic senses (Paterson xi). In our social science-driven approach (e.g. Ahmed & Stacey, 2003), touch – and lack of touch – is also seen a central channel to transmit emotions, affects and moral codes in the society. From the very start, touch plays a crucial role in early life and parent-child relationships, since touch is an essential channel of communication with caregivers for a child (Field, 1990). A physical and caring touch enhances the attachment between a parent and a child by signifying security through the body: "I am here – you are safe". Of course, depending on the styles of touch, affective touch can generate negative emotions, for child if the caregiver's touch is rough or abusive.

Merleau-Ponty (1968, 146-49) describes touch as a "double sensation" since touch always occurs between two discrete entities forming the *reversibility of touching*. Merleau-Ponty's idea of the reversibility of touching becomes clear when we consider nurse-patient interaction. When a nurse intentionally touches a patient's hand, the patient feels the nurse's touch but also the nurse is touched by the patient. The reversibility of touching means that there cannot ever be a unidirectional or one-way touch but touching always includes a moment of being touched. The patient can make her own interpretation of the meaning of touching that is not necessarily the same as nurse's intention. So, sometimes a caring touch can be considered patronizing or humiliating, even if that is not the nurse's intention. In this way the reversibility between touching and being touched forms a highly complex and dynamic structure in nurse-patient interaction.

Recently, empirical studies on touch have shown that adults have an innate ability to decode emotions via touch alone (e.g. Hertenstein et al., 2009). Touch can communicate multiple different emotions - anger, fear, joy, love, sympathy disgust, gratitude and sadness - in much more nuanced, sophisticated, and precise ways than were expected previously. The phrase "affective touch" describes how touch includes emotional content or conjunction with emotion. The reversibility of

affective touch is a crucial issue since touching can transmit and designate the moral values of culture, indicating what kind of behavior is allowed and what is forbidden.

It is relevant to discuss affective touch but also *lack of touch* in society. Many researchers have stated that some societies are more “touch-phobic cultures” than others (Kinnunen, 2013; Hertenstein et al., 2009). In the touch-phobic cultures, people are not allowed to touch strangers or even their family members or friends, thus, they have no possibility to cultivate their touch skills and develop affective bonding structures with others through touch. Thus, different cultures have different tolerance levels for touch regarding same-sex and opposite-sex touching as well as the quality of the touch, the duration, the intensity and the circumstances. Similarly, there are huge variations regarding individuals and how they enjoy or tolerate touch.

Touch in care work is inevitable, because clients are dependent on nurses for many activities in daily living, such as bathing, eating, lifting, dressing, and other similar types of care activities that are related to the well-being and medical treatment of older, disabled or sick people. Drawing on discussions of touch in nursing science (e.g. Routasalo, 1999; Gleeson & Timmons, 2004) we differentiate between *instrumental* (physical, functional, necessary, procedural) touch (Routasalo, 1999) and *expressive* (non-necessary, communicative, caring) touch (Belgrave, 2009) in nursing practices. Instrumental touch refers to physical contact between a nurse and a patient when, for instance, the nurse takes a blood test, measures blood pressure or transfers patients between wards or rooms. This kind of physical touch is associated with routine tasks within nursing, in the sense that touching has an effect and impact on performing necessary work duties. When expressive touch is used, nurses usually touch the patient’s hands, arms, or shoulders to say hello and goodbye or show caring, compassion and support to patients. At its best, expressive touch and the presence of nurses can have a major role in developing care environment that advances patients' recovery. Small gestures can be crucial when professionals face people in vulnerable situations. According to Berg and Hallberg’s (2000) empirical findings, caring for people with mental illness demands an intensified presence, and one is not allowed to emotionally glide away, close the door or just disappear (Berg and Hallberg 2000, p. 329). For patients with depression, the nurse being present by the bedside is beneficial and helps to alleviate the patients’ fears (Moyle 2003).

Instrumental touch is far more common in nursing situations than expressive touch (Routasalo 1999). According to Gleeson and Timmons (2004), the widespread adoption of touch as a caring intervention is discouraged in the absence of clear guidelines that could develop touch as a nursing work skill. They suggest that many nurses do not touch patients more than is necessary but only to conduct their duties, so most patients do not necessarily receive any affective touch from their professional caregivers when they are most vulnerable.

However, it is important to recall that functional, purposeful and instrumental touch when lifting or dressing the client can still carry affective intentions, such as comforting, reassuring, and encouraging the patient or protecting the patient from physical harm (Parviainen & Pirhonen 2016). Instrumental touch can be affective touch even if it is done for functional purposes. In a similar way, expressive touch can be a strictly formal gesture, for instance, when the nurse routinely shakes the patient’s hand to say hello.

Whether nursing touch is functional or expressive, the nurse's touch is always supposed to be a "professional touch". Closely connected to professional ethics, professional touch refers to a special professional and ethical attitude in which the client's body is cared for and attended to mindfully and respectfully but not too personally, emotionally or in an intimate manner. Professional touch is also sharply separated from violence such as sexual abuse and harassment, so it is supposed to be sensitive toward the patient's individual needs and respect her/his personal intimacy (Paterson, 2007). This implies that professional touching is inherently reflective in its nature and that nurses need to consider sensitively the manner in which they touch the patient, considering social and cultural contexts.

Care work involves a great deal of "body work". Body work is an essential part of caring because it involves direct, hands-on activities, handling, assessing and manipulating bodies (Twigg, Wolkowitch, Cohen & Nettleton, 2011). Professional touch in human care can take different forms. As stated above, all tactile communication is reciprocal in nature: when a nurse touches a client s/he is also being touched by the client (Belgrave 2009). Touching a living body, a care worker reflects, usually internally, on how her/his touch is being felt by the other body. All ethically sensitive touch, including professional touch, is a tentative activity as it requires awareness of the patient's intimate space. Touch has very different meanings in a multicultural society where people live together with different systems of touching (van Dongen & Elema, 2001). Touch involves a risk of misinterpretation and misunderstanding, and nurses are usually well aware of the dangers of touch.

Being touched or being seen by others is considered vital for all people but is especially important for the well-being of babies and older people (Routasalo & Isola, 1996). Empirical studies on older people show that those parts of the body that are touched most frequently are the hands, arms, forehead, hair and shoulders; those that are touched less often are the legs, ankles, abdomen, chest and forearm; and those that are touched rarely or not at all are the neck, ears, lips and genitalia (McCann & McKenna, 1993). However, according to Langland and Panicussi (1982), the more unable to communicate elderly people are, due to for example, memory disorders or other cognitive impairments, the more touch-deprived they become. This implies that in human care there is a need for expressive caring touch without any functional purpose. Yet people with communicative or social restrictions often interpret feelings and affects that touching mediates and experience pleasure or displeasure within physical care practices (Bush, 2001). Touching is usually more than just physical contact between bodies; it can include various affective atmospheres such as an icy atmosphere when we feel chilly, an uncanny situation that makes our hair stand on end, or a tense interpersonal climate that is felt as oppressive or suffocating (Fuchs, 2013).

Despite the ethics of professional touch, not all touching in care work is pleasurable for care workers or clients. In problematic situations—when a patient is violent, sexually aroused or psychotic—a care worker may need to call on colleagues or safeguards to help. In nurse–client relationships, feelings of disgust, shame, guilt or embarrassment are also common. These negative feelings are not seen to fit into the idea of professional nursing behavior. Some tasks such as removing feces and changing diapers include bodywork and co-presence with patients

(Wolkowitch, 2006). These tasks can be considered repulsive even if professionals feel sympathy for the patients.

Touching becomes a more complex phenomenon when new technologies intervene in nurse–client relationships. The use of robotics for lifting patients out of their bed or into the bath, for example, does not necessarily mean limiting the direct touching of patients. New equipment may be used with a minimum of human effort but may still require human presence to support, surveille or encourage the activity.

In Merleau-Ponty's (1968) phenomenology, one of his influential formulations concerns touching inanimate things – touch of artifacts – including natural objects (trees) or human-made artifacts like tea cups and robots. The main difference between human-human interaction and human-artifact interaction is lack of reversibility: robots and other artifacts do not feel affective touch as humans and animals do. Even if the sensors of robots can be designed to respond to a touching act as if they “feel” touch, the fact is that artifacts do not sense anything.

Drawing on Merleau-Ponty's (1968) formation of touch, Kerruish (2017) discusses tactile sensations that social robots provide to users. She considers that each tactile perception is embedded in an embodied imagination that includes memories, ideals, cultural norms and values, among other things (Merleau-Ponty, 1962/1989). Tactile meanings emerge from this human embodied perception and the messy materialism of the device in which the discrete units of the digital are instantiated. Sensations provoked through touching are never completely precise or predictable.

The difference in touching animate and inanimate beings is fundamental to humans. This becomes clear when we touch something that we expect to be an inanimate object but only after touching it do we realize that it is alive. Similarly, touching something that is expected to be alive influences our touching style when we notice that the object is an inanimate thing. The latter case is typical, including sometimes embarrassing moments when we come across social robots which appear to be living beings. Nevertheless, touching inanimate objects can involve as much emotional tactile content as touching living beings but reversibility does not exist between humans and artifacts.

3 Robotic Technology and Care Work

So far, very little robotic technology is used in care work if we define a robot as a programmable machine, with some degree of autonomy and the capability of performing intended tasks and moving around or otherwise adjusting to its environment (International Federation of Robotics). The most common service robot is still a vacuum cleaner (Hennala, et al., 2017)[19] and the robotic pet Paro, the baby seal, is the most common robot used in the care of older people (Van Aerschot, Turja et Särkikoski, 2017). For the practical tasks of lifting, eating, bathing or moving, some robotic devices are found on the market but they are not yet widely used.

When it comes to using robots in the context of care, it has been shown that clients and patients do not wish robots to replace human contacts with care givers (Alaiad & Zhou, 2014; Beedholm,

Fredriksen, Skovsgaard Fredriksen & Lomborg, 2015; Jenkins & Draper, 2015). According to Aimee van Wynsberghe (2013) robots should be designed to support and promote the fundamental values of care, for example, patient safety, dignity and well-being. Contemplating care work more concretely, the different tasks can be divided into direct patient care, indirect patient care and other activities, including, for example documentation, administration and planning use of a medication (Ballermann, Shaw, Mayers, Gibney & Westbrook, 2011). In general, using robotic appliances for indirect activities of care or other, i.e. assistive, activities seems more easily acceptable among people than the idea of using robots in direct patient care which also includes touching, both instrumental and affective (Santoni de Sio & van Wynsberghe, 2016).

The research on care professionals' attitudes and opinions on robotic appliances designed to be used in care-giving shows varying results. On one hand, care professionals have been found not to welcome robot technology (Saborowski & Kollak, 2015; Katz & Halpern 2014) but, on the other hand, the care givers attitudes vary according to the kind of care that they are providing and the patients that they work with. According to Mutlu and Forlizzi (2008), nurses' readiness to integrate a delivery robot into their work environment was affected by their job definition, workload, and interruptibility. For example, nurses working with cancer patients who demand intensive care and attention often found that the robot was annoying and that it interrupted them in an undesirable way when they were in the middle of trying to do their work. On the contrary, nurses working in a post-partum ward found the delivery robot delightful and it conducted its tasks just fine. Robots are not especially desired for tasks that require social skills (Alaiad & Zhou 2014; Jenkins & Draper, 2015) but instead they could be used as tools or equipment for, say, monitoring or measuring (Pfadenhauer 2015). A qualitative research on using a bathtub robot in a setting of institutional care showed that the employees in managerial positions were more enthusiastic and positive than the staff members about the idea of using the technology, even if it had not been proved to have any economic benefit or to even function properly (Beedholm, et al., 2015).

Despite awareness of the opinion that robots are not wanted to replace human caregivers, the fear of robots diminishing human contacts is genuine. It has been stated that it is very likely that the more technology and robots are introduced in organizing and providing care, the more patients and clients will be left alone (Sharkey & Sharkey, 2012). It has also been shown that the interaction between doctors and patients has decreased since more computers and technologies have been introduced to provide treatment and care (Menon, 2015). However, there are expectations of robots assisting nursing staff in some routine tasks, which would free up working hours for more person-centered tasks (Sparrow & Sparrow 2006).

4 Desirable and Non-Desirable Robot Assistance

To analyze care professionals' attitudes toward robot assistance in care tasks we used two sets of survey data collected from professional care workers (N = 3800). The first sample was randomly selected from members of The Finnish Union of Practical Nurses, who were currently working

with older adults ($n = 2,218$). Every other individual in the population was chosen for sampling with an equal likelihood of selection. Participants were aged 17–68 ($M = 45.5$; $SD = 12.1$), and 89.8% were female. The response rate was 11%. The second sample was collected from The Union of Health and Social Care Professionals in Finland. The sample included every nurse and physiotherapist currently working with older adults and homecare services, and every third, randomly selected nurse and physiotherapist working at a health center or a hospital. This sample comprised mostly female (89.0%) nurses ($n = 1,701$) and physiotherapists ($n = 81$) aged 19–70 ($M = 47.5$; $SD = 10.4$). The response rate was 9%.

The samples were collected in October–November 2016. Online questionnaires included multiple choice questions about educational and occupational background, experiences with assistive tools in healthcare, and attitudes toward robots presented in a variety of care work scenarios and more specifically in services involving older people. Care work consists of a variety of tasks and physical labor is often a central part of the activities (Wolkowitch, 2006). The questionnaire presented scenarios of care tasks performed or assisted by a robot. The variety of scenarios emphasized tasks that include body work. In assessing the scenarios the respondents scaled (from 1 to 10) firstly the perceived usability of robotic assistance in care work ($\alpha 0.93$), and secondly the perceived usefulness of robotic assistance in services for older people. The latter were further categorized into autonomous robot assistance scenarios ($\alpha 0.97$) and teleoperated robot assistance scenarios ($\alpha 0.95$). The specific questions are presented in Appendix A.

Measuring the compatibility of personal values with using care robots, we modified three statements (see Appendix A) from the information system acceptance questionnaire validated by Karahanna et al. (2006) The response scale was from 1 (totally agree) to 5 (totally disagree), thus the composite variable ranged from 3 to 15 ($\alpha = .929$), with a higher score indicating care robots' compatibility with personal values.

We present our preliminary and descriptive results in percentages, means (M), standard deviations (SD) and differences between means (t). The statistical differences between single assessments of robot-assisted work scenarios are observed by confidence intervals of 95 percent. Regression tables present standardized betas (β) and the predictive power of the models (R^2).

Results

Most of the 3,800 respondents were working in the public sector (78%). Typically, they were practical nurses (56%) or registered nurses (35%), the rest being head nurses, physiotherapists or other care workers (9%). Healthcare technology was fairly familiar to the respondents: safety phone was familiar to 71 percent, meal automaton to 11 percent, and the Paro seal to 8 percent, to list a few.

Firstly, the respondents had to evaluate how comfortable they felt with the idea of robot assisting them with moving or lifting patients and heavy materials and also assisting them in threatening situations at work. Secondly, they had to evaluate how useful they perceived robot

assistance in elderly care scenarios such as helping a physically impaired resident to move around in the home and in the bathroom.

The respondents were most comfortable with the idea of a robot helping them with physically straining work. Figure 1 shows that care workers were significantly more approving of robot assistance for lifting heavy materials compared to lifting patients ($t = -20.77; p < .001$). Regarding lifting or moving patients, the respondents were more comfortable with the idea of a separate robotic assistant compared to an exoskeleton for a worker to wear ($t = -24.94; p < .001$). However, transferring patients using an autonomous stretcher was remarkably less welcomed compared to moving patients with any form of other robotic assistance ($t = -8.73; p < .001$). Summarizing these results, care workers see robots as desirable primarily in other tasks than patient work. In addition, if robots are used in patient work, the care workers prefer situations where a care worker is present.

Care workers saw potential in robots assisting in threatening situations. This is not surprising as studies have shown that care workers have to endure and be prepared for aggression from patients and those close to them (Twigg, et al., 2011; Kerruish, 2017). In care scenarios, touching is usually seen as something that happens on care workers' terms. Here, the respondents suggested that robotic applications could also be suitable for protective use where care workers are targets of unwanted contact.

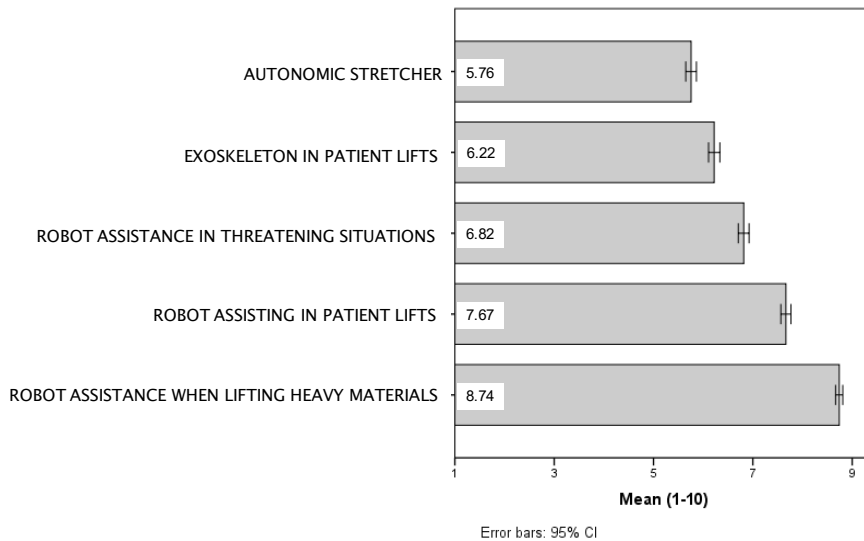


Figure 1. Acceptance of robot assistance at work, means on a scale from 1 to 10

When asked specifically about which services for older people could benefit from robotic assistance, the respondents found it easier to see the benefits of teleoperated robots ($M = 5.45$) compared to autonomous robots ($M = 5.16; t = -6.13; p < .001$). Figure 2 presents the means for some of the scenarios. Of these scenarios, care workers were most willing to see robots in situations where physical contact is not necessary, namely demonstrating light exercises. This kind of entertainment-like coaching by a robot was perceived as more feasible than teleoperated physiotherapy with a therapist ($t = 23.08; p < .001$). In addition, most of the respondents did not consider autonomous robots conducting physiotherapy as appropriate. The robotic assistance in

bathing, dressing and in the toilet was met with a similar refusal. However, general support in moving around the residence was viewed more positively. A robot which was remotely operated and monitored by care professionals could be used in the homes of older people as an assistant for moving, walking and getting up.

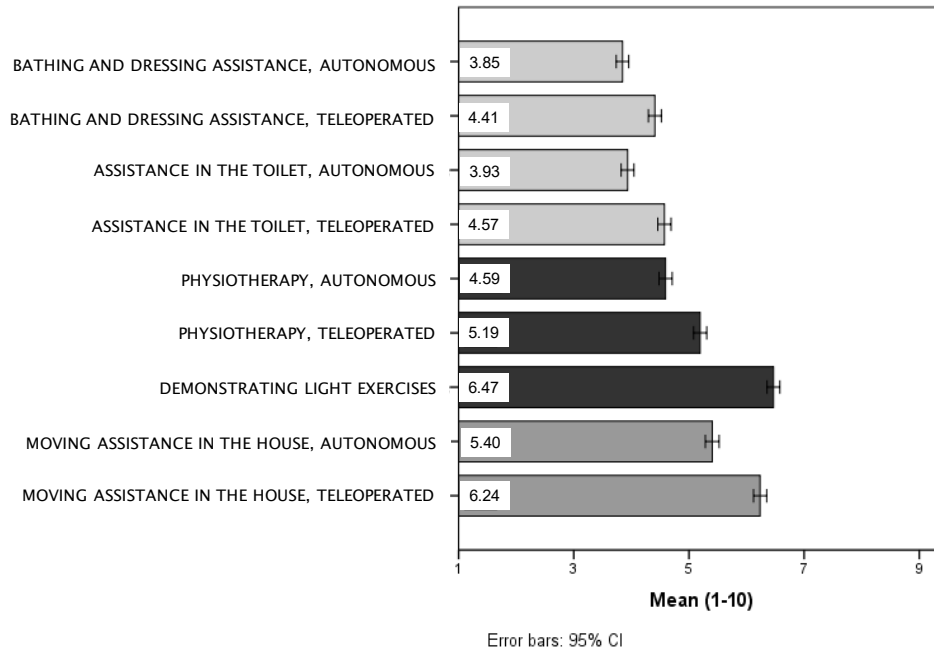


Figure 2. Acceptance of robot assistance in elderly care, means on a scale from 1 to 10

We further analyzed the mechanism of how robot acceptance varies between the least approved (robot assisting in bathing and dressing) and the most approved (robot demonstrating light exercises) examples of care-related tasks (Table 1). In the models, the robot’s usefulness was mostly explained by the compatibility between care robot use and personal values (e.g. “Using care robots does not fit the way I view the world”). The majority (64.5%) of the respondents did not find robot use in care compatible with their personal values ($M = 8.14$; $SD 3.61$). On average, the more the respondents found care robots compatible with their personal values, the more accepting they were toward robots.

While the acceptance in both the most and least approved tasks was highly connected with the compatibility with personal values, some differences were found. An autonomous robot assisting in bathing and dressing, as the least approved robot-assisted task, was perceived as more useful among older and male respondents with higher education, compared to younger female practical nurses. Experience with care robots did not quite have the power to explain the acceptance of robots assisting in bathing and dressing.

Among our examples, a robot demonstrating light exercises was perceived as the most useful form of robot assistance in care for older people. Because the robot assistance in demonstrating exercises was more broadly accepted by all of the respondents, fewer significant explanatory factors of perceived usefulness were found. Contrary to robots assisting in bathing and dressing,

the robot demonstrating light exercises was perceived as more useful among female respondents who had experience with the care robot Nao.

	Robot demonstrating light exercises		Robot assisting in bathing/dressing	
	β	p	β	p
(Constant)		<.001		.260
Age	.022	.173	.037	<.05
Male	-.056	<.001	.034	<.05
Practical nurse	.019	.250	-.070	<.001
Familiar with Nao robot	.035	<.05	.025	.113
Familiar with other care robot ¹⁾	-.007	.677	.028	.087
Personal values	.538	<.001	.512	<.001
Adjusted R ²	.288		.291	

Table 1. Perceived usefulness of robot assistance in care related tasks

¹⁾ Physiotherapy, telepresence, therapy animal or patient lifting robot

5 Social Robots Assisting in Human Care

In interpreting the empirical results of our survey data, the care workers emphasized both affective and functional touch as central in care work. In understating how robot solutions could assist in care work regarding both these aspects in the future, two types of social robots seem relevant. The first question is, how the affective touch of the robotic therapy animal can meet the needs of care of older people. Secondly, how are activities that require functional touch, such as bathing, feeding, lifting or dressing patients, intended to be assisted by service robots. New generation robots are expected to be useful in lifting and carrying but also in social interaction and, for example, feeding and bathing physically impaired persons. The use of these kinds of social robots still remains marginal both in care-giving facilities and home care; yet new robots are being developed. For instance, the teddy bear-faced patient lifting robot named RIBA (later Robear) was intended to overcome the current operational and technical limitations with added power and functionality. New joints in the robot's base and lower back enabled RIBA-II to crouch down and lift a patient from floor level. This could be a social robot assistant that could remarkably relieve the physically burdening care tasks of lifting and moving patients. In 2015, the Riken Center for Human-Interactive Robot Research in Japan was closed, so the Robear project is no longer being carried out at Riken. Unfortunately, the Robear robots did not possess such “embodied intelligence” that

they could have replaced human reflectivity of tactile-kinesthetic movements and carry patients safely and autonomously. Moreover, social robots cannot replace humans in providing emotional comfort to people who need another person's co-presence in a vulnerable situation (Turkle, 2011; Sharkey & Sharkey, 2012). Still, new generation robots are being developed with more human-like touch, with better fine motor skills and soft artificial skin (Cabibihan et al., 2016).

Lack of human presence can be seen as one of the reasons why transferring a patient using an autonomous stretcher was notably less welcomed by nurses than lifting patients with robotic assistance. From the physical presence point of view, a seemingly instrumental procedure of moving a patient from one ward to another on a stretcher can actually be a holistic and interactive event. Escorting a patient to an operation room, for example, is not just about the transport since a nurse may also provide attention, comfort and encouragement by being present and able to touch. Even if the automotive navigation system and the sensors of social robots can be programmed to transmit patients in hospitals or care homes, robots do not compensate for an escorting person's presence and being accessible and available (Moyle, 2003).

The empirical results of this study suggest that nurses consider robotic devices beneficial when assisting in physically demanding tasks of lifting patients and, especially, lifting heavy materials. However, care workers see robots as desirable to ease the physical strain of lifting, particularly in a situation where the autonomous system does not block nurses from the patient-robot interaction. In this way, nurse-patient interaction would remain intact and robot assistance would even enhance the interaction by providing more time and opportunities to support the patient emotionally.

Regarding robot assistance in services for older people, scenarios of using a robot for personal care such as assisting in bathing and dressing, or going to the toilet were evaluated as the least acceptable. Practical nurses in particular were prone to rejecting robot assistance in these scenarios, which we classified as intimate. This kind of intimate assistance may sometimes be seen as being at the core of care even though at the same time it may also entail negative feelings (e.g. assisting with toileting may provoke aversion). The care workers' opinions on robots assisting in their work and in tasks related to the care of older people reflect the idea that technology should only be used in care-related tasks which are not too intimate, affectionate or personal. The care giver and care receiver make use of technological devices in ways that suit their needs without losing the possibility for human touch and interaction.

In general, the nurses' opinions on useful and acceptable robot assistance indicated that they resisted the ideas of standardized, technologized care and endorsed the ideas of human dignity and individuality. With regard to this, it is surprising that nurses saw social robots as useful to provide distance and protect them in threatening situations. Recent research findings show that aggression from patients and their visitors in hospitals and other health care organizations has become more common (e.g. Speroni et al., 2014). Nurses certainly need new tools and skills to manage patients' violence, verbal abuse, threats or intimidation (Harwood, 2017) but the kind of "robocops" found in science fiction are hardly good solutions to prevent clients' violent behavior.

For ages, different tools and devices have been used to assist in care tasks or even to conduct them automatically, but nurses expect that care technologies should be designed to enhance the relation between care-giving and care receiving activities. Technologies should allow embodied practices of professional touching when nurses lift, bath, feed or move the care receiver and deliver medications or food, or bring sheets to the room. As stressed above, the affective touch involved in care practices transmits complex information about emotions and affects, creating a value-laden milieu (Turkle, 2011). Social robotics is considered valuable as an interpersonal intervention when it can develop a partnership and reciprocity in the nurse–client relationship.

6 Discussion

Recent research indicates that modern (Western) societies have developed toward touch-deprived cultures (Linden, 2015) or even touch-phobic cultures (Hertenstein, Holmes, Keltner & McCullough, 2009). Touching and physical presence are inevitable in care work; however, instrumental touch is used much more commonly than expressive caring touch. There are good reasons why touch has recently become a highly politicized issue; scandals concerning sexual harassment and the #Metoo movement, in particular. Yet touching is also an essential part of human interaction and a way of mediating empathy and comforting feeling. Elderly people in particular may suffer from a lack of touch. For instance in the United Kingdom, half a million older people have at least five or six days a week without seeing or speaking to anyone at all (Age UK 2018). Empirical research has shown that loneliness can increase people’s risk of premature death by up to one quarter (Holt-Lunstad, Smith, Baker, Harris & Stephenson, 2015). Findings also show that, as far life years are concerned, loneliness can be as harmful to people’s health as smoking 15 cigarettes a day (Holt-Lunstad, Smith & Layton, 2017). Protecting vulnerable people from abuse and sexual harassment has increased concern about whether no-touch policies fail to recognize the importance of touch for well-being in their lives (Linden 2015, 4). Not only elderly people but also children are suffering if their carers are unable to show them affection, intimacy, comforting closeness or to simply give them a hug.¹

While loneliness, particularly in late life, has been described as an epidemic in many modern countries, the service industry has started to commodify touch in the form of the “touch industry” in Europe, Australia and the US. Professional “cuddlers” operate workshops and services to help the touch-deprived. Similarly, in the industry of social robotics, researchers and designers are developing “huggiebots”, humanoid robots, programmed to offer hugs to humans. For instance, the Huggable is a new type of robotic companion being developed at the MIT Media Lab for healthcare, education, and social communication applications (Jeong et al., 2015). The Huggable is not designed to replace nurses or other caregivers but rather to enhance human social networks. In Japan, the “tranquility chair” or “anti-loneliness hugging chair” is built in the shape of a large

¹ While touch should be considered as an important value since it is found to be essential, especially for infants and elderly people, doctors in the UK have been warned by the Medical Defense Union (MDU, 2018) to avoid comforting patients with hugs since physical contact can easily be misinterpreted by patients.

fabric doll with long arms to wrap comfortably around the lonely sitter. Even if huggiebots and hugging chairs are not necessarily designed to replace humans, they are new commodities to relieve angst caused by missing human contact.

The crucial question that remains is why the technical equipment is designed to find solutions to problems that could also be solved by developing social interaction and enhancing the social contact of all people, especially the lonely and isolated. Thus, identifying the significance of touch associated with the use of social robots in care for older people is not necessarily the first step to providing solutions for people who suffer from loneliness and lack of touch. This does not mean that some people could not benefit from touching and being touched by a social robot. However, from the ethical point of view it is important to stress that the reversibility of touch is missing in the touch of an artifact. Still, there is also room for touch intensive social robots when developing societies toward more positive and multi-valued touch cultures.

Drawing on the distinction between instrumental touch and expressive touch, we pinpointed that nurses are not necessarily encouraged to use their affective touch capabilities as prominent work skills. If their touch skills have remained undeveloped, the relevant question is whether their work is more easily replaceable by social robots that can conduct simple instrumental work tasks? In these circumstances, perhaps new resources should be allocated to develop the skills of professional touching to educate nursing students to use their touch. If care professionals can cultivate their work skills, the use of touch and its inherently reflective nature offers great potential for health care organizations. Of course, more research is needed to examine how social robotics will change nurses' capabilities of using touch in human care and to what extent human touch can be replaced by a robot.

Taking seriously the idea that touching and presence are crucial for the well-being of older people, we do not believe the development of social robots should aim at replacing caregivers. We suggest, like many other researchers (Jenkins & Draper, 2015; Alaid & Zhou, 2014; Kristoffersson, Coradeshi, Loufti & Severinson-Eklund, 2011), that social robots should be designed to improve the quality of care rather than just to save money in the health care sector. When social robots become a part of the network, the distribution of roles and responsibilities as well as the care processes will change (van Wynsberghe, 2013; Verbeek, 2006). van Wynsberghe (2013) states that technologies are products of our culture and built on societal values and norms. Yet social robots also change the ways human organizations function, and they affect human habits and ways of acting. Also, as already stated, social robots may have a far reaching impact on the touch culture of societies: "social norms, values and morals find their way into technologies both implicitly and explicitly and act to reinforce beliefs or to alter beliefs and practices" (van Wynsberghe, 2013, p. 412). The use of independently functioning social robots, even for just a few tasks, would fundamentally alter relations between caregivers and care receivers and nurses' care practices in care for older people.

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