What Social Robots Can and Should Do
J. Seibt et al. (Eds.)
IOS Press, 2016

doi:10.3233/978-1-61499-708-5-210

Motions with Emotions?

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Abstract. This paper seeks to answer the question of how the interactive capabilities of social robots are related to their embodied character. Contributing to the discussions on the role of physical appearance in robotics, we apply a phenomenological theory of the body to develop a new understanding of the robot body. Drawing on Edmund Husserl's phenomenological distinction between the material and the lived body, we consider the robot body as "double" since it entails both objective and subjective aspects. We assume that the expressivity of "double bodies" can be seen as central in understanding the phenomenon of aliveness in social robots.

Keywords. social robots, phenomenology, double bodies, care of older people, robot body

1. Introduction

The use of robots in elderly care is a reasonably new research area, but the number of studies on the subject is increasing rapidly. Many researchers [e.g. 1] categorize three main types of robots in elderly care: (1) *monitoring robots* that help observing behaviour and health; (2) *assistive robots* that support the elderly and/or their care-givers in daily tasks; and (3) *social robots* that provide companionship. In this paper, we focus on social robots in elderly care and reflect on their "sociability" and interactive capabilities. First we look at the development of social robots and reflect on their uniqueness compared to other robots or robot-like technologies. Second, we introduce the phenomenological notion of the body to understand the robot body and its "aliveness". We then further consider what kind of companionship social robots can provide for elderly people. Finally, we discuss preliminary findings from an ongoing study on how the social (care) robot Zora[2] is introduced to elderly clients in care homes.

We seek to answer the question of how the interactive capabilities of robots are related to their embodied character. In trying to widen discussions on the role of physical appearance in social robotics [2], we apply a phenomenological theory of the body to develop a new understanding of robot embodiment. Traditionally, possibilities of physical activity are often determined by a robot's shape, size and physical function, while social capabilities are related to communication abilities—such as the function of eyes, speech and voice. Our starting point is the idea that the communicative potential of social robots also strongly depends on how their physical features and movements

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[2] Zora is the NAO robot installed with the Zora software.

appeal to users emotionally. We assume that for most people, robot bodies are not humans, not animals and not mere objects but quite something else, as stated by one of the interviewees in a care home who participated in our study.

The emergence of social robots, also referred to as emotional robots, robot toys or companion robots, has taken place since the 1990s. Some of them have been mooted as possible companions for older people. Companion robots include, for instance, NAO/Zora, the Sony AIBO dog and the Pleo dinosaur. Probably one of the best known robots, the seal robot Paro was designed to increase partnership, intimacy and reciprocity in the nurse-client relationship and for caring and comforting, physical intervention and alternative health practices. These types of robots interact with people and are intended to be used in the health and care sectors for different activities or as tools for (socio-) pedagogic, social or even therapeutic purposes—e.g. "robotherapy" [3].

2. Social Robots as Machines with Human-Like Features

Calo's [4] recent study on robot law cases in the United States over the last 60 years presents an interesting view of changing and varying uses of the term "robot". A conclusion in the study is that "robots blur the line between people and instruments". The robot can be defined as an artefact, but it can also be seen as something "animate". Technological designs, computer models and software applications call for standardization, so one of the challenges is how a companion robot can be programmed to cope with various user groups. *Technomorphism* has its adherents among the developers of service robotics. In product development, a compromise must be found between technical functionalities and inanimate features incorporated into the robot. Advocators for this strategy admit that the interaction between a human-like robot and a human goes far beyond a traditional human-machine relation. Therefore, technomorphic robot designers need to be familiar with social interaction aspects too. In 2008, they noted that "at present, however, findings are still too preliminary to serve as design guidelines for socially acceptable humanoid service robot" [5, see also 6].

The physical appearance of robots has a great significance in how they are used to perform tasks in human care. As many robots represent "bodies" or life-like appearance, Sharkey and Sharkey [7] suggest that robots and robotic technology should take a comprehensive approach to robot ethics and pay attention to the embodied character of robots. As humans, we have a tendency to *anthropomorphize* objects and machines and to imagine that they are capable of more than they actually are. Anthropomorphism is a process whereby people attribute distinctively human characteristics to non-humans—particularly the capacity of agency, including conscious feelings and rational thinking [8]. Mindful and embodied agents appear capable of controlling their own actions, so we tend to judge these objects as responsible for successful actions and to perform those with conscious awareness, foresight and planning [9, 10].

On one hand, people might derive pleasure from acting as if the robot could understand them whilst remaining aware of its mechanical nature [11]. On the other hand, human-like or animal-like appearances can encourage and mislead one into thinking that robots are capable of more social understanding than is actually the case. Their appearance and behaviour can lead people to think that they could form adequate replacements for human or animal companionship and interaction. This kind of

personalization plays a particularly important role in the interaction design of companion robotics.

Personified social robots and the role of their aliveness in human-robot interaction open up various ethical questions and conversations. For instance, what is essential about aliveness compared to the "aliveness" of robots? What is special about being a "real" person compared to "personified" robots? How can we identify the expression of "real" emotions compared to simulated emotions that robots represent in order to make us feel something? When a new technological genre of personified and embodied robots is emerging and entering into everyday life, we are not necessarily well-equipped to handle the change. Kahn et al. [12] suggest that there may be a need for a new ontological category beyond the traditional distinction between animate and inanimate. Along with person-like robots, the man/machine relationship is diverging into new directions. This is not a challenge exclusively for techno-science, but also for social analyses of robotization. "Nonhumans" can no longer be eliminated from studies on social interaction [13]. Seibt [14, 15] suggests that Kahn's and Cerulo's proposals should be developed further by outlining a more comprehensive theory of simulated human-robot interactions. Instead of dualist ontological categories "gradient" concepts of sociality and normativity could be used.

The "embodiment" of robots means that they are used to perform manners such as the simulation of eye contact and head movement when greeting a user, unlike purely computational devices. For instance, human-like robots like Zora can be used to interact with people by dancing or acting as an exercise instructor. In nursing homes, this small robot is used to demonstrate different exercises, which the residents then try to mimic. A human instructor is usually present as well and provides individual instruction to anyone needing extra attention. Next, we will look into the phenomenological notion of the body to understand "the robot body" in greater detail.

3. A Phenomenological Approach to the Robot Body

There is a growing amount of phenomenological research indicating that bodily behaviour and movements strongly influence one's emotional reaction toward certain situations or objects [e.g. 16-18]. In this theoretical framework, robots' motions and users' emotions are thus intrinsically connected: the user can be (emotionally) moved by the movements and "gestures" of robots. Users' embodied experiences and affects may include a variety of feelings, such as tactile-kinaesthetic sensations and feelings of pleasure, safety or embarrassment.

We have adopted a phenomenological approach to understand the robot body that simulates "aliveness" and personify features without being alive. Phenomenologists emphasize that the human (or the animal) body is never merely a "material thing", but something that constitutes a "conscious subject" [19]. Thus, Husserl provides a description of the body as a living entity, identifying several features of the body as constituting a conscious subject. In trying to clarify the notion of the lived body, he developed a conceptual distinction between the body as a physical/material object and the body as a living organism by using the German terms Körper and Leib. Körper, etymologically related to the English word corpse, is understood to mean "physical matter" and refers to the materiality of the body—that is, the body as a physical object extended in space. Leib is usually translated as lived body, which carries with it meanings of complexity of the experiential and subjective aspects of the body [20].

Following Husserl, Merleau-Ponty [21] regards the body first and foremost as an "incarnated mind", focusing primarily on the "first person" standpoint.

The phenomenological distinction between Körper and Leib becomes clearer if we consider the difference between the physiological function of the body and the expressivity of bodily gestures. Let us consider a situation where we attempt to understand another person's feelings by looking her or him in the eyes. In trying to interpret feelings by watching his or her eyes, we do not normally expect that the pigmentation of the iris (Körper) expresses affection, but the look in the eyes (Leib) might do that [22]. When interpreting expressions in a person's eyes, we move through his or her physicality (Körper) to apprehend the expressions of the lived body and seek to interpret whether the expression is spontaneous or performed to impress us.

However, it is important to realize that human and animal material bodies (Körper) can be also expressive without their own volition. In other words, the expressivity of the body does not merely emerge from conscious gestures, postures and facial expressions of lived bodies. As a biological entity, the physical state of Körper is expressive in the sense that it gives impressions of biological age, muscular tone and health conditions. Moreover, the material body (Körper) (such as size, height, weight, skin colour and sex) and its body parts (such as arms, legs and head) carry different cultural meanings and values [23]. Using here again our example of eyes and look, eye colour can carry different cultural meanings. In trying to interpret other persons' feelings by watching their eyes, we may sometimes misinterpret feelings and expressions. This happens, for example, if someone's bright blue eyes remind us of "innocence" or "honesty". Thus, it seems that the phenomenological distinction between Körper and Leib forms an expressive system of "double body", defining the material and lived body on one hand as a subject and on the other hand as an object that people perceive, interpret and understand in multiple ways. We use the notion of "double body" here to indicate that the material body's expressivity (Körper) does not necessarily coincide with the lived body (Leib) being felt and expressed internally [24].

We assume that the expressivity of "double body" can be seen as central in understanding the phenomenon of the aliveness of social robots. Robots are machines—i.e. material things whose physical structure depends largely on their function. Certain physical functions (for example, moving autonomously around) can be implemented in robots by wheels or two or more legs. When legs are chosen for movement, they usually represent human or animal types of physical bodies (Körper). The robots do not have lived bodies (Leib) as humans and animals do, so they cannot move intentionally, feel their kinaesthetic sensation internally or express their feelings and gestures intentionally. Robots can certainly be designed to simulate or imitate lived bodies. They can be designed to perform animal-like movements or human-like gestures, voices and postures that appeal emotionally to users. Thus, the phenomenon of the aliveness of social robots is related to two different aspects of the body: 1) their physical structures as shape, size and material that can simulate animal or human figures (Körper) and 2) how they simulate the expressivity of lived bodies and emotions (Leib). We assume that the "double body" of social robots can be a combination of different human and animal features. Those features can be highly contradictory in one robot, but surprisingly, it is not necessarily confusing from the user's point of view. For instance, a robot's movements can simulate human gestures while its material body can represent and be seen as entailing some other characters, such as an animal, doll or cartoon character.

We can see already now how astonishingly well robot heads and robot bodies can simulate and imitate (i.e. "resemble") human faces, gestures and movements (e.g. Sophia by Hanson Robotics or Atlas by Boston Robotics). We can assume that developing and improving these kinds of human and life-like qualities will be accelerated quickly. As this happens, it is likely and clear that designing and programming humanoid robots can no longer be just adding and improving their physical or communicative properties (like more "naturally" lifting their hands or eyebrows or speaking). Instead, it seems necessary to better understand what are those many—as well intentional as unintentional—psychological and social messages that are hiding behind bodily motions and subtly affect people. In people's minds, motions of social robots are not only functional, but they are also emotionally loaded. To take this "double body" perspective into account in designing is, of course, challenging. It means, for example, that we have to think of the limits of "normal" or justified robot behavior. How emotional might robotic motions be? Do we allow robot gestures to transgress against common decency?

4. Companionship of Robots

At present, robots are far from being real social companions. They can "interact" with people and even show simulations of emotions, such as joy and kindness, but their communicative abilities are still extremely limited [7]. Some studies [e.g. 25] suggest that elderly people, including those with advanced dementia, benefit from embodied interaction with Paro. Kanamori et al. [26] showed that elderly persons who interacted regularly with a Sony AIBO robotic dog had lower loneliness scores and higher quality of life assessment scores. The results reported by Kanamori et al. showed improvements in well-being over time between initial and later sessions. However, someone in solitary confinement might benefit from being given a robot companion—but he or she would benefit far more if offered a friendly social environment.

Indeed, one of the concerns that has been taken up regarding the increased use of companion robots in general is that it could lead to a reduced number of human interactions. Thus, companion robotics brings a risk of reducing older people's opportunities for social interaction and affiliation with others [27]. According to Sherry Turkle [11], older people easily connect to social robots such as My Real Baby, AIBO or Paro, as they need attention and care. According to Turkle [11, p. 11], "We are psychologically programmed not only to nurture what we love but to love what we nurture". As social robots are capable of responding, reacting and being interactive in their own way, it is easy to assume that they also have feelings like compassion or that they really listen. People want to be heard and listened to, so the robots touch on basic human desires. This may well be seen as therapeutic, as people may share their feelings and secrets with the robot. However, robots are not capable of real compassion, empathy or understanding, even if they can create a feeling or an illusion of these. In this sense, robots are poor substitutes for human company.

In this paper, we approach companion robotics in elderly care as a technological medium that takes place in the triangle between care-givers, care-receivers and robotics. Our interest is in how elderly people and care-givers respond to the aliveness of a companion robot. People may make the robot more "alive" by speaking, gesturing or referring to the robot. Alternatively, the same forms of communication can be used to deny the robot's "alive-like" character. For instance, Paro robot has been shown to

function as a kind of medium that brings people together as they focus on the new artefact and talk about its aliveness—thus increasing social interaction [e.g. 28]. We consider how the aliveness of the Zora robot–its size, shape, material and gesturing—appeals to users to outline the social capacity of Zora robots for seniors.

5. Empirical Research Setting: Data, Methods and Analytical Questions

The data was collected in a field study in two municipal sheltered homes in Lahti, Finland, from December 2015 to March 2016. The care robot Zora, re-named "Ilona"[3], was introduced to the clients and personnel in the homes. It was used for two weeks in the first home and four weeks in the second. The data consists of ethnographic observation of introducing Ilona and using it for rehabilitation exercises and of two focus group discussions with the care personnel. Both discussions lasted for approximately 1.5 hours. Altogether, 18 persons were interviewed (three in the first interview and 15 in the second). The interviewees were mainly nurses or assistant nurses, but an occupational therapist and a coach of group activities also participated. The topics of the discussions were the experiences of having Zora-Ilona as part of the activities in the homes and the personnel's experiences regarding these situations. The ethnographic observation consisted of 12 sessions where Ilona was either introduced to the customers in a special session or used as a part of the group activities, like physical exercises or literature groups. In all, 5-20 customers and 2-10 members of the care personnel attended the group activity sessions. Each session lasted for about an hour. Most of the sessions were observed by 2-3 researchers who took comprehensive notes and photos on the progress of the sessions as well as the interactions between the robot, customers and care personnel. A content analysis was used to analyse the observation and interview material.

Ilona was technically steered and instructed by a group of 2-4 nursing or physiotherapy students (depending on the session) who were responsible for planning the robot's exercises and activities and for the robot being interactive. The students made the robot to call people by name and respond to their utterances, instruct exercises, play music, perform dances and play interactive memory and guessing games with the inhabitants. When the robot was talking and walking consecutively, two students were involved. One student was responsible for the talking: writing the speech of the robot in the laptop to, for instance, ask general questions like "How are you today?" The robot was also made to react to the customers' responses. Another student steered the robot's walking function.

In addition to the students, at least one member of the care personnel took part in steering the sessions and acted, for example, as a mediator between the robot and the customers and ensured that the customers felt comfortable. The mediator repeated the robot's speech if it seemed that the customers and/or the robot did not hear what the other was saying. The members of the care personnel also inspired and encouraged customers to participate in the activities and provided individual guidance for the customers during exercise sessions if needed.

The following analytic questions were used to analyse the data:

[3] The robot was re-named as Ilona (a Finnish name containing the word "joy") to make it easier to approach and talk about.

- *How do people approach Zora-Ilona, and how do they interpret what the robot actually is?*
- *What does the sociability of Zora-Ilona consist of?*
- *What do the ways in which people approach, talk about and refer to the robot tell about how they assume the lived body of the robot to be like?*

Through these questions, we focus on how the notion of "double bodies" is applicable to Zora-Ilona.

The research was conducted according to ethical principles, avoiding any participant harm. Both the care personnel and the customers gave their consent to participate in the sessions and research. If someone expressed a willingness to leave a session before its end, this was permitted. The customers were also assisted if they, for instance, had moving problems. Customer security was assured, as the robot was never left without assistance. Research permission was obtained from the municipal social and health care service authorities responsible for elderly care services in the city of Lahti. The anonymity of the participants was assured by anonymizing the research material. No personal or health-related information can be identified from the material. Health-related information on the customers was neither inquired nor obtained.

6. Robot Simulates the Lived Body

The elderly people who met Ilona found it cute and admirable. Ilona did not raise scary feelings in general, but there were some patients who did find it frightening and did not want to have contact with it. The personnel underlined that the robot should look like a robot. A clone would be intimidating, and people with memory disorders would especially have difficulties in understanding that it is not a person.

> "You have to see immediately that it is not a human replacement, not a cat or a dog but something quite different" (Interview with the personnel).

Thus, the robot's physical body was preferred to be clearly distinct from human or animal bodies in order to clarify the distinction between human and non-human bodies. The personnel brought up that introducing a social robot must be pre-considered, prepared and based on knowledge of the clients' state and capabilities. This reflects the idea of taking responsibility for the clients, gathering that the "creature" that they are dealing with is something different from the ones they are used to. This, in turn, is somewhat challenging, as people still have little experience with robots—especially social robots—and lack comprehension and conceptualizations of their essence.

The elderly people in sheltered homes in Lahti found different ways to capture the essence of Ilona. They called it a baby, toy, puppet, space creature, ghost and little fellow. Ilona was described as amusing and cute. This is not surprising, as Ilona is programmed to be happy and joyful, giggling and throwing kisses. The small size and the joyful and spontaneous behaviour of Zora-Ilona calls on relating it with children. The ways in which people talked to Ilona or squatted next to it implicated that Ilona was indeed approached like a child or, in some cases, like a pet. People asked, for example, if Ilona wore diapers but also if it had a boyfriend. Even if the employees emphasized that it was important to distinguish that the robot is neither a human nor an animal, several of them referred to the robot as "she". The ways in which people

approached and talked to the robot and about the robot show that even if they were aware of it being non-human, they somewhat intuitively attached an idea of a lived body to it.

The fact that social robots are something new and unknown is a socially shared issue and something that can call on people to sort out socially. People wonder what robots are and try to make sense of them together. Thus, the sociability dimension of the robot might be more related to creating new interactions between people than creating the possibility of socializing with a robot [see e.g. 28, 12].

People in the sheltered homes quickly attached to Ilona. Both the personnel and the clients said that they felt a bit sad when Ilona was taken away. Both the clients and the personnel also talked about Ilona as if it had emotions and other human features: Ilona was assumed to get frightened of a flash light or to suffocate when wrapped in plastic. People verbalized Ilona's behaviour as if they were talking about a child: "Ilona is tired", "Ilona is acting up", "Ilona has not woken up yet" and "Ilona is having a thought". These quotes show that people assume the robot to have a personality and act according to it. It is easily forgotten that it is a machine [11] and "tiredness" or "sleeping" is due to a low battery or that "acting up" might be a software bug. Also, certain social and behavioural norms were applied with Ilona. People were applauding after Ilona's dance shows and often used salutations and compliments like "hello", "bye bye" and "thank you" when talking to the robot.

There were some problems in adjusting Ilona's activities for the clients. Ilona was used as an exercise and activity instructor in Lahti, but in the beginning, elderly people found Ilona's dances awkward; the music it played was described as "space music" and, according to an occupational therapist, the gymnastic exercises were not suitable for clients with heart disease. When Ilona was reading aloud or telling little stories, people struggled to hear or understand what it said. Also, even if Ilona gestured with hands while talking, observers felt that Ilona's contact with the audience remained thin. A storyteller needs to bond with the listeners to make the situation rich. As the dances, music, exercises and stories were selected and/or created by the programmers, the "social" effect of social robots in many ways lies in their empathic and other anthropomorphic capabilities.

Often, the students who steered Ilona acted as "interpreters" between the robot and the elderly people. They commented on technical problems, repeated what Ilona said and gave further instructions for people if they could not follow the exercises Ilona showed. The technical problems that occurred with Ilona were often funny (like talking too fast) but were also bewildering. The reactions of the "interpreters" and the personnel were essential for the atmosphere and dynamics: when there was no interpretation or mediation between the robot and the elderly people, problems became more confusing.

7. Conclusions

In this paper, we have sought to answer the question of how the interactive capabilities of a social robot in elderly care are related to its embodied character. We turned to a phenomenological theory of the body to develop a new understanding of the robot body. Our tentative empirical findings indicate that a social robot, like Zora-Ilona, of small size with big eyes, programmed to be glad and pleasant, is easily paralleled to a child or a pet—something cute and easy to approach. People easily attach to a robot like this

and begin to personalize it (e.g. assume that it has human-like needs and emotions and that its manners and ways of behaving are part of its personality). Zora-Ilona can be helpful for motivating elderly people to engage in conversation with their peers and care-givers, but its technical problems can lead to harm by moving the focus from social interaction to the robot as a mere machine. Problems in speech recognition and volume settings or functional delays easily disturb the interaction with the lived body and bring the malfunctioning technical body to the foreground.

In trying to avoid breaking the illusion of Ilona's aliveness, caregivers tended to hide its software or other technical problems by explaining them to be caused by reasons related to Ilona's "lived body". In caregivers' storytelling, Ilona can feel tired, or when it talks too fast, it just tries to entertain its audience. Developing narratives about Ilona's lived body provides topics of conversation and opportunities for connecting with elderly people [29]. If the traditional body-mind dualism and its difficulties stemmed from the approach whereby humans were viewed from a third-person point of view, that is, as physical objects (Körper) among other objects, in the case of robots, the tendency is quite opposite. Robots are viewed from a first-person point of view as lived bodies even if their plastic bodies are purely mechanical things. Interestingly, plastic robot bodies do not need to simulate the human physicality or any physical necessity [21, p. 91] to create an impression of aliveness.

Our preliminary empirical findings with Ilona suggest that the expressivity of its "double body" has a central role in drawing people together around it. Its material body can represent to users a variety of character while its movements can simulate human gestures and movements—including baby-like, genuine communication. This enables people to easily communicate and respond to the robot as they would with an infant. The essential point is not so much about what the robot is or does but what kind of emotions and conceptions it raises in people. A central part of the robot's sociability in the care home environment is related to the ambiguity of its embodiment and inconsistency between its physical nature and gesturing. The robot's physical and social features call on interpreting its behaviour and trying to understand what it is about. People tend to find importance in and sense the robot's material body and human-like lived body which, in fact, is lived and construed only by the persons who interact with it.

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