



# REELER Working Paper Series

Responsible Ethical  
Learning with Robotics

## Feeding assistive robotics, socio-technological imaginaries, and care

### The case of Bestic

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Working paper 1, version 2.0, November 2017

*Recommended citation:*

Nickelsen, Niels Christian Mossfeldt. 2018. "Feeding assistive robotics, socio-technological imaginaries, and care: The case of Bestic." REELER Working Paper Series, Aarhus University, Copenhagen, Denmark.  
[http://reeler.eu/fileadmin/user\\_upload/REELER/WP02\\_Feeding\\_Assistive\\_Robotics.pdf](http://reeler.eu/fileadmin/user_upload/REELER/WP02_Feeding_Assistive_Robotics.pdf)



"This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731726"

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The case of Bestic

By Niels Christian Mossfeldt Nickelsen

*REELER Working Paper Series*, working paper no. 2, version no. 1, 2018  
Cathrine Hasse, Stine Trentemøller, and Jessica Sorenson (Eds.)

**Feeding assistive robotics, socio-technological imaginaries, and care: The case of Bestic**  
*Responsible Ethical Learning with Robotics (REELER) working paper series*, Working paper no. 2,  
2018.

Working papers can be downloaded from the REELER project website, <http://www.reeler.eu>; and from the official dissemination portal for EU projects, CORDIS (Community Research and Development Information Service), [http://cordis.europa.eu/project/rcn/205953\\_en.html](http://cordis.europa.eu/project/rcn/205953_en.html).

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ISBN: TBD

DOI: 978-87-7684-600-8

## FOREWORD

Responsible Ethical Learning with Robotics – REELER – is an interdisciplinary H2020 project funded by the European Commission with 1,998,265 EUR from the 1<sup>st</sup> of January, 2017 – 31<sup>st</sup> of December, 2019. Its main objective is to develop the REELER Roadmap for responsible and ethical learning in robotics. The project involves four European partners from the fields of anthropology, learning, robotics, philosophy, and economics, who work closely together in a research-driven collaboration between SSH-RRI and Robotic-ICT communities. Together, they aim to raise awareness of the human potential in robotics development, with special attention to distributed responsibility, ethical and societal issues, collaborative learning, as well as economic and societal impacts. The REELER Roadmap aims at aligning roboticists’ visions of a future with robots with empirically-based knowledge of human needs and societal concerns, through a new proximity-based human-machine ethics that takes into account how individuals and communities connect with robot technologies. REELER’s comprehensive research methodology includes a design-anthropological approach to onsite studies of roboticists’ laboratories and daily work, as well as onsite ethnographic studies and impact studies of present and potential affected stakeholders. The project also includes quantitative research in geographical distribution of patents and an AMB (agent-based model) research approach. Furthermore, the project makes use of novel methodologies to give both robot-designers and affected stakeholders a space for mutual exchange about a robotic future, built around a number of REELER’s ethnographic case studies of robots being developed in Europe. These novel methods include experiments with mini-publics, role play, social drama, and also explorations of the established sociodrama approach with professional sociodramatists. REELER aims to include all relevant aspects of this research in the roadmap, which will present ethical guidelines for Human Proximity Levels (HPL) in design work, as well as prescriptions for policy makers and robot-designers for how to include the voices of new types of users and affected stakeholders. The project aims to present an agent-based simulation of the REELER research to be used by roboticists and policymakers. The working papers presented in this series present ongoing research results, literature reviews, and position papers.

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# FEEDING ASSISTIVE ROBOTICS, SOCIO-TECHNOLOGICAL IMAGINARIES, AND CARE: THE CASE OF BESTIC

By Niels Christian Mossfeldt Nickelsen

## ABSTRACT

*The media and political/managerial levels focus on the opportunities to re-perform Denmark through digitization. Feeding assistive robotics is a welfare technology, relevant to citizens with low or no function in their arms. Despite national dissemination strategies, it proves difficult to recruit suitable citizens. This working paper discusses roboticists' and governmental agencies' socio-technological imaginaries. I argue that imaginaries intertwine with stakeholders' organizing of their worlds and discuss the resulting tinkering during implementation. The ANT idea of 'follow the actor' inspired the study that took place as multi-sited ethnography at different locations in Denmark and Sweden. Based on desk research, observation of meals and interviews I examine socio-technological imaginaries and their practical implications. Human - robotics interaction demands engagement and understanding of the particular situation of the user. The study contributes to STS by providing an empirical analysis where political imaginaries, the technology developers' assumptions, and users and care providers hassles are all in focus.*

## 1.0 Introduction

This working paper explores the relation between socio-technological imaginaries and ongoing transformations in care for the disabled in Denmark. More precisely, I discuss implications of feeding assistive robotics (FAR) on care work settings, relations and routines, and issues of inclusion and exclusion. Citizens with low or no function in their arms are currently obvious candidates to use FAR. The association of municipalities, Local Government Denmark (Kommunernes Landsforening), and the governmental Agency for Digitization (Digitaliseringsstyrelsen) endorse this technology based on a business case carried out in 2012 (Gaedt, 2013). However, it proves difficult to recruit suitable citizens, to ensure implementation and to sustain use over an extended period. As early as in 1936, Charlie Chaplin envisioned mechanized feeding. In 'Modern Times' his little vagabond struggles to survive in the modern, industrialized world during the depression and is hired at a factory. As part of this imaginary, he is fed his lunch by crude machinery and thus, Chaplin showed the according to him, horrible conditions of efficient modern industrialization made tangible by mechanized food consumption. The use of FAR in the context of technological solutions in care for the disabled is obviously much less sinister, but still presents a complication of the relations between the technology, users, care providers (CPs), and developers. Arguably, in order to ensure ethical and responsible development of assistive robotics, there appear to be too much distance and too little collaborative learning among policy makers, technology developers, and affected stakeholders. This has likely to do with conflicting value systems that potentially undermine full use and may lead to robot sabotage (MIT Technology review, 2015) and other negative effects that hinder unfolding of potentials. In order to ensure an ethical and responsible development as well as collaborative learning in relation to assistive robotics, developers and affected stakeholders have to communicate more. In a comprehensive and thought-provoking review of ten pivotal ethnographic studies on the nature of the task of feeding completely dependent bodies Martinsen, Paterson, Harder & Biering-Soerensen (2007) identify two consistently emerging tropes among CPs; 'feeding as task' and 'feeding as

relationship'. Despite the fact that the task of feeding completely dependent persons constitutes a common activity in many health care settings, it enjoys surprisingly little interest from researchers as well as practitioners. During the last decades, manual feeding has disappeared from nurses' responsibilities. Thus, it is relegated to non-professional staff because it has become 'an efficiency task' and not a valued opportunity of 'the art of nursing'. It has in other words become low status and is now an obvious candidate for robotization.

Some groups have made compelling arguments and have presented digital health technologies in a favorable light as the healthcare of the future (Roos, 2017). There have been many promises for the potential of health technologies, including more cost-efficient healthcare delivery, engaged patients and connected health professionals (Susskind & Susskind, 2015). Yet, the realities of enacting technologically driven care innovation and assistive robotics, whether as patients or care providers, can be messy, uncertain and complicated, in ways often unanticipated by technology developers, policy-makers, government agencies and other advocates (Lupton, 2014). In this working paper, I present a case study of implementation of a particular type of assistive robotics namely the second generation of FAR. An example of the first generation FAR is the British 'Neater Eater Robotic', which has been claimed to be an intrusive element in the environment of its user. It is, for instance, noisy and takes up space among other things because it fixes to a table. In this sense, it pre-scripts the user scenario and allots new tasks and responsibilities to the CPs (Nickelsen, 2013). Recently second generation of FAR, the Swedish 'Bestic' has appeared on the market. Bestic means cutlery in Swedish and Danish and that is to the point of what it is intended to be. In relation to the Neater-Eater robotics, Bestic is more mobile, leaner, and technologically more advanced. In addition, it appears easier to manage for users and CPs. This study highlights the imaginaries and performed practices of governmental agencies, technology developers, care providers, users and occupational therapists in relation to introduction of the second generation FAR, Bestic..

## 2.0 Analytic inspiration

Robot development has great potential, but may lead to both altered human condition (Floridi, 1999), and skewed labor market (Ford, 2015). Using material semiotics (Mol, Moser & Pols. 2010; Orlikowski, 2010, 2000; Timmermans and Epstein, 2010) as analytic resources, the study draws on the Actor Network Theory idea of 'follow the actor' throughout the empirical work (Latour, 1987). As such, I scrutinize the socio-technological imaginaries, dreamscapes, values and ethics in relation to FAR (Jasanoff & Kim, 2015; McNeal et al, 2017) and not least the attunement and tinkering involved in adapting and forming new routines in relation to this technology (Winance, 2010).

The notion of socio-technological imaginaries draws on science and technology studies (STS). This notion is defined as: '[The] collectively held, institutionally stabilized and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through and supportive of, advances in science and technology' (Kim, 2015, p. 153). The naming of the concept of socio-technical imaginaries indicates links to both political theory notably Benedict Andersons (1983) work on imagined communities (see McNeil et al. 2017 for elaboration on this link) as well as science and technology studies (STS). The compound nature of the concept is intentional as it is an attempt to overcome the, arguably, excessive focus on the individual scientist and particularities of locality (Jasanoff, 2015). Focusing on the socio-technological imaginaries involved in Bestic is hence a relevant analytical lens as it invites me to dive into the relationship between imaginary in terms of applications of science and technology and the practical effects of this

imaginary in mundane everyday life. Importantly, the notion of 'socio-technological imaginaries' differ from for instance 'discourse' or 'master narrative', by focusing, not predominantly on language, but specifically also on the relation between anticipations of the future and performed relations. Moreover, 'socio-technological imaginaries' differ from the notion of 'culture' by being less monolithic and by socio-technological imaginaries being both contested and conflictual propositions. Various actors hold different socio-technological imaginaries that shift when enacted in practice. As such, imaginaries make connections and interpenetrates different times, places, ideas, structures and agencies.

The notion of socio-technological imaginaries is particularly interesting in relation to assistive robotics and welfare technology because it suggests analyses that combines politics, structure and interpersonal action by putting together prescribed futures and practices that various agencies aim to obtain or believe they ought to obtain. Therefore, I analyze a number of socio-technical imaginaries in regards to FAR as illustrations of ongoing re-imagination and re-performance of the Danish state, its institutions and relations that have very tangible implications for the everyday enactment of care for vulnerable citizens (McNeal et al. 2017). The socio-technological imaginaries such as 'Denmark as a digital pioneer', 'Danes as world champions in ICT' currently penetrate the political-administrative landscape and discourses in the media (see for instance Bernsen, 2017, 2018). Denmark has traditionally had a predominantly agricultural economy. In present times, much focus is on the opportunities for Denmark to re-perform itself by way of digitization. Thus, every government funded financial and economic stimulus package leads more money into digitization, automation and shared economy. In order to promote this development the Danish prime minister is the chairperson for the national Disruption Council in which leading officials and experts work to find potentials to use digitization in an increasing number of areas. As part of this imaginary the Danish government recently published an ambitious Digitization Strategy (2016-2020). This tells of highly profiled national implementation of welfare technology (p. 28). Four welfare technologies are being implemented on a national scale (FAR being one of them) to provide a modern infrastructure (Slota & Bowker, 2017; Star 1999) characterized by increased self-reliance for users, better work environment for CPs, and reduced costs.

We see these strategic and political acts as elements in a socio-technical imaginary on a national scale, but such imaginaries are certainly not only ideals and intentions. They also engrain in practice on an everyday level when CPs and users enact the socio-technical imaginaries in using FAR. By combining analyses of political level documents with field study and interviews with technology developers and affected stakeholders an analysis of imaginaries is in line with the ambitions of Latour (2005) of analyzing complex phenomena by both localizing the global and intangible and likewise globalizing the local by analyzing how particularities are linked to wider phenomena. Moreover, an analytic focus on socio-technical imaginaries not only puts focus on the here and now, but also includes the desirable futures, values and ethics towards which actors orient themselves. In that sense, socio-technological imaginaries are performed value systems.

When seeking to understand care innovation in relation to the socio-technological imaginaries of assistive robotics it is crucial to situate care workers' conduct not just in their relations with users, but also in all their relations. Focus must be broader than the discursive dimension; one must analyze the care workers values and how they practically organize their world of work through symbolic meanings and categorizations such as 'empathy', 'community' or 'the body'. It is necessary to study their agency

and modes of ordering (Law, 1994; Moser, 2005). Mol, Moser & Pols (2010) propose that care work is a matter of attentive tinkering with arrangements of people and technical aids. Winance (2010) has concisely demonstrated the tinkering and experimenting involved in adapting wheelchairs for the disabled. Tinkering, she argues, is to shape and arrange humans and non-humans in ways that suit them. It is a matter of arranging people and technical aids and continually to change tiny details to ensure that the collaboration between humans and non-humans work optimally. Thus, according to Winance, care is not merely something a CP gives to a patient, an elderly or a disabled person. Rather, care is continuous experimenting with people and things. It is to shape and arrange and continuously to change and rearrange details. In this perspective, we are all both subjects and objects of care. This is interesting because it opens up the possibility that assistive robotics, not only constitute an aid (or hindrance) to the user, but also to the care worker.

Therefore, the notion of tinkering has comprehensive implications for how to analyze the relation between assistive robotics, technology developers, CPs and users. Instead of casting care and technology as opposed, as respectively 'warm' and 'cold', technology is just another part of caring that leads to movement. Technology simply adds to what is already there. In relation this, 'passage' is an interesting and useful notion. Certain arrangements of humans and technical aids lead to good passages, which make competent users. Others lead to bad passages and make incompetent users or even indignity (Moser and Law, 1999). In this way, Mol, Moser & Pols (2010, p. 15) rethink and reframe care and technology together. In other words, they seek to disturb, complicate and contribute to the care-technology distinction. What do CPs do with the technology (assistive robotics) they face? Tinkering is a crucial notion that helps focus on care workers active organizing of their participation in technologically driven care innovation.

In another important work Mol (2006) problematizes the assumption that caring can be measured and defined outside the practice of care. Mol obviously refers to 'accountability' and 'evidence-based practice'. I do not interfere with these discussions in this working paper. However, I find that a comprehensive national strategy and rollout plan for the use of FAR in 98 municipalities in Denmark exemplifies an accountability process in the sense that it embraces centrally defined assumptions and imaginary of best practice. The key in relation to this working paper is that the use of FAR in care work is defined outside the practice of caring and as such forms a socio-technological imaginary of a golden standard. Nevertheless, according to Mol there is no singular, shared form of care for which to strive. Instead, Mol proposes, we should try to understand 'multiple care' as this performs in different sites of care. In addition, Mol, Moser and Pols (2010) argue that improvement of care, in general terms, is not something that has to pass a golden standard or an outside judgement. Rather it is something that takes place as attuned attentiveness as part of care itself.

Drawing on Jasanoff & Kim (2015) and Mol, Moser & Pols (2010), I follow Bestic around in various sites in order to explore how a number of socio-technological imaginaries interfere and have effects for this care innovation initiative. I combine the notions of socio-technological imaginaries and care as tinkering. Thus, my research questions are, 1) How do various stakeholders actively organize their worlds of action with Bestic in relation to imaginaries of the future? 2) How do relations, tinkering and practices among a number of socio-technological imaginaries entangle in ongoing transformations in care for the disabled?.

### 3.0 Design of the case study

The empirical study comprises qualitative data in relation to implementation of FAR (Bestic) for users with no or low functions in their arms and hands. The Actor-Network Theory methodological approach of following the actor inspired the study. The study was designed as a multi-sited case study at different locations in Denmark and Sweden (Flyvbjerg, 2006; Marcus, 1995; Yin, 2014). Data collection took four months. By taking advantage of the multi-sited ethnography (Marcus, 1995), the study examines the relationship between technology developers' and others' socio-technical imaginaries and the practical use of the robotics. Thus, I clarify and discuss ongoing transformations in care for the disabled. This methodological approach made it possible to untangle a network of pivotal actors with regard to the implementation of FAR in a Danish municipality. I am interested in FAR for several reasons. Firstly, due to the often high and widely expressed potential that is notably still unprecedented. Secondly, because of the human-robotics proximity that Bestic entails. The intimacy and the close human-robotics encounter makes FAR and Bestic an interesting example in relation to health robotics and future imaginaries. Thirdly, because of the paradox that FAR is immediately controversial and non-popular in many observers' eyes, and still broadly endorsed and implemented by the authorities.

Alongside reading of public documents, the data collection consisted of observation of 3 meals and semi-structured interviews with 16 informants. First, I interviewed an official in Local Government Denmark (LGDK) (the association of municipalities) about the making and faith of LGDK's national welfare technology plan encompassing a plan for financial savings (2014-2017). LGDK systematically monitor implementation of welfare technologies in Danish municipalities. Internationally, it is extraordinary that Danish policymakers launch national rollout plans of welfare technology. This likely has to do with the fact that Denmark is a small country and the Danish universal health care system. However, although Sweden also has a universal welfare system, there are no centrally initiated dissemination of welfare technology. In the Netherlands, they would never launch such a strategy due to a much more negotiated and privatized health care system. Moreover, whereas medicine is a thoroughly controlled market, welfare technology is a surprisingly open market based on business cases in Denmark (Kidholm in Bernsen, 2018). In order to get to know the technology in more detail, these initial considerations led to an interview with Careware, the distributor of Bestic in Denmark. Later, this directed me both to Slagelse and to Stockholm. In Stockholm, I interviewed the CEO and the developing engineer in Camanio Care, the producer of Bestic, about the design process and ethical considerations with regard to the use of Bestic. Following, I interviewed the head occupational therapist in Slagelse about the local FAR strategy. This gave access to a number of directly affected CPs and users. I interviewed two users suffering from cerebral palsy, four CPs at home institutions and four CPs at day care centers. Six of the interviewees are formally educated as pedagogues. Two are employed as care assistants. In the following, I refer to all of them as CPs. In order to protect the informants all mentioned names are pseudonyms.

I observed Tonni eat with Bestic three times. First, in the day care center where I also interviewed Tonni and the occupational therapist, and three CPs involved in Tonni's use of Bestic. Later, I observed Tonni eat his dinner in the home institution. In relation to this, I also interviewed Tonni and two CPs. This gave access to still another user, Tanja attending the same day care center. She had recently stopped using Bestic due to multiple problems. I found this span of experiences with Bestic interesting. First, I interviewed her and a CP at the day care center. Later I visited Tanja at the home institution where I interviewed two CPs particularly about the decision to stop using Bestic.

The interviews took between 30 and 120 minutes. I recorded them on a Dictaphone and a research assistant transcribed them verbatim. I used the Reeler interview guides, respectively for roboticists and affected stakeholders. Concerning the roboticists, I first asked about technical components and functions such as why Bestic was developed. In addition, I asked about the design process and evaluations of technological readiness. Moreover, I asked about challenges, any unintended effects, and relations to policy makers and users. Concerning the affected stakeholders the functions, ethical issues, everyday use in practice, implementation and emerging routines, were in focus. In this case, the interviews worked particularly as further inquiry into the observations of the preparation, context and process of the meal. I asked about Bestic as a worksite compared to the pre-robotics meal-worksite. Thus, focus was on 1. Routines and changes of routines in relation to the meal 2. Any observed changes in the CP-user relationships 3. Quality delivered to and experienced by the user.

I coded the interviews by a simple read/re-read and highlighter approach along two themes: 1. CPs tasks and change of tasks in relation to the robotics meal; 2. Changes in the relation between CPs and users due to Bestic. Then, I analyzed this material with the research questions in mind and drew inspiration from the notions of socio-technological imaginaries and tinkering.

I observed three one-hour sessions of meals with Bestic and one traditional feeding meal. Two meals were at the day care center and one at Tonni's home institution. During the meals, I was sitting right in front of Tonni with notebook and telephone. In advance, I had obtained permission to take photos and make small video recordings. Having in mind that eating is intimate; this set-up was perhaps excessive. It was supposed to support memory, analysis and detailed communication. From this position, I could observe and inquire into all aspects of the meal. I presented myself as robotics researcher and the users and CPs explicitly accepted the attendance and the set-up. The users and CPs unanimously found it important to communicate their experiences. The interest during observation focused on the performance of the robotics, the CP's organization of the meal, and the user's interaction with Bestic. I was interested in how they practiced and talked about eating, how they treated the food, and how long a meal took. Before and after the meal I observed and noted as much as possible. I also talked with the users and the CPs to elaborate on the observations.

I am not trying to position these findings as universally generalizable, nor do I intend to confound assistive robotics in general with the specificities of Bestic for users with low or no functions in their arms and hands. Currently, assistive robotics, undoubtedly, consist of a row of very different activities related to different set-ups and affordances (van Winsberghe, 2014). My interest comes, as mentioned out of the socio-technological imaginaries and ongoing national implementation of welfare technology in Denmark. Thus, I wish to contribute to continued responsible, ethical and solid implementation of (feeding) assistive robotics.

#### 4.0 Analysis

A complex case study always has multiple facets and focusing on any of these will necessarily foreground some aspects and marginalize others (Star, 1991). My approach is to present two different readings of the empirical material, one from the perspective of being an implementation case with a master narrative of the sociotechnical imaginary of 'Danes as world champions in technology' and the other reading it as a case of multiple intersecting socio-technical imaginaries.

The master narrative of 'Danes as world champions in technology' is evident throughout the case, and its relevant point of origin is various governmental agencies. In 2014 LGDK establishes 'Center for

Welfare Technology', an office, with the task to continuously produce outcome measures for the dissemination of robust welfare technology in the municipalities based on convincing business cases. Thus, they imagine, the following are able to produce quality, savings and flexibility and they decide to implement them on a big scale: 1) Patient lifting technologies, 2) Wash toilets, 3) FAR and 4) Better use of assistive technologies.

An example of a user of one of these welfare technologies is Tonni who is 32 years old and suffers from cerebral palsy. While writing, he has used Bestic for 14 months. He lives at a home institution with five other challenged citizens. He gets manual help with eating in the mornings. He brings FAR in a knapsack from the home institution to the day care center, where he is part of a music group. At the day care center, he enjoys his lunch with Bestic. He also eats his dinner with Bestic at home. In contrast, Tanja recently terminated using Bestic. It worked well at the day care center. However, Tanja and the CPs in the home institution experienced a number of constraints. Tanja used Bestic for three daily meals for 5 months before terminating. She spent 15 minutes more per meal with Bestic, which due to logistics was particularly a problem in the mornings. These two vignettes illustrate that users and CPs appropriate Bestic differently in different contexts. Interestingly, in both cases Bestic works well at the day care center. However, in the home institution, it only works well at Tonni's place.

The technology developers recognize they face problems in implementing Bestic in care practice, *'It often stops with the CPs. They need to change routines in relation to the meal'*, they say. The CEO and the development engineer propose that this mainly has to do with lack of knowledge because there is neither training in use of assistive robotics in formal basic education, nor is there professional courses for CPs. Thus, the technology developers point at a need for training and continuing education in relation to problems arising during mealtime. An initial assessment is that the key hindrance in implementing Bestic is a lack of training. I will now revisit the above-mentioned participants to discuss not only the immediately articulated problems, but also the socio-technical imaginaries and show how they intersect and are misaligned. I am interested in what various socio-technological imaginaries seek, foster and hope for and what is articulated as respectively 'good' and 'bad'. Moreover, I am interested in what happens when different performances of 'good' meet.

#### *4.1 Love of technology as an imaginary*

As we now go back to Tonni, his use of Bestic is far from smooth and homogeneous as initially presented. A more detailed scrutiny of a meal with Bestic illustrates both the empowerment and the daily hassles that it comprises. In the following, I will show how the socio-technological imaginary of being a leading nation in digitization intertwines with the daily tinkering to make the robotics work.

Nete (a CP) prepares Tonni's lunch by mounting a table on the wheelchair (see photos 1,2,3). She unpacks the FAR from Tonni's knapsack and mounts it on the table. Attentively, she spreads chicken and rice that Tonni has brought from home on the plate. Soon, Tonni carefully activates a blue button with his left elbow. The Bestic-spoon and arm immediately goes down to the plate for food, but unfortunately, it shovels the food over the edge of the plate. It ends on the table. The CP smoothly lifts the food back with a spoon, and consequently gently adjusts the position of Bestic. As Tonni continues, the arm and spoon swing too far out. Now, the spoon pushes the cheek and due to his lack of muscle control and despite, he bends his neck and snaps after the food, Tonni has difficulties getting the spoonful into his mouth. Again, Nete rearranges the position of Bestic. The three CPs sit at an adjacent table and eat their lunch. Before Bestic, one of the CPs would sit completely with Tonni and

manually feed him. Now, the three of them sit together and talk during the lunch (now more or less a lunchbreak). However, one of them needs to monitor the meal and now and then needs to help Tonni. This provides them with flexibility and overview, they say. One of the CPs, June, is particularly fond of Bestic. She appears to be Tonni's favorite manual eating partner. She thinks Bestic not only cares for Tonni, but also for her. Feeding another human being manually can be demanding, she explains. Tonni does not get more food around his face, in his lap, on the table and on the floor when he eats with the robot than when manually fed, June says. The CPs tell about Tonni's manual eating partner

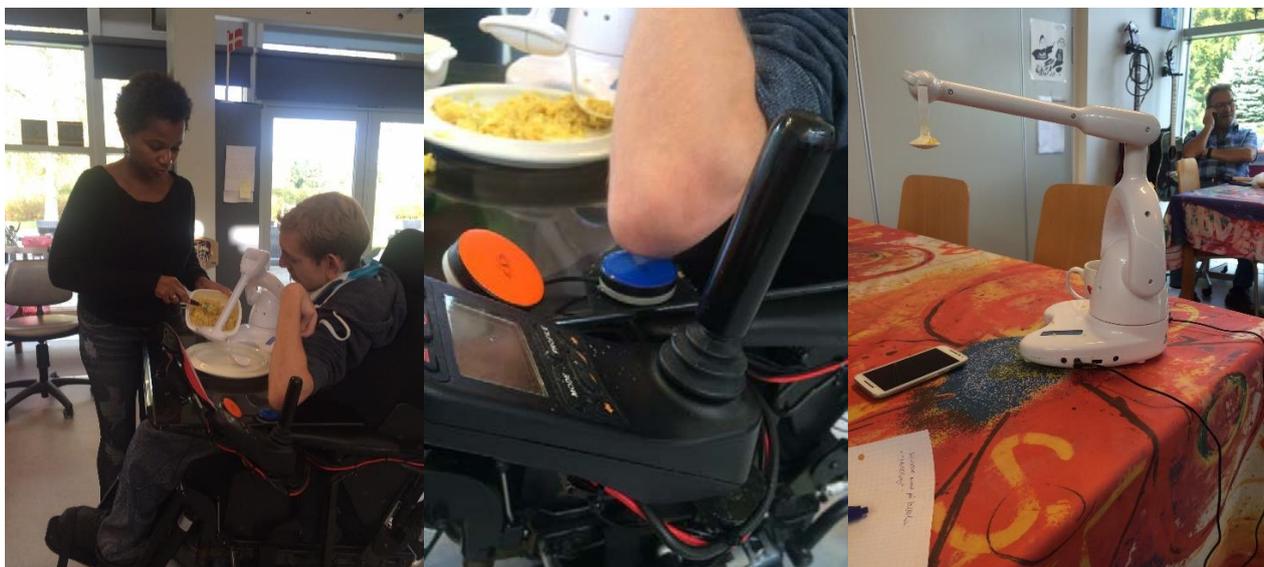


Photo 1. Nete prepares the lunch at the day care center. Photo 2 Tonni presses the blue panel with the elbow and activates Bestic. Photo 3. Helge sitting at the adjacent table in the lunchroom

hierarchy. Tonni prefers to eat with June, but he prefers Bestic to Nete, they say. Tonni does not want to eat with Helge at all, who is thus in the last place, and the robot is rated as the second best eating partner. This example, I believe, illustrates both opportunities and transformations in caring at the day care center. Human services now explicitly compares with robotic assistance and CPs are now to some degree exchanged with robotics. This lead to clashes among care values and interferes with the CPs' imaginaries of care as a question of gathering, community, empathy and positive regard. However, in this case, Helge stresses that he will rather fill his function of activating the attendees, which is to play music, than feed Tonni.

Space and task appear to be important with regard to implementation of FAR. The day care center is an activity offer and values playing music together. Bestic is welcome as it actually frees up time for music. However, at the home institutions the CPs express doubt as to the long-term value of Bestic. They constitute 'homes', the CPs' at home say. Helle, a CP in Tonni's home institution states, '*Here it is important that we do the things that you do at home....When we eat, we sit down and there we are together. We are a home. There are some specific values that apply*'. As such, Helle emphasizes the particular context and style that applies to 'home' and as such, she questions whether Bestic is appropriate. In a home, you eat cozily together and apparently not alone with robotics in your room. Interestingly however, this is exactly what Tonni wants to achieve.

While the CPs at the day care center to some extend are fond of Bestic and see it as a tool for their use, the CPs at the home institution stress that Tonni always ought to decide when to use FAR. Helle

worry that Bestic may be 'too convenient' and due to potential municipal budget cuts the FAR will likely soon need to function without the assistance of a human. As another CP puts it, *'It should not be so that Tonni uses Bestic because he has to'* (due to savings of personnel). Tonni agrees; *'I am the one to decide. Sometimes in the morning, I forget Bestic as an act of will. I just tell them there is something wrong with it'*. In other words, he insists that Bestic is his tools. It is not the CPs' tool.

An important fact necessary to understand this is that Tonni loves technology. Technology enables him to have agency. His primary interface with his surroundings apart from having CPs help him is a control box and a joystick mounted on his wheelchair. By way of this, he opens and closes the bedroom door. He controls the curtains and even the ventilator in the kitchen. He uses the joystick and control box to navigate his phone, put on music (also in the bathroom), and start movies. During evenings, Tonni prefers to eat alone with Bestic in his room while watching old Danish movies. Unfortunately, there are serious constraints. Michael (CP) needs to remove the Joystick of the control box to attach the eating table on the wheelchair, and thus he cuts Tonni off from interacting with his environment (see photos). Michael places Bestic with a Velcro strap so it does not fall or move; serves the food, starts a movie, and leaves Tonni's room. Tonni now eats alone, and that is an achievement, but he has no control besides simple activation of Bestic. Tonni explains he is afraid of choking on the food and suffocate. If that happens, he cannot contact the CPs. He may shout, but potentially no one will hear him, as during mealtime, the CPs are busy. If he wants to change the movie, he cannot. He can only wait. Because of this, the CPs have recently decided that Tonni can only eat alone in his room with Bestic when three CPs are at work. In the future exactly due to the FAR, the CPs' fear, they are scheduled to be only two at work at dinnertime. This example, I believe, tells of a pressing dilemma concerning socio-technological imaginaries in relation to simultaneous employee savings, self-reliance and love of technology experienced by the user. Those imaginaries and aims intertwine and collide.

This point relates interestingly to both Floridi's (1999) notion of 'robot envelopment' and to the fact that the roboticists claim that generally CPs are not willing to change meal-routines according to the affordances of the FAR. Robot envelopment means that the robot demands a certain environment to be able to function well. In the literature, robot envelopment is a matter of organizing the environment so that it meets the needs of the robotics. In this case, the result is a bad passage. Tonni is actually able to eat alone in his room with Bestic and that is an important achievement, but at the same time he is incompetent (Moser & Law, 1999). Instead of collaborating among technologies, Michael needs to dismantle the joystick to the box to make Bestic work. Thus, in a way Bestic worsen Tonni's agency and self-reliance. Much point to the possibility that particularly the CPs at the home

institutions generally see FAR as impairing care. It appears, they are not willing to skip imaginaries of gathering, community and empathy during mealtime. This point to the case of Tanja.

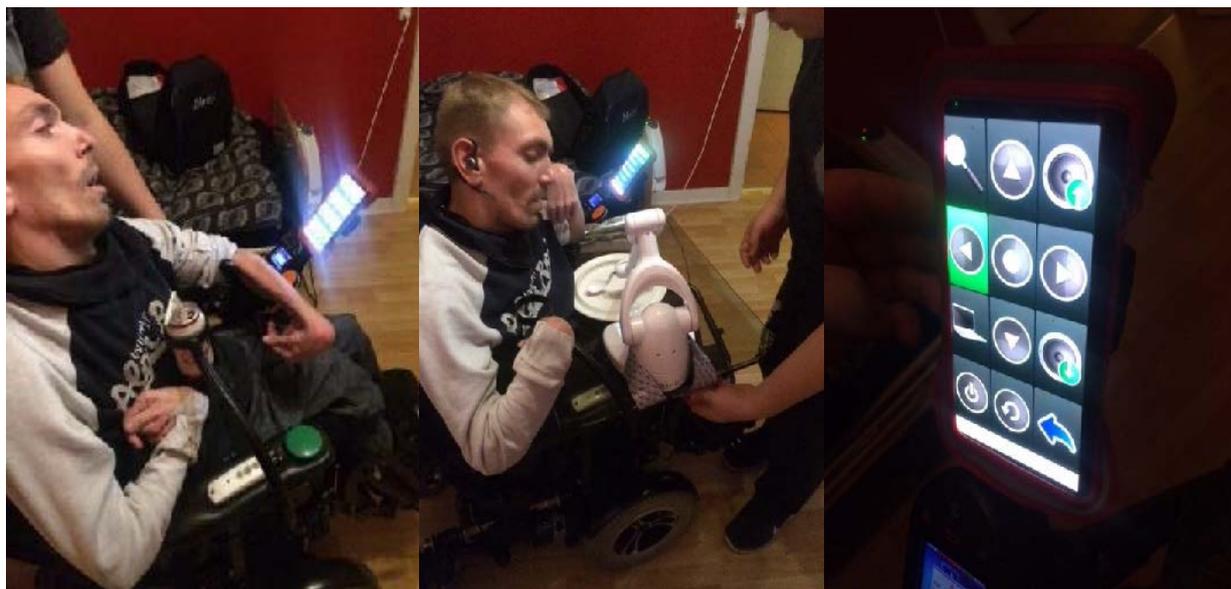


Photo 4. Tonni at home at night sitting in his chair with box and the joystick under his left arm. Photo 5. When using Bestic the joystick has to be unmounted. Photo 6. Box interface

#### 4.2 The socio-technological imaginary of impaired care

Tanja also had trouble in using Bestic and stopped after 5 months. It was difficult for the CPs to make Tanja sit right at the table. For instance, she has a flex arm and a cloth attached to the wheelchair. Therefore, she could not get close enough to the table and Bestic did not work properly. After some time they got another table but then there was no space for the footrests mounted on her wheelchair. The CPs had to unmount the footrests at the beginning of every meal, and reinstall them afterwards. Consequently, Tanja had trouble keeping her balance during meals, which is essential when using Bestic. The CPs tried to support her feet in various ways with a footstool and pillows. The occupational therapist was involved and tried a number of options. She made drawings and templates to show exactly where Tanja ought to sit in relation to the table and the robotics. However, in order to eat comfortably Tanja had to place herself so close to the table that she could neither grab the cloth, nor press the blue button to activate Bestic. After some time, she began to have neck-pain likely due to a strained eating position. Furthermore, the spoon broke twice, the first time because Tanja had been stuck. Thus, there were continuous material and emotional arrangements, rearrangements and resistances. One day, Bestic fell on the floor, broke down and sent to Sweden for repair. In fact, it never came back. In the meantime, Tanja ate with the CPs. The CPs at the home institution decided to abandon the FAR. The contact person says,

*When Bestic broke down it was as if Tanja came back to the table and had social contact with the group again. It was as if Tanja, due to the [FAR] table arrangement, came at a distance from the group. She was in a way sitting at the end of the table all by herself. She had come too far away and this made the contact difficult. I think she missed contact.*

Although she stopped, it is obvious to suspect Tanja still wants to use Bestic. I do not know whether this is actually the case. Unfortunately, Tanja is a vulnerable citizen and does not articulate that wish clearly. Mostly, she communicates through sounds not easily understood. However, during the

interview, Tanja stresses that it makes a difference who helps, and that the CPs do not have equally positive opinions towards Bestic. Nevertheless, the contact person imagines that Tanja prefers to sit together with other residents while eating, to have contact and enjoy empathy. Like Tonni, Tanja ate well with Bestic at the day care center. At the two home institutions though, intricacy and comprehensive tinkering emerged. Again, socio-technological imaginaries of good care in various sites differ. While, Bestic helps the day care center to focus on music, the home institution doubts whether Bestic belongs in a home, characterized by contact. In addition, it must be justifiably emphasized that relationships in the home are often more complicated and demanding than relationships in an activity offer.

Thus, Tanja's use of Bestic entangles in different socio-technological imaginaries. It begs ethical questions of what is most worthy, to eat independently with Bestic or to have contact and food with fellow residents and CPs. While I believe, there are no answers to that question outside the specificities of situations; the CPs blame themselves when the human-robotics arrangement does not work. 'It could have been otherwise if we had done more', a CP said as a response to why Tanja stopped. This point on one side to insurmountable work with matching human and material that comes with FAR implementation. On the other side, it points to the fact that the CPs face a technology they, to some extent, believe impairs caring and which at the end even might save their own job away. I can sum up this section by stating that there are various versions depending on space and task among CPs in relation to the usefulness of Bestic; tinkering is necessary to make it work as is buying in to the imaginary of robotics being enabling of a more agential life. In the next section, I explore the socio-technological imaginary of empowerment and training.

#### *4.3 Empowerment of the user as a socio-technological imaginary*

Camano Care in Stockholm designs and sells Bestic. A factory in Eskilstuna, Sweden assembles it. Just like the usage stories, the Bestic design story include interwoven technology and people. An engineer in automation and mechatronics, who had recently graduated university, met an affluent economist suffering from post-polio. He had a dream of producing a FAR solution for himself. She was looking for a job, and eventually they started designing the first version of Bestic in 2004. Patients at hospitals with amputated arms acted as informants throughout the early design phase. At a later stage, the design process took place in close collaboration with three design students from the university doing voluntary work. They worked on the Bestic design as part of their Masters project. For half a year, the developing engineer also had an office at the university. In close collaboration, they designed Bestic. The first versions of Bestic came with a five-button control panel. It had arrows and colored buttons indicating arm-directions and speed. It readily appeared too complicated for many users. To compensate, they developed a simple blue one-button panel to activate the arm and spoon (see photo 2). Consequently, the robotics can be set to different programs depending on rhythm of the meal, physical and cognitive ability of the user. Furthermore, in relation to start-up, Bestic is individually set in terms of exact position, how far the arm swings out, and how high and deep it goes. As soon as it is individually set for a certain user, it does not need adjustment.

The CEO and the developing engineer at Camano Care expound four ethical claims in connection with practical use of FAR: 1. Empowerment 2. Usability 3. Changes in meal-routines 4. Education. The first and most important claim is the question of empowerment. Empowerment is, according to the roboticists, an issue of really wanting to support and help the user. The Bestic user ought to control decisions, they say. Therefore, empowerment is about respect, caution, and security. The CEO says,

*Being fed by a person may very well feel more unethical than eating by yourself with an aid. Those coming to help me can be anyone who I do not know and who do things more or less the way I prefer. To say that humans are always ethical and machines are always unethical is too black and white..... One can seriously problematize the extent of human empathy*

Secondly, according to the developing engineer the questions of usability and aesthetics are crucial. Usability was a guiding principle through the design process. A meal is not simply about eating, nor is it only a matter of moving food from the plate and into the mouth, rather the meal is a very particular setting to which we have all kinds of expectations. Among other things, the meal is an important social event and it relates to community, gathering, pleasure and conversation. The developing engineer says, 'At almost every celebration we have a meal. That is what we want the users to be part of. So, Bestic shouldn't stick out too much'. In order to be used the FAR must fit on the table, be neat and blend into the environment. It should not look too much like a robot. The two technology developers agree that the earlier models, such as the Neater-Eater robotics, are too prominent and noisy. Consequently, the developing engineer listened to a number of motors, and in order to make Bestic as silent as possible it ended up having two small motors. The design group also wanted Bestic to be white and shiny. Although it is made of plastic, it is intended to look like porcelain. Throughout the design process, it was valued that Bestic was easy to clean and wipe off.

Thirdly, the technology developers find CPs ought to be prepared to shift work routines in relation to the meal. With FAR the meal changes in relation to what it was before. The financing as well as the development of assistive robotics, is challenging and long term. It takes time and effort to enter the market. Thus, the development engineer claim, Bestic is not simply a commercial product. Rather, it is a new way to think and work. Bestic embraces a new philosophy of the meal. The CPs for instance have to make sure Bestic is charged, and that all the needed elements are in place. Not least, they need to relate differently to the user during the meal. According to the CEO, the use of FAR often stops, because the CPs are not willing or able to make the necessary changes. Thus, it is a key value that the user and not the CPs is in control. If the user controls the use of Bestic, it is ethical, she says. Sometimes the users ought to be somewhat more assertive and say, 'I really want to use this robotics, could you please help me?' The point is that Bestic is not something you try for a period due to it being fun or interesting. It is a new way to eat, think and work. In relation to the fourth point, the roboticist propose there is a lack of knowledge. Training is lacking with regard to assistive robotics in formal basic education. Moreover, there are no continuing education in robotics for CPs. The roboticists particularly point at a need for training in understanding the problems arising during a meal. Due to this lacking, there are destructive myths about savings instead of quality, instrumentality instead of empathy etc. The CEO says,

*The use of feeding assistive robotics does not lead to more quality or less quality in itself; neither does it lead to more or reduced staff in itself. This is a question of what you do with it, but there are often not sufficient staff at breakfast, lunch and dinner. This is where Bestic may or may not lead to improved quality.*

Consequently, Camanio Care developed 'Mealtime Puzzle', a course they teach at Karolinska University Hospital in Stockholm. They have also developed an app called 'Mealtime quality index' (MQI) consisting of a number of questions posed to both CPs and users in order to consider what a

good meal is. The course treats a number of issues during a meal you have to be aware of - nutrition, speed, senses, physical arrangement, organization etc.

#### 4.4 *The imagination of digitized healthcare*

After an election in Denmark, in their coalition agreement 'A united Denmark' (October, 2011) the new government wrote 'We will work for a more cohesive focus on telemedicine and will promote ambitious and binding goals, which commit regions and hospitals to welfare technological services on a large scale' (p. 44). The government coalition agreement mentions welfare technology five times - even as a prominent Danish export article. The Ministry of Social Affairs in close conjunction with The Welfare Fund moreover claims there are three goals regarding public funding for implementation of welfare technological projects 1) labor savings 2) quality experienced by the citizen, and 3) work environment flexibility. In the wake of this, LGDK launched its public digitization strategy (2014-2017) to strengthen the dissemination of welfare technology in social work and ensure dissemination of the best practice on technological solutions. The municipalities' financial agreement for 2014 launched a joint municipal effort for national dissemination of mature welfare technology solutions. They promoted this in relation to a plan of a profit realization of 70 million euros. LGDK's social policy proposal titled 'Invest before it happens' states that municipal efforts must be based on the citizens own resources, their active participation and be able to support people's self-determination and independence. Increased use of welfare technology, they claim, is one means to realize the visions. The Center for Welfare Technology produces yearly status measurements for the implementation of the four prioritized areas of welfare technology. January 1 2017, the latest report states that the municipalities have purchased 180 FARs and that 100 of those are in use (KL, 2016). At the same time it is stated by LGDK that the municipalities have already realized the projected for profit of the investment. LGDK recently launched a new strategy for welfare technology (2017-2020) and The Board of Digitization emphasize continued dissemination of digital welfare solutions in their new strategy (2016-2020).

#### 5.0 Discussion

There have been many promises regarding digital health technologies and assistive robotics, including better and more cost-efficient healthcare delivery, engaged patients and connected health care professionals. However, enacting these can be messy, uncertain and complicated, in ways often unanticipated by technology developers, policy-makers and government agencies. Welfare technological services, I propose, constitute a strong contemporary socio-technical imaginary of care for the chronically ill, the elderly and the disabled as well as the Danish welfare state. This relates not only to modernization, but also more specifically to *savings*, *quality* and *flexibility* in care work. Yet, Bestic is indeed such a technology, it appears, there are noteworthy discrepancies between imaginaries and long-term implementation and results. Inspired by material semiotics I have analyzed a number of participations and practices to open up questions, tell stories and demonstrate different imaginaries and versions of Bestic (Jasanoff, 2015; Despret, 2004; Mol, 1999). This illustrates that there are a number of unprecedented expectations and unresolved issues.

There are obvious tensions between the digitization strategy in relation to assistive robotics promoted by various governmental agencies, the technology developers' vision of empowerment-through-training and the described obstacles in day care centers and home institutions. By way of observation and stories told by affected stakeholders, the vignettes elucidate both strivings for self-reliance and

indeed crumbling of FAR when the tinkering with arrangements of people and Bestic is not successful. The vignettes demonstrate that successful use of Bestic comprises persistent experimenting and hard footwork and there are surprisingly little learning across different user environments. In none of the cases did the CPs at the home institution for instance communicate with the CPs at the day care center despite the day care centers more successfully used Bestic. I will now revisit the vignettes to discuss the connections between the socio-technological imaginaries, the tinkering involved in the practical use of Bestic and the implications for care work. I have organized the discussion according to three themes: 1)Tinkering with people and stuff, 2)Enabling desired futures with robotics 3)Personalized care as a consequence of robotization.

### *5.1 Tinkering with people and stuff*

The notion of ‘tinkering with people and stuff’ is interesting in terms of putting assistive robotics in perspective. Tinkering, Winance (2010) argues, is to shape and arrange humans and non-humans in ways that suit them. It is a matter of arranging people and technical aids and continually to change tiny details to ensure that the collaboration between humans and non-humans works optimally. Tinkering helps to understand the impact of assistive robotics on workplace relations, routines, and issues of inclusion and exclusion in institutions. Despite the fact that Bestic intends to fit neatly into the work, home and day care environments, it also interferes with these spaces. The food needs to be of a certain kind. Chicken and rice is for instance good, and lettuce and rocket is bad. In addition, the food has to be prepared in certain ways; the CP also needs to prepare not only the food, but also mount Bestic before the meal starts. Not least, the CP needs to monitor the process during eating. In other words, Bestic obviously interferes with mealtime routines that have to be adapted and readapted. This is as I have elucidated particularly the case in home institutions for the disabled. I will return to this point.

### *5.2 Enabling desired futures with robotics*

According to the technology developers in Stockholm, Bestic embraces the potential for self-reliance. The technology developers make hopes about Bestic leading to empowerment of vulnerable citizens and even new ways to think about the meal. Unfortunately, according to the CEO and the developing engineer, this often stops with the CPs. They are often not willing or able to shift work routines. However, this analysis elucidates there are notable differences among CP groups. Whereas the CPs at the day care center to some extent welcome Bestic, the CPs at the home institution are somewhat cautious. The day care center is an activity offer and since, thanks to Bestic, they do not need to feed citizens’ manually anymore, they are able to focus more intensely on their pedagogical offer. As I have elucidated, it appears, Bestic has actually freed up a little time for the CPs. Thus, to the CPs at the day care centers, FAR supports relevant use of resources. As such, Bestic also comprises the possibility of professional work with music. As mentioned earlier, Helge stresses that he will rather fill his function of activating the attendees, which is to play music, than manually feed Tonni. Bestic, in other words, not only supports Tonni, but also Helge, the CP’s, and the pedagogical activity at the day care center.

The CP’s at the home institutions, on the other hand, are worried. In opposition to the day care center, they define themselves as a ‘home’. They are concerned about the compulsion of resources in the long term that Bestic may impose on them. An informant for instance explains that she fears, municipal savings will eventually force Tonni to eat with Bestic; he will eventually have no choice, she fears, as the CPs will not be able to handle the peak hour tasks of serving meals without FAR. Another

CP predict that within long Tonni has no choice, but to eat with FAR. Moreover, the CPs at the home institution worry for their jobs in the long term. Thus, Bestic both supports and stresses them. Because of this intertwining of aims, I propose socio-technical imaginaries play a crucial role in fostering tinkering and attentiveness towards specific desirable futures. What I see is a group of home institution CPs that do not seem to buy into the imagined future where assistive robotics assist them (or the users), rather than make them obsolete.

Thus, due to robotization of the process of feeding, care tasks transforms and divide in new ways. This transformation is a consequence, I argue, of a number of socio-technical imaginaries. The perceptions of futures with robotics lead CPs to orient towards technology in ways that enable realization of their desired future. In this sense tinkering with people and stuff leads to care tasks that are more technical in nature and not least involve considerable invisible work (Star, 1999). This invisible work implies among other things to understand the program, functionality and demands of the robotics, to set it up safely and to ensure the process of safe, neat and pleasant meals. Moreover, Bestic and FAR more generally, implies more a supervisory role for the caregivers. They become a kind of machine operators that do not feed citizens directly with a spoon as they did before. Rather, they monitor the meal heedfully at the proper distance and support, adjust and interfere when needed. It provides some, but not much flexibility and thus the opportunity to focus elsewhere. It also mobilizes substantial resistance due to the strong discourse of shifting seemingly 'warm human labor' with 'cold technology', savings and efficiency. Whether one sees FAR as an element of empowerment in a technology driven future, or as a means to impair and worsen care, as we have seen, has considerable impact on how the CPs anticipate the technology.

### *5.3 Personalized care as an effect of robotization*

A further complication is that the implementation of robotics, I propose, leads to more personalized care. By that, I mean that assistive robotics leads to an increased focus not only on what the CP does in relation to the user, but also on the caregivers' knowledge, point of view and capability to engage in the individual users particular wishes and needs. In other words, implementation of assistive robotics fosters a kind of intensified responsibility. This has to do with the fact that technical aids often constitute individual solutions and thus CPs are exposed to particular new demands. Moreover, they have opinions towards the technology. '*It could have been otherwise if we had done more*', a contact person for instance states. This statement, I believe, elucidates the CP's self-awareness with regard to the increasing demands related to assistive robotics. She is aware of the fact that successful use of FAR depends on her own engagement, knowledge and hard work. It appears that successful implementation is never simply a matter of whether a FAR fits the body of a user or not. Rather, human-robotics interaction needs continuous adaption, testing and experimentation, and as we have seen, the outcome depends on the invested amount of energy and invisible work, all of which, I propose, link to socio-technological imaginaries. As mentioned earlier, Tanja emphasizes that the CPs are not equally positive towards Bestic. Thus, it makes a notable difference, which CP helps her eat. Undoubtedly, this careful statement points toward the significance of resilient personal relations when using FAR. In Tanja's case, the CPs even appeared burdened by the decision to abandon Bestic. As such, It is obvious that implementation of FAR will never be successful if nobody intensely engages and persistently does the footwork. The user, on the other side, is completely dependent on the effort of the care personnel, which I propose only intensifies the responsibility and urge to engage. This point emphasizes the (Camano Care) CEO's remarkable statement that users and CPs do not necessarily

understand each other well. Caregivers can be ignorant and robotics can appear to have as much empathy as people have. The constellation of people in care situations are often coincidental and this constitutes an important ethical point. The user is vulnerable, dependent, and perhaps even more so in relation to application of assistive robotics. I propose all this adds to personalization of care and intensified responsibility. Finally, yet importantly, according to Tonni's eating partner hierarchy the robotics is the second most preferred eating partner. This is another indication of a hinterland of personalized care that comes with assistive robotics. Humans compare to machines and perhaps therefore have to do an extra effort. Now, they not only compete with other CPs about users' admiration, appreciation and affection, they potentially have to see themselves beaten by robotics. I am not at all suggesting that everything would go well if CPs would be better at empathically listening to the wants of the user in need of assistance. Neither, do I naively believe that CPs' imaginaries could simply be more productive. In opposition, much point to the possibility that the home institution CPs' suspicion bases on concise observation of Bestic in practice over a period.

## 6.0 Conclusion

In this working paper, I have illustrated and discussed some of the complexities that follow with technologically driven innovation in care for the disabled. I have focused on feeding assistive robotics and Bestic and I have proposed there is considerable difference between the socio-technical imaginaries in terms of welfare technology promoted by governmental agencies and the practice of enacting such implementation among users and CPs'. As part of this divide, imaginaries of public officials, technology developers, users' and CPs' weave into the daily practice and shape present-day practice caring. In extension of Mol, Moser and Pols (2010) I propose that much is at stake and that human-assistive robotics interaction demands thorough engagement, continual tinkering as well as understanding of the particular situation and circumstance of the user. Thus, this working paper contributes to the literature on STS and socio-technical imaginaries by providing an empirical example of analysis of such complexity and phenomena from the middle of things, and in a manner where both political ambitions, the technology developers' assumptions concerning usability, users and CPs ambitions and hassles are in focus. It is my hope that the current analysis invites readers to broaden their understanding of welfare technologies and assistive robotics as well as provides an interesting example of the faith of societal ambitions enacted by users, technology developers and CPs.

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Feeding assistive robotics, socio-technological imaginaries, and care: The case of Bestic

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