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Sustainable Design

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Welfare technology, the promises and challenges in the processes of implementing an assistive eating device in cooperation with an elderly care network and a municipal department.



## ABSTRACT

A prime objective of the Danish government in cooperation with the Danish municipalities and the geographical regions of Denmark are to promote and support the use of welfare technology, to in their words meet the objectives of empowerment, Independence, and efficiency to sustain the welfare sector. This cross-governmental objective has become a joint common public sector strategy known as the 'Strategy for Digital Welfare 2013 – 2020'. The strategy has been followed up by the creation of government agencies and institutions to support collect and distribute data from specific pilot projects taking place in a large number of municipalities throughout the country. The strategies aim is to accelerate the use of Information and communication technology (ICT) as well as welfare technology in public service delivery and promote effective digital technological solutions in the area of healthcare, care of elderly, social services and education. The importance of formulating a coherent implementation plan for new technology is increasingly recognized by the government and municipalities. However, there is still a lack of knowledge as how to strategically take on this task. The aim of this study is to define and discuss a number of challenges arising from the implementation of one welfare technology product, namely the assistive eating device which is currently being tested on a national plan as a mature technology, e.g. a well-documented technology. The thesis findings are based on results from empirical data compiled during my observations and interactions at the elderly care network Skovhuset in Hilleroed municipality as well as inquiries into governmental ministries and agencies who have a common defined goal of knowledge sharing and cooperation to support implementation of welfare technologies. Successful implementation of welfare technology has a high degree of importance for the national government and municipalities in their goal to meet the demographic challenges, e.g. the continued growing number of elderly citizens needing health care while at the

same time the labor force is declining makes up for valid reasons to pursue strategies that can improve implementation of welfare technology in health care networks and institutions to compensate for the labor shortage and reduce future public expenditure.

**Key words:**

Welfare technology / Empowerment /Independence /Efficiency

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## INTRODUCTION

### TOPIC

Welfare technology in a broad definition is the technology we as societies use to improve the services provided by welfare systems to citizens with special needs and has as well the aim of making the provided services more cost efficient. The topic of welfare technology has current and far reaching significance to our society and is especially relevant now due to the growing elderly population, see figure 1. The new challenge in health care provision and the rising public expenses this involves is recognized by governments where strategies are being introduced to take on the challenges.

Almost a doubling of elderly citizens between 80 – 89 years by 2030

	2014	2020	2030	2040	2050
<b>Total</b>	5 627 235	5 746 161	5 974 766	6 122 203	6 212 544
<b>0-9 years</b>	634 928	601 470	708 242	698 856	669 197
<b>10-19 years</b>	690 488	670 852	611 745	718 034	708 704
<b>20-29 years</b>	701 981	768 480	739 346	681 752	789 344
<b>30-39 years</b>	687 825	667 480	783 676	758 857	704 876
<b>40-49 years</b>	809 755	745 046	657 350	773 079	750 516
<b>50-59 years</b>	737 542	792 546	722 547	633 928	750 020
<b>60-69 years</b>	694 294	664 249	746 157	685 628	604 143
<b>70-79 years</b>	435 531	565 299	578 374	668 452	626 454
<b>80-89 years</b>	193 366	224 950	364 476	392 117	477 997
<b>90-99 years</b>	40 529	44 682	61 204	108 727	125 857
<b>100 years and more</b>	996	1 107	1 649	2 773	5 436

Source: Denmark's Statistics

Figure 1 - Population projection for Denmark from 2014 to 2050

### The origins of welfare technology in Denmark

The terminology welfare technology originated in Denmark where it covers the definition of many different technologies (Jordansen, 2009a, 2009b; Hansen, 2007). The terminology was introduced by the Danish Board of Social Services in 2007 and became quickly a common definition used by both the public and private sectors (Jordansen, 2009a, 2009b) The terminology welfare technology is mainly used in Scandinavia and here especially in Denmark and Norway where this is believed to be a result of the vocabulary (welfare

and technology) which gives meaning within the Nordic welfare models (Helsedirektoratet 2012).

In Norway the terminology 'Care technology' (omsorgs teknologi) is also used to support the meaning of technology (NOU 2011:11). In the Nordic welfare societies the public sector offers a range of welfare services to citizens with special needs, e.g. nursing, home adaptation, rehabilitation and education to mention a few. Welfare technology is often part of these services and thereby is not restricted to any one specific sector, but bridges the many sectors mentioned above. Welfare technology serves as technical solutions to citizens with special needs and can compensate or support a disability but the technology is also used by the caregivers that assist disabled citizens. The current Danish government policies are steering welfare technology towards three objectives; **(1) empowerment**, to improve quality of life for citizens, **(2) Independence**, an easier everyday life and **(3) efficiency**, improved effective environment for employees. Welfare technology is hereby associated to promises of an improved less expensive public sector. It is of central interest to unwrap how the promises may be achieved and implemented.

The welfare technology artifact that is specifically studied in this report is the 'assistive eating device' and is characterized by having a high degree of citizen involvement. A major criterion for the success of the technology lies in the citizen's ability to use and benefit from the usage of the technology on an everyday basis. It can neither be underestimated that the staff and family in connection with the used technology should have a positive experience of the used welfare technology. The demographic challenges that are now evident in our society due to a growing ageing population's need for health and care services and at the same time the declining amount of young people entering the workforce will in the future demand that we we-think how these challenges can be met. It could be argued that a solution to the declining workforce could be to import the needed labor from

other countries with a labor surplus but this is not seen as a long-term solution and poses other issues such as cultural barriers. In this study the objective is to establish an understanding of the complexity involved in implementing a mature welfare technology as defined by government agencies in a micro scale at a care network and if upscaling of the technology can be launched by using existing established tools and methods such as the Welfare Technology Evaluation (VTV) from Danish Technological Institute.

## RESEARCH QUESTION

The main focus in this study is to explore how the heterogeneous networks in the process of implementing welfare technology, hereunder the assistive eating device interact. The promises they produce and the challenges they confront.

### Research question:

*What are the conditions and how do the heterogeneous networks surrounding welfare technology influence the implementation of an assistive eating device in a care network.*

### I have included two sub questions to help support the study.

*Are there tensions between the government agencies welfare technology promises in comparison to visions and aspirations of the care networks?*

*Can existing platforms such as the DTI Welfare Technology evaluation (VTV) platform contribute to an upscaling of welfare technologies?*

## CASE DESCRIPTION

This study seeks to answer questions related to how conditions and heterogeneous networks impact the implementation of welfare tech-

nology, in this case the assistive eating device. The study aims at providing qualitative knowledge within the care network, Skovhuset. I use the term care network in comparison to care center to illustrate the complexity of the interactions within the care center. It is not simply the care takers or other actors in Skovhuset that shape the implementation but it includes actors in the municipality department and elsewhere. I cooperate with the department for Elderly and Health in Hilleroed municipality who have initiated the implementation process as a continuation of the municipal 'Economic agreement 2014' where Local Government Denmark (LGDK) on behalf of the municipalities and the national government have agreed on the economic foundation for the plans to promote the use, testing and evaluating of mature welfare Technologies on a national plan until 2016. The terminology mature welfare technologies have become a definition for new technologies that have been documented by testing and documentation. The implementation of technologies is defined in the 'Strategy for Digital Welfare 2013-2020'. The Implementation process is therefore not simply a matter of interest for the department of Elderly and Health and the care network, in Skovhuset. The promises and aspirations of new welfare technology take its offset in strategies from government ministries and agencies. Therefore the network surrounding the implementation of welfare technology is examined from two perspectives (1) the airplane view where the government ministries and agencies spread the initiatives and promises over the landscape and (2) the floor level perspective, the care network takes up the task of implementation of new mature technology at local level.

## **THEORETICAL FRAMEWORK**

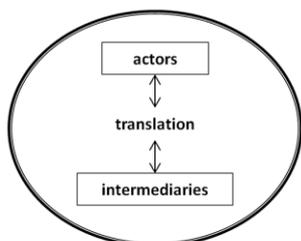
The theoretical framework for my research and analysis are drawn from Science and Technology Studies (STS). This study focuses on how the conditions and heterogeneous networks impact the implementation of welfare technology. The theoretical approach takes its

offset in perspectives from Actor Network Theory (ANT). Domestication theory and the concept of 'Scripts'.

### Actor Network Theory (ANT)

Actor-network theory (ANT) takes on the notion that all entities in a network, human and non-human are given equal agency (Callon, 1986; Latour, 1986; Latour, 1987; Law, 1992). Agency is here the capacity to act that is uncovered and untangled by studying the networks and how local truths emerge. Interactions in networks are interwoven heterogeneous relationships and should therefore be integrated into the same conceptual framework. By assigning equal agency to actors it is possible to understand the working mechanisms that hold the network together and at the same time allowing for an unbiased analysis of the actors. How actors are tied together by translation and able to associate intermediaries such as the texts, artifacts, humans and money (Law, 1992) is an important element in this study to unravel how the networks are linked and kept in place. Not only does it show that things (actors) have a capacity to act, but also they do so by virtue of their materiality (Latour, 1992). The relationship between actors and artifacts is not stable but is constantly being created, broken down and recreated. The new networks and associations according to Latour come into existence through what is called the translation process which is tied together by 4 moments of translation; Problematization: A problem agenda is set. Interessement: Actors become interested in joining the network and negotiate the terms of enrollment. Enrolment: The roles of the actors are defined. Mobilization: The actors actively work for the networks agenda.

The approach in this implementation study is to appreciate the complexity, fluidity and the dynamic relations of reality at the eating situation and the networks that keep the assistive eating device in place. It does not take on a linear approach of examination with simplistic assumptions in relation to the active roles of artifacts, actors and intermediaries and thereby does not to view any actor as a 'black-



The network of actors and intermediaries, tied together through translation



Actors are not 'black boxes' of information but play an active role in the ever ending network



Food is not a single point actor but can comprise of many material entities, e.g. foodstuffs with various properties

box' container of information (Latour, 1994) but as playing an active role that is determined in the ever ending network. The objective is as well to maintain an unbiased analysis keeping in mind that even though the networks and actors seem 'consolidated' or simplified to look like single point actors (Callon, 1986) it may not be the case. The assistive device at first sight is an artifact, an actor that has associations in many networks but it must be analyzed not only as an artifact but through its components, systems and associations e.g. the spoons, software programs, manuals and knowledge. The food that the assistive eating device is to take up and deliver to the citizen's mouth is neither a single point actor but can comprise of many material entities with various properties that require inquiry and knowledge to gain success in an implementation phase.

### Domestication theory

The domestication theory in this study has focus on meanings, functions and use of artifacts and how the meanings and use are enacted and how they can be understood. Central for the domestication process is the often unconscious attempt to make technologies fit into their surroundings in a way that makes them invisible or taken for granted. A domestication analysis goes beyond function and use (Silverstone et al. 1989, 1992; Lie & Sørensen, 1996). Silverstone and his collaborators have focused their domestication within household settings while Sørensen and his collaborators have widened their interests to contexts to outside the home such as cars and 'smart houses'. The artifact is designed with specific qualities and capabilities where producers and advertisers create certain meanings to its future use or non-use and the meanings that emerge. But what happens after the artifact is taken from the designer's workshop and arrives at the caretaker's office and later on to the dining room for use? Is the implementation of the artifact merely a simple linear process where the artifact is prepared, introduced, used and quickly becomes part of

everyday routines? Or is it something else, where the process becomes framed by barriers, conflicts and negotiations? The analysis examines relationships in daily settings to see how the process unravels in real life scenarios. A Domestication approach takes into account the processes where the technology, artifact is adapted to everyday life and the processes of everyday life's adaption to the technology. The process is defined in up to four stages; the **appropriation** phase where possession and ownership are central. The **objectification** phase tries to capture how values, tastes or styles are expressed through the new technology. The **incorporation** phase emphasizes how the technology is used, Silverstone et al. (1992) suggest that for an artefact to be incorporated it has to be actively used. The **conversion** phase is concerned with the relations between the household's internal affairs and the outside world.

The symbolic aspects of the adaption and use of the artifact is as well central in the study and analysis, the codes of the technology in relation to personalization connected to the actors identity and social relations (Lie & Sørensen, 1996) needs to be examined and understood.

### Script and inscriptions

The notion of scrip as a metaphor for the 'instruction manual' (Akrich, 1992) is useful in the way it conceptualizes the connections between design and use. Technology should be analyzed not only in terms of the social processes in which it is constructed, but as well in terms of the role it plays in social processes (Akrich, 1992). The concept indicates that things in use can prescribe specific forms of actions, in a way the script in a theatre play orchestrates what happens on stage. A to-go coffee cup, for instance has the script 'discard me after use'. But how does the inscription and design (visual and semiotic) of the assistive eating device 'Bestic' relate to the expectations and practices of an eating situation in the dining room and elsewhere? The device is designed to assist citizens with impaired physical functionality. The

procurement of the device is planned to do more than assisting, it has multi objectives such as defined in the ‘Strategy for Digital Welfare 2013-2020’ to along with other technologies create the basis for:

*“Empowerment, Flexibility and Efficiency”*

Inscriptions in artefacts of representations (the device represents ‘assistance’) and is an area of interest as it delegates responsibilities (Ouldshorn et al. 2005). Artefacts from this perspective are not neutral but need to be examined as active actors in the socio-material configurations. Ouldshorn et al, (2005) argue that designers thus define actors with specific tastes, competences, motives, aspirations, political prejudices. They assume that technology, science and economy will evolve in particular ways.

A large part of the work of innovators is that of ‘inscribing’ this vision of or prediction about the world in the technical content of the new object. The inscription of meaning in an artifact is not limited to its technical content (Akrich, 1992) but is equally the case regarding its design in general. The materialization of the designer’s presumptions, visions, predictions regarding the relations between the artifact and the human actors surrounding it becomes an effort at ordaining the understanding of the products use and meaning. However there is always the chance that the actors decide not to play the role ascribed to them by the designers the users can also misunderstand, choose to ignore or disregard the instruction manual and define their uses and the producers use and meanings in contradiction with the producers, designers intentions and as conveyed through the script.

The script is hereby a key to understanding how producers, designers and products and users negotiate and construct a sphere of actions and meanings. The involvement of the actors at every level of the product development is vital and may lead to better inscriptions (Ooudshorn et al., 2005). The assistive eating device is described as *“a solution to support physically impaired persons”* but it has been understood by Dorris as a toy.



The device is perceived by Dorris as a toy

## METHODOLOGY

### A QUALITATIVE ANALYSIS

The theoretical concepts presented in the previous chapter request a method that allows me to follow and analyze the technology, its users and networks. To discover how it is used and perceived in multiple contexts. My research question calls for a qualitative analysis as there is little or no quantitative material covering precisely this area of implementation, the testing of assistive eating devices that have been performed are predominantly carried out on younger individuals while at Skovhuset the citizens are seniors without exception.

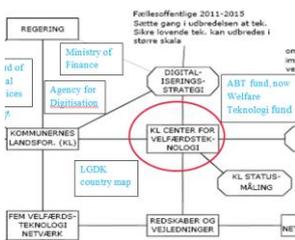
Here in the methods section I will explain the framework for the methods I utilize to conduct my research to help find answers to the research question.

### Unraveling the network

Inspired by Bijker et al. (1987) and Bijker (1995) in the initial research task I endeavor on gaining insight on the scale of the network surrounding the initiating and implementation of the assistive eating device see WS 08. The mapping is also used as a boundary object to promote dialogue in conversations and interviews as well as to assist in the recruitment of informants by, “rolling the snowball” (Bijker, 1995) especially outside the municipality and Skovhuset, see WS 07. Discovering the relevant actors in this large network is important as it is connected to whom is keeping the networks in place and where can the network fall apart. At an early stage in the study it becomes apparent that the networks stretched far outside the municipality of Hilleroed and Skovhuset and have strong links to government agencies that have initiated the implementation strategies, see WS 07. This methodology of mapping actors continued for the duration of the study, to ensure valid data as networks are not guaranteed stable and aligned (Callon, 1986). But I still need to gather empirical data to answer the implementation challenges at local level in the care network,



Observation of an eating situation in the dining room



The mapping used as a boundary object to assist “rolling the snowball” to discover relevant actors in the network.

here I use observations, conversations and informal interviews from situations at Skovhuset. Ooudshorn, Brouns, and Oost (2005) argue that science and technology studies can be enriched, by including a focus on place to understand the dynamic interactions between actor and artifact. The chain of conversations in the observation process as argued by Spradley (1979) are useful and valid as; *“It is best to think of ethnographic [qualitative] interviews as a series of friendly conversations into which the researcher slowly introduces new elements to assist informants to respond as informants”*. The primary objective of the conversations is to find new topics of interest that are not described in literature via free speech.

### Be the actor to gain first-hand knowledge



But do not forget the napkin

But how does it feel to eat with an assistive eating device? This question I attempt to answer by using the device myself in an eating situation, see WS 09. By being the actor in this case the user of the device I gain first-hand knowledge of the challenges and unwritten details of the device and as argued by Steen, Kuijt, Evers & Klock, (2007) to fuel inspiration by empathizing with the users. I use other dining rooms at Skovhuset where the device has not been introduced or used to uncover citizen feelings towards the device, what does it mean to them?

### Networks outside of Skovhuset

To gain information from actors outside Skovhuset I use predominantly semi-structured interviews (Spradley, 1997) supported whenever possible by dedicated use of boundary objects to promote dialogue.

To examine possibilities of upscaling welfare technology via an established assessment platform I analyze the Welfare Technology evaluation platform (VTV) from Danish Technological Institute (DTI). There are other upscaling methods such as the recently launched Local Government Denmark's (LGDK) new platform for upscaling. The (LGDK) method will not be analyzed in this study.

## PRIMARY ACTORS IN THE NETWORK

### GOVERNMENT MINISTRIES AND AGENCIES

The government ministries and agencies have since the launching of the government platform of October 2011 mobilized a focused agenda to promote and support the objectives in the platform. The platform was launched under the slogan ‘A united Denmark’ which calls for the public sector to meet its demands for public services by the promotion of innovation for as well to better the competitiveness of private companies. The aims of utilization of welfare technology are a core element in the platform. The prime minister, leader of the Danish Social Democrats, Helle Thorning Schmidt announced in her opening speech presenting the platform:



*“The Government wishes to use public sector demand actively to promote innovation and problem-solving, so as to enable private companies to become more competitive and the public sector to deliver better service to the general public. For example, in relation to development and utilization of modern welfare technology”*

*“We must take care of our welfare, not wear it down”*

The platform takes into account more than improving the services to citizens via modern welfare technology it also opens up for the inclusion of private companies in public service innovation and problem solving. Shortly after the introduction of the government platform government agencies were renamed to suit the welfare technology agendas, the ATP fund is renamed to the Welfare Technology Fund as a result of the municipal ‘economic agreement 2014’. The Agency for Digitization is geared via allowance to contribute with economical support to projects that test and evaluate welfare technology and new working methods in an effort to speed up the digitization process in Denmark and defined as a requirement to modernize the Danish Social sector. A new Center for Welfare Technology is initiated by the Welfare Technology Fund. The center is founded to support implementation of the ‘four mature technologies’ (see WS 07) and to collect



The Strategy '2013- 2020' has a clear message



Focus area 3 of 7 in the Strategy

data related to gains achieved through the implementations. In September 2013 the Welfare Technology Fund under the ministry of finance launched a long term plan the so called; 'Strategy for Digital Welfare 2013-2020' under the slogan:

*"Empowerment, Flexibility and Efficiency"*

*"Doing more for less"*

The strategy has the overall objectives of accelerating the use of Information and communication technology (ICT) as well as welfare technology in public service delivery. To promote effective digital technological solutions in the area of healthcare, care of elderly, social services and education under the slogan *"make everyday life easier for citizens"* while at the same time claiming that the strategy will enable;

*"Empowerment, Independence, Efficiency"*

*"Doing more with less"*

The strategy is divided into seven focus areas, each of which contains a number of initiatives. The focus areas may be expanded with new initiatives and objectives up to 2020. The objective of the strategy under focus area 3, Welfare technology in nursing and care is to:

*"...deploy the four mature technologies throughout Denmark that will free up at least DKK 500 billion annually from 2017 at local government level"*

*"In 2020, digital technologies will have become an integrated part of rehabilitation pathways, wherever relevant"*

## Launching the strategy 2013 - 2020

The speeches at the press conference to launch the strategy were well aligned. The different minister's praise the strategy using much the same vocabulary to back up both the economic and social attributes of the contents in the strategy;

*"Everyone across the public sector is now joining forces to ensure rapid dissemination of effective solutions to all of Denmark. Citizens can look forward to easier everyday lives and more self-empowerment. At the same time, this means*



The aligned governmental network, saying the same things about the strategy



*freeing up money which can be used to strengthen our society. This is indeed something to be pleased about,"*

Minister of Finance, Bjarne Corydon

*"... A central goal of this strategy is to make life easier for citizens, while also using public resources as efficiently as possible. I'm convinced that the new technologies give citizens new possibilities, greater empowerment and a better quality of life. And they also make work easier for public employees. Technology both can and should help improve the public sector; including the social area".*

Minister for Social Affairs, Children and Integration, Annette Vilhelmsen

## LGDK's CENTER FOR WELFARE TECHNOLOGY

In continuation of the municipal 'Economic Agreement 2014' and the 'Strategy for Digital Welfare 2013 – 2020' a new Center for Welfare Technology is founded in the autumn of 2014 by the Welfare Technology Fund, see WS 07. The center has an expected lifespan until 2017. The center is created to support the implementation of the four mature technologies and to collect data related to the gains achieved through the implementations. The Center publishes an annual report (baseline evaluation) with findings generated in the municipalities in baseline evaluation documents. The Center does not involve themselves in the qualities of, nor have they preferences of any one of the four technologies as illustrated during the meeting at the center.

*"We do not involve ourselves in the qualities of the four technologies. They have been tested and are qualified. "*

*"We have no preferences in relation to the technologies"*

Apart from the baseline evaluation the Center has a defined objective to support the municipalities in achieving the future planned savings:

*"We do all we can to support the municipalities in knowledge sharing. Our objective is that the municipalities achieve the planned savings of DKK 500 million"*



The DKK 500 million is an important goal to meet for the Center

The planned Baseline Evaluation Report planned for release may 2015 has not been released yet

Frederikshavn municipality; *“We have our backs against the wall, we have to make it work”*



Regeringen  
KL

## Aftale om kommunernes økonomi for 2014

13. juni 2013

### 1. Indledning

Regeringen og KL indgik i februar 2013 som led i Vækstplan DK en forståelse om rammerne for kommunernes økonomi i 2014, der indebærer en prioritering af højere kommunale investeringer i 2014 mod tilsvarende lavere serviceudgifter. Aftalen om kommunernes økonomi for 2014 ligger inden for rammerne af denne forståelse.



cooperation between municipalities is a key component in the strategy 2013 - 2020

The center has become aware of the value in education and points at Frederikshavn municipality as a model for successful implementation;

*“Frederikshavn arrange diploma course with ECTS points”*

## THE MUNICIPALITIES OF DENMARK

The Danish municipalities are organized under Local Government Denmark (LGDK). Even if it is a voluntary organization figures show that all 98 municipalities are members. LGDK has in cooperation with the five geographical regions committed to the strategy for digital welfare 2013-2020. The parties are agreed on that the strategy can contribute to improved efficiency in the public sector. To support the strategy LGDK and the Danish government launch the economic agreement 2014. The plan aims at implementing mature welfare technology solutions and inter municipality technology knowledge sharing on a national scale to in LGDK's words to improve citizen's independence and to promote a more efficient working environment for caretakers. The Center for Welfare Technology is under the governance of LGDK.

## THE FIVE GEOGRAPHICAL DANISH REGIONS (DR)

The five geographical Danish regions contain the sum of the 98 municipalities and have Since 1. January 2007 been responsible for the public hospitals, including health care services. The regions along with national government have established the basis for the creation of the Strategy for Welfare Technology 2013 - 2020. They have as well agreed on the Economic plan 2014 for the municipalities that support the implementation of welfare technologies. The Regions have established five welfare technology networks that according to Local Government Denmark (LGDK) will support the municipalities in joint municipal system information accumulation, test and distribution of knowledge on implementation and operation of welfare

The regions have established the 5 regional technology networks to support national cooperation

technology solutions. This is in line with objectives in the strategy 2013 – 2020 for the municipalities to cooperate in knowledge sharing. Two network meetings are held twice annually where challenges, activities and relevant topics are discussed. The meetings have the overall objective that the municipalities must become better at using each other's experiences. The primary users will according to LGDK typically be project managers, development employees and team managers who work within institutions or organizations with relation to welfare technology.

### HILLEROED MUNICIPALITY

Hilleroed municipality has defined a strategy for welfare technology for the period 2013-2016. The strategy builds on their definition of welfare technology, vision, reason, practice for cooperation with other municipalities, organizational implementation, organizing and financing. The municipality has a specific project specification relating to “implementation of assistive eating robots” the projekt takes its offset in the agreement for municipalities economy 2014 where the four mature technologies are defined. The municipality has defined objectives related to the implementation of the eating robot. *“The project shall facilitate the testing of the assistive eating robot and describe the conditions for sustainable implementation and a broader upscaling in the organization”*. The municipality has divided the testing of the eating robot into two phases. Phase 1, testing of two robots at Skovhuset and later to test ten robots at other places in order to gain experience in upscaling. Phase 2 is geared at examining the technology from a three dimensional perspective; A) increase citizen independence, B) strengthen the quality of the eating situation for the citizen and the caretakers; C) contribute to a more efficient less resource demanding eating situation. The focus group for phase 1 screened and matched citizen candidates from Skovhuset as well as relevant actors with



leader functions from the department of Elderly and Health and Skovhuset.

## THE CARE CENTER NETWORK, SKOVHUSET

The care center Skovhuset is located in Hilleroed municipality. It is a contemporary care center that is both a home for 104 citizens and a workplace for about 165 employees. Skovhuset consists of 8 residential units with 12 apartments in each unit, as well as a guesthouse with eight apartments. The care center has a day center (Skovkilden) for 25 daily guests and houses daily activities for the guests and citizens. The defined objectives for Skovhuset and Skovkilden is to create a framework for an everyday life which is characterized by well-being and a high quality of life for everyone in the houses. A defined objective in the center is to provide a framework for the life citizens previously lived with the assistance of meaningful technology.



The care network has a technology network



The care network has a well-established network to support technology implementation

*“We have been involved in the technology design and infrastructure here from the beginning....”*

Development nurse, care center

This means that both the physical environment and organization should offer nearness and high professional quality of care. The nearness is created in part by the physical building and through a stable employee group. The high professional quality is achieved by interdisciplinary teams and with ongoing competence building. Technology is used to support everyday life based on the individual's specific needs. Skovhuset has a close working relationship with the department of Elderly and Health in Hilleroed municipality and have been chosen by this department to test the assistive eating device.

*“In Skovhuset we use technology, when it gives meaning”*

Skovhuset, care center leader

The care center has built up a structure of networks to promote and facilitate welfare technologies. The center has as well practical experi-

ence in the use of new technologies such as ‘smart floors’ and emergency GPS citizen location systems.

## THE TECHNOLOGY DEVICE SUPPLIER

The municipality of Hilleroed has chosen to perform phase 1; testing the implementation of assistive eating robots at the care network Skovhuset. The municipality has for this purpose decided on the purchase of two assistive eating devices to pursue the task. The care network Skovhuset has as the extended arm of the municipality has decided to purchase the eating devices from the Danish company Carewarekompagniet who in their own words are “*specialists in eating and welfare technology solutions*”. Carewarekompagniet are agents for the eating device Bestic which is developed and manufactured in Sweden. According to the supplier, Bestic can be described as;

*“... a small, robotic arm with a spoon in the end that can easily be maneuvered (...) it is easy to use, flexible and most importantly, controlled by you, the user. By choosing a suitable control device, the user can independently control the movement of the spoon on the plate and choose what and when to eat”*

## THE TECHNOLOGY DEVICE PRODUCER AND PRODUCT

The robotic feeding assistant ‘Bestic’ is developed and produced by the Swedish company Bestic AB, see WS 05. The company was founded in 2004 by Sten Hemmingsson who depends on eating assistance due to health complications derived from Polio. The process of developing the device was completed with help from Swedish agencies such as the Swedish Institute of Assistive Technologies see WS 05. The device is developed according to Bestic as;

*“... a solution to support physically impaired persons with reduced or no capability in their arms or hands. You*



The device Bestic is developed and produced in Sweden.

*achieve independence during the meal through our assistive eating device and several other accessories”*



A mobile concept, can be carried in a bag

Bestic is a CE-marked product for technical medicine. The name Bestic has been given to the assistive device for reasons that is explained by Bestic’s development engineer as suitable to convey the message that now this is your (citizens) bestic (bestic meaning cutlery) replacing your previous bestic. Bestic is according to the producer a robot comprising of a mechanical arm driven by motors and controlled by a choice of two remote contacts, the ‘Piko’ and the ‘Picasso’, see WS 01. The arm is equipped with a spoon to pick up food on a plate that is specially designed to suit the food and spoon functions. The device has no cognitive features nor are there any cognition features planned for the near future.

## THE CITIZEN

Dorris (fictive name) is an 84 year old female who suffers from Parkinson’s disease. After a fall her mobility has been reduced and she needs help to complete most daily tasks. Dorris can eat herself at a slow pace. The eating process is slow due to Dorris having difficulty getting food onto the cutlery and keeping it there on the way to her mouth. Cutting food is also a problem for Dorris meaning that all meal times need to be preplanned in that most food needs to be cut out in suitable sizes. Dorris has a low level of mobility in arms, back and legs. She gets about with help of a walking aid and wheelchair. Dorris is lacking facial mimic which makes it difficult to read her state of mind and even if she has good cognitive abilities she has slow bodily reactions both oral and physical (latency).

Dorris 84 år  
 Diagnose: Kemt med Parkinson  
 Efter fald, er Dorris' funktionsniveau svært begrænset  
 Har brug for meget hjælp i dagligdagen. På søjning er der problemer med at skære mad ud og problemer med at spise selv. Skæve af føde stævet til munden, men har svært ved at få maden på ske eller gaffel  
 Bliver trætt ved let fysisk aktivitet  
 alment svækket  
 Indskrænket bevægelighed i arme  
 Indskrænket bevægelighed i ben  
 Indskrænket bevægelighed i ryggen  
 manglende ansigtsmimik  
 ganghastighed 0-25 m

Dorris is no exception, there is a ‘personas’ of all the citizens at Skovhuset

## SCREENING AND MATCHING GUIDES

In relation to the assistive eating device there are three main screening guides that are accessible A) Skovhuset’s in-house guide, B) Screening guide from Danish Technological Institute (DTI) and C) Local Government Denmark’s (LGDK) screening guide.

## A) Skovhuset's in-house screening guide for citizens

Skovhuset has an in-house screening guide to assist in matching the citizens and the technology device, in this case the purchased assistive eating device, type Bestic. The guide is subdivided into three subsections:

- 1) *Screening the citizen to match the one-step assistive eating device.* The guide has a comprehensive listing of relationships that need to be achieved by the organization hereunder caretakers and accepted by the citizen before any form of implementation of device takes place. The screening takes as well as the technology and physical cognitive condition of the citizen, the food that is suited or less suited for use by the device.
- 2) A guide to implementation of the device. The implementation guide is as the screening to match the citizen a comprehensive guide to the steps and tasks that should be undertaken prior to and during the implementation. The steps start with the idea of naming the device to give a signal of independence to the citizen. It calls for the caretakers to eat with the device themselves in order for them to have a feeling of what it is like to eat with such a device. It proposes that the product manual be simplified and proposes that the device supplier should perform this task. An analysis of who should support the implementation should be made where family, friends, caretakers and volunteers should be involved. Food and which foods are to be ordered in cooperation with the citizen and how food is placed on the plate are important topics to be agreed on by the involved group. The device is proposed to be part of the common eating situation just as one sets the table in everyday situations.
- 3) The next steps. Carry out Anthropological fieldwork in the department. Testing the 2-step assistive eating device with other

Indhold af bogen: Her kan man få en idé om, hvordan bogen er opbygget.

- Screening af borgeren inden for brug af den assistive spisestole.
- Behov for hjælp til spising eller med risiko for inden for kort tid, at skulle have behov for hjælp til spising.
- Opsætning af tilbehør til spise apparatet.
- Borgeren skal kunne se.
- Skal armbånd og spise mad ud. Der findes ikke og der er enten metal eller plastik.
- Skal tykke kunne føle armen til berøringstakt, som kan lægges på bordet eller monteres på kanten af armbåndet.
- Skal kunne holde en spise redskab (stikke eller karede), anden fedt eller understøttet.
- Skal kunne tage sig frem, enten ved hæl eller knæ eller ved hjælp af støttespind.
- Skal kunne gendanne hovedet for at kunne hente maden til borden.
- Skal kunne give kroppen et let tryk for at berøre spise apparatets spise situationer.
- Skal kunne kunne være tilstand til at berøre spise apparatets spise situationer.
- Skal kunne håndtere, spise eller se mad på de spise situationer, med (one step) berøring har nogle begreber (fx, mad på bordet, stykker):
  - rygning
  - frugt og grønt
  - kød og fisk
  - ost
  - smør
  - ketchup
  - søde sager
  - sylter

The in-house screening guide developed as a step by step literature without illustrations or graphics

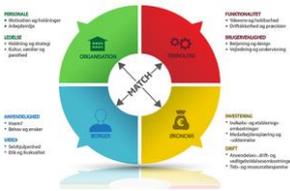
Naming the device to signal independence

Eat yourself with the device

Involvement of family and friends is important

foods such as rye bread. Will citizen latency be an exclusion factor? The citizen may have difficulty in recognizing the different types of cold cuts on the rye bread.

### B) Screening, matching guide from Danish Technological Institute (DTI)

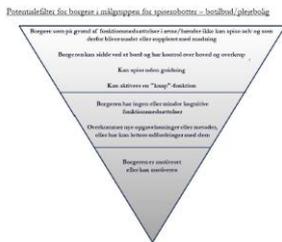


Four elements are to be analysed before a match can be made

Danish Technological Institute (DTI) have developed a screening guide that builds on four elements, Organization, Technology, Citizens and Economy that when applied will give a 360 degree assessment The aim of the guide is give an overview of parameters that need to be taken into account before there can be a match. Here the match is not alone the citizen and the technology but has focus on the organization as a whole and the economy as well.

### C) Local Government Denmark’s (LGDK) screening guide.

LGDK’ Center for Welfare Technology have developed a specific screening guide for eating assistive devices, the so called ‘potential filter’ with ‘personas’ that is supported by a manual aimed at finding potential citizens for the device. The idea behind the guide is to enhance the caretaker’s possibilities to find suitable candidates as it is the caretakers who have the firsthand knowledge of the citizens. The guide is built up as a triangular model with three steps for assisting the initial qualification of citizens.



The potential filter as a triangular model a funnel where you start at the top and work your way down

- 1) The physical condition of the citizen. The citizen must have control over his/her head and upper body and be able to use a contact button to activate the device.
- 2) The citizen should have no or only slightly reduced cognitive abilities.
- 3) The citizen is motivated or can be motivated

### The manual for the potential filter

The manual describes how the team leaders can present the ‘potential filter’ and ‘personas’ at the daily team meetings. The potential filter is explained as a funnel where one starts at the top, if the conditions her

Til Projektleder/Teamleder/Ergoterapeut

Vejledning til potentiafilter og personas, spiserobotter – botilbud/plejebolig

are not met then a solution must be found before ciphering down the funnel.

## REPORT 2012 FROM TECHNOLOGICAL INSTITUTE

In March 2011 the ATB Fund, now the Welfare Technology Fund under the ministry for social affairs initiated a project to test two assistive eating devices. The project took place at 7 care centers in 5 municipalities with an interest group of 25 young citizens with physical disabilities and their caretakers. The method of citizen study was based on Individual observation. The project used the Welfare Technology Assessment platform or VTV to evaluate its results. The project was documented in the report in 2012. The assistive eating devices used for the testing were; Neater Eater Electric (NEE) and the Neater Eater Manual (NEM). The test ran over an 11 month period. The citizens were evaluated on the basis of inclusion criteria including motivation, medical requirements, and the possible savings created by implementation of the technology. The users were evaluated over a minimum of 2 meals per day in their normal everyday settings.

Robotteknologi

TEKNOLOGISK  
INSTITUT

Velfærdsteknologi/assistenz  
i Socialstyrelsens AGT projekt

Spiserobot til borgere med  
fysisk handicap

The report 2012 lays  
the basis for choosing  
assistive eating devices  
as a mature technology



Neater Eater Electric  
NEE



Neater Eater Manual  
NEM

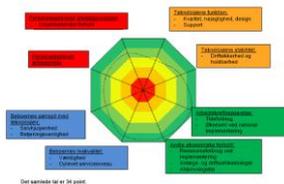
### Results of the project

The results of the study found that using the devices saved the assistance required during each meal by on average 16 minutes and 44 seconds. This time saving evolved naturally through use of the devices and accessories and caretaker interactions. It is calculated that 618,390 hours of caretaker time can be saved annually, based on 2567 people using eating machines for 2 meals per day in residential homes in Denmark. This means that on average a NEM will have paid for its cost within a 75 - 95 day time frame. The NEE will reimburse the investment within 212 days of its initial use. Another conclusion reached was that a deliberate attention to the work shift/release time could have the potential to generate even greater resource savings.

Residents expressed that the use of the device has contributed to greater autonomy, self-confidence, freedom and health in relation to chewing, swallowing and digesting food. The device is surveyed as creating a more equal relationship between staff and residents. The joy of being able to eat independently meant that residents felt a greater degree of dignity and self-esteem in everyday life. They enjoyed eating at their own pace, choosing what order to eat the food in. They appreciate not being fed too quickly and not having to wait for caretakers to get the next bite of food.

### Work and work processes/organizational issues

Implementation of the device has given rise to changing working conditions and work processes / workflow. Among other things, it was recorded that the preparation time for the meal is on average slightly longer. This was calculated by comparing the traditional method with the demands from the device; the food is often placed in special places on the plate when using the device. Much less time was spent by staff on the meal itself and also a little less time on the subsequent clean up. Therefore a very significant overall time saving was experienced by the care takers.



The overall score is found and the result is illustrated in the VTV model

### The overall conclusion

The study drew the following conclusions:

- The benefits of using the devices are clear and positive.
- Eating devices provide greater levels of independence, wellbeing, including health benefits.
- Care takers become more engaged with the client in the feeding process and are less stressed when the devices are in use.
- Time savings mean that the equipment reimburses the funding organization in a period of 75 - 212 days.

Baselinemåling pr. måltid pr. beboer	24 min. 22 sek.
Slutmåling pr. måltid pr. beboer	7 min. 38 sek.
Tidsbesparelse pr. måltid pr. beboer ved projektslutning (slutmåling - baseline)	16 min. 44 sek.
Ved projektslutning, besparelse i dagene for 1 beboer, 2 måltider om dagen	16 min. 44 sek. x 2 = 33 min. 28 sek.
Ved projektslutning, besparelse i dagene for 21 beboere, 2 måltider om dagen	21 x 33 min. 28 sek. = 11 timer 42 min. 48 sek.

Tabell 4: Arbejdskraftbesparelse i projekt ved projektslutning

The figures are produced

## MATURE WELFARE TECHNOLOGIES

The introduction of the terminology ‘mature welfare technologies’ became a reality in connection with results from the publication of results in the report from Danish Technological Institute (DTI) see WS 07. The notion of mature technology has been initiated by the ABT fund, later Welfare Technology Fund. But what is meant by Mature Welfare Technology? The terminology is described by the Welfare Technology Fund as;

*“A technology that improves citizen’s welfare and improves efficiency in the public health sector”*

The 4 mature technologies



Mature technologies currently include four technologies that all have been tested and according to Center for welfare Technology have been validated by figures. The mature technologies are planned to be implemented and evaluated during the period 2014 - 2016. The four technologies include:

- Assistive eating devices
- Help to lift (2 to 1)
- Shower toilets
- Better distribution of technology

The mature welfare technologies are evaluated annually by the Center for Welfare Technology who publishes an annual report on findings that are supplied by the municipalities in baseline evaluation documents. The mature technologies are as well supported in the economic agreement 2014 which states that welfare technology;

*“...will increase citizen’s independence and which promotes more efficient working environments on a national scale”*

Som en del af aftalen mellem regeringen og KL om kommunernes økonomi for 2014 er det aftalt, at kommunerne skal udbrede modne velfærdsteknologier. Det skal ske med hjælp fra et fælleskommunalt program for velfærdsteknologi.

## DESCRIPTION AND ANALYSIS

### INTRODUCTION

I have chosen to examine the implementation of the assistive eating device through the perspectives of the primary actors identified in the study. This includes the government ministries and agencies, the mu-



## INTRODUCTION OF THE DEVICE TO THE CITIZEN

The introduction of the assistive eating device to the citizen who is defined as a candidate through screening is the first step in the process in implementation of the device. There are no guarantees that the citizen will accept the offer to eat with help of the device, it is an offer that can be either accepted or rejected. Before the introduction the caretaker prepares the device in her office and makes sure all the parts, e.g. control contacts and plate with table mat are in the carry bag that is part of the device concept. The introduction will take place in Dorris's apartment. I accompany the caretaker to the apartment as an observer, the caretaker enters the room first to explain and ask if it is ok that I observe. Dorris who has good cognitive abilities even if 'latent' accepts my presence. This is the first time I have been in a private apartment at Skovhuset it looks much like most other modern apartments with private furniture and commodities. On our arrival at approx. 10 am Dorris is eating breakfast by herself (see WS 01) and continues to do so at her own slow pace. The caretaker unpacks the carry bag and puts the device on the small dining table adjacent to Dorris while she explains what it is and explains to Dorris that *"it is better to start now before you lose more mobility"*. Dorris continues eating and suddenly explains *"it looks like a toy"* where the caretaker laughs and replies, *"...yes it's fine that you call it a toy and all you have to do is push the blue button"* referring to the 'Piko' contact that activates the spoon. When mentioning spoon it is important to say that other cutlery artifacts like knives and forks are not part of the Bestic concept. Dorris explains that it is difficult to get the food to her mouth and that she finds it is difficult to cut rye bread. The caretaker responds to the rye bread with *"the device cannot take up rye bread"*. Dorris makes no comment to this and after a pause continues eating. The caretaker proposes that Dorris uses the device for one meal per day for a week to see how it functions for her. Dorris agrees to this and seems happy to be part of the test. The testing will take place in



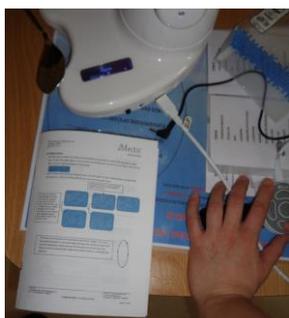
The screening / matching is followed up by the introduction of the device

the dining room as it is here that Dorris normally eats her main meals, lunch and dinner. No day for testing is agreed on, the caretaker explains that she will get back with a time proposal. Dorris explains what she normally eats which includes rye bread but other foods are included such as mashed potato and beef stew. The caretaker notes the information and packs the travel bag with the parts. On the way out the caretaker says to Dorris *"I'm leaving with the toy"* to the visible amusement of Dorris.

## TESTING THE DEVICE IN THE DINING ROOM

### The first test of the assistive eating device

Dorris has accepted to test the eating device during the introduction some days earlier. The test is later planned to take place in the dining room after lunch time without food as this test is only to see how the device works and how the preprogramming functions in comparison to Dorris and the physical place, the dining room with the standard table and Dorris sitting in her usual wheel chair (see WS 02). It is the first time the caretaker will use the device with a citizen. Dorris is pre-visited in her apartment in the morning of the test by the caretaker to take measurements of her eating height (height from mouth to table top) the measurements are afterwards applied to the device with a code, name of the citizen as the device can be programmed to suit multipliable users. On arrival at the apartment the caretaker opens with the comment *"we have arrived with the toy"* which causes Dorris to come with a quiet laugh as she seems to recognize the comment from the earlier introduction visit. Dorris wastes no time in asking questions about what the device is capable of *"can it cut out the food for me?"* asks Dorris. The caretaker explains that no, it cannot cut out food but that it can give her less dependency on others. *"It does the work for you"* says the caretaker. The test today shows that Dorris cannot reach the spoon or vice versa. Questions arise about the table top height and the Dorris's sitting position. Dorris does not have the



The planning. How does the device work?



Dorris and the spoon did not meet today

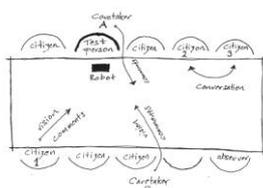
ability to reach the spoon and the spoon does not have the technical features or software facilities to come closer to Dorris's mouth.

### The second test of the assistive eating device

Dorris has agreed to continue as part of the testing, the second test takes place in the dining room at dinnertime between 6 - 7 pm (see WS 04). The measurements and data from the first test have been programmed in the device software so that it can move towards Dorris's mouth. The menu has been agreed a few days earlier as stewed strawberries with cream which is not on the menu today. The menu is mashed potato with meat stew. The caretakers who are present in the dining room have been briefed on the testing during the morning meeting by the physio. The other citizens whom there are seven of are not aware of the test until the assistive device is put on the table.

### Setting the table for dinner

The table is set for dinnertime as it is usually done by the caretakers where plates and cutlery with drinking glasses are set for the seven other citizens who are the group of citizens that use this dining room where they have common private fridges and where it is the center's objective to maintain as homely an environment as possible. I arrive at the dining room 10 minutes before dinnertime, I can observe that the table is almost set and that some of the citizens are arriving, some come on their own without aids and some arrive in wheelchairs pushed by caretakers and some come strolling behind walking aids. In the dining room everybody has their fixed places around the table. Dorris's place is not set yet. Shortly afterwards Dorris arrives with a caretaker and the device. No time is wasted getting Dorris to her place at the table while the device is setup where the electric supply cable is connected. The 'Piko' contact that Dorris will use to activate the device is connected and ready for use. The table is set this time as usual



Citizens sit at their usual places. The device is replacing the normal cutlery for Dorris

but this time there is a new cutlery for Dorris, the device with the spoon is replacing her usual knife and fork.

### Eating dinner in the dining room

Now that all the citizens are present and ready to eat the caretakers takes the plates to the adjacent kitchen where the prepared food is put on the plates as portions. Dorris's plate which is similar to the other plates except that it has higher perimeter edge to keep the food contained within the plate is taken along as well and a portion of mashed potato and beef stew is placed centrally on the plate.



Most of the citizens eat their main meals together in the dining room and know each other well

The caretakers have agreed functions when it comes to dining, two citizens need full eating assistance during dinner which calls for two assistants to place themselves at these citizens to feed them. Dorris as discussed earlier does not normally need assistance to eat other than cutting out food on her plate and even if she is a slow eater she can eat herself. Today is different because of the test, and this being the first time Dorris will eat with help of the device the caretaker places herself behind Dorris to assist and guide her. Like most other eating situations there are lively conversations going on around the table, the group of citizens know each other well *"We have known each other for a long time"* says Dorris. The eating starts after the traditional *"welcome"* (velbekomme) is said. Dorris with help of the caretaker begins to activate the device. The food today even if not strawberries and cream is well suited to the device and soon the spoon is scooping up a portion of potato and sauce that slowly makes its way to Dorris's mouth. The spoon is programmed to position itself at the same height as Dorris's mouth and can perform a horizontal movement towards her. Dorris is sitting in the wheel chair and attempts to reach the spoon but fails to do so as her lack of upper body mobility keeps her from moving the few centimeters to the spoon with the food. The caretaker moves the device and plate closer to the table edge but this has no positive effect. Dorris presses the 'Piko' contact which activates

the spoon to return to the plate and pick up more food, the device has no knowledge of the food on the spoon it has no cognitive abilities or skills, it obeys the signal from the Piko contact which Dorris has control of for this test.

### Everybody is eating but Dorris is not getting any food

The conversation among the other citizens takes a change when they can see that Dorris is trying to eat but not getting any food. The other citizens have not been informed of the test today and have no knowledge of the plans to test or any knowledge of the device.

*"I hope it's not our turn soon"*

*"I think its maltreatment, abuse of her"*

Comments from some citizens

The testing continues with the Piko contact getting the spoon to go up and down to the plate for food while the caretaker explains now to the other citizens that this is a test and Dorris will only use the device if it works for her. Dorris is calm and shows no dissatisfaction she has been prepared by the caretaker for some days up to the test. Dorris explains that she is aware that this is a test where it is important to gain knowledge of how to use the device.

*"Its fine, they just didn't know it was a test"*

*"We just had to explain to them what was going on"*

Dorris's reaction to the comments

*"Shouldn't the spoon be programmed to reach higher? Can I do it?"*

Caretaker to caretaker

The test ended without Dorris getting any food into her mouth, the spoon failed to move the missing few centimeters to reach Dorris's mouth and Dorris did not have the capacity to move her upper body to the spoon.

## EATING, AN ORGANISED OCCUPATION WITH NORMS

Eating meals are an important part of everyday life and is an occupation with norms that we engage in throughout our lifetime. For older people, meals comprises of one of the few remaining occupations around which the day is organized (Kofoed, 2000). During the introduction of the assistive eating device in the late morning, we see that Dorris is still eating breakfast in her private apartment, see WS 01. She uses normal everyday cutlery to perform the task. The task of eating has become slow for Dorris due to physical impairments; *“I’m still eating, no hurry here”* explains Dorris as we arrive in her apartment. She does not have a busy daily schedule so here the breakfast is her morning occupation that is part of an organized day. I use organized in the way that even if Dorris lives in her own private apartment she is part of the care network Skovhuset where main meals are organized in different dining rooms throughout the care center. It is not compulsory to eat all the main meals in the dining room but most of the citizens do so, explains the caretaker. Dorris explains other problems in relation to eating meals. Cutting rye bread and getting food to her mouth. Cutting the rye bread was one of the first things Dorris explained as a problem and shows how important this food entity is for her. It also becomes a dilemma when the device is explained as not capable of picking up rye bread, see WS 01. Even if Dorris has difficulty in getting the food to her mouth and cutting bread, she continues to perform this task to the best of her ability using a knife and fork, cutting in this case white bread with ham and cheese which can be considered as normal for breakfast. The terminology normal here has significance in the way distinct cultural norms surround eating; everything from selecting food, how it is prepared, when and together with whom to the actual act of eating and how and when to put food into the mouth. With eating difficulties, these norms, rules and values are frequently challenged and may be difficult to live up to (Fjellström, 2009). At institutions in particular, meals become either the success



Eating breakfast can be seen as an occupation for Dorris



This is not the norm, becomes a theme for conversation

or the disappointment of the day and an important topic of conversation (Elvbakken, 1993). As seen during the dinner situation in the dining room, see WS 04 where the citizens have come together to eat dinner. Everyone sits in their usual places and lively conversations develop. At the test dinner session something new is going on, the cutlery for Dorris has been changed to a device with cutlery, a spoon. During dinner it becomes apparent that Dorris is not getting anything to eat which results in quick responses from the other citizens demonstrating their disapproval of what is going on. Here the norm for how and when to eat is challenged and becomes a theme for conversation around the table. The other citizens successfully finish eating their food by themselves or with some care taker assistance while Dorris's plate is for many of the citizens perceived as disappointingly still full of food at the end of the organized mealtime at 7.00pm.

## A CHANGE OF OPINION, DORRIS IS REVISITED

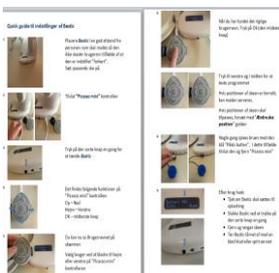
The second test of the device in the evening dinner context did not succeed in getting food into Dorris's mouth. The failure was believed to stem from two sources A) the devices lack of horizontal movement and B) Dorris's lack of ability to move her upper body to the spoon. If only one of the two sources can be overcome then the task of getting food to Dorris's mouth can potentially happen. After test no. 2 a meeting was held with the device supplier (see WS 05) it became clear that the device can be programmed to a greater degree of horizontal movement than was the case at test no. 2.

*"It can't what? Move sideways? Of course it can"*

*"It's is not enough knowing the citizen; you need to know the technology as well"*

Some comments from the device supplier at the meeting

The meeting results in that the Techno-Anthropologist (TA) who is present at the meeting later reviews the standard manual for the de-



The new quick guide and video becomes the manual

vice usage and from this creates her own, easy to follow 'Quick guide' and video to simplify the instructions for the controls and actions of the device (see WS 06). The TA uses photo illustrations with short descriptions as the simplification method. The Quick guide with the new information of the devices ability to move horizontally to a greater degree than was understood at the previous testing is presented to the Fysio and caretakers who agree on the basis of this new information to propose a new test to Dorris.

### The decision is made to continue testing the device

The caretakers and Fysio are cautious of promising something they cannot deliver they have experienced difficulties and failure to get food into Dorris's mouth at test no. 2. The caretakers discuss Dorris's physical condition, some days she is more mobile than others varying her needs for assistance. The decision is made to propose a new test after lunchtime in the dining room without the other citizens being present as the caretakers are convinced that low stress levels improves Dorris's mobility. Dorris agrees to continue with the test. After lunch Dorris is wheeled to the dining room where the testing is to be done without any food on the plate. The device is programmed following the Quick guide developed by the TA earlier. Dorris and the spoon have no problem in reaching each other today, see WS 06. The new knowledge acquired by the caretakers with the assistance of the quick guide enabled the successful meeting of the technology and Dorris.



Dorris and the spoon meet

## DISCUSSION AND REFLECTIONS

### TESTING OF THE ASSISTIVE DEVICE AT SKOVHUSET

Testing the assistive device at Skovhuset is aimed at finding out how the assistive eating device performs in relation to the citizen who has been chosen as a candidate via the in-house screening method to match the citizen and the assistive device. In this case a match is found and the assistive device is provided to the citizen (Dorris) This

provision of the device is in Domestication theory referred to as the appropriation phase (Silverstone et al. 1989; Lie & Sørensen, 1996) where the artifact, device is provided and Dorris has a feeling of possession.

### The introduction, provision of the assistive device to Dorris

The introduction and provision of the device is made in Dorris's apartment. On arrival at the apartment Dorris is eating her breakfast without help from others in her own slow fashion. Dorris has no knowledge of the device and says without hesitation *"it looks like a toy"*. There are three points of interest that quickly become apparent at this introduction (1) Dorris is eating on her own without assistance. (2) Dorris has no knowledge of the device. (3) Dorris recognises the device as a toy. Looking at the first point, Dorris is eating on her own without assistance. The caretaker explains that it is better to start using the device now before Dorris loses more mobility. Is this bringing forward Dorris's handicap? Her declining ability to eat is being proposed helped by an assistive eating device even though she is capable of eating independantly most of the time. The second point is that Dorris has no knowledge of the device and what it is capable of. This is helped explained by the caretaker as *"we can do it for a week, and then see what happens"* - we can *"begin with one meal per day"*. Here the process of negotiation is taking place; it is not a linear process without conflicts or negotiation (Lie & Sørensen, 1996) the proposed use of the device needs to be argued for by the caretaker. The third point is that Dorris recognises the device as a toy, this is in itself not necessarily a problem but it is showing that the inscription of the device is not clear. It is not conveying the message of the devices intended use 'an assistive device' and meaning (Akrich, 1992; Latour, 1999). Dorris's perception of the device as a toy takes on a symbolic meaning giving rise to the question if this can be converted into something personal (Lie & Sørensen, 1996). From an ANT approach, the network at breakfast time will change and include and exclude actors. The current

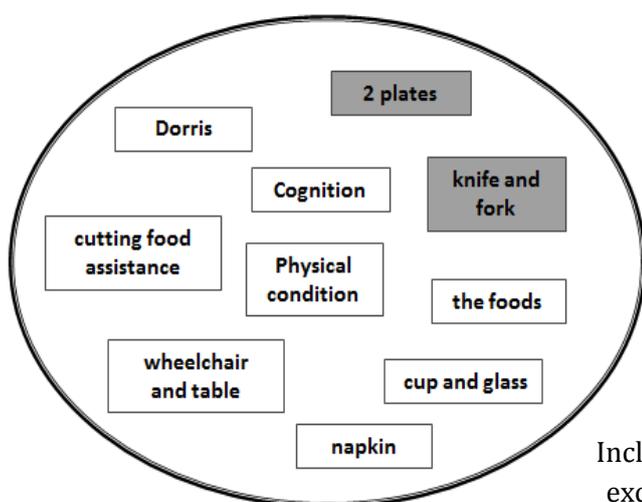


One argument; *"...you just have to move the blue button"*



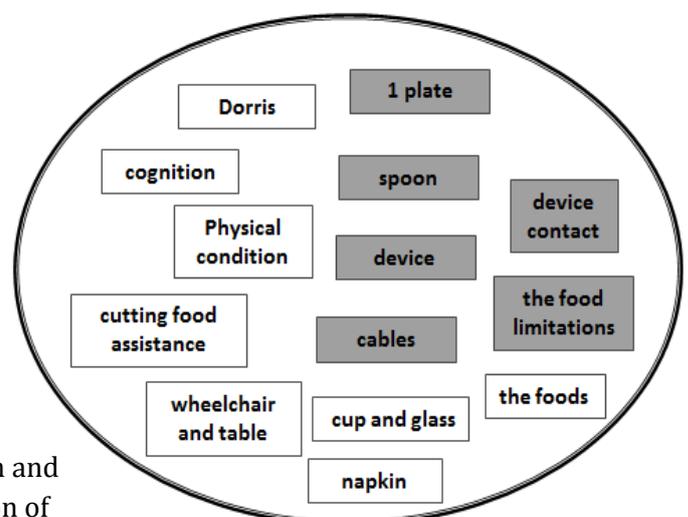
The plates with knife and fork used at breakfast

eating situation without the device as illustrated in figure 10 includes actors like the 2 plates with knife and fork. The network with the device, see figure 11 excludes a plate and the knife and fork while it includes other actors e.g. spoon, the device, cables, limitations to foods and the device 'Piko' contact. It is accepted that the current network at breakfast time is aligned and functions as Dorris eats breakfast on her own, there is a need to cut out some of the food but the choice of food is not limited by either the artefacts in use e.g. the knife and fork or the plates and even if there are some cognitive and physical deficiencies on Dorris's behalf resulting in slow eating abilities she still eats breakfast with a fork and knife in her apartment. The government agencies objectives and promises of empowerment (empowers the citizen), improved quality of life (flexibility) and improved working environment for caretakers (efficiency). The empowerment requires that the device executes the task of taking the food from the plate to the mouth as efficiently as the knife and fork or a traditional spoon while giving the citizen a free choice of food. The 'flexibility' requires improved quality of life and can be obtained if the assistive technology, device lives up to or improves the current eating conditions. The efficiency requires that the caretakers free-up time and gain an improved working position. The above objectives are difficult to see in relation to the realities of the eating situation.



The current network at breakfast time

Figure 10



The network at breakfast time with the device

Figure 11

Inclusion and  
exclusion of  
actors

## The testing of the assistive eating device in the dining room

The introduction and the provision of the device to Dorris was a success in the way that Dorris agreed to continue the testing.

### The first test without food on the plate



The device is given a place and made visible today

The first test after the introduction is to see how the device works in comparison to Dorris, no food is involved it is more for the caretaker to get acquainted with the device and test the physical attributes of the spoon and measurements before food is introduced. It is here the device is given its place and made visible (Lie & Sørensen, 1996). The place is the dining room where the device and its accessories are placed on the table and are now visible. The device shall not be taken for granted as visible. On a normal day the device is stored in a carry-bag in the office and out of sight.

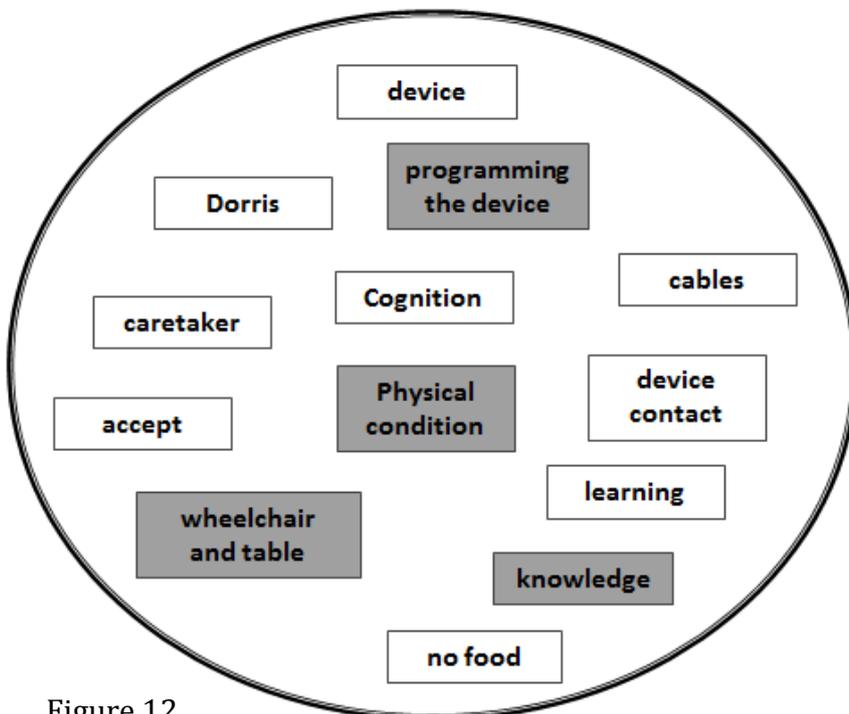


Figure 12

4 actors were identified as barriers during the test, see figure 12

### The network, during test without food

As shown in figure 12 there are no other citizens present at this test it is here the non-human actors such as device programming and learning take on a primary role with the objective of being prepared for the

next test where food and other citizens will be included in the network. The test showed that there are barriers in relation to the sitting position and the table (see WS 02). The wheelchair is Dorris's private property and is not something that will or can be modified to better suit the set up for eating. The table on the other hand is part of Skovhuset's inventory and will require funding if any modification or change is to be made here. The physical condition needs more attention, where stress situations can be reduced with improved mobility. The device programming lies both in the care takers knowledge of the technology and the willingness of the device producer to improve program design features.

*“Technologies do not, (...) evolve under the impetus of some necessary inner technological or scientific logic. (...). If they evolve or change it is because they have been pressed into that shape (Bijker & Law, 1992)*

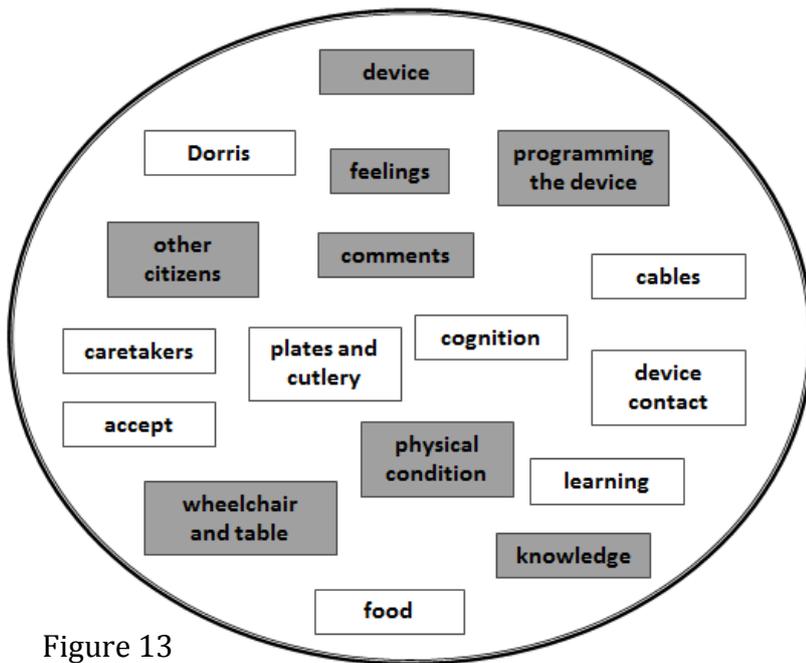
### The second test with food on the plate

The second test takes place in the dining room where the other citizens are present. This phase is as in the first test where the device is given its place and made visible (Lie & Sørensen, 1996). The table is set with the usual plates and cutlery for the citizens evening meal. At Dorris's place there is no cutlery or plate, the place is void. This is I know where the device will be set-up when it arrives in the carry-bag. The setting is otherwise close to the normal everyday setting in the dining room at dinnertime where the citizens sit at their fixed places around the table and where the caretakers have their routines of serving the food and assisting some of the citizens with eating. Apart from the four barriers identified at the first test other barriers take form during this test. The comments around the table where feelings are pronounced and the value of the device is disputed by other citizens become the conversation topic around the table. This is an illustration of meals in institutions becoming either the success or disappoint-



A change of cutlery for Dorris

ment of the day and a topic of conversation (Elvbakken, 1993). During the meal the situation is defused by the care takers explanation; *“She knows it is a test, isn’t that right Dorris”*. Even though the test did not succeed in getting food into Dorris’s mouth it provided knowledge of the importance of taking into account the need to make the device visible to all the actors involved in the eating situation.



Some of the same, but other barriers become evident as well, see figure 13.

Figure 13

**The network, during the test with food**

## I EAT WITH HELP OF THE ASSISTIVE EATING DEVICE

What is it really like to eat with help of a device? Is it just moving the blue button and eat as you please? To try and understand what eating with the device feels like and to gain better knowledge of the functions and features of the device I decide to eat lunch in the staff room at Skovhuset. We are two persons involved with the test, myself and the Techno-Anthropologist (TA), see WS 09. We have during the study acquired knowledge on the device and the TA has compiled an easy guide which we use to quickly apply our data to the device, e.g. the spoon height position to suit our individual mouth heights from the

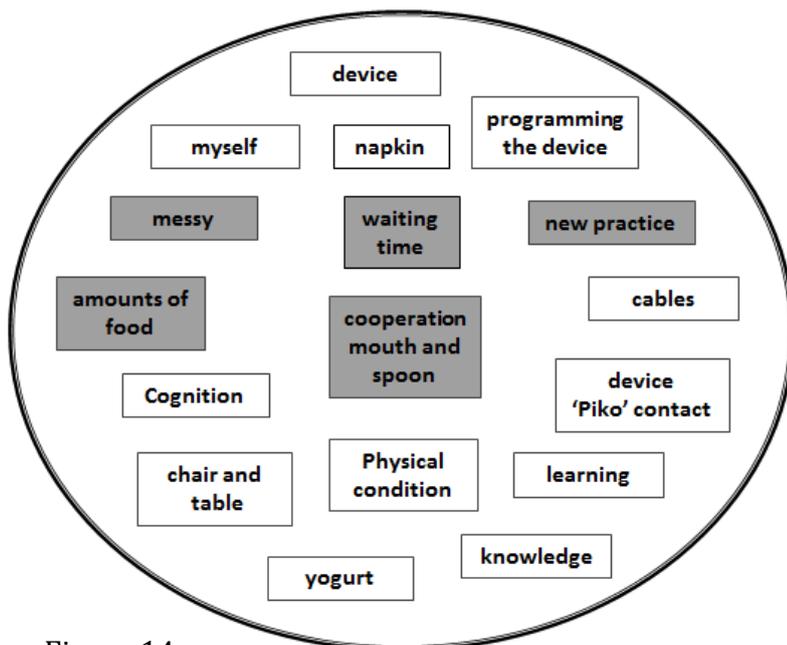
table. According to the manual and the in-house screening there are limitations to the food that can be used.

### Eating yogurt with the device

The first food I use is yogurt which is similar to pudding and porridge which are perceived to be easy for the spoon to pick up. My first comment is “*wow, it's slow*” saying this I refer actually to the speed I normally eat yogurt at. I also quickly become aware that I need a napkin as I am getting yogurt on my mouth region. Even if the spoon is programmed to suit my mouth position it feels as if there is something missing. When I eat normally with a spoon there is a meeting point where the spoon and my mouth/head cooperate to deliver the food into my mouth it's as if this cooperation is missing with the device spoon. The spoon stops at a pre-programmed position and waits for the next order of which I am in control of, I simply press the ‘blue button’ and the spoon will return to the plate and collect the next portion of yogurt, but before I do this I need to get my mouth around the spoon- the spoon is passive now and I need to get the portion of food positioned on the spoon into my mouth. It sound's perhaps easy but in



Napkins are important when eating yogurt



Barriers as waiting time, messy conditions, cooperation and a new practice become apparent while eating yogurt, see figure 14

Figure 14

The network, while I eat yogurt

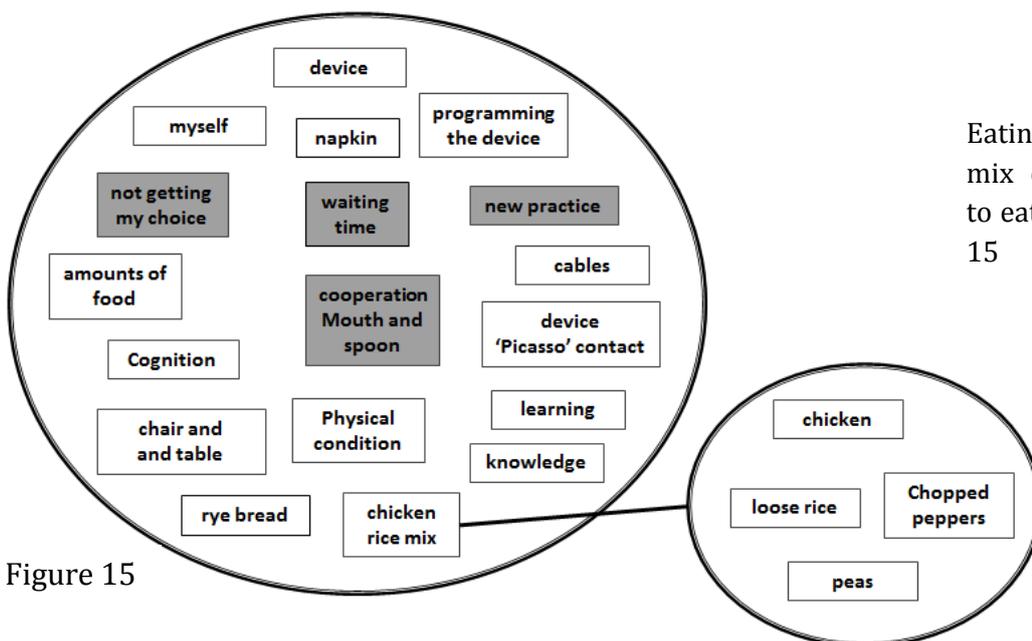
reality it is not a natural practice for me and it will take getting used to. This is also partly due to the amounts of yogurt that comes on the spoon, sometimes the spoon takes up a large amount of yogurt while other times the portions are small. It is the large amounts that cause the most mess, due to the configuration of the spoon and the unfamiliar way I need to get my mouth around the spoon.

### Eating chicken rice mix and rye bread with the device

Eating chicken rice mix with the device is much different than eating yogurt. Yogurt is a homogeneous material in that it is uniform in substance. Chicken rice mix is different and comprises of nonuniform heterogeneous material. The chicken rice mix in the processed portion purchased at the local grocery for this study contains primarily, chicken pieces, rice (in this case loose rice), chopped peppers and peas. The speed of the spoon and the need to wait for the food to reach my mouth were the first things that made eating with the robot feel different. The food tastes the same but the method of using a different technique that demands concentrating on using ones hand to control a contact, in this case 'Picasso' that controls the spoon is a lot different from eating directly via cutlery. As the test progressed I



The choice of food does not follow the script



Eating chicken and rice mix cannot be compared to eating yogurt, see figure 15

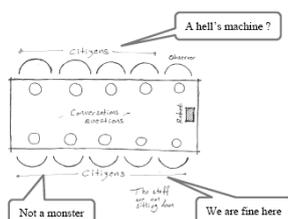
Figure 15

The network, while I eat chicken rice mix with rye bread

found it easier to cope with the new situation but the fact remained that I was never sure of getting what I was planning to get on the spoon to my mouth. The spoon is not obvious of my thoughts and continues to follow the program of delivering food at my mouth.

## THE ASSISTIVE EATING DEVICE IN ANOTHER CONTEXT

How is the assistive eating device perceived in other dining room in the care network? To gain insight on this I decided to take the device to another dining room where the citizens have no experience in using the device and where the citizens are well functioning and do not have a need for eating assistance see WS 03. The citizens have no prior knowledge of the casual test being performed. The device is placed at the head of the table where there is good visibility for all. As soon as the device is placed on the table the first question put to me is “*what is that?*” I reply promptly that it is an assistive eating device where the citizen replies, “*Yes I saw the spoon*”. The comments continue to come from the citizens where there is initially a negative tone and some amusement towards the device.



The 'script' remains open in this group

*"At first I thought of a hell's machine, a devil"*

Comment from citizen followed laughter and amusement. Later when the initial comments and the amusement dies down the comments take on a more serious tone where a citizen enquires:

*"Who is going to use it?"*

In the following conversations among the citizens they are agreed on that they are all fine here in the group and do not need any form for technical devices to eat. They are also agreed on that some people might be happy to use the device and one citizen comments:

*"Ok, it's not that much of a monster"*

The initial comments show that there is a barrier to be taken into account when introducing the device to a group of citizens who are well functioning as well. What if one citizen in the group develops a need for an assistive device? How will this be perceived in the group? Will

there be a need to move the citizen to another area in the center where it is normal to receive eating assistance?

In relation to recognizing the device, even if the citizens made an inquiry they knew more or less what it was. They recognized it via the spoon and the plate which are accessories to the device. The inscription in the device itself was not understood but the spoon and the plate are as one citizen says:

*“The plate is nothing new to us”*

## UPSCALING WELFARE TECHNOLOGY

### An objective of the municipality and the care center

It is an objective of the department of Elderly and Health in Hilleroed and the care center Skovhuset to gain know-how on how implementation of welfare technology can be upscaled. It is accepted by both institutions that implementation on a local scale e.g. lessons learned in the dining rooms at Skovhuset cannot simply be copied to implementation in other area such as institutions and private home care in the municipality. The department in cooperation with Skovhuset is currently looking at upscaling possibilities by using the Welfare Technology Evaluation (VTV) from Danish Technological Institute (DTI). The primary reason for the two institutions to examine possibilities in using the VTV is that it includes multiple welfare technologies including assistive eating devices. This idea being that upscaling lessons learned from the assistive eating devices can be utilized to other welfare technologies. In an upscaling scenario it is important too to be aware of that it is not known which of the assistive eating devices will be used. The knowledge developed about the technology in the study of the ‘Bestic’ device will not necessarily be the same when it comes to the ‘Neater Eater’ models.

### The Welfare Technology Evaluation (VTV)

The VTV platform can be used as described earlier in the report as a stand-alone screening and matching methodology in the initial phase

VTV  
Velfærds Teknologi Vurdering



of a welfare technology to match citizens and technology devices. The VTV is from DTI developed to, apart from the screening and matching to complete a 360 degree assessment of welfare technology. The purpose of VTV is as described by DTI an evaluation tool to provide authorities and institution's a validated overall assessment of a given welfare technology's potential. It was via this VTV assessment that assistive eating devices were chosen as a mature technology in 2012.

### Methodology of the VTV

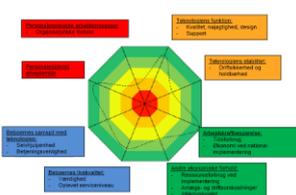


The 4 categories

A VTV consists of four broad categories (1) Organization, (2) Technology, (3) Citizen, (4) Economy, with eight independent assessment parameters that are structured according to the four categories where there to a greater or lesser extent is likely to be some significance or implications in relation to the planned welfare technology. There are two assessment parameters under each category.

### The idea behind the model, the DTI perspective

The basic idea behind the VTV model is according to DTI that welfare technology can contribute to a better use of resources and improve quality of life. There is however a very important link between the specific solutions on the one hand and the more object-orientated gains on the other hand. This link is often difficult to handle for both businesses and public institutions and the large gap between the possibilities of using technology and the technology that is actually in use, is a significant proof of this. There is therefore a classic 'Missing Link' situation where it is necessary to look at how to bridge the gap that both hinder opportunities (1) to qualify welfare and improving resource utilization and (2) a large growth potential for businesses. VTV can through specific analysis and assessments fill the role of the 'missing link' and provide the desired systematics and comprehensive assessments of the stakeholders on both sides of the table.



## The VTV support Pros and Cons

The VTV platform is a well-defined and is a comprehensive assessment platform. It has provided the results to qualify the assistive eating device as a mature technology in the REPORT 2012. The perspectives in the report states:



*“Some parameters need changing and there is a need for inquiry into certain things. But overall there is an immediate easy profit to be made for citizens, caretakers and society by starting an implementation of the assistive eating device”*

The categories with the eight assessments has a focused and well developed assessment of economy seen from a profit angle. In the case of elderly citizens the profit parameter as described in the baseline evaluation 2014 will be difficult to achieve. DTI promote welfare technology in a similar fashion to the government agencies, as something that will give monetary profit. The platform can be used, but not unlike the host study it cannot stand alone and any upscale scenario will need to be implemented, on a case by case level and will not necessarily produce profit but other values that are generated in the process will need to be assessed.

## A CLOSER LOOK AT THE DEVICE, A ROBOT, ASSISTIVE?

The Danish terminology for the device is ‘Spiserobot’ which if directly translated to English is ‘eating robot’. In the beginning of the study I have used the direct translation but have later chosen to change the terminology to ‘assistive eating device’ as I find that it is not easily understood via the direct translation. The robot does not eat itself but rather assists in the eating process by delivering food from the plate to the persons mouth. But what is a robot? The word ‘robot’ originates from the Czech word ‘robota’ which means slave worker. A robot is a machine that can be programmed to carry out automated processes. A fully automated robot can regulate its own behaviour (Teknologisk

fremsyn, 2006). Robots are mainly placed into two main groups (A) industrial robots and (B) service robots. An industrial robot is an automated re-programmable device that can be both fixed in position or mobile and used in industrial automated process, e.g. a car welding robot. A service robot is a robot that can perform a service to benefit people and equipment e.g. a robotic Hoover. Robot technology is based on many technologies that individually build on technical and scientific disciplines such as **Mobility planning** for autonomous navigation. **Computer Vision** that seeks to detect and analyse the surrounds of the robot. **Cognition** that strives to coordinate a robot's action with human action and that can regulate for error situations. (Teknologisk fremSyn, 2006). Looking at the "Spiserobot" Bestic from the description it is possible to define it in the bracket of 'robot' as it is capable of performing basic automated processes. It can from here be allocated in the group known as 'service robots' as it can perform a service to benefit people and equipment. I exclude the word 'benefit' here as it entitles other inquires. Lindegaard, et al., 2013 argues that assistive technologies cannot be taken for granted and that; *"assistive technologies should enable disabled and not disable them"*. In defining the device as assistive I am unwillingly taking on the standpoint that Ingunn Moser (2006) draws attention to in the way; *"...technologies used by disabled people are described in ways unlike those used by abled people. Technologies used by disabled people are conceived as 'assistive technologies' or technical aids"*. The terminology is in itself a barrier within domestication as it is continuing to reproduce boundaries between abled and disabled citizens the normal and abnormal.

### Recommendations from the 'Teknologisk fremSyn' study

In the steering group recommendations in the Teknologisk fremSyn (2006) report it is recommended that: In connection with the government's globalisation strategy to be allocated funds towards a dedicated research program within robot technology and cognition.

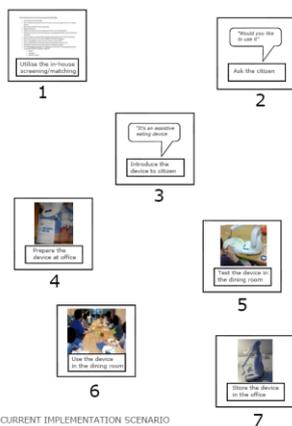
- That a program committee is established to support the dedicated research program with the goals of promoting network creation between interdisciplinary research environments and user groups at industry and public sector level.

Since the above recommendations there has been no documented research program launched by the ministry of science and technology towards robot cognition even if it can have potential to improve coordination between robot action and human action.

## CURRENT AND FUTURE IMPLEMENTATION SCENARIOS

### Current implementation scenario

In examining the implementation I start by looking at the current implementation scenario as enacted in Skovhuset. The implementation scenario is a sequence of seven steps, see WS 10. (1) The in-house screening and matching is used to find suitable candidates (citizens), the so called matching of the technology and citizen. (2) When a match is found the citizen is asked if he/she will take part in using and testing the technology device. (3) The device is introduced to the citizen while measurements are taken for the software programming of the device. (4) The device is prepared at the office, measurements are applied to the device software program and parts and accessories are put into the carry bag for transportation to the dining room. (5) The device is tested in the dining room, without food and without other citizens present. This is the onsite test to validate the measurements in relation to the place. (6) The device is tested in the dining room with food at dinnertime with other citizens present. (7) The device is brought back to the staff office and stored there until needed next time.

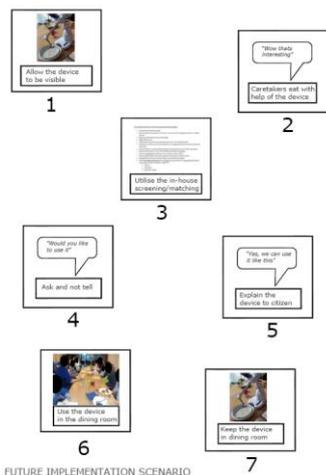


Current implementation scenario

### Future implementation scenario

Based on the study findings, how can a future implementation scenario be proposed? I propose a scenario based on a sequence of seven steps, see WS 10. (1) Allow the device to be visible at all times. Placing

the device in the dining room where citizens, family and caretakers can see and be acquainted with it on a daily basis. (2) Care takers and if possible citizen family members or friends be encouraged to eat with help of the device during normal meal times to promote dialogue regarding the device. It is only here the detailed knowledge of the device and its capabilities can be known. (3) The in-house screening and matching is used to find suitable candidates (citizens), the so called matching of the technology and citizen. This is not unlike the present scenario, it just happens at a later stage where more knowledge of the device has been acquired by actors in the care network. (4) When a match is found the citizen is asked if he/she will take part in using the technology device. This step may seem similar to step 2 in the current scenario but here much more focus must be on how to ask the question and must have nothing to do with telling why the device should be used. (5) The device is explained to the citizen. This is not an introduction as the device is presumed known to the citizen via its visibility in the dining room. (6) The device is tested in the dining room at dinnertime with other citizens present. Here as in step 5 it is presumed that other citizens know the device via its visibility in the dining room. (7) Similar to step 1, keep and store the device in the dining room visible for all to see.



Future implementation scenario

## FINDINGS FROM THE STUDY

### The study uncovers two distinctive streams of activity:

- The government ministries and agencies spread the promises of the goods of welfare technology from their ‘airplane view’ over the landscape in their push for the implementation of welfare technology to take up the demographic challenges of fewer young to take care of the growing elderly population. The story telling of “Empowerment, Independence and Efficiency” for all involved in the healthcare sector is a reoccurring event produced and reproduced in strategy launches and initiatives. The ministries and agencies also

initiate the basis for the implementation process by introducing the strategies, initiatives and the economic support to the municipalities who have responsibility for the institutions (care networks) and are depending on their capabilities and skills to carry out the implementations.

- The institutions within the municipalities, the care networks such as Skovhuset have the task of performing the practical technology implementation at 'floor level'. They screen and match citizens in the care network to find suitable candidates (citizens) and thereby match technology and citizen. In the case of the care network in study the implementation is challenged by without exception the citizens being seniors and not fitting into the bracket of inquiry that qualified the four technologies in the first place. Whatever the case, the situation on the ground is defined under the governmental agencies umbrella of; "Empowerment, Independence and Efficiency" for the entire care network.

### Main findings:

The introduction and test situations show a high level of motivation from the caretakers to take up the challenge of implementing the new technology. The study shows that it is not the caretakers alone who will secure the implementation and domestication of the device. The results from the Frederikshavn model where the network, including municipal and institutional managers and leaders with the caretakers complete the implementation diploma course with ECTS points giving in their words a more aligned network could prove useful in the Skovhuset care network as some groups are not as visible in the network as expected e.g. the area leaders x 4 and the technology group. The in-house screening and matching methods are in place, comprising of step by step text instructions. Some of the steps are overseen, e.g. family involvement and to eat yourself with the device. Here as for the device instruction manual a simpler pictogram solution can be

used to better illustrate and simplify the necessary steps. The device performance has limitations related to food choice. If Dorris will continue to use the device there will be choices to be made, certain foods can be used and some are defined as not suitable. The device is defined as the new Bestic or cutlery that will replace the old cutlery. In the case of Dorris this means changing her knife and fork to a spoon. Dorris currently eats breakfast with a knife and fork the new cutlery will challenge the way she eats and what she eats. Dorris is motivated by the promises that the device will enable and empower her. The promises need to be revisited due to the device limitations as observed. Is it enabling or disabling her? The rye bread that she is notably glad for is not part of the food program for the device. Will this mean rye bread must be excluded from her diet or eaten in a different way to suit the device, for example rye bread porridge (øllebrød) that is suitable for device use. For Dorris and many other elderly citizens there are daily occupational routines embedded in eating meals. Meals become the success or the disappointment topic of the day. The lack of knowledge of the technology device during the introduction and provision is a barrier that can be helped by allowing the device to be visible and discussed in the dining room. Other citizen's fear of the technology device observed at meal times needs to be overcome in the same way thru the device being part of the everyday routines in the dining room. From the study it becomes evident that the initial negative comments quickly take on a positive tone during conversations and discussions. The provision of the assistive device is not simply a guarantee that the device will be domesticated, for Dorris the domestication process stopped at the objectification phase as Dorris did not incorporate the device into her daily practice.

The details of the complexities of eating with help of an assistive eating device become apparent when using the device yourself. The speed, messy conditions and the waiting time for the food delivery to the mouth is a lot different when eating with one's own hands and

traditional cutlery. The spoon becomes a passive actor when it reaches the mouth region. This is much different than eating with hands and cutlery where the hand and cutlery cooperate with the mouth to deliver the food. This topic of technology cooperation is not new in any way. In the report from teknologisk fremsyn, (2006). It is recognised that cognition can be a method to coordinate a robot's action with human action and that it can regulate for error situations. In the steering group recommendations from the Teknologisk fremsyn (2006) report it is recommended that there is allocated funds towards a dedicated research program within robot technology and cognition. There is no visible emphasis on this recommendation within the many welfare technology initiatives currently being launched by government ministries or agencies. Since the above recommendations there has been no documented research program launched by the ministry of science and technology towards robot cognition even if it can have the potential to improve coordination between robot action and human action.

The regional technology networks to support inter municipal cooperation and knowledge sharing as well as local technology networks are established but have not discussed the 'big picture', the initial implementation plans from the government ministries in relation to local capabilities and objectives.

Upscaling of welfare technology can arguably be achieved by using the Welfare Technology Evaluation (VTV). Upscaling will need to be on a case by case level and will not necessarily produce profit.

## CONCLUSION

The report unravels, describes and discusses the conditions and the heterogeneous networks surrounding the implementation of a welfare technology artifact, the assistive eating device in a care network. The method of mapping actors to discover who is who in initiating and keeping the device in the networks has provided valid insight into

the networks as a whole, but also has value in understanding the networks at local level. Via the qualitative methods at the care network using observations and conversations detailed knowledge of everyday interactions, use, understandings and feelings towards the technology is gained and better understood. By eating myself I gain first-hand knowledge of the device in relation to food entities and the cooperation that is taken for granted in a normal cognitive eating situations. The theoretical concept of ANT has assisted in understanding the complexity of associations within the networks, it helps illustrate that it is not just the technology artifact on its own that defines the success or failure of an implementation but shall also include other associated entities such as feelings, norms, waiting times ect. The appropriation, provision and objectification of the device has been studied and analyzed through the lens of domestication. Here it is shown that provision is no guarantee for the device to become domesticated, the domestication process stopped at the objectification phase, it did not become incorporated into daily practice. The artifact is prescribed as an assistive device but through the notion of 'script' I gain understanding how the script remains open when it is exposed to multi users. At the introduction the device was understood as a toy while in a dining room it was initially perceived as a monster.

The research shows the elaborate network that is in place to support and sustain the technology device. It also shows that the device is not alone in the world but it is associated to the 3 other mature technologies that are being evaluated as a group until ultimo 2016. The first baseline evaluation may 2014 has shown that the device has not generated monetary profit in the care institutions that are testing it. The second scheduled evaluation may 2015 has not yet been released but whatever the result, the device will be temporarily kept in the network as a result of the municipal economic agreement of 2016. The future of the device, post 2016 will I argue depend not only on the care network but on the willingness of the networks in the govern-

ment ministries and agencies to sustain the device as a mature technology in the pursuance of “Empowerment, Independence and Efficiency. Will eating assistive eating devices live up to the promises of “Empowerment, Independence and Efficiency”? Is a question that deserves much more discussion and alignment among the actors in the networks. The Danish regions have as shown founded the 5 regional technology networks to promote welfare technology knowledge sharing and the municipalities have representation via Local Government Denmark in the 5 networks. The care networks have too their own technology group network to support technology implementation in the care center. The study shows that implementation is not merely a linear process, but is challenged by barriers. It is here the tensions between the government ministries promises and the aspirations and plans of the care center become evident. I have during the study uncovered the technology networks and their objectives but have not witnessed that the technology networks are being utilized to meet their defined common objectives. To address the tensions a focused utilization of the existing technology networks where the promises generated through the governmental ministries and spread over the landscape; “Empowerment, Independence and Efficiency” need to be discussed at floor level within the networks.

From the study it can be argued that that upscaling of welfare technology can be achieved by using the Welfare Technology Evaluation (VTV). It cannot however stand alone, upscaling will need to be on a case by case level and will not necessarily produce profit as described in the in the baseline evaluation 2014 but other values that are potentially generated in the process will need to be assessed. This study has due to scope not provided much detailed insight into the development of the device. The study does however show a distinct need for device development with focus on cooperation between device and citizen and as described can potentially be improved by a device cognition approach.

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## APPENDIX

### WORKSHEETS 1 – 10

**The visitation at home**

The test person is visited in her apartment by the caretaker in the morning  
 The Eating robot is introduced  
 Questions are asked of what the test person normally eats  
 It is agreed that the test will happen in the dining room, no day is set



The dining room will be the test locality

The test person eats at home as well

**Some comments from the visit**

*“It looks like a toy”* Test person (repeats this a few times)  
*“I’m still eating, no hurry here”* Test person  
*“I find it difficult to cut bread, rye bread you know”* Test person  
*“It’s difficult to get the food up”* Test person  
*“The robot cannot take up rye bread”* Caretaker to test person  
*“It is better to start now before you lose more ability”* Caretaker to test person  
*“You just have to move the blue button”* Caretaker to test person  
*“I propose we do it for a week, and then we see what happens”* Caretaker to test person  
*“We can begin with one meal per day”* Caretaker to test person  
*“I’m leaving with the toy”* Caretaker to test person (when leaving the room)

**The Robot and plate**



The eating robot is the model, type “**Bestic**”



The plate, contacts, mat, robot and spoons make up the eating system

**The two contacts**



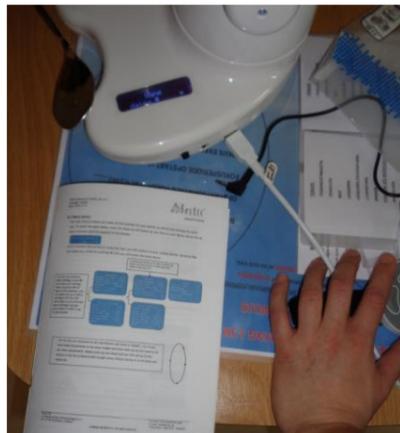
**Piko contact**  
 Simple on and off contact



**Picasso contact:**  
 Multi-function contact. Can change the basic settings

**The pre-test activities**

The test person is visited in her apartment by the caretaker  
 Explanations of the robot and measurements for robot programming purposes  
 The test is planned to happen after lunch hours today, 1 pm  
 It is the first time the caretaker will use the robot for feeding purposes



**The test phase**



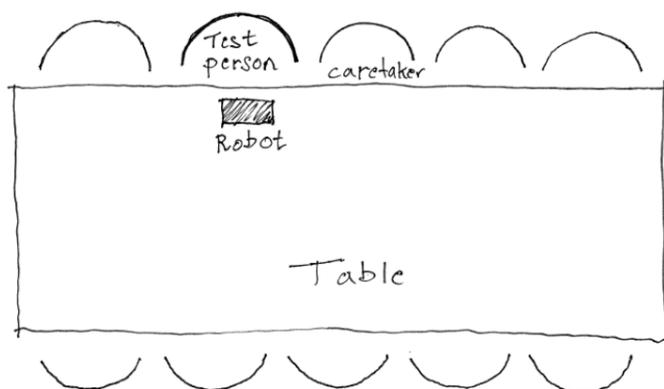
The spoon cannot be programmed to reach the test persons mouth

The test person cannot reach the spoon

The test is terminated due to the test person's physical condition (lack of mobility)

**The setting in the dining room**

The dining room table is not being used by others  
 The eating robot is placed on the dining table  
 The test person is sitting in her usual chair and unable to lean forward towards the spoon  
 There is no food involved in the test



The sitting position / chair / table

**Some comments before the test**

- "We have arrived with the toy"* Caretaker to test person
- "When I get the food on the spoon (own spoon) it falls off again"* Test person
- "Can it cut out the food for me"* Test person
- "We will stop the test if you don't want to continue"* Caretaker to test person
- "It may mean, you being less dependent"* Caretaker to test person
- "It does the work for you"* Caretaker to test person

**Some comments during the test**

- "I am not sitting so well"* Test person
- "It may be easier to adjust the table"* Caretaker
- "It could be an idea with a height adjustable table"* Caretaker

## The activity

### The objective:

To observe reactions from citizens to the Eating robot.

### The Location:

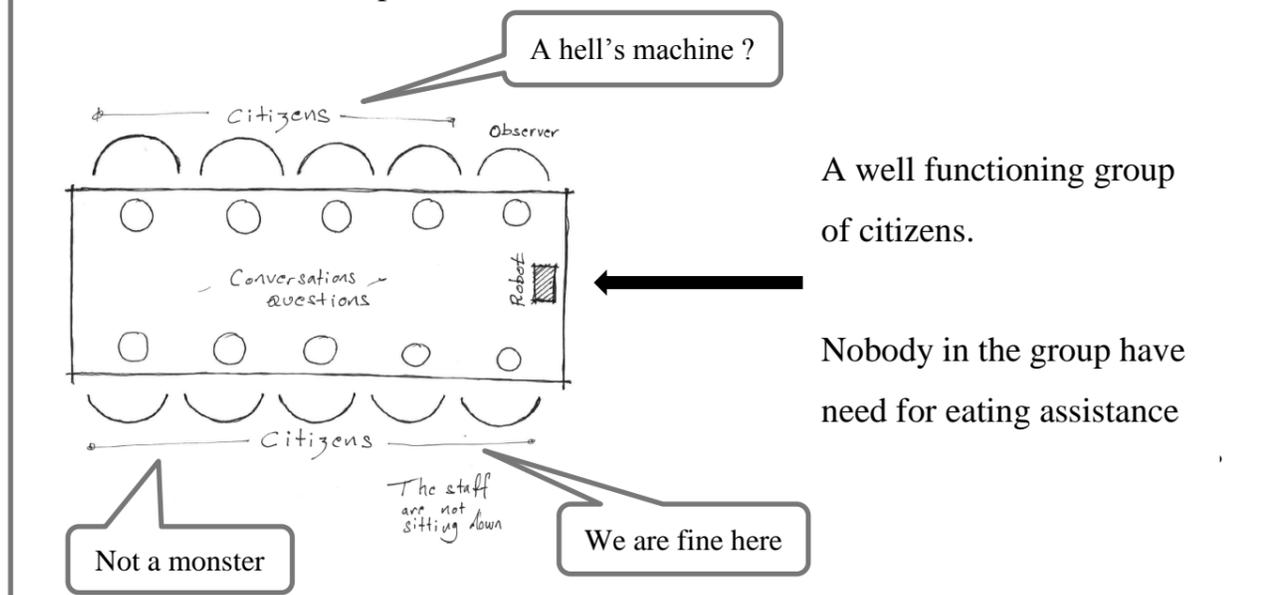
Dining room on the first floor, south

The Eating robot has not been used in this location before

The observer eats lunch with the citizens

The Eating robot is placed on the table, without prior information to the citizens

The staff is aware of the plans

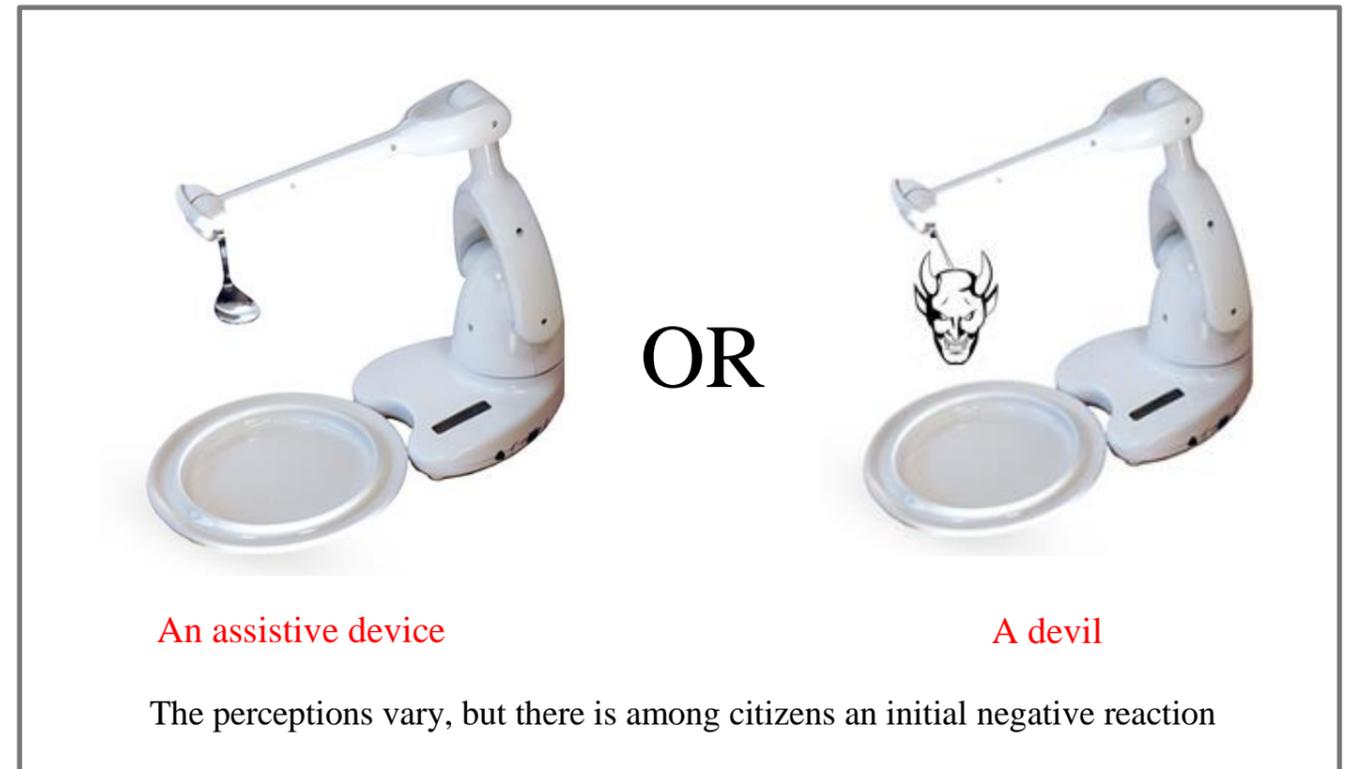


## Some reflections

Some citizens question the robot before I get a chance to introduce it or myself  
The first reactions have a negative tone with some amusement, later on the tones changes to be more positive.

There is something about “hell’s machines” and “devils” that needs to be understood.  
The citizens relate quickly to things they recognise, eg. the plate and the spoon

## What is it?



## Some comments from the citizens

“What is that?” (referring to Eating robot) Citizen

“It is an assistive eating device” Observer

“Who is going to use it?” Citizen (Observer answers “nobody here, it’s used downstairs”)

“Yes, I saw the spoon so I knew more or less what it was” Citizen

“The plate is nothing new to us” Citizen

“At first I thought of a hell’s machine, a devil” Citizen (most of the citizens laugh at this)

“Ok, it’s not that much of a monster” Citizen

“Yes, ok if you can’t move your hands it could be ok” Citizen

“We are all fine here, but some people might be happy to use it” Citizen

The pre-test activities

The test is planned to take place in the dining room at Skovhuset  
 The Eating robot has been re-programmed to move towards the citizen's mouth  
 Test person has been informed two days earlier and has consented to the testing  
 The menu has been agreed on for the test. Stewed strawberries with cream  
 The test is planned to happen during normal dinner hours, 6 – 7pm.  
 The implicated staff members are informed – morning briefs  
 The testing will continue for the rest of the week

Informing citizens?

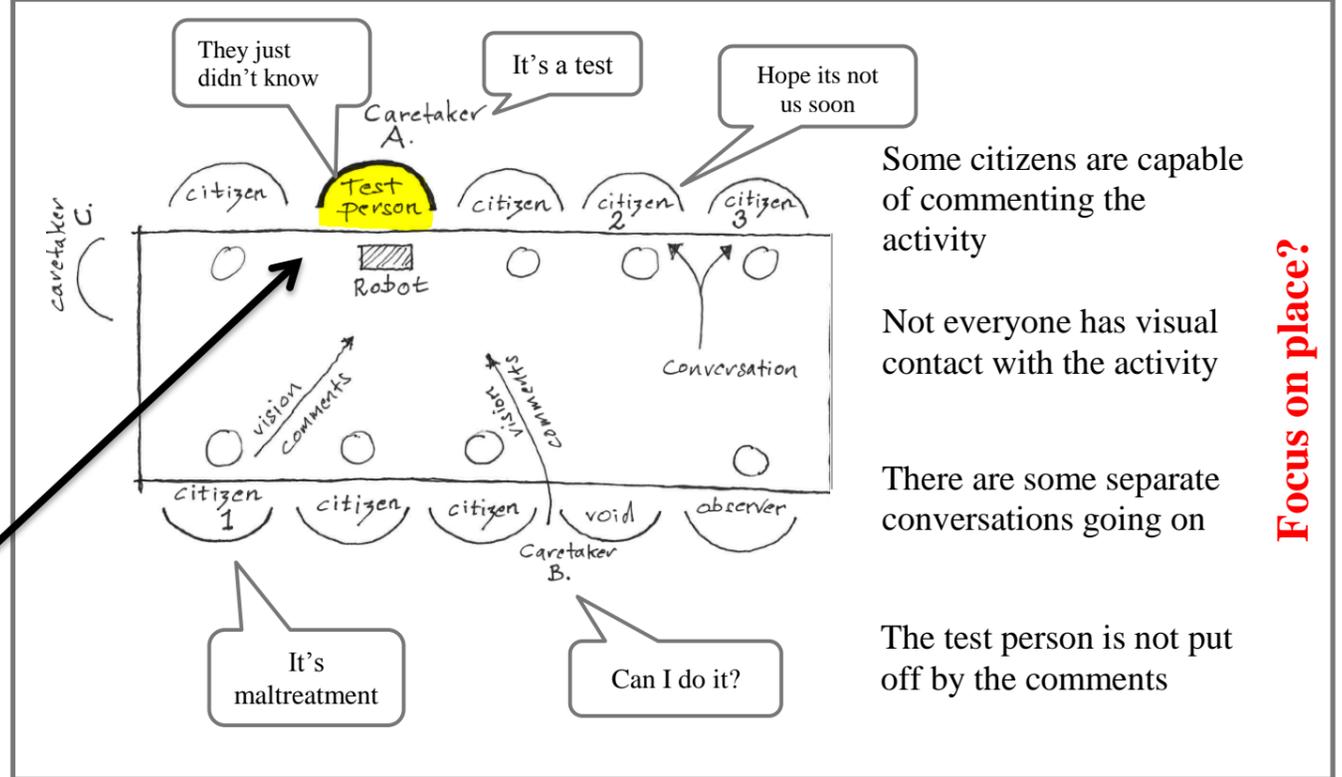
The setting

The dining room table is prepared and set as usual for the evening meal  
 The eating robot is placed on the table as the evening meal begins  
 The other citizens are not aware of the test until the testing begins



The usual setting –  
But what is going on?

The test phase



Some citizens are capable of commenting the activity  
 Not everyone has visual contact with the activity  
 There are some separate conversations going on  
 The test person is not put off by the comments

Focus on place?

Some comments during the test

“I think it is maltreatment, abuse of her.” Citizen 1  
 “I think it is horrible, what you are doing to her.” Citizen 1  
 “She knows it is a test, isn't that right (name).” Caretaker A to citizen 1  
 “Shouldn't the spoon be programmed to reach higher? Can I do it?” Caretaker B to caretaker A  
 “What if you couldn't move your hands, then you might think differently.” Caretaker A to citizen 1  
 “I hope it is not our turn soon.” Citizen 2 to citizen 3  
 “It's the first time I have seen the robot, yes I have heard of it.” Citizen 2  
 “It's fine, they just didn't know it was a test” Test person  
 “We just had to explain to them what was going on” Test person  
 “We know each other for a long time now” Test person

They didn't know

Well prepared test person

The eating position



Almost there, but the few missing centimeters were not overcome today

The table and chair has not been adopted

**No definite reason for the failure to eat!**

Difficult working positions



There was little space for the caretaker to manouvre

Keeping the fixed places around the table conflicts with the space issues

**The working position!**

Notes and reflections

**The pre-test activities**

The test person was informed that the test would take place and the menu was agreed on to be stewed strawberries with cream as there are some foodstuffs that the spoon has difficulty taking up. The menu as agreed did not materialize but the spoon had no visible problems taking up the mashed potato and meat stew.

**The setting**

The table is set in the usual manner before the meal is served. The citizens have their usual fixed places around the table. The Eating robot is placed on the table at the space where the test person normally sits. Two citizens at the table get assistance to eat or are fed manually by caretakers, so getting eating assistance is not something new.

**The test phase**

Even though the robot has been programmed to suit todays test it reaches its final position approx. 2 cm from the test person's mouth. The test person has very little upper body movement and cannot get her mouth to the spoon.

A few trials are performed where the spoon repeats its movement to the plate and back towards the mouth position without the test person receiving the food. It is however not clear whether the problem can be improved by adjusting the chair or moving the robot on the table.

**Other citizens**

The visible failure of the robot to feed the test person caused reactions from other citizens. Citizen 1 who has a clear vision of what is happening makes statements (see comments) that are audible around the table and results in that caretaker A needs to explain that it is a test and if the results are not satisfactory the robot will not be used by the test person. The comments from citizen 2 to 3 are also audible around the table.

Some citizens even though physically disabled have good cognitive and speech capabilities and can easily express themselves orally. (they comment quickly to situations)

There are citizens as well that lack the ability to easily express themselves even though they have good cognitive abilities and understand what is going on around them. ("latency")

**Test person**

The test person had been well prepared prior to the test and expressed no dissatisfaction with the process. She felt herself as part of a test aimed at improving something important.



The change of opinion, grounded in new knowledge

The meeting with Carewarekompagniet lay the basis for re-visitation of the citizen

The key points:

- New information on the technology
- The creation of an easy to follow quick guide by the Techno-Anthropologist (TA)
- The creation of an intro video
- The (TA) broke the news to Skovhuset

Some comments and new information from meeting with Bestic (WS 4)

“It can't what? Move sideways? – of course it can!” Consultant

“It's not enough knowing the citizen; you need to know the technology as well” Consultant

“We have all kinds of customers; meaning that even minor changes can make a difference” Consultant

“We have expert technicians who constantly work to improve things” Consultant

The test person re-visited after lunch time



The test person can reach the spoon

Less stress more mobility

The spoon and the test person connect

The quick guide by the (TA)

**Quick guide til indstillinger af Bestic**

- Placere *Bestic* i en god afstand fra personen som skal mades så den ikke skader brugeren i tilfælde af at den er indstillet "forkert". Sæt passende ske på.
- Tilslut "Picasso mini" kontrollen
- Tryk på den sorte knap en gang for at tænde *Bestic*
- Det findes følgende funktioner på "Picasso mini" kontrollen:  
Op – Ned  
Højre – Venstre  
OK – midterste knap
- Du kan nu se Brugernavnet på skærmen  
Vælg bruger ved at blade til højre eller venstre på "Picasso mini" kontrolleren

A need for simplicity

- Når du har fundet det rigtige brugernavn, Tryk på Ok (den mideste knap)
- Tryk til venstre og i midten for at teste programmet  
Hvis positionen af skeen er korrekt, kan maden serveres.  
Hvis positionen af skeen skal tilpasses, forsæt med "Ændre ske position" guiden
- The video

The quick guide and video, developed by the (TA) to simplify the instructions for staff

Notes and reflections (From observations (TA))

The staff is cautious of promising something they cannot deliver.

If the test person collaborates they must keep to the plans. The staff raises the issue of the physical condition of the test person – some days she is much more mobile than others, thus her needs can vary.

The new test today showed that the test person could reach the spoon. This is believed by staff to result from the lower stress level today improved her mobility. This is interesting and showing the importance of knowing the level of knowledge required of the socio/technical material.

**The Meeting at LGDK**

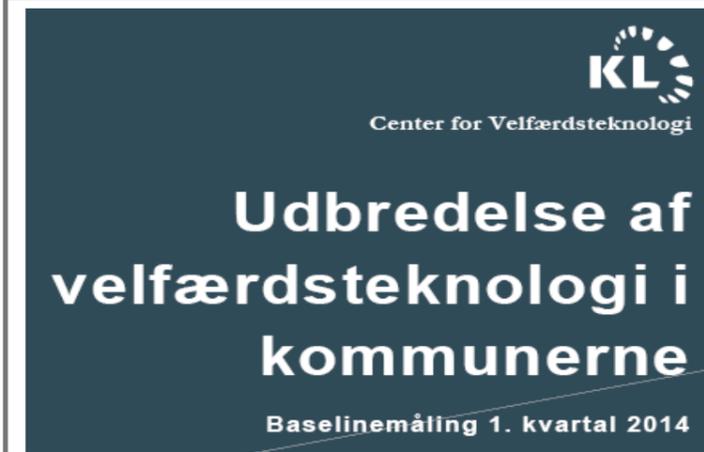
LGDK's, Center for Welfare Technology. Weidekampsgade 10, 2300 Copenhagen S  
 Contact person: Rikke Sølvsten Sørensen (consultant)



**Objective of the meeting**

- To discuss the origins and purpose of the Center
- To discuss in brief the technologies. Why they were chosen
- To discuss the network around the technologies

**The Centers annual report**



The first of four annual reports has been released in May 2014 (Baselinemåling)

Second report to be released in May 2015

**The origins and purpose of the center**

The ABT Fund, now the Welfare Technology Fund initiated the Center in 2013

**Purpose of the Center**

- Support implementation of the four technologies
- To facilitate the collection and documentation of gains from the technologies
- Publish annual reports 2014 until 2017

**Some comments from the consultant**

*“This center is created to support implementation of the four technologies and to collect data related to gains achieved through the implementations”*

*“We do not involve ourselves in the qualities of the four technologies. They have been tested and are qualified.”*

*“We have no preferences in relation to the technologies”*

*“We do all we can to support the municipalities in knowledge sharing”*

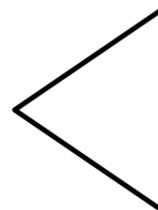
*“Our objective is that the municipalities achieve the planned savings of 500 mill. Dkr”*

*“The center is planned to exist until 2017, an expected lifespan of 3.5 years”*

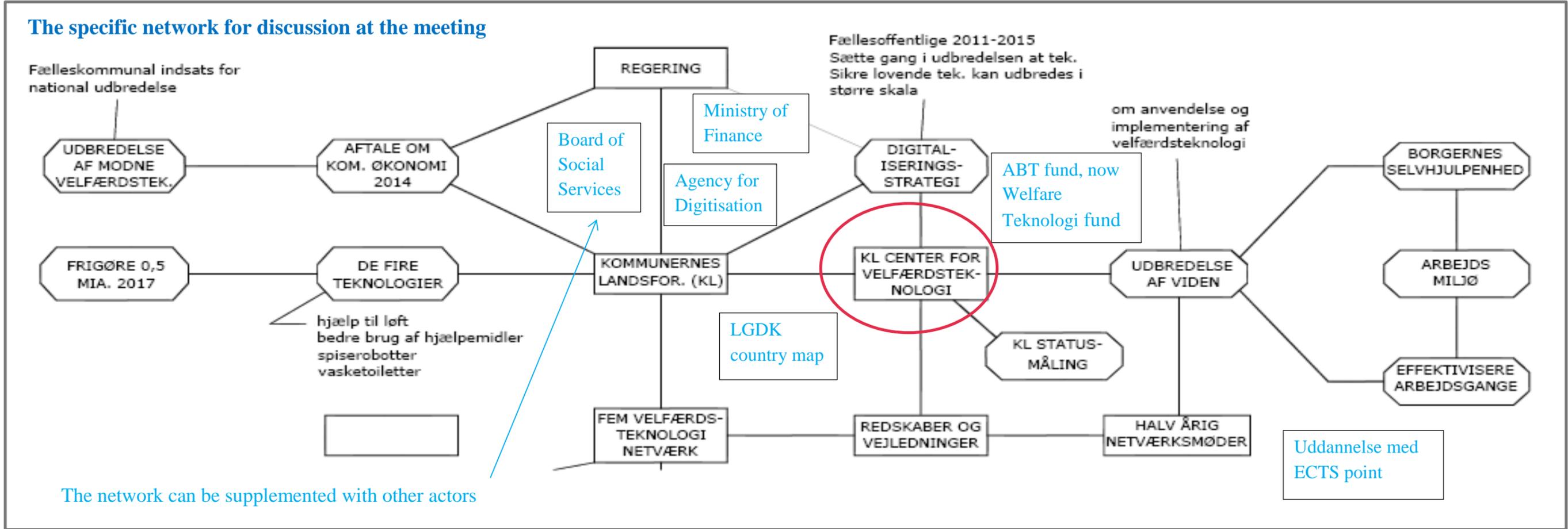
*“Education is relevant. Frederikshavn have a 2 day ECTS point course”*

**The four technologies**

- **Eating robot's** (self-feeding robots)
- **Help to lift, from 2 to 1**
- **Washing toilets**
- **Better use of help appliances**



Technologies chosen by the Welfare Technology Fund, based on qualities of tested and proven results. Become known as 'mature technologies'



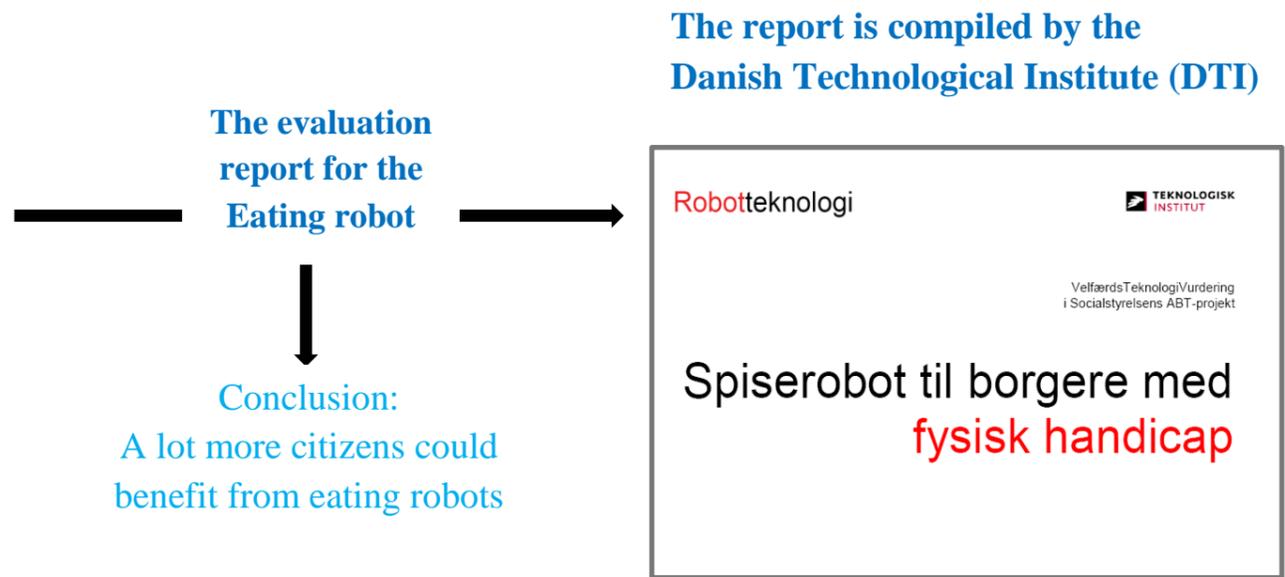
**Notes**

**The technologies from the Centers viewpoint:**

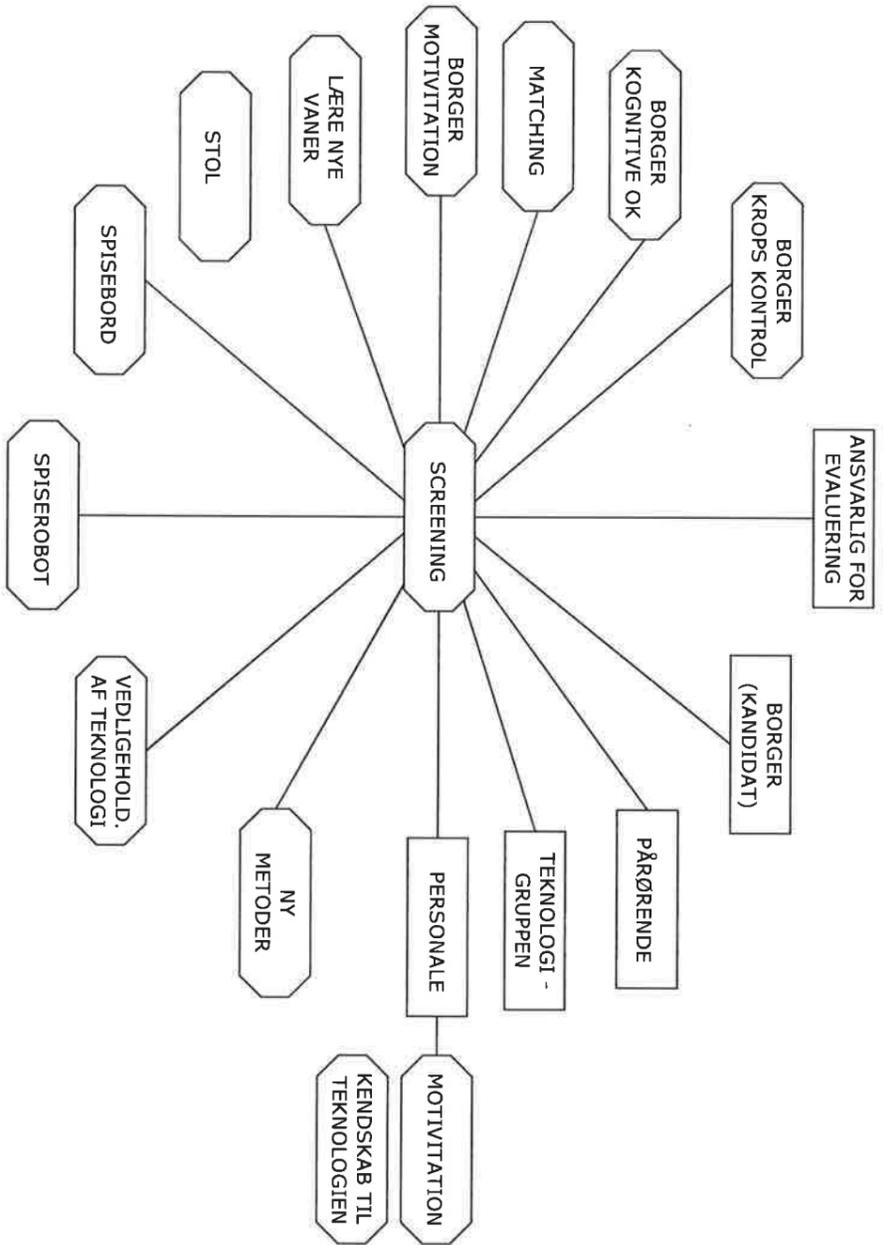
The qualities of the technologies are accepted as mature and capable of performing the tasks assigned to them. They have been chosen by the organization Welfare Technology Fund, (earlier named ABT fund) based on qualities of tested and proven results.

The results are based on findings gained through two eating robots

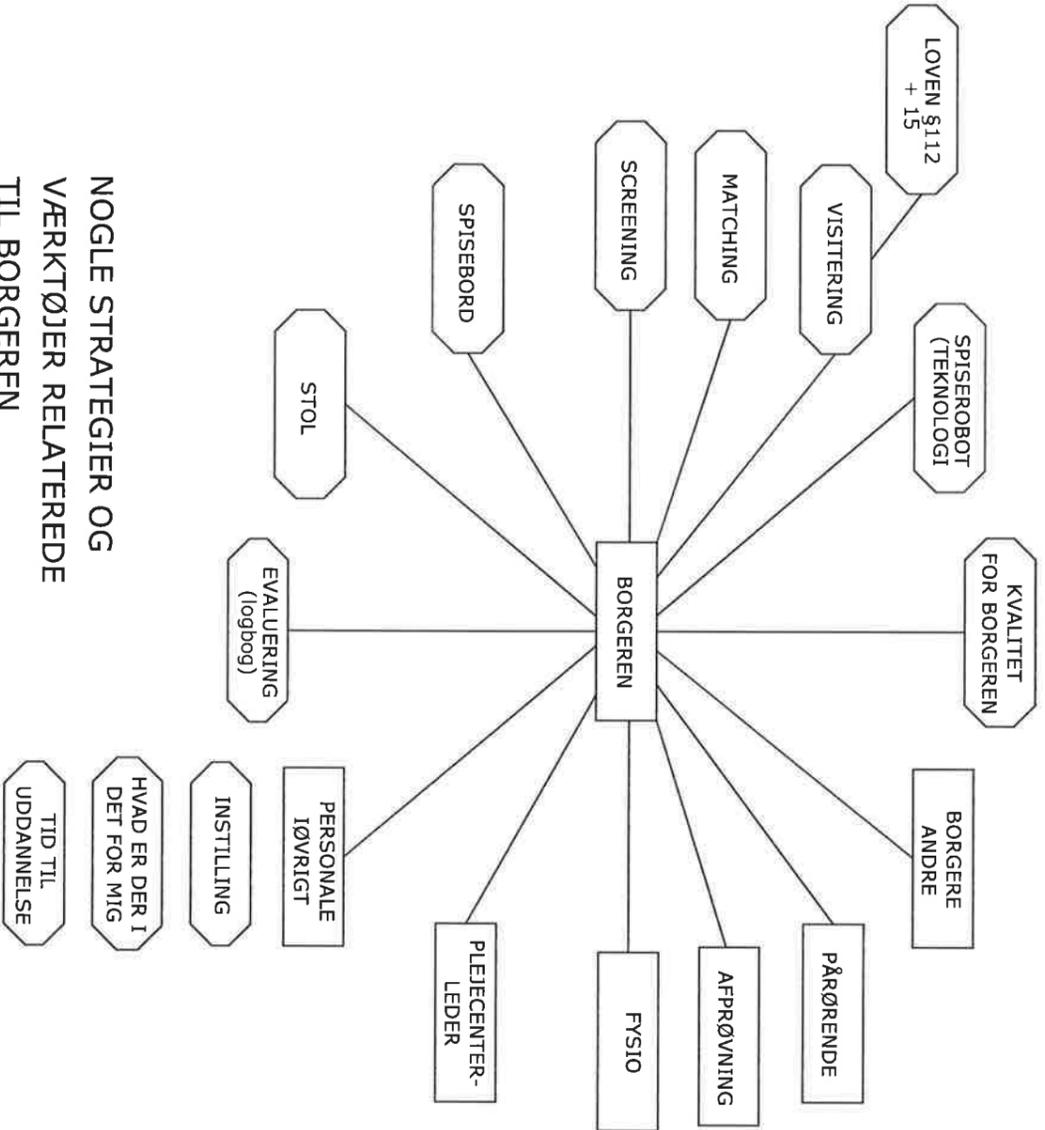
1. Neater Eater Electric (NEE)
2. "Neater Eater Manual (NEM)





NOGLE STRATEGIER, TING OG SOCIAL GRUPPER RELATEREDE TIL SCREENING VÆRKTØJET



NOGLE STRATEGIER OG VÆRKTØJER RELATEREDE TIL BORGEREN

## The pre-test activities and objectives

The test takes place at Skovhuset  
 There are two persons involved in the test, myself and the Techno-Anthropologist (TA).  
 Both of us eat with the robot  
 We decide to use both contacts “Piko” and the “Picasso”

### Objective of the test

- To try and understand how it feels to eat with help of an eating robot
- To better understand the functions and features of the robot

## The preparations

The eating robot is programmed to suit both test persons (spoon height from table)  
 The food is planned as yogurt, chicken and rice mix and rye bread (according to the robot specifications rye bread is not suitable)



We program the device – using the “easy guide”

*Only certain foods are recommended*



The food choice today includes rye bread which the robot could take up on the spoon

## The testing



*The meeting mouth and spoon is challenging*

The spoon takes up the food at its own pace and follows a pre-programmed route

I control the spoon with both the ‘Piko’ and the ‘Picasso’  
 Contact without much problems

The spoon speed or slow movements would take getting used to

## Some comments from the test

“Wow, it’s slow” myself

“Just as well I can use a napkin” myself - referring to the yogurt

“I had hoped to get some meat that time” myself

“It’s annoying getting chicken and rice 3 times in a row” TA

“Placement of food on the plate needs to be talked about in advance” TA

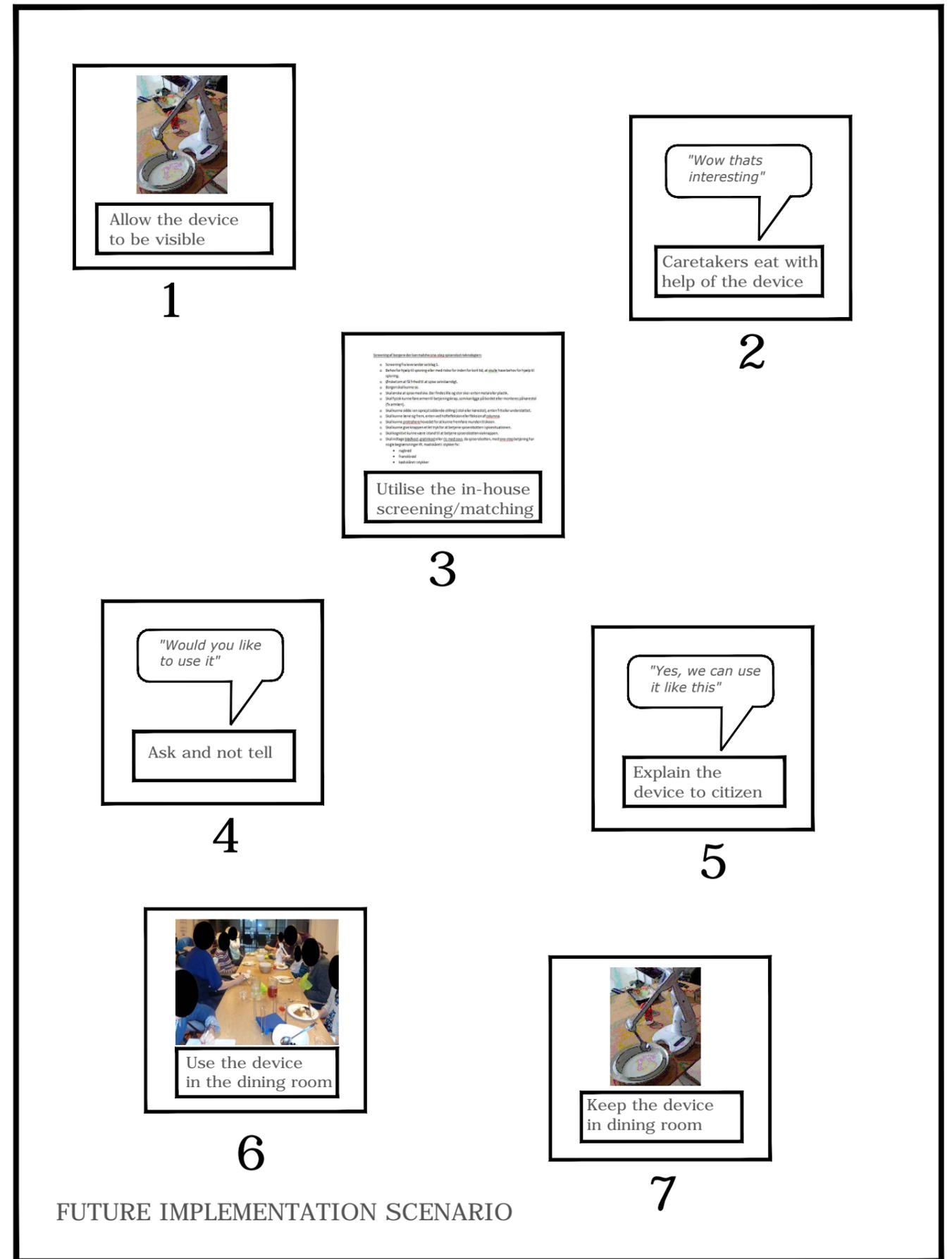
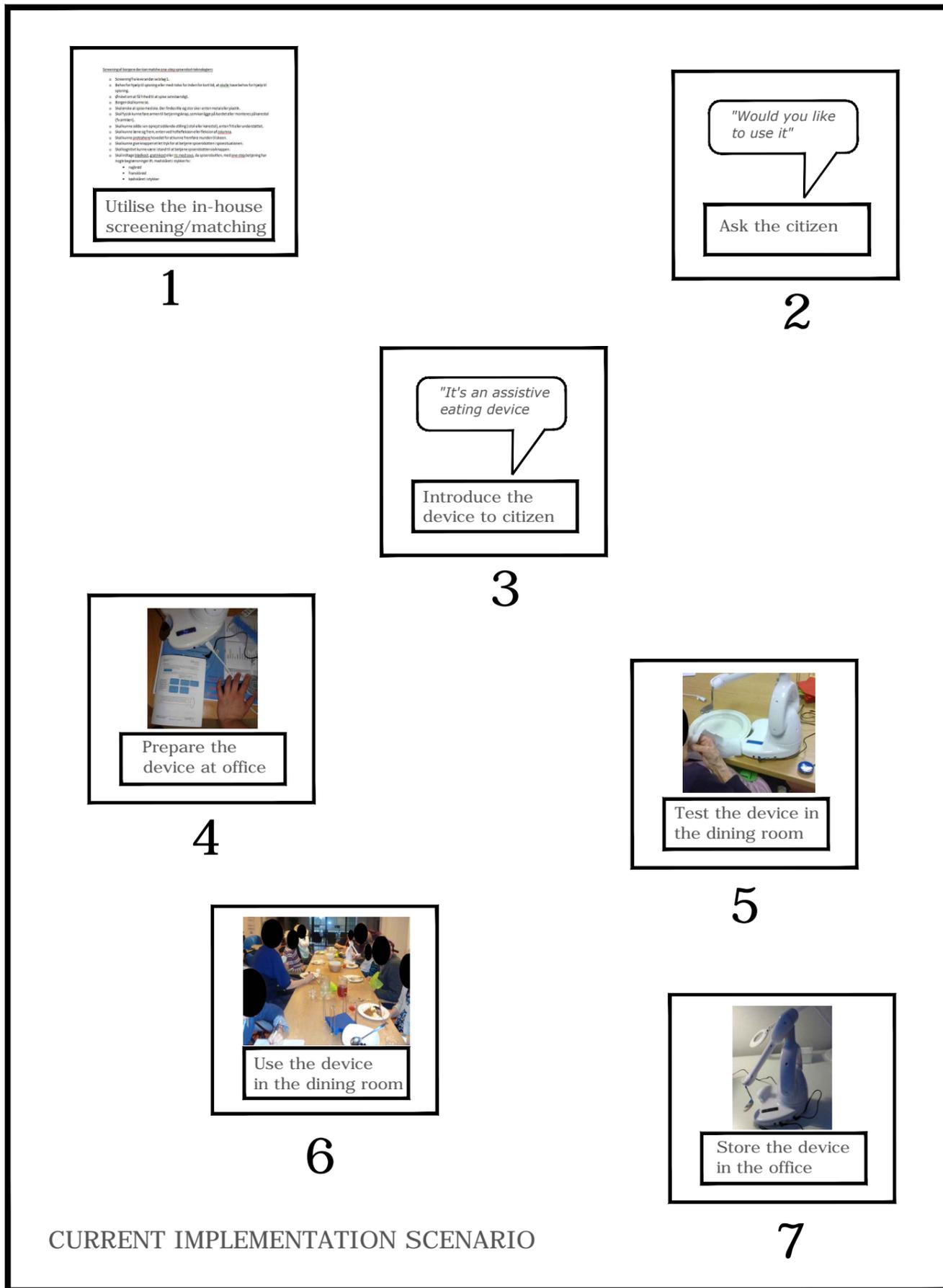
“It’s a bit messy in comparison to how I normally eat” TA

*Where’s my napkin*

## Some reflections

The speed of the spoon and the need to wait for the food to reach my mouth were the first things that made eating with the robot feel different. The food tastes the same but the method of using a different technique that demands concentrating on using ones hand to control a contact that controls the spoon is a lot different from eating directly via cutlery.

As the test progressed I found it easier to cope with the new situation but the fact remained that I was never sure of getting what I was planning to get on the spoon to my mouth. The spoon is not obvious of my thoughts and continues to follow the program of delivering at my mouth.



1