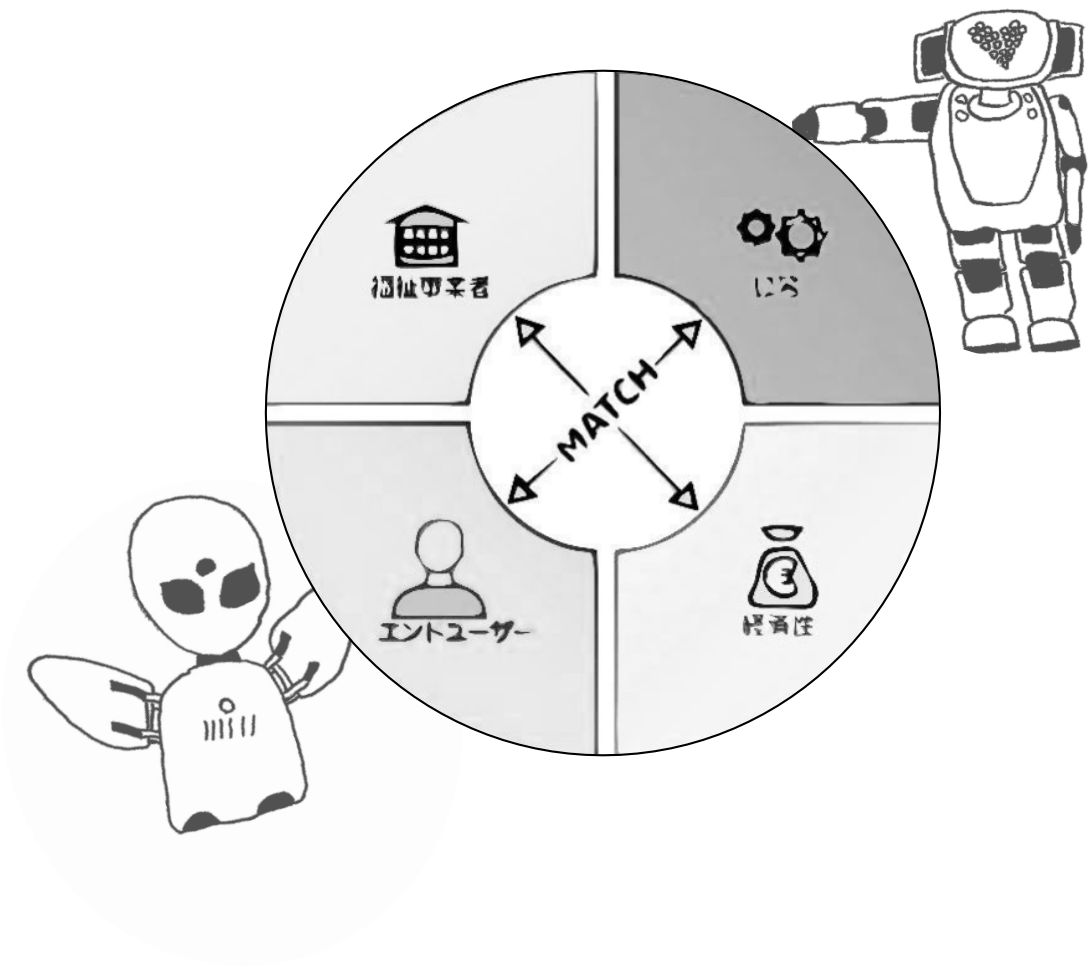
PERCEPTIONS ON BRINGING THE VTV TO JAPAN AND ROBOTS INTO CARE

A study of the Danish welfare technology assessment model 'VTV' in Japan



A TECHNO-ANTRHOPOLOGICAL
MASTER THESIS

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BREAKING NEW GROUND
AALBORG UNIVERSITY

Perceptions on bringing the VTV to Japan and robots into care

A study of the Danish welfare technology assessment model 'VTV' in Japan

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Abstract

This thesis researches how the Danish welfare technology assessment model, 'VelfærdsTeknologiVurdering' (VTV), is brought to Japan. Our analysis is based on fieldwork in Japan, where we collaborated with the persons involved in the transformation of the VTV, which they have renamed, 'Assistive Technology Assessment Tool' (ATAT). The aim of our research has been to understand how the VTV is perceived when it is brought from a Danish to a Japanese context, and what kind of value and challenges it approaches in relation to developing and introducing care robots. Our methodology for studying this has been based on qualitative interviews, combined with participatory observations and workshops to understand stakeholders' perceptions on the ATAT. Additionally, we have also got involved ourselves by trying to apply the ATAT on two communication robots, OriHime by OryLab and Palro by Fujisoft. With approaches from STS and 'situational analysis' (Clarke 2005), we find that the relevancy of the ATAT is perceived in the light of how the development and implementation of care robots are entangled in political strategies. The ATAT is seen as relevant, as the effects of the robots are too complex to be assessed by measuring delimited and predictable outcomes. By using the term 'boundary object' (Griesemer & Leigh Star 1989), we find that it can be challenging for the ATAT to function as a tool allowing many divergent perspectives to present their experiences to each other, and that flexibility is necessary. We experienced that the term 'assessment' can reduce the flexibility of the model, as it is linked to the conception of measuring predictable effects and assure quality. We argue that the model does not contain the answers in itself and still needs further adjustments. But the ATAT might be able to force decision-makers to relate more to implicated stakeholders and complications when implementing new technology in the care sector.

Resumé

Denne afhandling undersøger, hvordan Teknologisk Instituts 'VelfærdsTeknologiVurdering' (VTV) bliver taget til Japan. Vores analyse er baseret på et feltarbejde i Japan, hvor vi samarbejdede med de personer, der er involveret i transformationen af VTV'en, som de har omdøbt til 'Assistive Technology Assessment Tool' (ATAT). Formålet med vores undersøgelse har været at forstå, hvordan VTV'en betragtes, når den tages fra en dansk til en japansk kontekst. Derudover er vi interesseret i hvilke værdier og udfordringer modellen møder og bliver forbundet med, når den ses i relation til udvikling og implementering af pleje robotter. Til at undersøge dette har vi anvendt kvalitative interviews, deltagende observationer og workshops til at undersøge interessenters holdninger til ATAT'en. Derudover har vi selv anvendt ATAT'en på to kommunikations robotter, OriHime hos OryLab og Palro i Fujisoft. Ved at anvende tilgange fra STS og 'situationsanalyse' (Clarke 2005) finder vi frem til at VTV'ens relevans ses i lyset af politiske strategier for udviklingen og implementering af robotter i plejesektoren. VTV'ens relevans ses i lyset af, at konventionelle evalueringsmetoder i Japan kan være utilstrækkelige, da effekterne af robotternes samspil med mennesker er svære at måle og forudsige. Ved at bruge begrebet 'grænse objekt' (Griesemer & Leigh Star 1989), analyserer vi på hvordan implicerede interessenter betragter hvordan ATAT'en kan indgå i samarbejdet på tværs af dem, med det formål, at de kan præsentere deres erfaringer og oplevelser. Vi finder frem til, at fleksibilitet af ATAT'en er nødvendig for at sociale verdener med vidt forskellige synspunkter og ambitioner, kan bruge ATAT'en i deres kontekst. Vi mener, at begrebet 'vurdering' er medvirkende til at reducere modellens fleksibilitet, da begrebet i Japan er forbundet til forestillingen om at være i stand til at måle forudsigelige effekter. Vi argumenterer for, at modellen ikke indeholder svarene i sig selv og stadig har brug for yderligere tilpasninger. Ved at fokusere på situationen og omstændighederne, modellen befinder sig i, betragter vi ATAT'en som et vigtigt skridt i den rigtige retning. ATAT'en kan medvirke til, at beslutningstagere i højere grad forholder sig til implicerede interessenter, uforudsigeligheder og komplikationer ved implementering af ny teknologi i plejesektoren.

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Reading guide

In this thesis, we vary between using the family name and given name of our informants. It depends how they introduced themselves, and what we called them, while spending time together with them in Japan.

Some quotes are translated from Danish to English by us. We will write [OT], meaning own translation, after the quotes to make the reader aware of this.

We have made a list of abbreviations that can be found in Appendix 1

To get a better feeling and understanding of what we experienced during our fieldwork in Japan and what exactly the robots can do, we have added QR codes to show videos in this thesis. We urge the reader to watch the videos, as they will supplement our descriptions and take you closer to what we experienced. To watch the videos, scan the QR codes with a smartphone or tablet, by opening the camera. If that for some reason does not work you can download a QR scanner application in App Store or Google Play, or use the link in the PDF version.

We have made all our informants aware when we made audio recordings during our interview, and asked permission before taking pictures or recording videos. No one has expressed that they wanted to be anonymized.

We have inserted the date of when the interviews were conducted, except for the quotes of Jun Yamaguchi, since we have been in regular contact with him from December 2018 to June 2019.

* * *

We walked into the Japanese bookstore on the heels of Jun. We were eager to see the Avatar robot OriHime being controlled by a person, who now was able to work from home despite disability causing mobility impairment. As we turned around the corner we immediately saw that there was green light in its eyes, meaning that a person was online. For a moment, as it occurred that we were right in the person's sight, we froze. Not really sure what our next step would be, we chose to copy Jun who had walked over to the bookshelf and picked up a book. Jun was blending in as other people in the bookstore, while we were just standing there, feeling completely out of place and to tall to go unnoticed. After we had turned our back to the robot we were facing the bookshelf, pretending to look interested in books filled with letters we did not understand. We laughed nervously and agreed that this was not the most ethical situation, we needed to introduce ourselves. We told Jun that we would like to say hi. As we went there and introduced ourselves, it occurred to us that the person spoke English, but we found it difficult to recognize all the words spoken with Japanese accent coming out of the little white robots' speaker. It was a short conversation and we already felt overwhelmed. Right after, Jun said that we should interview him for our assessment of OriHime, and that he could translate. So, we took our notebook and a pen, laid it down on the nearest table we could find and started writing down all the questions we discussed prior to arriving in Japan. We were about to conduct the first ever, evaluation with the 'Assistive Technology Assessment Tool' in Japan.

* * *

Chapter 1

Introduction

1.1 Problem Field

Japan, like most other countries in the world, will experience a growth in the number and proportion of elderly people in their population (United Nations, n.d.). Japan is facing some of the biggest demographic changes with both ageing and decreasing population leading to some serious challenges for the future. According to the Japanese Ministry of Health, Labour, and Welfare (MHLW), 27.7% of the population was above 65 years old in 2017, which is estimated to increase to 30% by 2025 and 37.7% by 2050 (Cabinet Office 2018 in Wright 2019, p. 2). If the birth rate of 1.4 children per woman from 2016 remains unchanged going forward, it is expected that the Japanese population will shrink by a third in 2060 (Robertson 2018, p.18). It is clear that it will affect all parts of the Japanese society, including the private households. In nursing care, the number of elderly people who needs care will rise, while the number of caregivers will decrease. This will lead to increased financial costs combined with labour shortage and an additional 337.000 caregivers will be needed by 2025 (Wright 2019, p. 2). The labour shortage of caregivers is also happening because it is not considered an attractive occupation, partly due to bad working conditions. The job is considered unsafe, unclean and though with physical and mental burdens for the caregivers (Ishiguro 2018, p. 257; Wright 2018, p. 25). The salary for caregivers is low compared to other service occupations. The salary for home-based care was according to MHLW in 2016 32,5% lower than national average wages. It is estimated that Japanese care workers to a great extent are not getting paid for overtime work in order to reduce the costs for care provision of the care facility centre (Theobald et al. 2018, p. 221). At the same time, unpaid overtime work is a general culture among several occupations in Japan (ibid).

To solve the challenges in the care sector that will only be intensified in the future due to the demographic changes, the Japanese government looks to robotics:

> "*By supporting the development and introduction of robotic care equipment in the essential areas and creating a new market for robotic care equipment, we may partially lift the burden from care workers and empower those who require care*" (RobotCare, n.d.).

This announcement comes from the Ministry of Economy, Trade and Industry (METI), and illustrate how they believe that the development and introduction of robotic care equipment will improve the quality of care for both the care workers and those who require it.

The challenge of an ageing population is also found in Denmark, which is facing demographic changes as there is an increasing proportion of children and elderly people. The number of people in their last half of the 70s will increase with 20% in 2040, and at the same time, the number of people in the 80s will increase with 90%. Unlike Japan, Denmark's population will not decrease, but there will still be a demand for care workers in the future (KL 2019). But not only human care workers are perceived as a solution to the ageing population in Denmark. The government in Denmark has also shown an interest in robotic solutions to the ageing population. In late 2008, the Danish government bought 1000 units of the Japanese developed PARO[1] for nursing homes (Wagner 2010, p. 147).

But not only has Denmark shown interest in the technologies from Japan. Japan is also looking towards Denmark:

> "*Unfortunately, the situation is that in Japan, we are really good at inventing new technology, but we are not really good at using it*." [OT] (Ishiguro in Fagbladet FOA, 2018)

The quote comes from a video clip[2] from Fagbladets FOA, where two Japanese researchers visit a nursing home in Denmark, to learn about how they use technology. One of the researchers, Nobu Ishiguro, explains that Denmark is good at implementing and using technology. She is in particular impressed with how citizens are involved in decision-making in Denmark (Fagbladet FOA, 2018).

[1] PARO is an advanced interactive therapeutic seal looking robot targeted the healthcare sector (Paro, n.d.)
[2] See video clip: https://www.youtube.com/watch?v=HIYx8b_PZP8

The mutual interest can also be found in the Danish plan: 'Economic growth for health and welfare technology'[3], that was presented in 2013 by the Danish government. The plan describes that a more formal relationship needs to be developed between Denmark and Japan, in order to benefit from the growth of the welfare technology market. The purpose of collaborating is specifically targeted the development and testing of robots:

> *"Japan has strong competencies within robotics that they want to develop further. At the same time, Denmark is known as an attractive test market for new technologies and in relation to user-driven innovation"* (Regeringen 2013, p. 51).

This project is about how a Danish evaluation model is brought to Japan and how it is seen in relation to advanced robots that are currently being developed for care in Japan.

1.1.1 Access to the field

We started researching robots in the care sector in Japan because we were fascinated with the exotic and sometimes crazy stories we had heard. Our interest in initiating fieldwork in technology cultures in Japan is similar to other fieldworkers:

> "*When people say "that's really weird" or "aren't they strange," a fieldworker hears these comments as signals for investigation*" (Sunstein & Chiseri-Strater 2012, p. 6).

In the very beginning, our conception was based on stories about how robots are entering every nursing home in Japan and solving problems of a growing elderly population.

This conception of robots in Japan began to crumble as we ventured out on desk research in both the online and personal network. We heard stories about how caregivers still lifted elderly people themselves and how even humanoid robots have been developed for this particular problem[4], instead of using aerial lifts. But despite the robots being highly advanced, they did not work well. This was another narrative than what we had come across in our initial research. Looking back, it was sometimes difficult to tell the difference between

[3] In Danish: 'Danmark i arbejde. Vækstplan for sundheds- og velfærdsløsninger'
[4] RIBA is a humanoid robot developed for lifting a person in a similar way as a person (Riken-Tri Collaboration Center, n.d.).

reality, vision and expectations that were portrayed in the media and documentaries about robots in Japan. The anthropologist, Jennifer Robertson, argues that communication robots do not yet exist in society's actual institutions and will perhaps never be integrated into society as much as industrial robots (Robertson 2018, p.17):

> "*Most are still in the prototype stage and mainly interact with humans in settings like corporate showrooms, shopping malls, department stores, science museums, and closely monitored situations within select schools, nursing homes, and hospitals. Humanoid robots are rarely visible outside of these supervised settings, and certainly not in ordinary households*." (Robertson 2018, p.18).

This did not align with how they were portrayed in relation to the narrative formed by the Japanese government of how they will be a solution to the ageing population and already were widely entering the everyday life in Japan. This also indicated that getting access might be difficult, as we were interested in seeing the robots' implications in the society's actual institutions and not as narratives or visions of the future. Establishing contact was going to be a problem on its own, and we knew that our ambitions could not be achieved without help. We reached out to everybody in our network who had the slightest affiliation to Japan and started getting pointers about how we should behave and contact Japanese corporations. It occurred to us that establishing contact often relied on personal introduction (Udenrigsministeriet, n.d.) and that a gatekeeper speaking fluently English was necessary.

We heard about Jun Yamaguchi from a group of former techno-anthropologist students who had already been to Japan to research AI robots. They told us that Jun was planning to do an assessment of a telepresence device with the Danish welfare technology assessment model 'VelfærdsTeknologiVurdering' (VTV), which Jun has renamed 'Assistive Technology Assessment Tool' (ATAT)[5]. The group of former students explained that Jun wanted to bring the VTV to Japan, in order to promote feedback and knowledge that could be used for better implementation and development of assistive technologies. This was a different approach, and a domain, where we could mutually benefit from each other. With help from the group, we started contacting Jun to arrange a collaboration with him. We had knowledge and experience from working with the VTV and a human-centred approach, while Jun had

[5] When using 'VTV' we refer to a Danish context, while 'ATAT' will relate to a Japanese context. We will elaborate on what the VTV is in chapter 2.

knowledge about Japan's care sector, its challenges and a lot of key stakeholders of the industry in his own network.

We held several meetings with Jun over Skype already in December 2018, where we proposed to help him make ATATs on two different communication robots, while Jun would help us with our research for our thesis. We used these Skype meetings to formulate our research design of both our thesis and the cases of communication robots, we had a desire to make an ATAT of. The aim of these research designs was that Jun could use them to recruit relevant informants and set-up interview appointments. In order to make the recruitment more efficient, we made a website, where we could describe ourselves, the aim of our project and information about our desire to make assessments on two communication robots. Jun helped us with translating the content, so we could refer people who did not speak English to the website[6].

After initial contact with Jun where we agreed on collaboration, we finally decided to pack our suitcases and fly to Tokyo. In Tokyo, we met Jun to discuss the coming research of our thesis and the ATATs of the two communication robots.

1.1.2 From high-tech robot kingdom to misplaced robots

In contrast to our initial view on Japan where we believed robots to be a well-integrated part of the society, we experienced several times that there was a gap between developing the robots and integrating them into practice. While visiting Jun's workplace, the Research Institute at the National Rehabilitation Center for Persons with Disability, he showed us one of many robots that were collecting dust. Jun explained that many robot designers just want to utilize their skills without solving any problems:

> "*You will never guess why this robot was built?*" I point to the lifting device and say to test this? And Jun says; "*no, it was built by a researcher to a fashion show. NRHC had a fashion show, and this robot can wear clothes that can be a bit different. This is the kind of thing that I'm opposed to. Why waste money to build something like this. The developer just wanted to utilize his skills and not to solve any problems*. (…). *It is*

[6] See our website at www.jd-welfaretech.com

like car developers, it is their dream to design nice cars, not because they are needed." - our fieldnotes

Figure 1: Picture of the robot in Jun's workplace

Another example of a robot not solving any problems or practical functions was at the office of Yasuko Akutsu, whom Jun is collaborating with about introducing the VTV in Japan. A humanoid robot with AI called 'Pepper'[7] was placed in a corner with its head bowed down, making it look like it was taking a nap. Yasuko explained, she had become irritating because Pepper was talking too much. Therefore, she decided to stop using it at the office. In addition, Yasuko told us that a robot like Pepper is not suiting the care sector either since they are too expensive to afford for care facility centers.

[7] Pepper is intended to be used as an assistant in various job functions. Here among welcoming visitors or at nursing homes to facilitate group exercise (SoftBank Robotics, n.d.).

Figure 2: Pepper has slept for a long time at Yasuko's office

When we realized that the implementation of robots is not solely a success in Japan, because there, seems to exist a gap between robots and the actual use, triggered an analytical interest of combining this problem field with Jun's plan of bringing the VTV from Denmark to Japan. This made us start asking ourselves a lot of questions such as: Is it possible to use a Danish framework as the VTV in another cultural context? How are methods from social science perceived in a country famous for advantages in engineering and natural science? How can the VTV relate to the Japanese government's aim of supporting the development and introduction of care robots? This curiosity combined with our opportunity to make VTVs of two different communication robots planned to be implemented in the care sector, made us formulate the following problem statement.

1. 2 Problem Statement

How is the technology assessment model 'VTV' perceived when it is brought from a Danish to a Japanese context, and what kind of value and challenges does the approach of the VTV meet in relation to developing and introducing care robots?

1.3 Outline of the thesis

To answer this problem statement, we have structured our thesis with eight chapters as outlined in the following:

In **Chapter 2** we will describe what the VTV is, and explain the term Welfare Technology, which the VTV is aimed at assessing. After that, we will shed light on how technology is provided as care in Japan, and then we will explain the two communication robots that we have been researching with the ATAT as part of this thesis. To finish off, we will briefly explain the ATAT and changes made to it when brought to Japan.

In **Chapter 3** we will explain the theoretical approach to this thesis. We will describe how we have been inspired by STS literature to analyze the ATAT in Japan. Then we will describe the methodology, we have applied and central reflections about the knowledge they produce.

In **Chapter 4** we will touch upon some of the political entanglements robots are tied to in Japan. We will give examples on some of the strategies, and explain how the ATAT is perceived in the light of them.

In **Chapter 5** we will describe the evaluation culture we met in Japan and give an example of how it was applied to an assessment of the communication robot, Palro.

In **Chapter 6** we will analyze how the ATAT is envisioned as a collaboration tool among different stakeholders. We will use the term 'boundary object' to give a picture of the different social worlds relating to the ATAT and how they perceive the model. We will describe how it can be challenging for the ATAT to function as a tool allowing many divergent perspectives to use and present their experiences to each other.

In **Chapter 7** we will introduce how we experimented with the ATAT to obtain practical experiences with. We will discuss these experiences in relation to the cultural context of Japan.

In **Chapter 8** we will discuss how the ATAT can have positive implications on conceptions of technology that we experienced in Japan.

1.4 Delimitation

Robots and welfare technology are an interdisciplinary project, making it subject to many different knowledge domains and framings. We will not go in depth with the many different

assessment models but focus on the qualitative and humanistic aspects in the VTV. Although we will describe some of the different knowledge domains and how they engage in assessing the robots, we will delimit our focus from going in depth with this. It is important to notice that we do not argue that the approach in the VTV should replace other kinds of assessments, but rather serve as an addition. We also discovered that the model currently is being updated. We will therefore not strive at making or suggesting a completely new version. New parameters are being added and visualization is also being changed. We do not have full access to all the changes, and we delimit our research from taking them into account, although we have been talking with the people making the new version, and know that it is to take more socio-technical and ethical considerations into account.

1.5 Literature review

In order to make our research design, we have been focusing on academic literature about the visions and design of robots for the care sector in Japan and cultural values related to care and using robots.

We found that a lot of the literature covered the reasons for how robots are envisioned in Japan. Jennifer Robertson is a professor at the faculty of anthropology and history of art at the University of Michigan. Robertson grew up in Japan (Robertson 2018, p.1), and wrote the book 'Robo Sapiens Japanicus: Robots, Gender, Family, and the Japanese Nation' in 2018. We have used Robertson's book to gain an understanding of how robots are perceived and developed in Japan. In the book, she thoroughly describes how cultural factors and values result in a very different view of robots, compared to Western culture. She highlights the difference in how we often perceive robots in Western culture in relation to natural or unnatural. In Japan, such demarcations are not as sharp and *Nature* and *Natural* is perceived as far more than ecology or environment (Robertson 2018 p. 15). In the book, this is exemplified with Shinto beliefs, where material objects are spirited or contain an essence of agency (*Kami*). Nature is shaped by the social world, including rituals, religion and scientific experiments, and is not seen as an external factor from society and culture. Robertson makes a comparison of animism and how developers of robots in Japan think about robots, with visions of mutual and beneficial coexistence with humans in society (Robertson 2018 p. 15).

The Danish anthropologist, Christina Leeson, has studied Japanese and Danish collaboration of developing, testing and implementing the telepresence robot; Telenoid in her Ph.D from 2017. She does this by following it from where it is developed in Japan, and how it is brought to a care institution in Denmark by the Danish Technological Institute (DTI). The Telenoid is assessed with the VTV in Denmark, and Leeson find her involved in the field:

> "*During the tests of Telenoid in Denmark, for instance, I became responsible for supporting the staff in their daily use of the robot on the one hand, and reporting and discussing results and complications with consultants on the other*" (Leeson 2017, p. 12).

Leeson's Ph.D. has helped us understand the relationship between Japan and Denmark, with a specific focus on how Japanese robots are travelling to Denmark to be tested. In the Ph.D., she has not researched how the VTV is perceived or used in Japan.

Both Robertson and Leeson describe political entanglements of how robots are developed and envisioned in Japan. Most of the research we have found is about cultural and political aspects and how they are projected into the development and visions of robots. But we only found little empirical research on the responses to the technology and visions from the actors in Japan who are intended to use them.

The English anthropologist, James Wright, has written the article: 'Tactile care, mechanical Hugs: Japanese caregivers and robotic lifting devices' from 2018. In his seven months fieldwork at a care facility center in Japan, he researches the responses from caregivers and elderly residents, when the robot "Hug" is introduced at a care facility center (Wright 2018). In his research, Wright relates his empirical findings at the nursing home to the government's strategies. Wright points to how the robots are developed with two purposes: To promote advanced technology by applying Japan's technological expertise, and to solve the problems of an ageing society (ibid., p. 25). In the article, Wright shows how there are misalignments between the development projects that the government pours money into and how the caregivers and managers are adopting the robots (ibid., p. 1). The professor in language and culture at Osaka University, Nobu Ishiguro, is also interested in why the visions and development projects from the government, is not succeeding in adopting the new robots at the nursery homes. Ishiguro has written the article 'Care robots in Japanese elderly care,

cultural values in focus' from 2018. Ishiguro focuses on cultural values, to research why the robots are not adopted well in care. She researches the attitudes towards the robots at nursery homes, based on focus group discussions with care workers, that have no or little experience with technology, including robots (Ishiguro 2018 p. 262). In the conclusion of the chapter, Ishiguro points to the relevance of research in this:

> "*Finally, I argue the necessity of discussing the benefits and disadvantages of each specific care robot/assistive technology, in addition to presenting a general discussion on robots/technology.* (...) *Research into this area is currently lacking, despite the government's enthusiasm for promoting care robots and the abundant research that has been conducted by engineers and robotics professionals.*" (Ishiguro 2018, pp. 266-267).

In line with Ishiguro, the Danish cultural analyst studying transfer of technology, Lasse Blond, argues in his article 'Studying robots outside the lab: HRI as ethnography' from 2019 that the sociality of social robots is shaped in the everyday practices, thus the sociality and acceptance of social robots are flexible depending on the users' interpretation of them. Blond emphasizes, there is a need for longer-term empirical and ethnographic studies, in the research of Human-Robot Interface (HRI), to understand how robots are used and perceived in actual use cases (Blond 2019, pp. 123-124).

From our literature search, it became clear that there is a gap between the robot development and caregivers. A lot of the literature points to the government promoting robots despite the engineers' lack of understanding the needs of the caregivers.
But in our experience, different stakeholders in Japan also attempts to bridge this hole by introducing a wide range of potential solutions, such as assessments, qualitative methods and design thinking. We experienced what we believe to be a sincere interest in our techno-anthropological approach. This interest might have occurred in the wake of the acknowledgement, that robotic professionals and engineers cannot lift the job alone, which various literature directly or indirectly point to.

We experienced that the emphasis is now placed on facilitating the grounds not just for research into robotics, but also for the actual application of robots within care institutions and society as a whole. We hope to contribute to this challenge.

Chapter 2

The technologies in our project

In this chapter, we will first outline the Danish welfare technology assessment, VTV, and then we will describe the term 'welfare technology'. Afterwards, we will shed light on how technology is provided as care in the Japanese welfare system. At last, we will introduce the two communication robots we have researched as cases for making ATATs in Japan.

2.1 What is the VTV?

The VTV is an assessment tool for welfare technology, developed by the Danish Technological Institute (DTI). DTI is a self-owned institute and their main purpose is to help their customers with converting the newest knowledge and technology into value (Teknologisk Institut, n.d.). They provide consultancy on many different technological areas, including welfare and robot technology. The model strives to provide a systematic, holistic and nuanced assessment of welfare technology in an organization with a focus on the technologies' ability to give a better quality of welfare service and better use of resources (Teknologisk Institut 2017, p. 4). The assessment is carried out by researching four different categories which the model is divided into: Organization, Citizen, Technology, and Economy. Each category has further two underlying assessment parameters (Teknologisk Institut, n.d. 1). DTI argues that the model can give a nuanced 360-degree assessment of the welfare technology (ibid.), and give distributors, municipalities, governments or organizations concrete and well-documented information about a welfare technology (Teknologisk Institut 2017, p. 3).

Furthermore, two main purposes of conducting a VTV are related to the people who can benefit from the knowledge. The first purpose of the VTV is to provide knowledge, to people interested in buying a specific technology, of how it can contribute to their welfare service. In other cases, it will provide knowledge about why they cannot be used and what kind of complications are related to the technology in the given context. Secondly, it can provide knowledge for the company that develops the technology, by providing information and

documentation about how their technology functions and how it is received by their user group (ibid.).

2.1.1 Assessment parameters

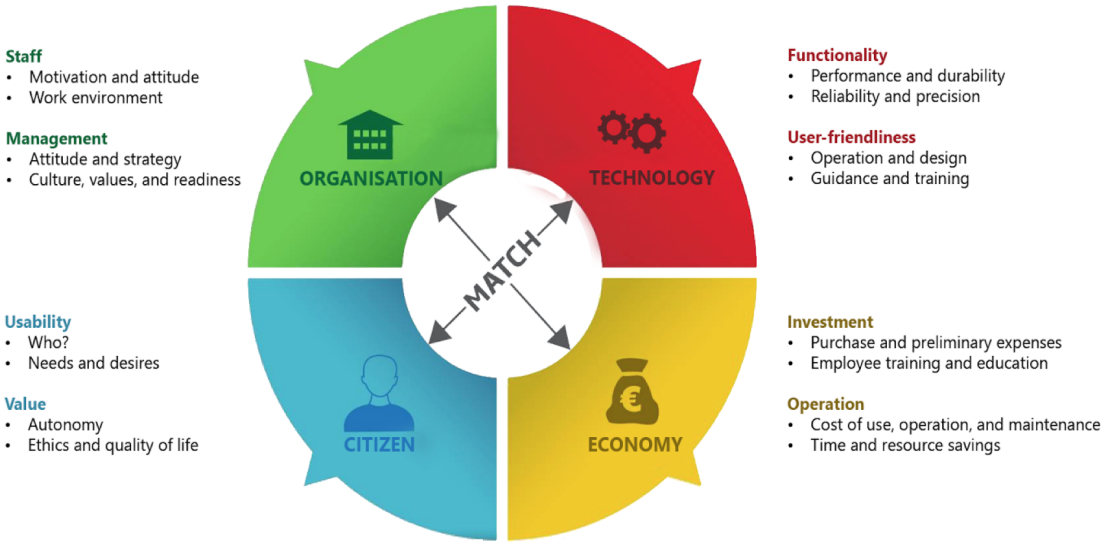

Figure 3: Illustration of the assessment parameters in the VTV from DTI (Børsen et al. forthcoming, p. 4).

The category *Organisation* is assessed according to the two parameters 'staff' and 'management'. When the staff is researched, the welfare technology is assessed in relation to the impact on the working environment, cultural aspects and motivation. The management parameter is assessed in relation to the management's strategy and attitude towards the technology. Further, the readiness of the organization to implement the technology, culture and values are taken into consideration.

The category *Technology* is assessed from the two parameters 'functionality' and 'user-friendliness'. In the parameter functionality, the technical function is assessed in relation to performance, durability, precision and reliability. This parameter is based on a factual approach and is delimited for how the users perceive it. The other parameter, user friendliness, considers how the test person experienced the technology. Here the design and how the person controls it is assessed according to their experience. It is also considered if the manuals and guidance are sufficient or if the use of the technology requires training.

The category *Economy* is assessed with the two parameters 'investment' and 'operation'. The purpose of the investment parameter is to shed light on the cost of the welfare technology and related expenses such as installation or sim-card subscription e.g. expenses related to training or educating the staff is also considered. The operation is assessed by how much support and maintenance is necessary. The technology is also assessed in relation to the ability to make the work more effective and reducing the workload or other costly resources.

The category *Citizen* is assessed by the parameters 'usability' and 'value'. The parameter value is related to the match of the technology and the person who will be using it. Here the citizens' needs and desires are taken into account and whether the technology is able to meet them. The value is assessed in relation to the technology's impact on autonomy, quality of life and if it is able to make the citizen more self-sufficient. In this category, ethical perspectives are often part of assessing the technology's positive or undesired impact on the citizens' life and human values (Børsen et al. forthcoming, pp. 3-5).

2.1.2 The origin of the VTV

The VTV is inspired by the assessment model, 'Medicinsk Teknologivurdering' (MTV), which can be translated as Medical Technology Assessment. The term MTV has existed since the 1980s in the health domain (Kristensen & Sigmund 2007, p. 15) and the approach is internationally used (ibid., p. 18). During an interview on the VTV's development in Denmark with one of the co-writers of the VTV from DTI, Troels Oliver Vilms Pedersen, we were told how MTV was used as inspiration to further develop a welfare technology-oriented assessment model:

> "*There was a demand for an evaluation concept from people in the welfare technology domain. At that time we looked at MTV, which is Medical Technical Assessment. The idea was quite simple, to make an evaluation concept that was directly appropriate to the care and care-oriented technologies*." - [OT] Troels Oliver Vilms Pedersen, 18.02.2019

The MTV is an interdisciplinary approach aimed at providing a systematic assessment of the implications and consequences of using medical technology (Kristensen & Sigmund, 2007 p. 16), that is introduced to the medical domain to prevent, diagnostic, treatment, nursing and

rehabilitation (ibid.). The categories are similar to the VTV and they are divided into Technology, Organisation, Economy and Patient. The key methodological approach of MTV is evidence-based. The evidence-based approach is related to the clinical discipline and uses scientific results, in order to provide exact and rational documentation of the effects and side effects (ibid., p. 18).

2.1.3 Methods in the VTV

Although the categories in the VTV are similar to MTV, the methodological approach in the VTV is very different. The VTV moves away from the medical research paradigm, by drawing on human and social science (Hannerup-Nielsen et al. 2016, p. 25). The VTV focuses on researching the case where welfare technology is applied, rather than the technologies effect in general. The VTV provides parameters to assess but does not dictate what specific kind of methods that should be used (Børsen et al. forthcoming, p. 13).

Therefore the person conducting the VTV has to choose methods relevant for researching the category and specific case. The VTV has a mixed methods approach, and can vary from being of a qualitative, quantitative and/or comparative character, enabling methods as surveys, questionnaires, cost-benefit analysis, semi-structured interviews, participatory observations and focus group interviews (Teknologisk Institut 2017, p. 6).

In this report, we will focus on the qualitative methods of the VTV, hereby semi-structured interviews and participatory observations.

2.1.4 The VTV as a service and a free tool

VTV was offered as a learning course and a consultant service by DTI. But VTVs are also made independently from DTI. This became clear at a meeting with one of the co-authors of the VTV; Lone Gaedt. She told us that many VTVs do not refer or mention DTI. In addition, guiding material about how to conduct a VTV can be found on several municipalities websites. In the interview with Troels from DTI, he told us that the VTV turned out to be beneficial in a different way than first anticipated. Originally it was expected to be a service or certificate from DTI:

> *"Where the VTV has proved to be useful, is when the municipalities, producers and educational institutions use it. At educational institutions, I have experienced that*

> *students have learned a little about the model in their education. I have also met people who are studying to become nurses, therapists or caregivers who have been making a VTV about welfare technology. But it is most often consultants in municipalities who make these reports and share them with each other. In DTI we have also used it in some of the major evaluations that we have made for the Ministry of Finance."* - [OT] Troels Oliver Vilms Pedersen, 18.02.2019

The VTV did not function by gaining revenue through product certifications, but instead, it placed DTI as a central and knowledgeable actor in the field of welfare technology. This has enabled DTI to provide consultants, education and courses about the VTV. But the VTV is not certified by DTI and everybody can freely use it without paying. This also means that the VTVs that can be found in Denmark are made by many different people with different educational background. The VTVs can have many different appearances, length and made with different purposes in mind. Depending on how the model is perceived, this can be a strength or a weakness. If the model is perceived as a neutral and objective 360-degree assessment, it can be seen as a bias, if the conductors are care professionals who themselves are part of the categories in the assessment (Børsen et al. forthcoming 2019, p. 15). But if the model is seen as an expression of desires by marginalized and vulnerable groups, the opportunity for them to express themselves through the VTV can be seen as a strength rather than bias (ibid., p. 14).

2.2 What is welfare technology?

We have translated the term 'velfærdsteknologi' to 'welfare technology'. In the Danish dictionary it is described as; *"knowledge and technical aids used within for example the elderly, nursing and health care area"* [OT] (Den Danske Ordbog, n.d.), but the direct translation 'welfare technology' is not widely used outside of Scandinavia (Aaen et al. 2018, p. 240).

The term welfare technology was introduced in 2007 in Denmark and withheld the expectations of new technologies being introduced for the public sector while also providing a new growing industry (ibid., p. 236). In Denmark welfare technology is often used as an umbrella term, linked to using new technology for re-organizing the welfare services, that are provided by the Danish welfare state (ibid., p. 237). Welfare technology is targeted for

elderly care, people with disabilities, or people who are socially exposed. In general, welfare technological solutions can target everyone who receives welfare services because of specific needs. The technologies are often defined with the ability to improve the quality and effectiveness of welfare services for citizens, in order to empower the ability for the citizens to manage their own lives (Dansk Standard 2011, p. 8). It is also characterized by its purpose of making the workload for the welfare service more efficient and less time consuming (Aaen et al. 2018, p. 242).

In Denmark, following suggestions from Dansk Standard[8] have been made for requirements and standards on the broad definition:

> - *There is a societal benefit to utilizing welfare technology products and services.*
> - *There should be a workforce optimization element. For example, by creating a greater effect with the same entry of labor.*
> - *Covers both private and public products and services.*
>
> *Guidelines that delimit welfare technology*
>
> - *Welfare technology products and services do not include drugs and raw materials for the manufacture of medicine.*
> - *Welfare technology does not deal with activities taking place in the hospital for treatment.*
>
> [OT] (Dansk Standard 2011, p. 10).

The broad definition leads to many different technologies being deployed as welfare technology, here among robots. We experienced that the term welfare technology is not used in the same way in Japan as in Denmark. During our first interview, we used the term 'welfare technology' assuming that it referred to the same, but our informant told us that in Japan, welfare technology only refers to technology for elderly people. The term welfare technology was confused with the Japanese term 'Welfare equipment for elderly people' - (Fukushi Yougu; 福祉用具), that are used to describe technology or devices that can be used

[8] In English: Danish Standard. 'Dansk Standard' is a governmental institution who develops and publish standards (Dansk Standard, n.d.).

by the elderly to help them in their everyday life and reduce the caregivers' burden. Fukushi Yougu can for an example be a special bed that can adjust height and position, a wheelchair, a lift etc. The financing of Fukushi Yougu is provided through the Long Term Care Insurance (LTCI). We experienced that Fukushi Yougu often refers to traditional/low tech welfare technology. But, in the government's action and vision for the development and introduction of technology for elderly care, there is a focus on using high tech robot care devices rather than what might be referred to as low tech/mechanical (Wright 2018, p. 25). Both Japan and Denmark are striving for providing welfare services through technologies, and in the next part, we will look into this.

2.2.1 Providing welfare through technology

One central initiative, the Japanese government has made to solve the challenges of providing and financing care service for the ageing population in nursing care, is the adoption of the Long Term Care Insurance (LTCI) in 2000 (Theobald et al. 2018, p. 217). LTCI is a mandatory insurance that covers a percentage of the care services the elderly citizens aged over 65 can receive, and some citizens in the age between 40-65 with specific needs (ibid.). The LTCI makes it possible for users to choose between a wide range of both non-profit and for-profit providers that must align to nationally fixed prices. Hereby, a purpose of LTCI is to engage new service providers and raise the number of available services with the aim of increasing the care quality. (ibid., p. 218). Citizens are categorized at a level between 1 to 5 based on their need for care and support. This is done with a 74-item questionnaire about citizens life and activities (Iwagami & Tamiya 2019, p. 68).

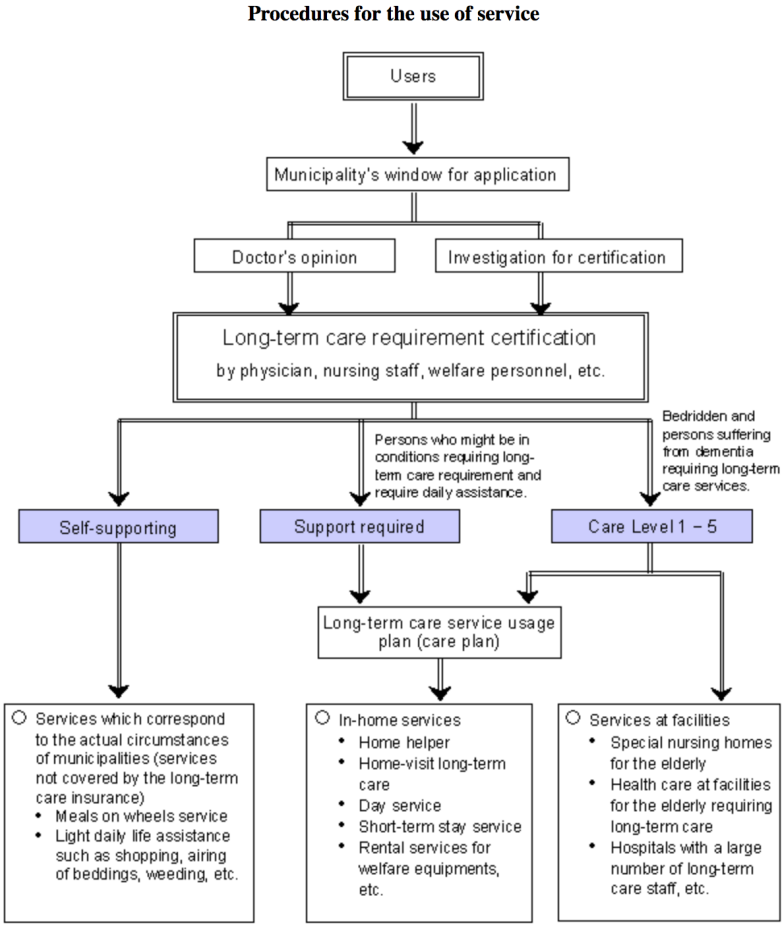

Figure 4: Procedures for the use of long term care insurance (MHLW, n.d.)

By using national standardised certification of needs, it is assessed what the citizen is eligible to receive. If the technology or service is not on the list, it is not possible to get covered a percentage of it. The Fukushi Yougu technologies for elderly people have to live up to the standards and requirements determined by the government, of what the technology should be able to do and look like. For example, the height and width of the product should meet the requirements defined for this type of product.

The LTCI has been criticized by many, especially people related to home-care. By adapting LTCI, the government hoped to renew the traditional home-care system, where families have the responsibility of taking care of their elderly family members. However, the family is still providing most of the care for their elderly members, and according to a survey from 2013 more than half of the users receiving home-care have experienced a service reduction with LTCI, while more than half of the home-caregivers have anxiety about the quality of home care (Yuki et al. 2014 in Theobald et al. 2018, p. 218).

In contrast to technologies provided for elderly people, the technology that is provided for disabled is not funded by insurance, but by tax money. Here the category 'Body-worn equipment' - (Hosougu; 補装具) is used for technology that can be worn or extend the body. Further, the technology that goes under the definition Hosougu is something that compensates a person's loss of function[9], and what the person is eligible to get covered is decided by the level of disability, which is determined by a doctor. For Hosougu, the list does not contain the same well-defined requirements to exact measures as the list for LTCI. But they are thoroughly described and requirements are accompanied by a maximum price that is covered. According to Jun, this means that many Japanese producers make their product according to the price from the government, so no self-payment by the user is necessary.

As there are not many robots on the schemes, the residential homes and citizens have to finance the whole purchase of an expensive robot themselves (Ishiguro 2018, p. 260).
But as the government has an interest in implementing robots in the care sector, robots also find their way to nursing homes by being financed through development projects for the purpose of testing, which we will elaborate on in chapter 5.

2.3 Eight priority areas for development of robot care devices

From 2013-17, the METI spent approximately € 100,4 million on the 'Project to Promote the Development and Introduction of Robotic Devices for Nursing Care' that was led by The National Institute of Advanced Industrial Science and Technology (AIST), one of the largest public research institutes in Japan, with guidance from Japan Agency for Medical Research and Development (AMED) (Wright 2018, p. 25). The project is prolonged, and at the moment they have identified 8 priority areas for development of robot care devices, and currently, they are working on defining the criteria of communication robots as the next focus area. The devices belonging to the 8 priority areas are normally not associated with the definition of robots e.g. portable toilets and bathing machines, thus Wright calls them "*broad state definitions of care robots*" (Wright 2019, p.18). METI decided to use the term 'robotic assistive technology' since robotics were incorporated in assistive devices (Ishiguro 2018, p.

[9] E.g. wheelchair, hearing aid or glasses.

257). According to AIST, there are three types of robotics that are used in the different devices. These three types of robotics are: Smart sensor used for "*safety surveillance sensor using a smart processing of range data*", smart control that is the "*control of a walker for power and safety assist*," and multi-link structure used "*to implement a transfer assist device*" (AIST 2018). The 8 priority areas for development of robotic assistive technology that can be seen at the illustration below:

Figure 5: The 8 priority areas of robotic assistive technology (RobotCare, n.d.)

Currently, 98 robotic assistive devices have been developed in this project, and 15 commercial products have been repurposed for nursing care (AIST 2018). The central

government have a wish to include more priority areas, here among communication robots (AMED n.d.).

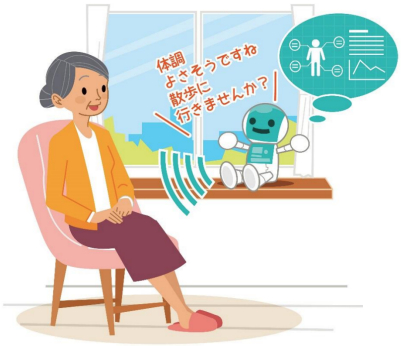

Figure 6: Illustration from AMED of the desired priority area of communication robots (AMED n.d., p. 12)

2.4 Communication robots

During our fieldwork, we have been assessing two different humanoid communication robots. Many of the communication robots are not specifically developed as care products, but introduced in the care field in order to see if they can be applied there. In 2010, the German doctorate in Japanology, Cosima Wagner, made three categorizations for social robots in Japan, where two of them are aimed for elderly care:

> "*Within the first two categories, a field of special interest is the "elderly care"-sector, as it contains an increasing number of elderly people who will need support in daily tasks and care in the near future*." (Wagner 2010, p. 133)

The categories are called 'robots for daily life' and 'research oriented humanoids'. Wagner describes that robots for daily life can be used for entertainment and even therapeutic purposes. The category consists of robots, as the baby seal robot Paro, that is made for entering the care sector and households in Japan. The second category, 'research oriented humanoid robots', is described as humanoids that are developed as national prestige projects with big national budgets, she exemplifies this category with Honda's humanoid ASIMO (Wagner 2010, p. 134).

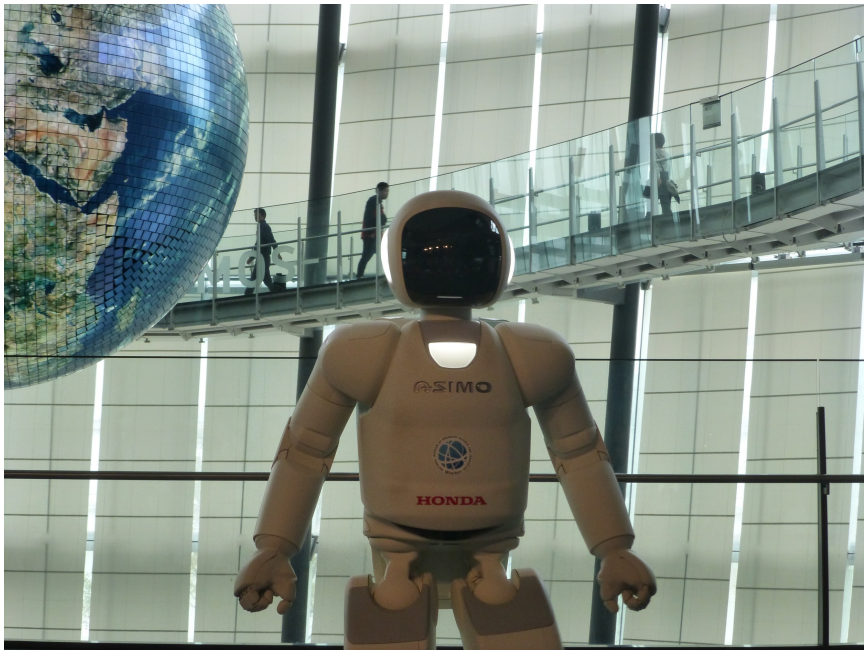

Figure 7: Demonstration of ASIMO at The National Museum of Emerging Science and Innovation

The robots we have been researching resembles all the above categories. They are both humanoids and can be considered as prestige projects, therapeutic and meant to be used for everyday life. Not only can it be difficult to tell apart the categories, but it can also be difficult to distinguish testing and development, from actual products and solutions. We will now describe the two communication robots that we assessed with the ATAT in Japan.

2.4.1 Palro (パルロ)

Palro is a humanoid communication robot with artificial intelligence (AI), developed by the company FujiSoft. It entered the market in 2010, and FujiSoft describes that they have since that time improved its AI (FujiSoft n.d). It was not originally developed with the purpose of entering the care market, which became clear at our interview with FujiSoft:

> "*As a beginning, FujiSoft have organised robot sumo wrestling for 30 years. It was a request from the Ministry of Education, Culture, Sports, Science and Technology. They wanted to draw students and grow the next generation of software engineers. The robot is the highest combination of software programs. So, the educational program organized robot sumo wrestling competition, and Palro was the referee of that competition.*" - Employee from FujiSoft's Palro department, 19.03.2019

Palro is able to have conversations, sing, dance and walk (FujiSoft n.d. 1). Palro is usually placed on the table by the user and is about 40 cm tall and 18 cm wide. It weighs 1,8 kg. Palro can recognize people's faces and autonomously evolve and tailor each conversation for the person (Kodate al. 2018, p. 4). Palro is sold or leased for elderly care. It is expected to be used at nursing homes for recreation, where Palro can talk with elderly residents and perform collective exercises as singing and dancing with the elderly people. According to an information sheet we received at FujiSoft, Palro is established at over 1000 nursing homes in Japan (FujiSoft n.d. 2). FujiSoft has announced that Palro soon will be available with a watching function for monitoring elderly people. They describe that it will happen in a more natural way than surveillance, as it can pass information onto caregivers and family through conversation (FujiSoft n.d. 3).

See video from the demonstration of Palro at the interview with FujiSoft. Use the QR code or the link: https://vimeo.com/335820600

2.4.2 OriHime(オリヒメ)

The OriHime is a telepresence avatar robot. It is developed by Ory Laboratory. The company was co-founded by the CEO: Kentaro Yoshifuj (called Ory). During our fieldwork, we visited the Ory Laboratory, where Ory explained that he had himself experienced loneliness in his youth because of Hikikomori (ひきこもり, which is a Japanese term that describes people who avoid social contact by staying in their room (Oxford English Dictionary 2010). The vision behind the OriHime is to fight loneliness and can be used by people who cannot physically participate in social activities. OriHime targets several user groups, here among people who cannot participate physically in working or social events because of disability that leads to mobility impairment or paralysis, such as Amyotrophic Lateral Sclerosis (ALS). The user can control the OriHime with the product OriHime Eye or OriHime switch, which enables full control of a tablet with an eye gaze or sensitive finger movement. The telepresence robot also targets the use for education, which children can be refrained from participating in, because of medical treatment or hospitalization. OriHime is also sold to let

people participate, despite any distance, in activities at home or for remote working (OryLab 2015).

Figure 8: Waiting room outside OryLab. Here we were received by an OriHime, when the eyes started lighting green, a receptionist welcomed us. On the table, a figurine of Ory and his book, and on the floor another model called OriHime-D was placed.

The different components consist of a wide-angle camera, microphone and speaker that allow the user to see, hear and communicate through. The head of the robot can move, so the user can look around and nod. OriHime has arms/wings, so the user can make gestures, allowing the user to raise its hands, clap etc. The OriHime has a height of 21,5 cm, and when it has folded hands the width is 15 cm. It weighs 587 g. The robot is connected to the internet by wifi and can be controlled with a computer or smartphone/tablet. One OriHime unit can be accessed and controlled by different accounts, and can, therefore, be shared by multiple users (OryLab n.d.). Several versions and prototypes have been made prior to how the OriHime is designed at the moment:

> *"The first version was a telepresence device, where there was a smartphone on the top of the body. Many people did not use it. People at hospitals and home feel irritation to show their own face. Because you have to show your room, you have to clean it up and wear suits, makeup and setting the hair. On the other hand, do we want to see the person's face? It not necessary when we talk on the phone - we can imagine the other person when you are talking-"*
> - Kentaro Yoshifuj (Ory), 18.03.2019

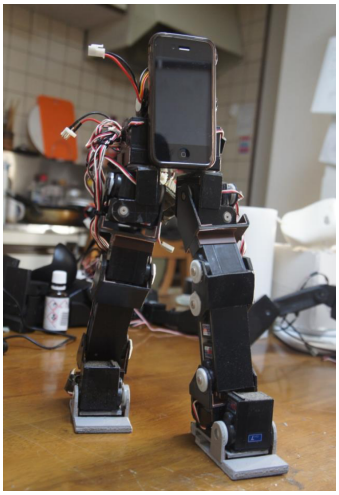

Figure 9: The first version of OriHime. Courtesy of Ory who posted it on Twitter (Yoshifuj 2019)

The latest version of the OriHime is not able to move around itself and is placed on a table or tripod. Its appearance is based on the traditional white 'Noh mask' (能 *Nō*):

2.5 Changes in the VTV

In this section, we will describe changes in the VTV that have been made in the translation by Jun Yamaguchi, when bringing it to Japan. They have been made, in order to translate it and for it to correspond to the welfare system in Japan. The name of the assessment itself has been changed. The VTV is not translated to Welfare Technology Assessment but instead renamed to Assistive Technology Assessment Tool (ATAT). As welfare technology only relates to the elderly people in Japan, the term assistive incorporate a wider spectrum of technologies.

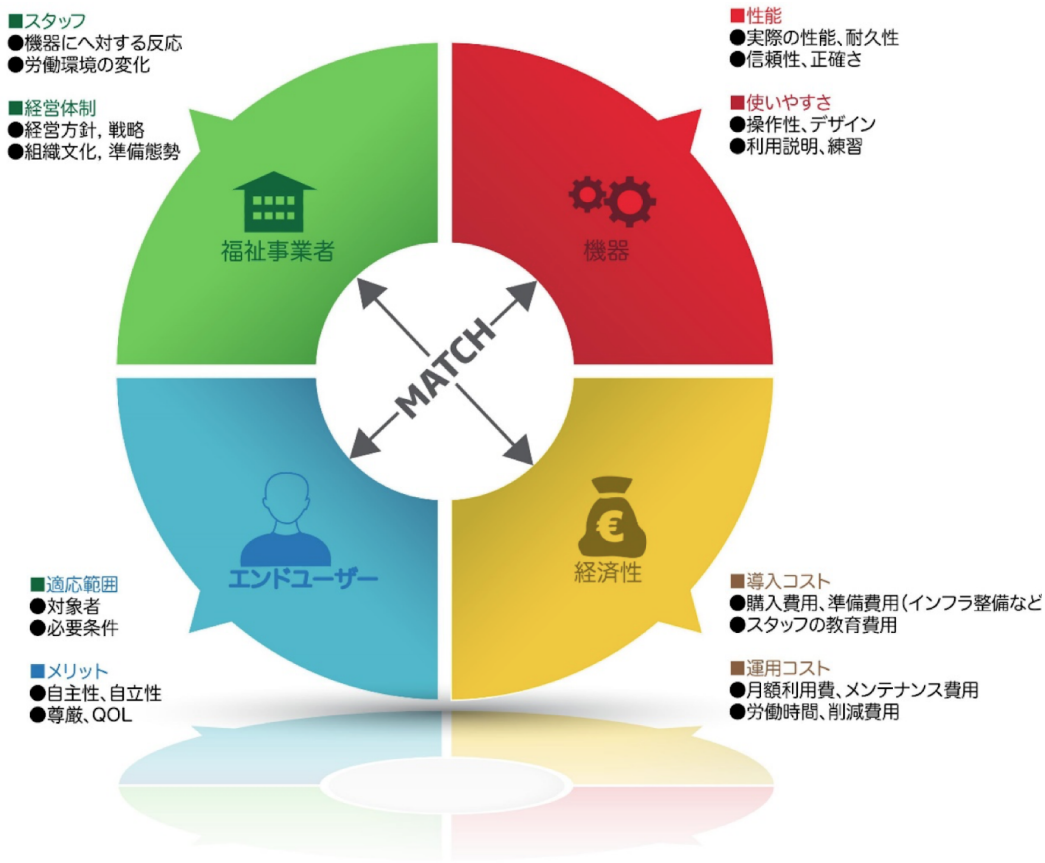

Figure 10: Illustration of the ATAT in Japanese (AIST 2019, p. 8)

Jun told us that he had made the following changes when bringing it to a Japanese context:

Organization to Welfare Entity

The category ‘organization’ in the VTV, is changed to ‘welfare entity’. This is done so the ATAT matches the many different entities that provide welfare service in Japan. In Denmark welfare is distributed by the state, and the municipalities choose the services. But in Japan, the service is distributed by many different profitable or non-profit providers. These include nursery homes, day activity centers and a culture of informal care.

> “*VTV is useful for municipalities in Denmark, which has the commission to decide their service contents. But in Japan, (and other non-Nordic countries) has a more*

centralized policy and the stakeholders providing welfare technology are unclear." - Jun Yamaguchi

The ATAT is seen as an applicable tool, not only for assessing the technologies working in a welfare system provided by a government, but also private companies and homes.

Citizen to End-user

The category 'citizen' is changed to 'end-user'. This change is also related to how the VTV moves away from the public sector, and into a welfare system with more private service providers. This can make it more complicated to assess from parameters related to improving welfare service to the citizens, and it can also be argued that the term user is based on a presumption that the person is using a technology rather than a welfare service.

From economy being about saving money to making money

Although Jun did not mention it, we find differences in how economy is thought. As the technology might be provided in a privatized system, where some service providers depend on profits rather than achieving political goals. This can potentially lead to a re-focus of the economic perspective. Jun's translation of the VTV has not changed it per se, but it can potentially mean that economy is framed as a business case that can make a profit, rather than saving resources or allocating them in a different way within the welfare system.

The changes in the VTV making it to the ATAT are kept at a minimum, to make it possible for everybody to use the ATAT and compare their results:

"*The category names and the smaller category names should be the same in any society and any country. Because then other people can compare the results with others. I want to keep the VTV as it is*." - Jun Yamaguchi

But we experienced that the changes in the context and perception of technologies and welfare are comprehensive in a Japanese context compared to a Danish. We will unfold how the VTV confronted these differences in the thesis.

Chapter 3

Theory and methods

In the process of making this thesis, we have applied different approaches and concepts within Science, Technology and Society studies (STS). Our approach to the field has been two folded, and therefore we have been looking for theoretical approaches to both understand the implementation of the ATAT including stakeholders' interests in using it, and to understand the specific communication robots we conducted the ATATs of. We found it difficult to draw a line of where the two approaches were separated, and in hindsight, they have been overlapping throughout the research. At the beginning of the project, we thought that we neatly would separate researching the stakeholders' view on ATAT, from experimenting with the ATAT by applying it to two cases. But this separated approach quickly became intertwined, for example when our gatekeeper and informant Jun Yamaguchi's interests in the ATAT, became most apparent when he was helping us to conduct the ATAT in practice.

3.1 Theoretical framework

We have been inspired by different approaches from STS, in order to understand the complexities of bringing the VTV to Japan, and perceive technological development as socio-technical arrangements and hereby grasp more of the complexity regarding care robots in Japan, than the four different categories in the VTV could provide us with.

We found inspiration in the chapter 'A contemporary framework for assessing welfare technology' by Børsen et al. (forthcoming), which explores the possibility of re-thinking the VTV to a techno-anthropological understanding and approaches within STS.

The approaches of STS have affected how we conducted the ATATs during our fieldwork in Japan, to understand the field as a whole, and to analyze how the ATAT is perceived in a Japanese context. We will in the following describe our theoretical sources of inspiration and explain how we applied them.

3.1.1 SCOT

We found Social Construction of Technology (SCOT) (Pinch & Bijker 1987 [1984]) relevant, as it offers an analytical perspective of different social groups' interests and interpretations of technology. This is similar to the aim in the VTV, but the VTV model locks down a series of stakeholders in which it argues, they are relevant in relation to welfare technology, and thereby provides a fixed overview. Thus, the VTV might oversee stakeholders in some situations in a Japanese context. Further, we saw potential in using SCOT to research relevant stakeholders' interests and perceptions on the ATAT.

SCOT offers a 'multi-directional' model in contrast to a linear approach to conceptualize how innovation and development of technology occur (Pinch & Bijker 1984, p. 411). The British sociologist, Trevor Pinch, and the Dutch professor of Technology and Society, Wiebe Bijker, exemplify the multi-directional model by considering the development of the bicycle. Here, they explain how 'relevant social groups' interpret the bicycle in different ways, and how this has an effect on the bicycle's development (ibid., pp. 411-419).

The concept, relevant social groups, covers institutions, organizations, and both organized and unorganized groups of individuals. The members in these groups share the same set of meanings to a specific artefact for being called a relevant social group (ibid., p. 414).

The theoretical term 'interpretative flexibility', refers to how technologies are socially constructed and interpreted, resulting in social groups advocating for versions that suit their interpretations of what the technology should be able to do (ibid., p. 421). Eventually, the technology will enter a stage of 'closure and stabilization', where the social groups have shaped the technology so it no longer results in open contestation (ibid., p. 424).

The conception of SCOT is relevant for understanding stakeholders' perception on welfare technology and the VTV, as it emphasizes how the development of an artefact shaped by many different stakeholders can lead to many different versions (Børsen et al. forthcoming, p. 1). The focus shift from being on the artefact itself and underpins how technology does not have an essence determining its final form, nor that the result relies on a genius inventor solely creating the success (ibid).

Further, we saw a potential for using SCOT to see how the problems were framed by the social relevant groups on a larger level. Pinch and Bijker also mention the term 'the wider context', which is about "*to relate the content of the technological artefact to the wider sociopolitical milieu*" (Pinch & Bijker 1984, p. 428). The idea of analyzing the wider context is to show how the sociopolitical situation shapes relevant social groups' norms and values, which affect their interpretation of the technological artefact (ibid.).

In our analysis, the wider context plays a central role, thus we are drawing attention to how the development and introduction of nursing care robots are entangled in the Japanese government's promotion of them. We find SCOT to be insufficient to shed light on this, and the theory has also been criticized for giving the wider context too little attention and thereby neglect the structural perspective (Klein & Kleinman 2002). Pinch and Bijker have also acknowledged and participated in this critique (Pinch 1996 in Klein & Kleinman 2002, p. 30). In 1995, Bijker added a new main concept to SCOT called 'the technological frame', that structures the interactions of the individuals belonging to a relevant social group (Bijker 1995, p. 123). The technological frame is the social group's common interpretation of an artefact, and can include;

> "*goals, key problems, problem-solving strategies (heuristics), requirements to be met by problem solutions, current theories, tacit knowledge, testing procedures, and design methods and criteria*" (Bijker 1995, p. 123).

The introduction of the concept of the technological frame is according to Klein & Kleinman an important move for SCOT to make its research programme more structural oriented since it explains why certain actions among social groups are encouraged, while other actions are discouraged. Nevertheless, Klein & Kleinman do not think SCOT has enough structural considerations due to the research programme's missing attention to the power asymmetry between relevant social groups. Hereby, a focus on why some social groups' opinions have more relevance in the technology development than others, not to forget those social groups who have no voice at all, is a critique point of SCOT (Klein & Kleinman 2002, p. 34).

In order to achieve more reflexivity about the complicated relations between the social groups, we have turned our analytical and methodological eye towards 'situational analysis' (Clarke 2005). It must be said that this analytical and methodological move will not function

as a way to give hidden groups in our empirical data a voice, but instead contribute with reflexivity about our data related to the integration of the ATAT.

3.1.2 Situational Analysis

To navigate in the complexity of the field with different STS approaches, we have been inspired by Adele Clarke's analytical approach and methodologies of 'situational analysis' (2005), from where we decided to use maps as a way to process and analyze our data.

Clarke finds her epistemological background in grounded theory that is "*an abductive approach in which the analyst tacks back and forth between the empirical materials and conceptual means of expressing them*" (Clarke & Leigh Star 2008, p. 117). Because of this, the framework of situational analysis is attentive to that theory and methods operate as a package in which they are both co-constitutive: "*Method, then, is not the servant of theory: method actually grounds theory*" (Jenks 1995, p. 12 in Clarke & Leigh Star 2008, p. 117). Clarke's aim of introducing situational analysis is to enlarge and take grounded theory around the postmodern turn (Clarke 2005). The reason to do this is her critique of grounded theory of representing the field as too plain and simple resulting in objective representations of the field:

> *"Shifting from assumptions and representational strategies of simplifying normativities and homogeneity to complexities, differences, and heterogeneities*" (Clarke 2005, p. 19).

In this shift, Clarke emphasizes the importance of representing differences and complexities. The methodology of situational analysis consists of making maps to represent the field's messiness. By making maps, Clarke hopes researchers will "*analyze a particular situation of interest through the specification, re-representation, and subsequent examination of the most salient elements in that situation and their relations*" (Clarke 2005, p. 29).

We decided to construct maps on the basis of our empirical data and literature we had read to understand the most salient elements involved in our field of study. Hereby, constructing maps have functioned to process and analyze our data, by helping us to navigate in the large amount of varied empirical data containing discourses, materiality and our own position and presumptions of the field.

Clarke presents three types of maps, the researcher can use to make a situational analysis; situational maps, social worlds/arenas maps and positional maps. We have found inspiration in situational maps, where "*all actors (individual or collective) and actants (elements, bodies, discourses) are mapped and then their relationships to each other analysed.*" (Mathar 2008, p. 5). Further, we have also been inspired by social worlds/arenas map to "*elucidate which social worlds and subworlds or segments come together in a particular arena and why*" (Clarke 2005, p. 110 in Mathar 2008, p. 9). We found inspiration in this type of map to understand the broader field of interests, interactions and complicated relations among social worlds (ibid., p. 11). To better understand Clarke's situational analysis, we will introduce two concepts; 'social worlds' and 'social arenas'.

Social worlds are *'*universes of discourses', meaning; "*groups with shared commitments to certain activities, sharing resources of many kinds to achieve their goals and building shared ideologies about how to go about their business*" (Clarke & Leigh Star 2008, p. 115). In this sense, the concept of social world goes beyond the sociological classification of how groups of people are normally highly bounded in e.g. organizations and institutions. Instead, social worlds are "*more open, fluidly bounded, yet discourse-based forms of collective action. Analysis must take into account more problematically bounded and contingent discursive as well as organizational arrangements*" (Clarke 1991 in Clarke & Leigh Star 2008, pp. 116-117).

Social arenas consist of several social worlds that are organized around "*issues of mutual concern and commitment to action*" (Clarke & Leigh Star 2008, p. 113). Therefore, many interests and viewpoints from various social worlds do exist in social arenas. While a social world is a fluidly bounded group of people with shared commitments to certain activities, a social arena is a political space, where various worlds intersect. Thus, we have in our analysis both been engaged with studying the different social worlds views, and the political agendas characterizing the social arena.

Constructing the maps has been an ongoing process, where we have developed different versions of maps pointing in different directions. One central point when making these maps is that they are not representing any objective truth of the field, since these maps contain constructivist elements and are an analysis based on our research of a situation, which is dynamic and changeable:

> "*The conditional elements of the situation need to be specified in the analysis of the situation itself as they are constitutive of it, not merely surrounding it or framing it or contributing to it. They are it. Ultimately, what structures and conditions any situation is an empirical question—or set of analytic questions*" (Clarke & Leigh Star 2008, p. 128).

The elements, the maps contain are unique for this situational analysis, and the maps would look differently if time and space were changed.[10] We have not only constructed the maps with this approach, but the maps have also guided us in constructing our project design.

3.1.3 Boundary object

By using boundary object as an analytical concept, our aim is to shed light on the complexities of the ATAT, when various social worlds with different views have to collaborate. The intention is to obtain an understanding of how the ATAT is perceived by different social worlds, including the values and challenges the social worlds attribute to it. We find the concept, boundary object, particularly interesting, as it fits well with how we experienced the VTV in Denmark. By using boundary object, we seek to understand if the ATAT is able to exist in many different formats and conducted by people with different professions and interests.

Susan Leigh Star and James Griesemer study how heterogeneity and cooperation coexist between social worlds at the Museum of Vertebrate Zoology at the University of Berkeley in their article from 1989. They argue that science requires cooperation between different social worlds, but they emphasize that "*consensus is not necessary for cooperation nor for the successful conduct of work*" (Griesemer & Leigh Star 1989, p. 388). Because of this, they suggest modification of the interessement process described by Michel Callon (1986), since they see it as being too funneling for studying how actors have to obtain consensus by moving through a narrow passage point (Griesemer & Leigh Star 1989, pp. 388,390). Besides, Griesemer and Leigh Star do not think that the interessement can be understood from a single viewpoint, because "*entrepreneurs from more than one social world are trying to conduct such translation simultaneously*" (Griesemer & Leigh Star 1989, p. 389). Hereby,

[10] See an example of our maps in Appendix 4

they advocate for a more ecological approach, which does not have an epistemological assumption that any viewpoint should be more dominating than other viewpoints (ibid.). Griesemer and Leigh Star present two central activities that are essential for the cooperation between the social worlds' heterogeneous viewpoints; standardization of methods and boundary objects (Griesemer & Leigh Star 1989), where we will concentrate on the last mentioned concept:

> "*Boundary objects are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites*" (Griesemer & Leigh Star 1989, p. 393).

Boundary objects are able to gather intersecting social worlds by being recognizable in these worlds, and allows that various social worlds to meet in a social arena of mutual concern (ibid.). Here, the social worlds can cooperate without it is a demand for them to obtain consensus. Griesemer and Leigh Star identify different boundary objects in their study; specimens, field notes, museums and maps (ibid., p. 408). Besides, they define four types of boundary objects; repositories, ideal types, coincident boundaries and standardized forms (ibid., pp. 410-411). In our analysis of the ATAT as a boundary object in chapter 6, we will elaborate on how the VTV can be seen in the light of two of these types of boundary objects.

Although we have been studying a boundary object from various viewpoints, we have not been able to study those viewpoints equally, since Jun has been our gatekeeper (ibid., p. 396). Jun has made many of the appointments with stakeholder for us, been our most used translator and sparring partner. Therefore, our collaboration with Jun has indeed affected our research and our perception of the different social worlds intersecting the boundary object as the ATAT constitute. In the next section, we will elaborate on our methodological reflections from our research in Japan, where we will start reflecting upon our collaboration with Jun.

3.2 Methodological framework

In this section, we will describe and reflect about the ethnographic methods, we have used during our research. To get an overview of our empirical material and the informants we have talked with, see Appendix 3.

3.2.1 The collaboration with the 'entrepreneur' Jun Yamaguchi

Jun invested a lot of time to help and guide us during our research. We had many conversations with him about his visions of taking the VTV to Japan, the political agendas of promoting the development and introduction of care robots, and about the complex health care system in Japan. Besides, Jun used his network to set-up interview appointments for us and even participated in these interviews as our translator. In return, we offered to make an ATAT on OriHime (Appendix 2) and to share our master thesis with him, which Jun can use to show stakeholders finding the ATAT approach interesting.

The entrepreneur

When understanding the ATAT as a boundary object consisting of different intersecting social worlds, Jun and Yasuko Akutsu from MT Healthcare Design Research Inc. can be described as 'entrepreneurs'. In relation to the social world theory, we describe them with this term as they are; "*deeply committed and active individuals (Becker, 1963), cluster around the core of the world and mobilize those around them*" (Clarke & Leigh Star 2008, p. 118). By saying this, we want to clarify that Jun surely had interests in play, when helping us throughout our research. When setting interviews appointments up for us and participating as a translator in the interviews, Jun got the chance at the end of the interviews to mobilize stakeholders by spreading his word about his visions of using the ATAT in Japan and making a platform, where stakeholders will have the possibility to exchange information about assistive technologies.

Using an informant as translator and interpreter

Jun has been indispensable for conducting this research, but he has also resulted in methodological challenges and many reflections about his active role. We are aware of that working with a translator affect the empirical data. Especially, between two distinctive cultures, the perfect equivalence between concepts will be lost in translation (Bujra 2006, p. 176). But it was essential for us to use a translator, because of the fact, that only a few Japanese people are speaking fluently English. Jun did not receive any money for being our

translator but did it because of his own interests. We have been reflective about using Jun as a translator, because of his stakes in the arena we aim to study. We talked with him about this and said that we would prefer if he could as much as possible translate directly what the informants say without adding his own opinion. Our intention with telling him this was to avoid that he would interpret what was being said, on the basis of his own point of view. Jun did that very well, by saying explicit, if he wanted to add his own opinion or interpretation of what was being said. Even though Jun strived to translate the interviews as neutral as possible, we are aware that his political position in the arena might affect his translations (ibid., p. 175). The anthropologist Janet Bujra (2006) is discussing this issue:

> "*Translators are not simple ciphers without political or social views of their own. They may find it hard not to betray this in their translations, presenting one side's position with more conviction and elaboration than the other, or even contradicting the accounts that are given in order to present their own opinions. More generally, it is common for the translators to 'filter out' what they consider unimportant, even though this might be precisely what the researcher needs and wishes to know*" (Bujra 2006, p. 176).

Jun might implicit have influenced our data collection by his translations, and since the informants knew that Jun was advocating for integrating the ATAT in Japan, they might have struggled with criticizing it in front of him. But Jun has indeed affected our view of the field by his explicit opinions too, while he was not acting as our translator. After our interviews, we went to the closest coffee shop to debrief the interview, and here Jun could express his own opinions and interpret the meaning of some aspects from the interview. Jun was definitely more than being our translator of language, he was also our interpreter of cultural meaning (Bujra 2006, p. 175). He could explain with his cultural understanding, why people acted and said as they do, and how they are in relation to other stakeholders etc. Jun contributed with a lot of background information making us understand the field a lot better, thus he became a key informant in our research.

Reflections about using the empirical data from Jun

These reflections about Jun's role in our research, have made us discuss how we wanted to use our empirical data coming from him. We want to make it clear here, that we have no intention to use Jun's statements as general truths. Therefore, when we are explicit using

Jun's statements, these statements are representing Jun's own perception and opinion. Nevertheless, Jun's involvement and knowledge about our field of study, makes him a central informant in our study, because he possesses knowledge coming from an insider's perspective. Jun has pointed us in many directions in relation to our analytical focus, but we have strived to be critical towards this because his views do only constitute a part of the social arena we are studying.

3.2.2 Our position and roles in the field

During our fieldwork, we have been allocated many different roles. These roles have made us able to enter the field in different ways, but also affecting our position. We will now explain the central roles we were given in the field that had an impact on our position in the field.

Danes & VTV experts

Early in our fieldwork, we noticed that literally almost all our informants that were interested in the ATAT had visited Denmark in relation to their job. Many of our informants had a positive relation to Denmark and found an interest in us for being able to learn more about Denmark.

The company Laere[11], who are running AIST Design school, finds inspiration in Denmark. Jun was inspired by Denmark, and had lived there for a period of his life. And Akiko obviously affiliated to Denmark, as she was working at the Danish embassy. Jun, Laere and Akiko were our primary contacts, who helped us by reaching out in their network. This means that comparing Denmark and Japan became a central focus in many interviews. It was to some extend difficult to shed light on how things in Denmark were not always perfect, since Denmark was perceived as an inspiration in many different ways e.g. as a place where there is room for differences, have short working hours, one of the happiest countries in the world, the super welfare state, learn how to think for ourselves at a young age and as a tolerant society (Forbes Japan 2018). The focus on comparing Denmark and Japan was undeniable affecting our position as we represented Denmark, and sometimes the comparison became characterized and stereotypical in order to understand each other.

[11] Laere is named after the Danish word 'Lære' meaning: Teacher

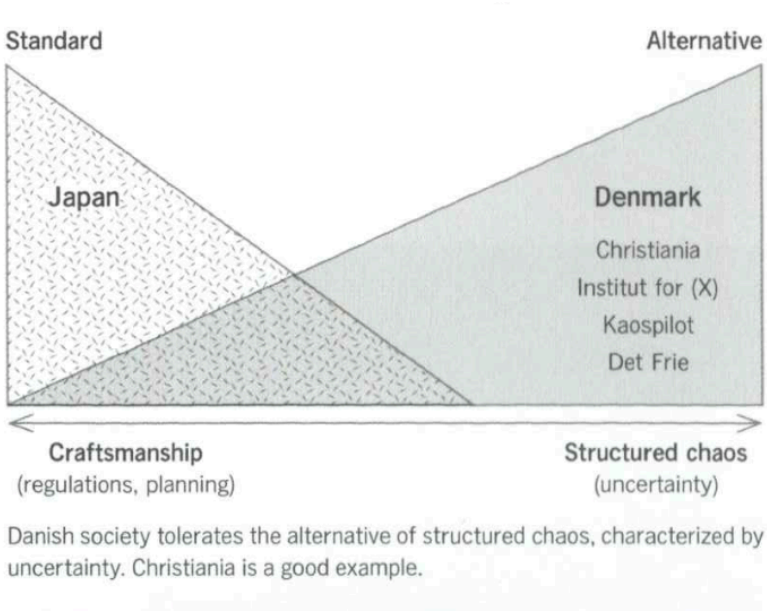

Figure 11: Example of how Denmark and Japan are compared in the book 'Workmill: The Danish Way' by Forbes. We received an English translated version by Laere (Forbes Japan 2018, p. 101)

We were often seen as experts in the Danish welfare system and in the VTV, thus we were asked to tell about the VTV and the Danish welfare society during many of our interviews. We were also invited to present our project and the ideas of the VTV and how we in Denmark try to involve citizens in the development and assessment of welfare technologies. This happened twice during our fieldwork; at AIST Design School and at a seminar organized by MT Healthcare Research Design Inc. The role of Danes and VTV experts made us responsible for showing the Danish way to do things. This became apparent when we facilitated the two workshops after our presentations at AIST Design School and at the seminar. We were not only using valuable time of engineers and other stakeholders to generate data, but also demonstrating an example of a Danish method. When we visited AIST Design school, we used this opportunity to ask into how the students coming from AIST and the companies Panasonic and Hitachi use what they learn about user involvement from the design school in their daily work, what they see as the biggest challenges of doing user involvement in Japan, and what they think about the ATAT. Here, we could feel the cultural differences of having such a joint discussion. The participants felt shy and needed to be asked directly, before saying anything. It may be since they were feeling uncomfortable with speaking English.

Figure 12: Group picture after the presentation for students at AIST Design School

At the seminar organized by MT Healthcare Design Research Inc. we again presented the idea of the VTV, and afterwards we facilitated a workshop, where the participants were separated into groups depending on their profession. This time, we had prepared four questions about their attitudes towards the ATAT on two A3 sheets to give them the opportunity to write their answers. We had prepared to facilitate the workshop in this way, because of our previous experiences from the first joint discussion at AIST Design School.

Figure 13: Picture from the workshop, where participants are discussing in the groups they were divided into

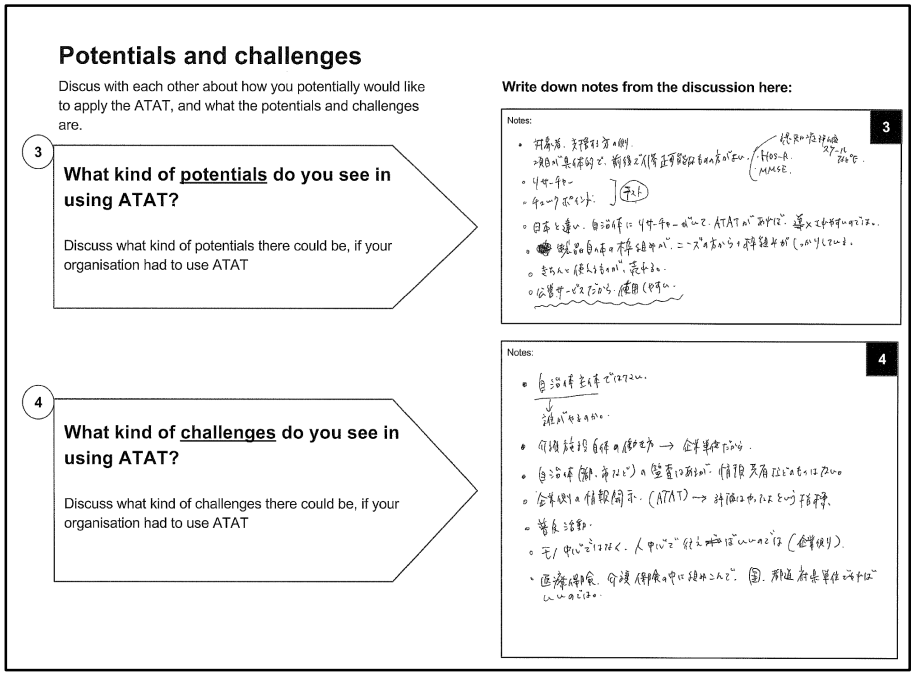

Figure 14: Example of an answer from the group discussion, they wrote it on the paper with discussion subjects, that we handed out to each group

ATAT evaluators

We were also given the role of making an ATAT of both Palro and OriHime, which determined our position. This gave us an opportunity to speak with stakeholders (end-users, manufacturers and representatives from the welfare entity) related to these two cases, and to get a better understanding of the challenges when applying the methodology of the ATAT in practice. This made it possible to challenge our own and potential users of the ATAT assumptions of the assessment model. We will elaborate on our findings from experimenting with the ATAT in practice in chapter 7.

Techno-anthropologists

The informants we were in touch with during our research in Japan, had a big interest in our academic background in Techno-Anthropology. Especially, the anthropological methods were considered with big admiration. Jun often asked with interest, how we as anthropologists understood aspects from our interviews and was curious about how we would tackle different situations such as observing an OriHime user working at a bookstore. Sometimes we considered it as he expected that we almost had a kind of extraordinary skills to do things differently according to or academic background. Also, the employees from Laere had a big interest in our methodology as techno-anthropologists. They had a big desire

to hear about, how we through our education had worked with 'problem based learning'[12], qualitative methods and user involvement. The informants' interest in how we as techno-anthropologist operate, made us able to experiment with our familiar methodology in an unfamiliar context, which provided us with insights about the application of the ATAT that is to some extent based on the same methodology.

3.2.3 Participatory observations

Our time in Japan has been compressed, therefore we have been focusing on getting in dialogue with many stakeholders at different sites, rather than spending the whole month at the same location. With our mapping approach and inspiration of SCOT, we did not define who could be relevant to talk with from the beginning, which we also were hindered in due to our limited knowledge and relation to Japan. We have been inspired by the method from SCOT called 'roll a snowball' to identify the relevant stakeholders (Bijker 1995, p. 46 in Klein & Kleinman 2002, p. 32). Jun, and Akiko from the Danish Embassy identified relevant informants and helped with setting interviews up for us. Sometimes the informants pointed to new persons that they thought was relevant for us to talk with. After about two weeks in Japan, people started to refer to those we had already got in touch with.

By rolling a snowball during our fieldwork in Japan, means that we have not made participatory observations in a traditional way, where we have spent a long time at the same location with the same informants to build a relationship of trust for making our presence a more natural part of the field (Bernard 2011, p. 370). Nevertheless, as we have described above, our position in the field was determined by the role we were given. Through our position as either Danes, VTV experts, ATAT evaluators or techno-anthropologists, we became a natural part of the field, where we got access to make participatory observations in both formal and more relaxed settings. During our participation in interviews, meetings, workshops and visits to care facility centers, we have followed James Spradley's notion on the importance to be aware of three elements, when making observations; the space, actors and activities (Spradley 1980, pp. 39-41). Our participatory observations have contributed to a better understanding of the attitudes to assessment of assistive technologies among stakeholders since we have noticed their mutual discussions and arguments, while debating

[12] Problem based learning is an approach from Aalborg University, where the students are making a project independently with supervision from an associate professor. The projects are based on solving problems from actual situations (Aalborg University n.d.)

the topic. This has provided different empirical insights compared to our qualitative interviews, where only us, and a couple of informants, possessing the same persuasion, could discuss our prepared questions. The qualitative interview has definitely also some strengths, which we will explain in the next section.

3.2.4 Qualitative interviews

Most of our empirical data is based on qualitative interviews with stakeholders relevant for our analytical focus on assessment of assistive technologies, the Japanese health care system and the cases of Palro and OriHime.[13]

In our qualitative interviews, we have used the semi-structured format (Brinkmann & Tanggaard 2015, pp. 37-38) to prepare questions for some analytical themes we wanted to get covered in the interviews, while being open for, if the interview could contribute with new inputs that could form our analytical focus in the further process. In the start of the interviews, we had prepared grand tour questions (Spradley 1979, p. 50) to get descriptive explanations of their daily work and the visions they are striving for. To supplement these questions, we were following up with more direct questions (Bernard 2011, p. 212) to get answers on details we found interesting to dig deeper into. Some of our informal interviews were conducted without a prepared interview guide since we met some stakeholders by coincidence e.g. to a symposium called 'Symposium for human resource development for utilization of nursing care robots' held in Tokyo, where manufacturers demonstrated their new robot care devices. Here, we had the chance to talk with two senior researchers from AIST and a representative from Fujisoft providing information about Palro. In such situations, we had to improvise and formulate the questions in the moment, and because of this, these situations functioned as relatively unstructured interviews. They were not completely unstructured since our questions were still based on our analytical curiosity (Brinkmann & Tanggaard 2015, pp. 34-35). We combined the interviews with observations, and to remember the observations, we had a focus on writing fieldnotes during our research. Our use of this method will we elaborate on in the next section.

[13] See description of informants in Appendix 3

3.2.5 Writing fieldnotes

Writing fieldnotes has been an activity, we have highly prioritized during our research in Japan. When being in the field, we have written fieldnotes in two different ways depending on the situation: Since a lot of our interviews took place in a formal setting, we felt in these situations that it was acceptable to act as a researcher taking notes on either paper or the computer. In these interviews, we divided the roles between us, so one of us wrote notes, while the other one had the responsibility of facilitating the interview.
In situations, where the interview setting was more relaxed or while we were making observations, we only scratched some notes down in our notebooks. We did it to remember important details, without losing our attention to the conversation or observation: "*Fieldnotes get in the way. They interfere with what fieldwork is all about - the doing*" (Sanjek 1990, p. 96). When taking scratch notes, we were aware of writing them out to fieldnotes preferably the same day: "*The scratch-notes-to-descriptive-fieldnotes writing act must be timely, before the scratches get 'cold'*" (Sanjek 1990, p. 97). We did this during our time in transportation, which we used a couple of hours on each day in the area of Tokyo, or back in our apartment if the trains had been too overcrowded to sit with the computer on the lap. The transformation from scratch notes to fieldnotes was a process, where we enlarged and interpreted our jottings into fieldnotes (ibid.). This is in line with what Clifford Geertz thinks the job of the ethnographer is: "*What does the ethnographer do? - he writes*" (Geertz 1973, p. 19 in Sanjek 1990, p. 95). Geertz emphasizes that it is through the writing of 'thick descriptions', the ethnographer makes her interpretation of the collected data in order to search for understanding. In this sense, data is never raw, since they are constructions of other people's deconstructions (Sjørslev 2015, pp. 127-129).

In the next section, we will explain how we processed our empirical data in order to provide transparency of how our analysis has been established.

3.2.6 Analyzing the empirical material

Returning from our fieldwork in Japan, we had already a good idea of which direction our analysis should go in. After spending a month together in Tokyo in an apartment smaller than a Danish prison cell, we had thoroughly discussed our collected empirical material during the fieldwork. After an ended interview, we talked about whether it provided us with new insights or that it confirmed what we had heard from other stakeholders. In our preparation of

interview guides to a coming interview, we discussed the output we found interesting to get from it and prepared our question in line with this. Thereby, our analytical focus evolved during our fieldwork due to what we found central to pursue.

The first thing we did, after coming back to Denmark, was to make a corpus of our analysis. We made an outline for each chapter, which surely has changed during our writing, where we have continuously moved back and forth our empirical data and theories to explain the data with. Since we had 23 hours recorded interview material, plenty of pages with fieldnotes, recorded videos from interviews, workshops and observations, we decided that it would be too overwhelming to make full transcriptions, and thereafter discover salient patterns. Therefore, we chose to revisit the empirical material and code it on the basis of the corpus we had already constructed. We wrote notes and central quotes down, while inserted timestamps, so we could find the passages quickly again. Our analysis cannot be seen as an isolated activity after our fieldwork was ended since it has been an ongoing process already started during our data collection. This is in line with our inspiration in grounded theory, including situational analysis.

Chapter 4

Political entanglements of providing care with robots in Japan's ageing society

This chapter will provide an understanding about the political entanglements, the ATAT has to relate to. We will show how the Ministry of Economy, Industry and Trade (METI) is involved in developing robots and promoting a narrative about robots being the solution for the lack of workforce in an ageing society.

We discovered that the government's strategies were seen as an important backdrop to the ATAT. When the ATAT is brought to Japan, it is seen as an alternative that can challenge the strategies and narrative from the government, who are trying to implement robots in the care sector from a top-down approach. We will start by shedding light on the prominent role that the robots are given through state initiatives, and then we will give examples from governmental strategies.

4.1 From the industry to the care site

Japan is often referred to as the robot kingdom (Schodt 1988). Since the 1980s robots have been widely applied for manufacturing in the industry of automobiles and electronics (METI 2015, p. 2).

> *"It goes without saying that these industries have played an active role for Japan to usher in an era of Japan as No. 1 driven indeed by the utilization of robots*" (METI 2015, p. 2).

The success in robotics is related to the shift in focus of the Japanese government in the 1970s from traditional heavy industries as automobiles to knowledge-intensive industries. This led to big national companies developing technologies as computer and microelectronics

(Morris-Suzuki 1994, pp. 210-211). *"The ultimate aim, as a MITI report of 1980 put it, was to transform Japan from being 'a nation built on trade' to being 'a nation built on technology"* (Morris-Suzuki 1994, p. 211). This strategy on focusing on advanced technology, led to Japan being home to 60 percent of the world's total population of industrial robots in 1986 (Leeson 2017, p. 34), and Japanese companies were leading in the production of microchips and commercialize high-definition television in the end of the 1980s. In the 1990s, Japan met economic challenges and had some years of decline. Nevertheless, Japan kept its economic superpower in the start of the new millennium, and was still the forerunner on a wide range of technologies such as digital cameras, laptop computers and automation technology as industrial robots. During the 2010s, robots were now used in almost every sector of the Japanese society (ibid., p. 35).

The introduction of robots in non-industrial applications was initiated by a report called 'Technology strategy for creating a 'robot society' in the 21st century' published by the Japan Robot Association (JARA) and Japan Machinery Federation (JMF) in 2001 where they highlighted the future potentials of the robot industry (Wagner 2010, p. 135):

> "*The main message of the report was a recommendation for the Japanese government to promote research and development in the promising field of non-industrial applications of robot technology*" (Wagner 2010, p. 137).

According to Wagner (2010), this report caused a discussion in METI, and on the basis of that, METI recommended promotion for robots targeting everyday life and elderly care (ibid., p. 137). The reason to promote the introduction of so-called 'next generation robots' into these two non-industrial fields, was primarily because of the Japanese government's belief, that they can solve the worldwide demographic challenges and health issues, which will be an enormous profit for the Japanese society and robot industry (Leeson 2017, pp. 35-36).

We will now present how the promotion of robotic devices for nursing care is stated in two governmental documents; the governmental blueprint 'Innovation 25' from 2007 and METI's report from 2015 called 'Japan's Robot Strategy'.

Innovation 25

The Japanese government's promotion of using robotics in nursing care started with the blueprint 'Innovation 25', which was presented by Prime Minister Abe from the conservative Liberal Democratic Party during his first term as Prime Minister in February 2007. This blueprint is setting Japan's strategy until 2025. Described by Jennifer Robertson, it was clear that different fields of society should be optimized by the use of advanced technologies:

> "*According to his vision, industrial robots would accelerate production; household robots would provide elder care and child care and thereby make married life and motherhood more attractive to women; and robotics spin-off ventures would generate employment and profitable investments and exports.*" (Robertson 2018, p.29).

According to Robertson, the Japanese government view robotics as a method to both make the industry more efficient, improve the economy and stabilize the family. The vision is to integrate robots in all branches of society, and by this "*innovation 25 promotes a robot-dependent society and lifestyle that is anzen (safe), anshin (comforting), and benri (convenient)* (Robertson 2018, p.20).

Based on this blueprint, the Japanese government invested € 23,3 billion in the industry of robotics for distribution until 2017. By promoting the robot industry with massive financial support and political attention, it is clear that the development of robots in Japan is a result of the political aim of stabilizing the institutions of the society and solve the demographic changes (Leeson 2017, p. 39).

Japan's Robot Strategy (2015)

The Robot Strategy is made by METI in 2015. It covers a broad spectrum of achievements that should be attained by 2020 and 2025, here among to integrate robots broadly in industries and everyday life, and to enhance Japan's ability to create robots and make Japan the leading robot innovation hub in the world, and showcasing their progress of integrating robots in order to disseminate the new industry to the world. METI equate their strategy with a 'robotic revolution' (METI 2015).

In the report, METI states that before 2020 "*more than 100 cases of support to put medical care-related equipment using robot technology will be implemented*" (METI 2015, p. 64),

therefore METI also aim at improving the appreciation for robots in nursing care (ibid., p. 89). METI wants to increase the percentage of people who wish to use nursing care robots for providing care to 80 % from the current 59,8 %, and increase the percentage of people who wish to have robots used when undergoing care to 80 % from the current 65,1 % (ibid.).

4.2 Care robots as prestige projects

Nobu Ishiguro (2018) has described the incentives for METI of integrating robot care devices in nursing care, based on four care robot discourses she has identified in governmental documents. The first one is the 'workload discourse', which states that robots in nursing care can reduce the physical and mental burdens for care work, which might make care work a more attractive occupation. According to government documents, robots can be a solution to the issue that 70 % of caregivers have a backache. The second is 'quality discourse' that states the care robots will enable elderly people to live more self-dependent which can lead to an increased quality of life. The third is 'robot industry discourse', where METI aims to increase the economic growth in the Japanese robot industry from 16,7 billion yen (€ 134,3 million) in 2012 to 404,3 billion yen (€ 3,3 billion) in 2035. The fourth is 'cost-saving discourses' that states the introduction of care robots will increase efficiency and productivity in nursing care with less caregivers (Ishiguro 2018, pp. 258-259). While the two first discourses deal with the quality of care with focus on both the caregivers and the elderly people receiving care, the two last discourses deal with profit and optimization benefiting the robot industry and Japan as a state. It testifies that METI has ambiguous interests in its promotion of introducing robot devices in nursing care.

METI's strategy for promoting robots is not only to solve the challenges of the ageing population with new robotic innovations, but also to export the advanced technology and utilize their knowledge to the global market:

> *"Furthermore, such new innovation in robotics can be accelerated by setting and striving to reach a specific and integrated goal. Therefore, Japan has a huge potential of honing itself to become global hub of robot innovation by capitalizing on its status as a leading nation of challenges, and as a result, Japan will be able to spread across the world its future-oriented system utilizing robots"* (METI 2015, p. 6).

The robots developed as prestige projects which are difficult for other countries to copy (Wagner 2010, p. 133) is also apparent in the strategy for 'Robot Olympic'. As the Olympic Games are held in Japan in 2020, it is seen as a perfect opportunity to showcase that Japan is leading in integrating robots into everyday life:

> "*By accelerating activities aimed at the realization of the robot revolution and bringing "daily life with robots" to all over the country in the year of the Olympic Games, the state of Japan, where the whole city is integrated with robotic technology, will be shown to the world as a robot showcase*" (METI 2015, p. 48).

It is clear how METI interventions are influencing the way in which care robots are strived to be stabilized. Klein & Kleinman are commenting on how the state's role can influence the development of artifacts:

> "*Economic development grants, provision of credit, and technical advice can all affect the kinds of artifacts (and, indeed, the meanings attributed to them) developed by firms. Policy may allow states to precisely dictate artifact development or may provide a supportive environment for particular kinds of developments*" (Klein & Kleinman 2002, p. 42).

We consider METI as a central stakeholder in the development and introduction of care robots. METI's encouragement of care robots can be seen as a 'technological frame', where they use their political power to structure Japanese stakeholders' strategies and problem-solving, by giving them an economical incitement for developing and implementing care robots. James Wight points to how it is not the Ministry of Labour, Health and Welfare (MLHW) that are initiating the projects to improve care, which one might have expected (Wright 2018, p. 25). Wright argues that there seem to be misalignments between how METI envisions the advanced robots as being able to provide care, and how care is considered at the actual site (ibid., p. 23). Jun also wanted to exemplify the misalignments between caregivers and government officials. When Jun took us to a symposium about care robotics, he wanted us to notice that no caregivers were present, only elderly men in suits. We realized that the ATAT was seen as a way to connect the caregivers and manufactures, and to challenge the action plans and narrative of how robots will be the solution to societal challenges. We will unfold this in chapter 6 where we analyze how the ATAT is envisioned to connect different

stakeholders to share their practical experiences. In the next chapter, we will describe examples of assessments aimed at validating robots for the care sector, by measuring their effect in order to disseminate them in line with the robot strategies from the government.

Chapter 5

Assessment of robots to qualify them in nursing care

In this chapter, we will explain different examples of how assessments of communication robots are perceived and done with the purpose of measuring and proving effect. We will describe how quantitative, evidence-based and standardized methods are thought into many different aspects of developing communication robots and how it is part of political demands for assessments. Then we will exemplify a case of introducing communication robots at a nursing home, where the effect of the robots was measured with funding from the government. We will discuss how such an assessment is related to the conceptions of Technology Assessment described by the philosopher of technology, Armin Grunwald (2009), who has made a thorough description of concepts and methods within the discipline of Technology Assessment. At last, we will describe how the current assessments are insufficient for understanding the communication robots, which results in stakeholders looking for new methods.

5.1 Standardized and evidence-based assessments

By meeting and interviewing stakeholders about their interest in ATAT, we also got an insight into how they currently assess care robots. Common to all of the stakeholders we interviewed, were their emphasis on the importance of evidence and standardized methods. This is related to the government, that use these assessments to determine whether the technologies must be eligible for funding by the national insurance.

> *"When the government give fundings, they need to know the fact of whether the technology is very helpful for actual users and what kinds of situations are helped for the future by using such technology. Therefore, the evaluations need to show statistic data like the percentage of how satisfied they are by using that type of technology. Especially about the functionality such kind of statistic data is needed as a background data. Of course, it is important to know the users' feelings and use*

> *qualitative data that is more detailed but it is important when they show it to the government site, that the evaluations are based on statistical data. The evidence covered by many people of how to use the technology is really important."* - Kiyokuni Goshima, Association of Technical Aids (ATA), 06.03.2019

This quote comes from Kiyokuni Goshima, who is the director of The Association of Technical Aids (ATA). ATA is provided with a budget by the Ministry of Welfare, Labour and Health (MWLH) with the aim of contributing to the advancement of the welfare of elderly people and persons with disabilities, and to promote the safe and effective use of welfare equipment by supporting survey research and clinical evaluations on welfare equipment. According to Goshima, since these assessments constitute a central role in the decision of whether to implement the technology on the nursing care market, where it gets subsidies from the national insurance, it is important they are reliable and generalizable. Additionally, in Japan they do not have CE marking, the products in Europe have to carry according to EU directives that determine the demands of the products in order to protect the consumers against dangerous or harmful products (Dansk Standard n.d. 1). Because of these reasons, the assessments need to be made by centralized governmental organizations that can ensure standardized scientific and generalizable knowledge to approve that the products can be used in nursing care (Goshima, 06.03.2019).

5.2 Safety first

Another aspect regarding assessments of assistive technologies that require standardized methods is the widespread focus on safety in Japan. The focus on safety is one of the highest priorities in the development and introduction of robotic care devices. During our fieldwork, we had a chance to visit the Robot Safety Center in Tsukuba where safety techniques have been developed for robots and verification tests take place. The importance of the safety verification is underlined in the material we received about the Robot Safety Center:

> "*Many service robots that operate with unspecified groups or individuals under various circumstances still have high residual risks because human safety verification methods have not been established. Since we cannot expect full scale dissemination with only private enterprises' approaches, it's imperative to establish verification bodies and testing authorities as well as international standards*" (AIST et al. 2012).

The verification at the facility follows the International Organization of Standardization (ISO) 13482 from 2014 that defines the safety requirements and guidelines for personal care robots. ISO 13482 has the aim of reducing or eliminating hazards associated with the use of robots in human care (ISO 2014), where people and robots are intended to interact side by side.

AIST, who is running the project for developing and introducing care robots in nursing care under the guidance of AMED, is advocating for evidence-based assessments with an emphasis on safety aspects:

> "*Accelerating the development of robotic care equipment and achieving care that improves people's abilities requires strict and repeated safety verification from various angles. AMED assists equipment developers by making available to them a full array of safety verification facilities and devices capable of obtaining more precise data. This includes giving them opportunities to conduct the various kinds of simulation and testing that are needed during development with robots developed to avoid putting strain on actual human bodies*" (AIST & AMED 2016, p. 8).

Before introducing the robots in nursing care, test and simulations are made to verify the robots will not do any damage to any people, property or environment (AIST 2018). The reason for making these closed simulations and test was elaborated by the senior researcher from AIST, Dr. Isamu Kajitani:

> "*We should make more experiments in the laboratory before testing assistive technologies at the care site. The reason is that the products are too new when they are tested at the care site, which means that we do not know how to use them - we need to know more about the robots itself.*" – Dr. Isamu Kajitani, AIST, 13.03.2019

Kajitani expresses a reluctance to test technology at the care site that is too new in its development. This means that only technologies seen as having a complete design are introduced at the care site in order to get the final verification of its functions. To illustrate the development process of robotic care equipment, where there is attention to safety at all stages, AIST and AMED use the V-model. The model is divided into two layers, respectively

'Relationship with humans' and the 'Engineering system' in their attempt to bridge technologies with humans. The following statement shows how they perceive the process, the V-model illustrates:

> "*Our first concern is to clarify the objective-specifically, how to make a robot that benefits 'people' - and then to set about designing and producing a robot that achieves it. From there, the task is to substantiate the robot's effectiveness through the results of efficacy and safety verifications. This process serves as an important mind-set in R&D for robotic care equipment that benefits people*" (AIST & AMED 2016, p. 9).

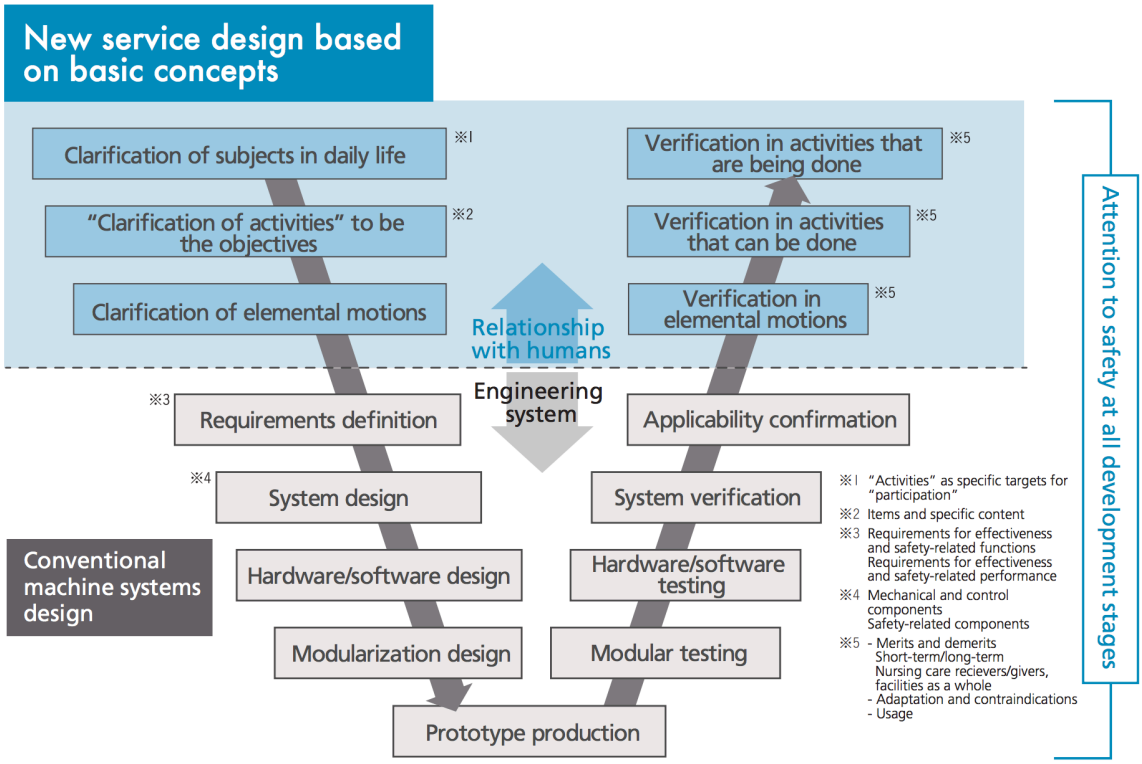

Figure 15: The V-model (AIST & AMED 2016)

By prioritizing the safety aspect through the different development stages, AIST and AMED ensure that the robots will not do any harm when using them. And since the Japanese government has already decided that robots need to be implemented in nursing care, they are after the verification of their relationship with humans approved to be used in the provision of care. The V model depicts how the process of the innovation and development of robotics is conceived in a very linear way. This linear conception aligns with what The Social

Construction of Technology (SCOT) theory challenges. The V-model presents an understanding where the technology is solely developed by the R&D department and then be brought to the care sector where it will work efficiently.

The V-model also sharply divides humans and technical objects. This separation of humans and technical objects closes down the intertwined relationship of how the development of technologies is an ongoing and social process. The SCOT theory exemplifies this with focus on how the interpretation of the technology is flexible, and different social relevant groups might advocate for the construction that fits their interpretation of the technology and the problems it should solve (Pinch & Bijker 1984, pp. 421). In the V-model, technology does only relate to humans in the process of clarification and verification. This shifts the focus from how people can take part in shaping the technology, which would be possible in a process where the technology is not perceived as completely finished and ready to make its impact on society.

In the next section, we will present a case where the assessment focuses on the verification of communication robots, by measuring the impact on elderly people.

5.3 Assessing Palro and Sota to qualify them as robot care devices

We will now present a case describing an assessment of the communication robots Palro and Sota at a nursing facility center in order to exemplify how standardized and evidence-based methods are used to qualify robotics as efficient for nursing care. We visited the nursing home, Tokyo Seishin-kai, located approximately an hour outside Tokyo. Here we discussed how they assessed communication robots, with the director of the care facility centre and president of Universal Accessibility Evaluation Organization (UAEO), Kazuko Obayashi, and Prof. Shigeru Masuyama from Tokyo Medical University. The meeting was arranged because we told Kiyokuni Goshima about our interest in Palro, and he immediately called the facility to hear if we could visit them. As with many other interviews, our prior knowledge of what was going to happen was very limited. Before arriving we were actually expecting to see Palro interacting with the elderly residents, and thought we would have an opportunity to talk with the care staff, in order to gather empirical data for our ATAT. When we entered the facility, we saw Palro in the reception, and immediately thought ‘oh there is the Palro’.

Figure 16: Palro in the reception at the nursery home

Despite our curiosity towards the Palro in the reception, we were brought directly to an office. Palro and another similar communication robot called Sota was placed on the table in the office. There was also a furry pillow with a tail, that purrs and vibrates similar to a cat. In the background of the office, they also had a large figurine of Astro boy; a famous robot cartoon figure that was aired on Fuji TV in 1963 in Japan (Robertson 2018, pp. 1-2). During our visit, we also received a tour of the nursing home. And here we saw how they had posters with news about the use of communication robots at the facility.

Figure 17: ***Left:*** *Discussing their evaluation and ATAT in the office, with Palro and Sota on the table.* ***Right****: Picture from the tour where they presented posters with results from assessments.*

During the interview, they told us that the facility had 16 Palro robots and 16 Sota robots. In addition, 20 sensors to monitor elderlies' bed were installed. Despite the many robots, it was not possible to see them being used with the elderly residents, because they were having a break, in order to compare the effect between use periods and intermediate breaks. Instead, they were willing to discuss the ATAT model and their assessments of robotic care devices and use of robotics at the nursing home.

We were in particular interested in how they assessed the robots, what kind of parameters was considered and why they had decided to buy the robots. We found out that all of the devices were funded with 100% by AMED, because the facility agreed to collaborate in a comprehensive assessment of them. AMED's funding is related to METI's aim of promoting the introduction of robots in nursing care, and define communication robots as a new category of robotic assistive devices. We were handed two articles based on the assessment of the robotic care devices (Kodate et al. 2018; Obayashi 2016). In one of the articles, the assessments' relation to METI and AMED is stated as follows:

> "*In March 2016, a robot-assisted walker was added, for the first time, to the list of reimbursable items under the Long-Term Care Insurance scheme. The list of items is to be expanded in 2017. The Japan Agency for Medical Research and Development (AMED) with support from the Ministry of Economy, Trade and Industry (METI), has been funding pilot studies, which test robots with communication and social support functions for older people. Against such a background, this study was designed in response to one of the research funding calls from AMED, and aimed to investigate whether socially assistive robots can positively influence older people in receipt of nursing care*" (Kodate et al. 2018, p. 1).

At the interview, they told us that the government has introduced 1130 robots in different fields for making assessments like this. In order to assess whether communication robots can contribute to nursing care and have a positive influence, elderly people from five nursing homes have participated in the study. At each nursing home, they used the communication robots Palro and Sota for eight weeks for a Robot Intervention Group (RG), whilst a Control Group (CG) was set up to compare their test results.

To assess the robots, they used WHO's standardized method; International Classification of Function, Disability and Health (ICF) (Kodate et al. 2018, pp. 4-5). WHO describes ICF as an international standard and framework to describe and measure health and disability, with a focus on the context and environment it occurs in (WHO 2018). Five out of seven nursing care goals related to activities and social participation were selected for each person:

> "*For activities and participation, the ICF lists (a) communication, (b) movement, (c) self care, (d) domestic, (e) interpersonal activities, (f) performing tasks in a major life area, and (g) tasks in social and civic life*" (Kodate et al. 2018, pp. 4-5).

They were integrated into the care plan and assessed by the caregivers' observations, based on a standardized 7-point scoring scale. The goals that were chosen to determine improvements on 'quality of life' (QOL) were related to the elderly residents' physical ability and health. An example of how the performance of the robots on self-care was tested, was to assess whether the robotic device had a positive impact on the elderly people's skin care, as the robot can communicate and remind by saying "*Let's wash your face*" or "*Let's do make-up*" (Kodate et al. 2018 1, p. 3).

We discovered that the robots purpose and their effect were framed within a medical and clinical paradigm. When using the parameters from ICF and clinical methods to measure, the QOL became about the functionality and capability of the elderly. In the interview, they also told us that the ICF framework does not enable them to assess feelings and well-being in relation to QOL:

> "*We already knew, that we can evaluate the functionality of life, by using ICF. But it cannot say anything about mentality or feelings. We cannot evaluate this by using ICF.* (...) *We need a new evaluation list, to check such kind of things*." - Prof. Shigeru Masuyama, 15.03.2019

They told us that in the future it might be possible to evaluate this, by using the robots themselves, as they already have sensors that can recognize faces and are connected to the internet. The evaluation could then be done by integrating them in automatic assessments systems based on care plans, that functions with automatic cloud computing. With this integration, it might be possible to monitor and register QOL with the robot itself.

"It is very useful for evaluation because the robots already have monitoring functions and sensors. So of course if a person smile, and lips go up and eyes go like that, it can be registered (Obayashi uses her fingers to point to her face and exemplify how facial expression looks when glad). *In the future, this can be really convenient to use for the evaluation."* - Kazuko Obayashi, 15.03.2019

5.3.1 What should the robots perform?

The results of the studies verify that communication robots improved elderly people's level of activity and social participation according to the chosen ICF items (Kodate et al. 2018). In the article, there is no focus on how the elderlies desire to use it, or how the robot should be improved. There is also no focus on the economic cost of implementation, training of staff or other potential requirements to be aware of if the robots would be implemented. As previously mentioned, the assessment has been funded by METI. If the nursing home themself had to buy Palro, it would cost them a lot of money. The monthly rental for Palro is 30.000 Yen (€ 241) and the sales price is 67.000 Yen (€ 5.385). They also highlighted this as an important point, when talking about economic perspectives:

"One important point is, that this kind of nursery home cannot buy without any support from the government. That is why they definitely need government support and subsidies. (...) The introducing of the robot can improve the quality of life for the user, but this care facility can not earn the money itself." - Kazuko Obayashi 15.03.2019

In order to finance the robots, they need to be on the LTCI scheme in the future. The use and benefits of the communication robots are also highly related to the future as they are not perceived as fully developed. It seems challenging to measure the effect within clinical parameters if the robots are not functioning as finished products. In one of the articles, further development is also addressed in the limitation of the study:

"The development of these SARs (social assistive robots) *is still ongoing, and the conversation engine of the communication robots in particular needs further improvement. Specifically, in order to fulfil interactive components between a human being and the robot, more sophisticated speech analysis ability and accuracy of*

> *understanding language are desired. In terms of AI supported cloud robotics, there are a number of issues to be resolved in the fields of face recognition, verification, and security."* (Kodate et al. 2018, p. 8).

To frame the robots and assessments within a medical and clinical field, where evidence needs to be proven, are perhaps related to METI's desire for verifying the effect of the robots. The assessment is centered on measuring the effect, despite Palro and Sota currently being seen as still in development. Although the assessment relates to the future, it does not focus on how and when it makes sense to use communication robots. Neither does the assessment shed light on the potential consequences of implementing them or the desires for elderly residents and caregivers. The quantification and standardized evidence-based approach leave little room for local knowledge about the caregivers or elderlies that can be used for further improvements of the robots or knowledge about how to use them.

In the next section, we will outline some of the different approaches in Technology Assessment (TA), and how they have developed. We will discuss how the assessments of assistive technologies in Japan, are related to the theoretical conceptions of TA described by Armin Grunwald.

5.4 Conceptions of Technology Assessment

At the moment, there is no consensual definition of what TA is. TA is most commonly used to describe scientifically systematic methods to investigate consequences and conditions by making a societal evaluation of technology (Grunwald 2009 p. 1104). Armin Grunwald describes the main characteristics of TA as following:

> "*What characterises TA is its specific combination of knowledge production (concerning the development, consequences and conditions for implementing technology), the evaluation of this knowledge from a societal perspective, and the recommendations made to politics and society*" (Grunwald 2009 p. 1103).

Under this definition lies different approaches, ranging from determining risk related to the use of a technology, foreseeing consequences, making decision processes more participatory and thereby more legitimate, promoting innovation and making technological conflicts

visible (ibid., p. 1104). This can be done through different concepts and methods. In Japan, we experienced that the view on assessment highly resembles what Armin Grunwald pins down as the 'Classical Technology Assessment', which we will elaborate on the next section. In contrast to DTI's description of the VTV, where it can be read in the title that it is 'a new assessment paradigm for welfare technology' (Teknologisk Institut 2017), and the VTV is not resembling the Classical technology assessment approach. The VTV would be more in line with 'Constructive Technology Assessment' (CTA). CTA is concerned with including a wide range of stakeholders in the design and implementation process, in order to bring forward the social problems that surround the technology (Grunwald 2009, p. 1117).

5.4.1 Japan's classical TA conception

Assessments of robotic assistive devices in Japan is characterized by evaluating the risks and safety of robots in care, and making a quality assurance of the efficiency of the care robots from a perspective on improvements of the elderly people's physical ability and health. High demands are placed to the methodologies that need to be standardized and evidence-based to give a reliable outcome for the political decision-making of whether to introduce the robot in nursing care.

This perception of assessments in Japan seems to be highly linked to a classical field of TA. Grunwald breaks down some elements, that have been apparent in the TA. He argues that there has been a positivistic approach, as classical TA has a positivistic understanding of science. In this sense, the purpose of TA in its classical sense is to provide objective and value-free information about the technology and the outcomes (Grunwald 2009, p. 1114). The idea is that the assessment contains value-free and objective knowledge, that is exact and comprehensible, where recommendation and independent judgement are kept out as it belongs to the political sphere. In the political sphere, the value-free information is evaluated and decisions are made (ibid.). In the classical TA, quantification is highly valued. Grunwald explains that it was expected that quantifying methods could resolve problems with subjectivity in the assessment (ibid., p. 1115). Another characterization of classical TA is that it centers around experts. Experts are expected to be the ones who make advice for politicians. Therefore, this kind of TA is sometimes referred to as expertocratic (Grunwald 2009 p. 1115). The classical field of TA, to some extent, resembles the assessment of robotic assistive technology for the care sector in Japan since this traditional assessment approach is necessary when knowledge is intended to be used in the political sphere.

Searching for new methods to understand communication robots

During our research of communication robots in Japan, we experienced a big interest in how we research and use methods from the VTV and Techno-Anthropology. We experienced that a lot of the informants who worked with communication robots were looking for new methods and ways of thinking, in order to understand the complex relation to humans that the communication robots have. Some of the methods that are currently used to assess, develop and implement technology, that directly substitutes the individual physical functioning loss or to improve a medical condition, becomes insufficient when applied to the complex field of substituting or supporting care workers.

This is also clear in AIST and AMED's presentation of the 'project to promote the development and introduction of robotic devices for nursing care' (AIST & AMED 2016) that the objective of developing and using nursing care robots are more blurred than for instance a walker or a walking cane:

> "*View the purpose and effects of robotic care equipment in terms of its impact on 'people.' Do not simply pursue mechanical performance. Develop and apply nursing care robots with the clear objective of 'making people's lives better.' (...) View robotic care equipment as a physical means of providing 'nursing care that brings improvement.' Nursing care robots are not to be a means for compensating for disability. They are to be positioned within overall nursing care programs that are developed with focus on an interactive relationship with human-provided nursing care*" (AIST & AMED 2016, p. 7).

The search for new methods that can be applied for these complex technologies, was in particular clear during our visit to AIST Design School. AIST Design school is a good example of how qualitative methods and new ways of thinking are attempted to be brought into the field of engineering and robotics. Dr Kohtaro Ohba, the deputy director of 'robot innovation' in AIST, realized what they should teach the engineers at the design school while presenting a humanoid robot to students in Denmark:

> *"I was surprised when giving a presentation in Denmark: When they gave a presentation on a humanoid to the students, none of them showed any interest in the*

technology. Instead, they kept asking about 'why' this humanoid was developed rather than 'how'. "When I give the same presentation to Japanese students, they all show interest in this cutting-edge technology. But not many students have a social perspective. They don't wonder what it is actually for. I realized that this was what we needed to teach people in our design school" - (Ohba in Forbes Japan 2018, p. 62).

At the workshop we facilitated at AIST Design school about their experience of applying qualitative methods in the field of robotics, two engineers expressed the following challenges:

"In AIST we have some projects about assessment of assisting robots, where we evaluate the safety of rehabilitation robots. We did not need qualitative measurements, because we can measure everything such as dynamics and safety. But in this case, we need to measure human emotions, so we need to understand how the human behaves, when they use such kinds of assisting robots, and it is very challenging." - A student from AIST Design School, 08.03.2019

"*So.. I'm a researcher and an engineer, and engineer usually do not use those methods. And AIST is a research institute, so there are many engineers, and it is based on science. They are not used to these methods, so it is challenging to apply qualitative methods for social experiments. It is very important but also very hard to interview. Usually we don't interview users, only small groups such as in the lab or for examining small subjects. So, this is the first time for face to face communication and discussion with many people.*"- A student from AIST Design School, 08.03.2019

Both of them find it hard to apply qualitative methodologies because it is unfamiliar for them to navigate in the abstract field of research that is about 'to understand how the human behaves'. But instead of following another conception of assessing technologies, one of the engineers expressed a willingness to assess the relationship between humans and technologies in a natural scientific way by *measuring* human emotions.

The ambition, as stated by Ohba, to ask why the robots are developed rather than how is not achieved if the engineer or evaluator focuses on measuring the effects. By having this approach, they are continuing with having a focus on the functionality of the specific

technology, instead of understanding the context it is considered to be implemented into, and hereby stay open for reframing the purpose of the technology.

In this chapter, we have given examples of how assessment of communication robots is currently done in Japan. The goal of measuring the effect, is a central bearing in the perspectives of assessment that we have experienced. The central government makes demands of having factual numbers, thus clinical evidence is to be provided when using Palro to improve elderly people's health. Consequently, innovating engineers can find it tempting to measure the effect, rather than reframing the purpose.

The knowledge provided by the assessments is perceived as objective and value-free if they are aligned to standardized and evidence-based methods, although the assessments are highly entangled in the political agenda of promoting them for nursing care. We argue that the accumulation of knowledge provided by assessments of robotic care devices depends on a paradigm that aligns with the Japanese government and in particular METI's strategy of solving the societal challenges with robotics.
The methodologies and conceptions that are part of this paradigm have ventured into a new field, where it becomes difficult to measure and use evidence-based methods. We have experienced how stakeholders are searching for new methods to better understand the humans involved and how to implement the robots in a successful way. This interest and search of methods are also why the VTV comes into the picture. In the next chapter, we will shed light on the stakeholders who are interested in applying the VTV and for what reasons.

Chapter 6

Perceptions on the VTV

This chapter consists of an analysis of the transformation, the VTV undergoes on its journey to Japan, since it has to work among many perspectives and interests that are different from its origin in Denmark.

6.1 The vision of bringing the VTV to Japan

Jun Yamaguchi has previously been working at the Danish Technological Institute (DTI) for 10 months. His job contained of providing the DTI services to Japanese manufactures. After working in Denmark, he started as a senior researcher at the 'robot service department' in AIST. Jun proposed to AIST that they could translate the VTV into Japanese. The translated version was published at the beginning of 2019. The relevance of translating the VTV to Japanese is based on how it offers a different approach than other assessment methodologies that Jun has discovered during his previous research:

> "*I used QUEST: Quebec User Evaluation of Satisfaction with Assistive Technology and PIADS: Psychosocial Impact of Assistive Devices Scale. QUEST is to understand satisfaction. PIADS is to measure the psychological impact of the assisted device.* (...) *I also searched for information about how people make evaluation on assistive technology - I found nothing useful. I also studied how medical evaluations are used. But according to welfare technology, people have different conditions even though they have the same diagnosis. The definition of assistive technology is not to fulfil their functional loss - it was in the past - here it was a more narrow definition. It was just a physical compensation. But nowadays things have changed, and I try to find any methodology or useful experiences. But I could only find medical or engineering perspectives*" - Jun Yamaguchi

Jun found that the existing assessment models were insufficient, as he had experienced, that each case where welfare technology is considered to be used in, is unique. The technologies

were related to more than merely the function or health of the user, and therefore could not only be assessed by measuring and comparing the ability to improve it. Jun explained that the assessment models have been suitable for technologies that can for an example prevent bedsore, as the health effect can be measured with a control group. But he experienced that the technologies today and their effect are more complicated, thus he found a need for alternative methodologies to assess technologies as communication robots.
Jun also realized that data coming from the existing science or medical based assessments did not contribute to decision-making for stakeholders at a decentralized level. Hereby, Jun saw some benefits in the approach of the VTV in contrast to other assessment methodologies:

> *"The VTV is totally different from other assessment methodologies because it is not scientific, it is much more practical - it is for managers to decide to buy technologies for their welfare services as an economic activity."* - Jun Yamaguchi

Jun thinks it is important that stakeholders themselves can make decisions based on their own assessments since technologies and society change fast, thus there is no time to wait on long and bureaucratic decision processes

One of Jun's main intentions with bringing the VTV to Japan is to create a network, where stakeholders use the ATAT to provide knowledge about technologies in different use cases and then share it to the other stakeholders in the network: "*In Japan, the network of sharing results is needed. Even if it is not good results, they can be used to avoid bad decision making.*" - Jun Yamaguchi

We see how the assessment becomes focused on providing a set of methodological tools and categorizations, that are envisioned to bring forward perspectives that are overseen in the development of robotics and other new assistive technologies in Japan.
The ATAT is grounded in the vision of sharing user experiences among a wide range of stakeholders. The sharing of user experiences pre-supposes that stakeholders are willing to collaborate. It is not at this point certain that manufactures, care providers, citizens, caregivers, engineers etc. accept to share the experiences and knowledge they possess.

6.1.1 A tool for bridging various stakeholders

"*The VTV is not something fantastic, I want to connect people*." - Jun Yamaguchi

We argue that the understanding of how the ATAT should function in Japan is not necessarily as an assessment. We experienced that the name caused confusion because it did not align with the strong understanding of what assessment is and should contain. In a Japanese context, Jun perceived the ATAT as a concept that can encourage a certain mindset and methodologies to achieve insight and understanding among social worlds.

In the following, we will analyze the ATAT as a tool that attempts to bridge the distances between manufacturers, government, caregivers, welfare entities, and include more stakeholders in the development and implementation of assistive technologies, despite their different social worlds and perceptions. The ATAT's focus on a wider context of stakeholders, and in particular the methods that are used to research their perspectives and involve them, is important in a Japanese context since a lot of the perspectives of affected stakeholders are not represented in the development and introduction of care robots.

We will start by describing how the involvement of stakeholders in the VTV stems from a line of thinking related to a Danish (and Scandinavian) context. This will contribute with perspectives on how the ATAT in a Japanese context is intended to be a tool for involving various stakeholders.

6.1.2 The aim of involving stakeholders

The approach of the VTV is also a well-known methodology for companies and scholars to get to know about a certain social group of people. In the description of the VTV from the Danish Technological Institute (DTI), methods such as ethnographic interview, participatory observation, focus groups, and personas are mentioned (Teknologisk Institut 2017). Today these methods are widely used by developers/manufactures in order to gain a better understanding of the customers (Hyysalo et al. 2016). Henry G. Weaver that worked at General Motors was probably among the first to describe the role of a user researcher. In the 1930s, Weaver argued that the consumer was torn away from the intimate link that there was between the customer and producer:

> "*Weaver suggested that "a hundred years ago," in other words, in 1832, there was an intimate link between users and producers, since most goods were produced in one-man shops. This intimacy was broken, however, with the rise of "modern industry," where an increasing number of links had become inserted between the consumer and the producer*" (Hyysalo et al. 2016, p. 5).

The reason for the further distance was the industrial set-up, where the developers of the product had to go through many links, such as engineering department, production, sales, dealers before reaching the consumer (ibid., pp. 5-6).
Weaver envisioned the role of the consumer researcher to create a liaison between consumers and producers (ibid), and since the 1970s a lot of different responses and methods to connect the missing links have been developed (ibid., p. 7):

> "*This new emphasis on knowledge residing in users themselves entailed an important shift in the production and productive roles of users. In broad terms, the shift could be described as a move from seeing users as objects that producers should know better, to seeing users as subjects that producers should find ways to learn from and collaborate with*" (Hyysalo et al. 2016, p. 7).

The methods have moved into many different disciplines, where the involvement of users is seen valuable for more than merely selling more products to consumers. This stems from a perception that even though they are not experts, they have valuable insight about their own life and the context the technology has to be applied in (ibid., p. 7). The VTV is also described as providing a solution to the missing link between the producers of welfare technology and the municipality (Teknologisk Institut 2017, p. 6).

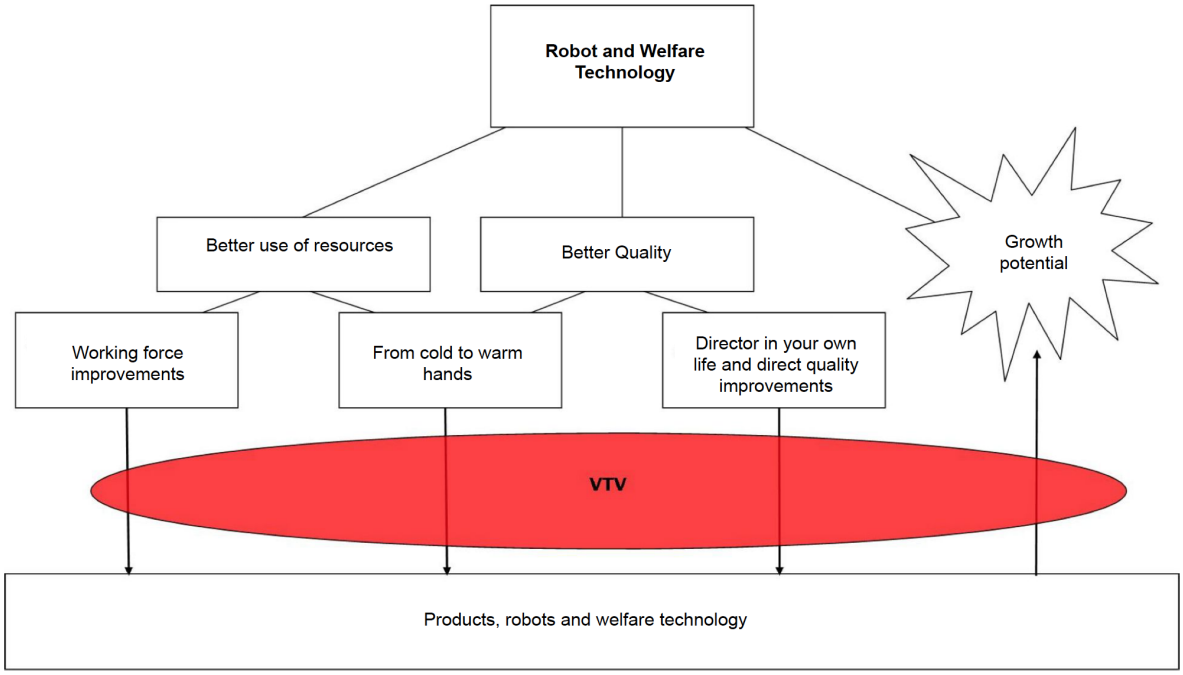

Figure 18: DTI's illustration of the goals of welfare technology in Denmark, and were the VTV is placed according to these goals. [OT] (Teknologisk Institut 2017, p. 5)

Although the involvement that happens in the VTV can be argued to take place late in the process, users role is still today seen in relation to the responses and innovation they are making to products. When users are seen as subjects, they can contribute to the design process. But in user research, it is also seen that users also innovate themselves and appropriate product corresponding to their own needs (Hyysalo et al. 2016, p. 15). Not only is user involvement tied to a belief of being an effective method, but it is also related to political objectives. The participatory approach is highly rooted in Scandinavia, where participatory and collaborative approaches to innovation stem from the introduction of new automated technology in factories. Because these new technologies threatened the floor workers, by their ability to transform their job to consist of routine tasks that did not require any skills. In the 1970s, unions in Scandinavia preserved the workers' interest in the conflict, by using workshops and prototypes. Since then, the Scandinavian approach to participation in design and innovation has resulted in many new experimental ways for collaboration (ibid., pp. 10-11).

These perspectives on user involvement are central as the ATAT is perceived as being a way to include various stakeholders' perspectives in the decision-making of buying new

technology. The VTV also refers to the more open and collaborative approach between users, government and manufacturers, which is found in the open end-user environments and Living Labs:

> *"In a VTV, a pilot test of the technology in a real end-user environment or Living Lab, is most often included. This means that the technology is tested in practice in the everyday life that it will be part of, and in relation to the users that the technology is aimed at. This is a necessity in order to say something about all of the assessment categories in the VTV"* [OT] (Teknologisk Institut 2017, p. 15).

The ATAT is linked to the idea of how users should play a contributing role in open test environment or Living Labs. It is a meeting ground for all actors to discuss and participate in projects, which also makes it subject to many different interpretations. We will, therefore, describe how the collaboration is challenged by different social worlds and their interpretations of the ATAT in a Japanese context.

6.2 ATAT interpretations

In this section, we will open up for some of the complexity that arises when different professions, disciplines and stakeholders have different views on the ATAT and how to use it. We will analyze this with the terms 'boundary objects' and 'social worlds' (Star & Griesemer 1989). We will use the term social worlds, to describe a group of actors who are organized around a primary activity. Social worlds are dynamic and intersect each other e.g. by borrowing methods, tools or technologies (Bossen & Lauritzen 2007, p. 144). In this project, the social worlds are intersecting by the use and application of assistive technology, their interest in the ATAT and methods involved.

We argue that ATAT can be described as a boundary object and that it can help shed light on the vision of ATAT's role in the collaboration between many different social worlds. Jun Yamaguchi also highlights how the ATAT is thought to be used differently by stakeholders:

> *"It is not the general standard scale. Every player has a different context, different background, different way of decision making, just different ways."* - Jun Yamaguchi

The analytical approach of boundary object is used to analyze how it is possible for different social worlds to collaborate, without completely conforming to each other's way of operating (Bossen & Lauritzen 2007 p. 147). We find this analytical approach relevant, as the VTV is open for interpretations and is already applied in different ways and used by different social worlds in Denmark, while still remaining a common identity.

Susan Leigh Star and James Griesemer describe four different types of boundary objects, and we argue that the VTV can be seen in the light of two of them. 'Ideal type' is boundary objects that function well because of its vague and abstract nature. Star and Griesemer use the example of a diagram (Bossen & Lauritzen 2007 p. 146). In the case of VTV, the illustration/diagram of the four categories and parameters is general enough for different social worlds to use it. The ideal type of boundary object can be adjusted and specified to the local context, according to the social world who are going to use it (ibid., pp. 146-147). This aligns with how Jun Yamaguchi perceives the VTV:

> *"The VTV is up to you and how you choose to use it. It is a concept, according to who makes the VTV, it evolves in different ways."* - Jun Yamaguchi

Another type of boundary object is the 'standardized formula'. This kind of boundary object can be used when actors from different social worlds have to communicate with each other. The formula can be made by one social world and filled out by another (Bossen & Lauritzen 2007, p. 147). The perception of the VTV in Japan also aligns with this type of boundary object: "*The VTV is guidance, concept and a checklist.*" - Jun Yamaguchi. The ATAT provides a checklist of aspects that it encourages stakeholders to consider and understand better when developing, testing and implementing new assistive technology and robots.

As seen in the section describing the Japanese welfare system, even more different social worlds are involved and expected to use the ATAT in Japan compared to a Danish context. In order for the boundary object to work, different intersecting social worlds need to find the informational requirements satisfying and enough for each of them. The flexibility of the model can be seen as a strength, as many different social worlds are able to conform it to their local needs when using it. But it can also be seen as a weakness, as the purpose of the ATAT can become unclear, or the adaptation to some stakeholders' local needs, might result in their version of the ATAT is seen as invalid by other. A representative from AIST, who

was participating in the AIST Design School, expressed the following challenge with the ATAT:

> "*It is about different specialists in the team. It is interesting for different stakeholders. But it is very hard in Japan to communicate across other types of specialists. It is very difficult to involve the user*." - A student from AIST Design School, 08.03.2019

At the seminar and during our interviews, we also experienced that some of the social worlds, who showed an interest in the ATAT were skeptical about the collaboration between representatives from the intersecting social worlds.

6.2.1 Different interpretations and social worlds

In the following, we will attempt to paint a picture of the different social worlds and their visions, and further how the divergent point of views can challenge the collaboration.

During our study, we have been following the entrepreneurs, who are committed to bring the VTV to Japan, by mobilizing stakeholders to start using the ATAT and to join the network of stakeholders sharing their knowledge of assistive technologies. It is therefore important to underline that we cannot represent the different social worlds equally, and are forced to trace the network from this position, as their work spans into other intersecting social worlds (Star & Griesemer 1989, p. 396). We will represent the social worlds based on how the entrepreneurs perceive the worlds' role in relation to the ATAT on the basis of our many conversations with the entrepreneurs of how different stakeholders perceive the ATAT. In addition, we facilitated a mapping exercise at the end of the interview with Jun, to get him to map and elaborate on the stakeholders having an interest in the ATAT. We asked Jun to start writing his own name in the middle of a paper. After that, he should write the names of the persons, groups of people or organizations he had a current collaboration with and those he thought could be potential collaboration partners in relation to his plans of using the ATAT in Japan and establish a platform for sharing information about assistive technology. After doing this, we asked Jun to add those groups of people, professions and if possible concrete organizations, he thought would not have an interest in his plans. Based on this exercise, we made a digital version of the map (Appendix 5). By making this exercise, we gained an initial understanding of how Jun tries to integrate the ATAT in Japan by meeting demands from

potential collaboration partners, and how it can contribute to stabilize elements within these worlds.
Further, we will include our empirical data concentrating on the attitudes towards the ATAT that occurred while we interviewed different stakeholders, and facilitated the workshop after presenting the ideas of the VTV at the seminar Jun and Yasuko organized. Those social worlds described in the following are all important to mobilize for the entrepreneurs in order to support the initiation of the ATAT.

The entrepreneurs: Jun Yamaguchi & Yasuko Akutsu

As we have written in the section explaining the reasons why the ATAT has been taken to Japan, Jun perceives the ATAT as a good concept for supporting decentralized decision-making, regarding implementation of assistive technologies. Jun wants to create a network of stakeholders (citizens, manufacturers, engineers, caregivers, care managers, service providers ect.), where they share information and experiences with assistive technologies of specific use-cases provided by the framework of the ATAT. The aim is to launch an online platform with the ATATs, so everybody that is a part of the network can use the information to make decisions and products that suit the real-life settings better. Yasuko, representing MT Healthcare Research Design Inc. and Ageing Japan, is interested in the ATAT since she knows that technologies are not the solutions in themselves, thus the ATAT can be used to check whether a technology is useful or not. To support the initiation of the ATAT, Yasuko on behalf of Ageing Japan made the decision to organize the ATAT seminar.

Jun emphasizes that every stakeholder, regardless of educational and cultural background, can contribute to an ATAT. According to Jun, any ATAT no matter the level of quality is relevant to share with other stakeholders as long as they contain raw data, so it is easier to compare them across boundaries.

Even though Jun advocates that all stakeholders should have the opportunity to make an ATAT, he played with the idea of making a ranking system according to the quality of the ATATs. The intention of providing certifications to organizations interested in the ATAT started of as Yasuko's idea. She believes that Japanese organizations appreciate the idea of getting certifications, and will hereby provide a paid course for some of their employees. In other words, the ATAT is still in an open and experimental phase in order to figure out how it can be implemented in a Japanese context in a meaningful way.

Manufactures

From the entrepreneurs' point of view, the purpose of the ATAT regarding manufacturers is to serve as a possibility for them to gain more knowledge about their target groups, and how their products or services can contribute as a solution to the problems and needs the target groups are facing. The ATAT can provide knowledge about different use case, and how the product or service can be improved for the context.

We have conducted interviews with manufacturers in Japan, where we asked into their perspectives and interests in the ATAT. During our fieldwork, we met with representatives from FujiSoft and the CEO, Ory, from Ory Laboratory where we discussed the ATAT in relation to their products. Moreover, at the seminar arranged by the entrepreneurs, four different participants were representing companies that manufacture technology for elderly care. The manufacturers had different visions about how it can be used in accordance with their local context.

In general, we experienced that it was difficult to explain that the purpose of the ATAT is about assessing the case and context, rather than testing and approving the functionalities of the specific product. Several manufacturers expected the ATAT to result in quality assurance and requirements, rather than providing information about different needs or how the users intended to interact with the technology. In the group discussion at the seminar, this conception was also highlighted, by one of the manufactures who had written the following about his interest in the ATAT:

> "*Thinking that we might be able to sell lots of our sensor if receiving high score of ATAT*." - A representative from a monitoring sensor manufacturer, 25.03.2019

This conception also aligns with the standardized approach of selling and financing Fukushi Yougu or Hosougu, that are covered by LTCI and approved through categorizations matching levels of disability. In a conversation with Jun after the seminar, we followed up on our experience of this challenge, and asked how Jun perceived the manufacturers in relation to ATAT:

"*Their expectation is that the government becomes their customer. That they are chosen by the government, and the government are looking for a scale or standard, so they can assure to improve and optimize their services. It is like in medicine, if the medical effect is validated and approved by the government, then the company can sell the drug, and assure their continual income. Those manufacturers expect the same thing through welfare technology if the government approves that it can improve the quality of life. Unfortunately, this is the motivation among the suppliers in the market*." - Jun Yamaguchi

While this is the case for some of the manufacturers, others were interested in the feedback to further develop their product and knowledge about how it is used in practice. The OriHime is not possible to get funded by LTCI or through the categorizations of body-worn technology for disability. It is used by many different target groups and is intended to solve different problems. Ory from OryLab shared an enthusiasm for the idea of assessing the cases rather than the technology:

Ory: "*ATAT is definitely relevant for OriHime Eye*[14]*, but I am not sure if it's relevant for OriHime, as the use is very different. Some use it for school, some use it for leisure activities, some for ALS.*."

Jun: "*We should make it clear that it is not an evaluation of the technology, but an evaluation of the case*"

Ory: "*It is Fantastic. In Japan, most of the evaluation is only about the technology*."
- Kentaro Yoshifuj (Ory), 18.03.2019

When the company wants to use the ATAT to gain knowledge about different target groups and their needs, it is likely that they want to keep the information to themselves, as they are the one paying for making the ATAT. Some manufacturers might see it as a threat, that competing companies can use the information for free. Another challenge with sharing information provided by the ATAT was also brought up at the seminar. A manufacturer expressed that he was concerned about the feedback from laypersons since it could make

[14] Ory Eye is a product from Orylab, that can be used to control a tablet with eye gaze. The product can also be used to control the OriHime robot with the tablet

their product look bad. He was skeptical whether the person conducting the ATAT would be qualified for the task:

> "*I worry about how the result is authorized, and how the results should be published. Since the manufacturer is not involved in the assessment, how do they evaluate the safety of the product?*" - A manufacturer participating in the seminar about ATAT, 25.03.2019

There can potentially be a conflict of ownership of the results when manufacturers apply the ATAT. This might hinder the desired collaboration as seen by other social worlds. In an interview with Yasuko, she highlighted how the ATAT also can be used by the industry to gain knowledge about the market:

> "*ATAT is important for the industry because the welfare technology industry is very small. So, they focus on the technology, and they are anxious about.. they don't know if their product can enter the market. Before* [*entering the market*] *they should evaluate this*." - Yasuko Akutsu, 14.03.2019

Manufacturers might view the ATAT as a quality assurance assessment, although it is not envisioned in such a way. Also, it is likely that they perceive the ATAT as a tool for market research, which is knowledge they want to keep for themselves. This might be asymmetrical for other social worlds perceptions, where there is a focus on sharing the knowledge between all stakeholders.

Care professional

During our fieldwork, it was difficult to get access to speak with care professionals, here among caregivers. We spoke only with one caregiver, who is a friend of Jun, and this interview had a focus on understanding the conditions of working as a caregiver. Therefore, we will represent how they are envisioned and why they matter. The envisioned role of caregivers became clear at a symposium on care robot devices for elderly homes. We attended the symposium together with Jun. In a speech at the symposium, the specialist in 'learning robot care', Yuko Ito, expressed that it was a problem for caregivers that they lack knowledge about new robotic technology that is brought into the care sector. The speaker Yuko Ito said the following:

"*Please tell us how to use the technology and for whom it is relevant, show us examples.*" - Yuko Ito, 13.03.2019

Persons talking on behalf of the caregivers, often point to the difficulties in receiving information about how to use the technology, and the little knowledge available for caregivers of how to integrate new technologies into their daily work does only consist of demonstrations and not examples from real practices. At the moment, the caregivers are not receiving information or training in their education about how the robots can be used (Ishiguro 2018 p. 260).

At the seminar about the ATAT, two care professionals participated. One of them was an occupational therapist, the other working as a nurse. They saw the benefits of the ATAT to be a more human-centered approach, rather than product centered. A person had written that a benefit from ATAT is that it might help them sell products that are more suitable to the user. A challenge they had written was 'Information disclosures by company' meaning that the manufacturers want to keep information to themselves.

Care providers (also referred to as care industry)

The care providers can potentially use the ATAT to provide information that can inform decisions on whether to buy and implement technology. We did not have a chance to talk to care providers during our fieldwork, and can therefore only write about their envisioned role from the entrepreneurs' point of view. In Japan, the care providers have the primary responsibility for taking care of people requiring help, and according to Jun, the ATAT is really helpful for them to assess whether an assistive technology would be relevant to buy. Further, Yasuko mentioned her take on why the ATAT is relevant for care providers:

Q: "*For whom do you think ATAT is most important?*"
"*Mostly for [care] management and industry (...) Management needs the ATAT because Japanese caregivers are not used to IT.*" - Yasuko Akutsu, 14.03.2019

One of the goals of the ATAT is to support decentralized decision-making. Jun finds it important that more people will be involved, or even make the decisions themselves. It is

intended that this will lead to improvements of their knowledge and ability to think about technology:

> *"People's literacy of welfare technology has to be improved. The VTV can help with this because people on a more local/decentralized level will be responsible for taking decisions regarding welfare technology"* - Jun Yamaguchi

For both the care providers and caregivers, the ATAT is envisioned to help their literacy and knowledge on how and when to use assistive technology, by sharing knowledge and providing a framework to assess assistive technology.

Municipalities and prefectures

Jun perceives both municipalities and prefectures as potential users of ATAT if they are interested in introducing care robot devices in care sites:

> *"In Yokohama, they have a positive attitude towards robots, and actually buy them for citizens. But they cannot find information from other municipalities about what their experience with them is.* (...) *Therefore, it can be difficult for other municipalities to try new things, and therefore they only subsidy something they are used to."* - Jun Yamaguchi

According to Jun, some of the economically big municipalities and prefectures such as Yokohama and Osaka city, and prefectures as Kanagawa and Saitama, already buy and recommend technologies, but they are interested in more practical methodologies as well. With the ATAT, the entrepreneurs want to support a more bottom-up approach, by making it easier for municipalities and prefectures to choose new solutions, by learning from each other and provide a more practical framework.

Private users

As most of the new care robot technology is not funded or subsidized by insurance, and the family are still providing most of the care for their elderly members, both elderly people and their families are consumers of the market of robotic technologies (Leeson 2017, p. 39). Because of this, the entrepreneurs perceive these single private users of technology to be potential users of the ATAT as well. Jun expressed a desire for letting such private users

contribute with feedback and review of technologies since they can contribute with feedback about more rarely used technologies, which other stakeholders will find inspiring. An example of a private user is the mother of a 10-year-old girl that is diagnosed with Spinal Muscular Atrophy (SMA). She has made research on bathing devices for children, who have a severe condition. Based on her research, she invented a bathing device. It is research like this, Jun want to share among relevant stakeholders.

The National Institute of Advanced Industrial Science and Technology (AIST)
At the seminar, participants from AIST wrote the following bullet points of why they are interested in the ATAT:

Why are you interested in the ATAT?
- There should be a problem in implementing carerobotics. (often heard that they are difficult to use.)
- Difficult in match making and integration.
- Too much expectation from user side.
- User education might be needed.
- Service process should be studied and redesigned.

Figure 19: Answers from the workshop

AIST's interest in the ATAT is mainly based on getting acquainted with the model, since a big part of their business is to do research about development and implementation of care robot devices. AIST is interested in new methodologies of assessing the interaction between humans and care robots, hence they have started AIST Design School and the 'Robot Innovation Research Center' in Kashiwa-no-ha to research how humans relate to new technology as illustrated at their V-model, which we discussed in chapter 5. AIST has an interest in the approach of the ATAT, but the methodology does not meet their requirements for making evaluations, because they need to focus on the functionalities of the technology with emphasis on the safety aspect.

In the next section, we will comment on the social worlds' different interpretations of the ATAT, and how the entrepreneurs try to conquer the challenges the divergent perspectives create.

6.2.2 Is the ATAT plastic enough?

The social worlds' visions listed above have both similarities and differences. The social worlds share the same goal of finding new and better ways to provide care with the help of technology, in a society with lacking resources in the future due to demographic changes. ATAT is one of many approaches but differs in its way to include more stakeholders as active contribution partners who will share their experience with each other with the aim of decentralizing decision making. Getting representatives from different social worlds a desire to contribute to this process is difficult. By analyzing the ATAT as a boundary object, we can see how different social worlds want to adjust it to their local need. The ATAT then has to function as both a market analysis, a tool for improving knowledge, a tool to support decisions on implementing, a way for all the stakeholders to present their knowledge and experiences, a way for private users and developers to draw on other peoples experiences, and for municipalities and prefectures to choose new technological solutions. Due to the many divergent perspectives among the social worlds, it might be a challenge for them to accept different terms for how each stakeholder contribute to the mutual cooperation. It becomes clear that the ATAT has to be more plastic, so different social worlds potentially can conform it to their local needs. Based on this chapter, we argue, in order for the ATAT to be an accepted boundary object, a translation of language is not enough. It is in the hands of the entrepreneurs to mobilize social worlds related to the care field, by making social alliances with representatives, organizing seminars, cultivate one's network, disentangle misunderstandings, and fight traditional norms. In other words, it is the network of social worlds around the ATAT that needs to be constructed and stabilized.

In the next chapter, we will trace these challenges to a wider context. We emphasize that the cultural differences the ATAT is facing, in a Japanese context, are important to keep in mind.

Chapter 7

ATAT corresponding to the cultural context of Japan

This chapter is about cultural and contextual differences, that are important to be aware of when conducting an ATAT in Japan. We do not argue that culture in Japan is static and unchangeable. Culture is a dynamic entity, and there are differences in the generations over time (Erez & Gati 2004 in Ishiguro 2018, p. 256). The subsistence of the ATAT can be challenged because of the values and cultural differences it meets in a Japanese context, or at the same time, be seen as an agent for changing. We will start by introducing how we in practice experimented with the ATAT in Japan, and then we will relate our experiences to a broader cultural context.

7.1 Experimenting with the ATAT

During our fieldwork in Japan, we applied methods and the framework from the ATAT to assess the robots OriHime and Palro. We heard a lot of different perspectives on why it would be challenging to conduct and use the ATAT since it involves talking to caregivers and end-users. These challenges appeared more complex and less characterized, when we actually tried to talk to the stakeholders related to the robots. We were not able to make a full ATAT, as it is a tool for decision makers, and therefore often involves buying the technology to test it. This also often implies that the person conducting the ATAT will have more access to the field, and is able to make focus points about the purpose of the ATAT, in collaboration with the end-users and staff of the field of interest, before introducing the technology.

7.1.1 ATAT of OriHime

We applied ATAT on four different use cases of the telepresence robot OriHime. We will shortly introduce each case, and what we were able to research.[15]

[15] You can find the full ATAT in Appendix 2.

The bookstore

An OriHime was installed in the bookstore, Tsutaya Books, in Daikanyama in Tokyo from February 15th to March 3th 2019. The purpose of the OriHime was to provide information and draw attention to the books written by Ory Yoshifuji, who is the developer of OriHime. Six different people worked in the bookstore and shifted to control the same OriHime. Our approach was rather exploratory. We had arranged our first meeting with Jun at the bookstore, where the OriHime was placed, so we could get a first glimpse of how it functioned. Prior to the meeting, we had made focus points to the ATAT, and at the bookstore we decided to interview the pilot of OriHime (the end-user) based on this. We started by observing how people interacted with the OriHime and afterwards used our observations in the interview. The data collection went great and we decided to return to the bookstore the next day, to interview a new pilot, although Jun could not come and be our translator. This turned out to be difficult, as the person did not speak English and we could not interview and ask questions. Unexpected, the developer of the OriHime, Ory, visited the bookstore as it was the last day the OriHime was there. We managed to introduce ourselves and try to convince him to participate in an interview as he had not replied Jun yet. At the interview with Ory, we had an opportunity to talk to an additional end-user, who had been a pilot in the bookstore as well.

Figure 20: Group picture with Ory, the OriHime pilot and us

Children hospital

We interviewed the vice president and a teacher of Tokyo Metropolitan Koumei Gakuen. It is a school at the children hospital, National Center for Child, Health and Development, in Setagaya just outside Tokyo. The school has used OriHime for four years and at the moment they have three units of OriHime. The school consist of elementary, junior high, and high

school. The curriculum is the same as in normal schools, but the children can attend school, even if they are bedridden or hospitalized. The people visiting the children have to go through an infection control, that takes two weeks to be approved. Due to time limitations, we could not get access to talk with the children about their experience with OriHime.

NTT

We interviewed an HR manager and an employee, who had used OriHime to work from home at the company, NTT. The company owns 66 units of OriHime because they have introduced OriHime to support their initiative, where employees can choose where they wish to work from. The end-user who used this opportunity was a mother nursing her child. By using OriHime, she could attend socially at the office and feel more included, while working from home.

Mobility impairment

The end-user, in this case, is a 10-year-old girl that is diagnosed with Spinal Muscular Atrophy (SMA). The condition leads to mobility impairment and breathing difficulties. The girl is bedridden and depends on a machine that supports her breathing system. She has been living at home with her mother for the past nine years. Her mother spends a lot of time with her and is sometimes hindered in participating in activities outside the house. They both use OriHime to participate in social or learning activities in their free time. This case is based on an interview with the mother for approximately one hour, and additionally two hours of participatory observation in their private home. The mother and her daughter showed us how they controlled OriHime and explained the functions they frequently used. It was possible to get insights about appropriations to the technology and see a homemade manual, the mother finds necessary to give to the person, who will carry the OriHime in a remote location.

See video from the interview. Here the end-user show us the gestures she uses. Use the QR code or the link: https://vimeo.com/339571320

7.1.2 ATAT of Palro

In the pursuit of making an ATAT of Palro, we could not manage to talk to any elderly residents or caregivers who had used it. We went to the nursing home, who made the assessment described in chapter 5. But it was not possible to see any of the 15 Palro in action due to an intermediary break that was placed to compare the effect in the assessment. We also went to a care facility center with Matsumoto from AIST. But they had recently replaced the Palro with a Pepper, so the elderlies are able to hear and see the entertainment and exercises better, which is facilitated by the communication robot.

7.2 Letting stakeholders share their own experience

Before going to Japan, we started preparing ourselves for how we should conduct the interviews for the ATAT. We found that even in business meetings, you should not expect that the person was ever going to directly reject you or say no to your proposition. We also found that there is an unspoken hierarchy system, resulting in a complicated etiquette influencing everything from handling business cards, entering the room and seating at the table[16]. Further, it should be expected that a person always answers and express opinions on behalf of the collective to show loyalty rather than from their own position and interests (Hamada 2005, pp. 125-126).

This made us concerned about whether the informants would be able to express negative experiences or even talk about their own personal experiences. These challenges led to an impression that it would be near impossible to conduct an ATAT in Japan, as user involvement is not as familiar and widespread as in Denmark. The methods that are applied in an ATAT is based on a paradigm that users and citizens should be involved and participate, as described in the previous chapter. The aim of making citizens and care professionals participate and have a say is related to political objectives and a democratic approach to the development of technology:

> *"Being a democratic approach, user-driven innovation is both an overarching value and a crucial and efficient method"* (Forsknings- og Innovationsstyrelsen 2006, p. 7).

[16] We had prepared ourselves by reading pointers at many different websites, here among on the website of the Danish embassy, which also explains meeting etiquette e.g. that the Japanese find it difficult to say no and business cards are essential (Udenrigsministeriet n.d.).

The value of a democratic and participatory approach to the development of technology is also seen in the policies of the Danish Ministry of Science and Innovation. The policies state that the Scandinavian and participatory approach is both important and efficient. It states that innovation must include an open dialogue between the key actors involved (Hyysalo et al. 2016, p. 142). The democratic approach and open dialogue between stakeholders are not as common in Japan. In our interview with Yasuko, she expressed that this could be a challenge when using the ATAT and letting citizens into the decision process to talk about the value the technology gives:

> *"I think that it kind of depends on the democratic source because in Japan there is of course democracy, but Japanese people rely on the government. (...) Danish people are very independent. I think you are deciding by yourself, and you are talking about politics and welfare with each other. But Japanese people do not talk with each other about their quality of life. Because we said 'Okami'* (お上). *Okami is from before the Second World War, where everybody depended on the emperor and government. So older people depend on the 'lord'. After the war, the United States made us a democracy. But it is not democratic, because especially elderly people still think that someone will help us."* - Yasuko Akutsu, 14.03.2019

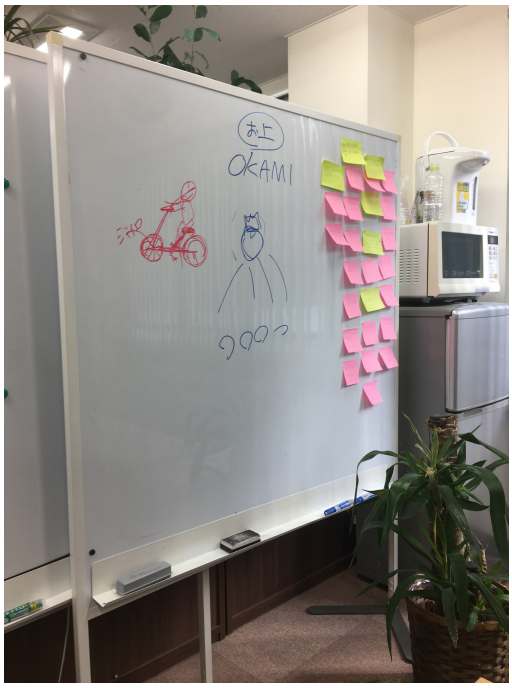

Figure 21: Yasuko's drawing to explain Okami

According to Yasuko, open discussion and dialogue between social worlds, the ATAT involves, might be a challenge because they are depending on the government to make the decisions for them. The Japanese professor in social science, Nobu Ishiguro, also points to the challenge of letting Japanese stakeholders be involved in a democratic innovation process:

> "*In determining whether care robots should be introduced or what kinds of technologies will be applied, care workers and recipients should be given opportunities to speak and be heard (Parks, 2010, p. 109). However, this democratic communication process can be challenging for Japanese care recipients and workers. The Japanese traditionally have negative attitudes toward speech/words*" (Ishiguro 2018, p. 264).

This posed a challenge for the methods and purpose that the ATAT is built upon. We were concerned if it was possible to get end-users and employees of an organization to talk on the basis of their own position, or if we solely needed to rely on observations if anybody even would allow us to do that. Jun had high ambitions about the methods of the ATAT and was very reflected about how they could enable people to open up and let them talk. From the very beginning of our recruitment of users, Jun underlined how we should look kind and welcoming, and make sure that the informants knew that we were interested in their knowledge and perspectives.[17] We played a central role in the tactic, as we according to Jun were young, casual dressed and kind looking. We represented a completely different approach and persona than the stiff old men in grey suits, that Jun referred to as 'bureaucrats' or 'salaryman' (サラリーマン)[18]. Jun told hypothetical stories about how they enter the nursing home with a structured survey, only hearing what the informants think they want to hear. As soon as they leave, the care professionals start to talk to each other about their concerns or distress about the technology.

7.2.1 Experiences with OriHime from actual use cases

In the planning of our research design for the ATAT on OriHime, we made sure to make it as clear as possible that we were interested in hearing about their own experiences and letting them know that there were no right or wrong answers. And with these tactics in mind, we succeeded in getting what we believe to be valuable knowledge about how the use of OriHime can both make everyday life easier and/or more challenging.

[17] See examples of recruitment letters in Appendix 6

[18] A Japanese term for the stereotype who is a dedicated corporate employee working long hours (Oxford Living Dictionaries 2019).

To exemplify this, we will highlight our interview with a teacher from a school at a children hospital, where they are using OriHime. Despite sitting next to the vice president of the school, the teacher had not a negative attitude towards expressing personal experiences. Although the teacher being doubtful at the beginning of the interview, not knowing if we were really interested in hearing what she had to say, she opened up after we made sure to approve what she was saying and show our interest. Jun who was acting as our translator said the following right after the interview was ended and the informants left:

> *"Maybe this is the point you should write in your report, that everybody is doubtful and say that they don't think they are eligible to answer. Everybody in Japan says that. But we have to acknowledge them and make it clear that it is important that they share their own experience."* - Jun Yamaguchi

During the interview, the informant shared knowledge about how to use the OriHime in her practice. We believe that this knowledge can be valuable for other people aiming to introduce OriHime in a similar context[19]. In the case of OriHime in the bookstore, we talked with a user about his experiences of working through OriHime and why this can be difficult.

See video from the interview. Use the QR code or the link: https://vimeo.com/340416012

The OriHime pilots also told us about how they shared knowledge with each other of how they could provide the best service in the bookstore. In the case of mobility impairment, the users showed and told us about how the OriHime was appropriated to the specific context. The mother had made her own user manuals and found out how to package and ship it to supporters that were needed in order to carry the OriHime at remote locations.

[19] The ATAT can be found in Appendix 2

The four cases are shedding light on important aspects of how the technology should not be seen as a demarcated entity. We argue that the construction of the technology happens in relation to how the users use it and that the pursuit of making an ATAT can open up for seeing complications in these relations. By using methods from the ATAT, it has been possible to get users to share knowledge about their practices, appropriations, desires, lifeworlds and in general allowing us to get an insight that cannot be achieved in a simulated test environment. We did not find the cultural value, Okami, a challenge for letting our informants share their experiences on the basis of their position. We argue that the ATAT can shed light on an important process that happens outside the R&D departments and open up for a more iterative conception for the development and introduction of robots in care. This is in line with the STS approach, here among SCOT, arguing that technologies are not situated outside society, nor do they have a final stage but are instead shaped in the interplay with society (Børsen et al., forthcoming p. 1). We argue, that robots have effects that cannot be predicted by the people who deploy or design them.

When making the ATATs, we have also been inspired by Don Ihde's theoretical term, 'multistability' (Børsen et al., forthcoming, p. 2). The term stems from the post-phenomenological approach, that seeks to understand how the world is mediated through and with technologies (Verbeek 2011). Multistability implies that the developers of a technology cannot anticipate or choose what the technology will do and what kind of effect it will have. The users can come up with new ways of using the technology, even if the technology is developed for completely other purposes. Therefore, Ihde argues that the technology should be defined by how the users actually use the technology (Verbeek 2011, p. 9). By making ATAT, we have scratched the surface of how it is relevant to research the intentions and anticipations from the designers and policymakers and the unforeseen ways the stakeholders actually use and respond to the robots. In the next section, we will give an example of how it is anticipated that Palro will contribute to elderly care.

7.2.2 Insights of the intentionalities behind Palro

As we were not able to talk with any users of Palro, it was difficult to shed light on the part of the development process, where users respond to it. Although we could not access any users, it was possible to talk with researchers and designers and shed light on the intentionalities behind it. As mentioned in chapter 4 about political ambitions, the communications robots are expected to enter nursing homes.

At the interview with representatives from FujiSoft, we were told that FujiSoft made several monitoring studies in different fields and industries, to test where it was possible for FujiSoft to apply their knowledge and resources. The care industry was chosen as a viable market in 2012, based on the result of these tests:

> "*The reason why they chose the care industry, is that they did many monitoring studies in many fields and industries. The people who liked Palro the most were elderly people. They simply wanted Palro the most*." - An employee from FujiSoft's Palro department, 19.03.2019

It was not possible to figure out if the monitoring studies led to adjustment according to how Palro was interpreted and appropriated, and how it was for the care staff to integrate Palro in their practices. They told us that Palro has to be fun and provide good communication in order for elderly people to like it. But since, it is too expensive for them to buy Palro, FujiSoft focuses on B2B by selling it to nursing homes. For selling Palro it is essential that they are covered by insurance. This requires that the effect is validated, so it is coherent why they are beneficial to use in care:

> "*To sell Palro to the owners of nursing homes, we need employees to continue to use Palro. (...) In that case, we have to explain that it will make employees work better. It is beneficial for each employee. At the same time, there is a political reason as well. You have to understand the political system and insurance care as well. The services are covered by tax, the tax can only be used if it seems good and works. They need a precise and clear reason for it can be covered by insurance. One reason, for the nursing home to use robots, is the lack of human resources. It is impossible for an android to replace humans at the moment, but it might be possible that robots assist human workers, and this idea matches the government point of view and objectives. This is why FujiSoft needs to add further explanation to the government.*" - An employee from FujiSoft's Palro department, 19.03.2019

While we in the ATAT of OriHime had access to four different use cases, and by this, could shed light on how it is perceived by different kinds of users, we had only access to speak with the developer of Palro. This resulted in totally different types of data that could provide us

with an understanding of the intentionalities behind Palro. Instead of leading to empirical data for the ATAT of Palro, it provided us with a deeper understanding of Jun's ambitions with the ATAT, which we will further unfold in the next section.

In the next section, we will shed light on how it is difficult to apply the ATAT and challenge the 'bureaucrats' and developers' anticipations concerning communication robots such as Palro.

7.3 Being critical towards prestigious robots

Palro is intended to solve problems in relation to lack of care workers and revitalize the economy. This means that it both has to be prestigious enough to show that Japan is leading in developing robotics, while also being adjusted to how the users perceive and use it. When trying to accommodate both purposes, it can be seen as walking on a line between demonstrating how well they work and making PR, while also learning from wrong anticipations. This can potentially lead to the dilemma of generating documentation that can motivate others to buy the product and simultaneously encourage users to share their criticism with the intention of improving the product. For that reason, it might be difficult to align the purpose of ATAT with the purpose of the prestigious robots that are intended to enter the care sector. Yasuko also mentioned how manufacturers are proud of their technology, and therefore trust their anticipations rather than the users' perception:

> *"Japanese industry is focused on the perfect finished product. But nowadays, agile processes with prototypes and evaluating is relevant. Before launching a product in Japan, we do not evaluate for many situations and points like the ATAT, because Japanese people are proud of their technology, just the technology. Japanese industry trust that they have good technology, so they push the technology."* - Yasuko Akutsu, 14.03.2019

Although we could not reach any users in our attempt to make an ATAT of Palro, it opened up for how complicated the development is and how it is tied to future visions about a new industry. Jun told us about how he saw many similarities in the lack of reviewing failures in the development of technology for the ageing population, with strategic failures from the Japanese Imperial Army in WWII. Jun referred to a specific book about the subject called

'The Essence of Failure' from 1991, which we could only find a translated summary of (Kase 2010):

> "*the Imperial Japanese Army did not have a mechanism to analyze the failed battles and wars from the viewpoint of strategy and tactics and draw lessons from it to apply the lessons to the organization*" (Kase 2010, pp. 14-15).

The book exemplifies how corporations in Japan still share many similarities with the management and strategy traits that led to the failure of the Imperial Japanese Army. The examples in the text, shows the lack of criticism towards outcome and those in charge, as evaluation of the officers was inappropriate due to the norms of treating officers. Instead, the strategies led to a focus on the intentions and processes rather than results and outcomes (ibid., p. 15). It is exactly this mind-set Jun wants to challenge with the ATAT. Jun does not see any potential in the government to use the ATAT, but rather that it can be used by decentralized stakeholders, as it potentially can show that they have to change their assumptions and beliefs:

> "*They are the leading person in the field. It can be researchers, developers or bureaucrats. They have a mind-set that welfare technology is useful, and that they know a lot about technology. But ATAT has completely different perspectives, actually the ATAT points to why care robots haven't been used in Japan because they were wrong. They have to accept that they lacked the point of view from management, economic or organizational aspects. They are the existing people who took the care robots so far. They are ministries, research institutes, consultants, professors etc. We have to accept, that we were wrong and that we failed and that we need to change directions. It means that even though we don't criticize, these people will feel shame or offended.*" - Jun Yamaguchi

Although Jun also wanted us to report on this learning, we find it difficult to base any concluding remarks on an ATAT about a Palro case. But from the very limited access, we were able to see that the caregivers we talked to had a central concern.[20] They both said that Palro was too small and quiet for the elderly to see and hear during group activities. We did

[20] We talked with caregivers in Tsukuba and with Max, the friend of Jun

manage to see the similar but bigger robot Pepper used for the same purpose. The nursing home had replaced their Palro with Pepper, because it was larger and louder. From our observations, it seemed difficult to direct the elderlies' attention and it looked like it required a lot of the caregivers to assist Pepper.

Other studies have unfolded some of the unanticipated effects and purposes of communication robots. Niemelä and Watanabe (2018) argue that robots also play a role in the recruitment of care workers, as they can help build an image of an attractive institution and workplace. In addition, Wright (2019) criticizes METI's anticipation of being able to replace foreign caregivers with care robots since he, among other things, finds that care robots actually demand additionally human care labor (Wright 2019, p. 3).

In our pursuit of making an ATAT of the Palro, we were only able to shed light on the policies and anticipations of the developers. But in doing so, we experienced that being critical towards the robots and to question their abilities was a central purpose of conducting the ATATs in Japan. The ATAT was not perceived by Jun as something that could unravel hidden potentials of the technologies, but emphasize the relevance of listening to often implicated stakeholders, that was not represented in the policies and the activities of the developers taken place far from them. In the next section, we will unfold how the parameters of the ATAT were challenging to use in different cases.

7.4 Assessment parameters

Although the ATAT is flexible and perceived as a concept that can be used everywhere, the assessment parameters and categories can be challenging to use because of the different cultural context.

When we arrived at the interview with NTT, our knowledge of what was going to happen was limited. We had prepared an interview guide for an end-user, which we assumed was a person with a disability that could work at NTT with the help of OriHime. Few awkward misunderstandings later, we found out that there was no one with disabilities present at the meeting. The end-user, we were interviewing, was sitting physically in the room and was not going to join us through the OriHime on the table, which had happened in other meetings. It turned out that the user was an employee, who had used the company initiative to work from

home in order to nurse her child and therefore had used the OriHime to be present at the office while working on her laptop from home.

When making an ATAT in practice, it was difficult to navigate between the many stakeholders providing welfare in Japan, as they were often intertwined in the categories. This was also problematic in the mobility impairment case, as the mother was doing informal care for her daughter while also using the OriHime herself. In the case of the bookstore, the entity providing welfare also consisted of the manufacturer OryLab. In the NTT case, our perception of what welfare is, was challenged. We did not regard the corporation as a welfare entity. As we had made our first draft for the ATAT, Jun commented on why we had not included the case from NTT, and this led to a discussion about what welfare technology is and who should provide it:

> *"That is why we use 'assistive technology' because it is more widely used than 'welfare technology'. How to support people who have drawback compared to other citizens. (...) So if NTT can reduce the burden of employees, we can say corporate welfare. They can protect and improve the employees' wellness, so we can consider it to be a welfare technology. (...) But the objective of the VTV is for the organization to improve their workflow and structure, it is innovation. So, in my point of view, when NTT uses OriHime it is welfare technology. (...) My definition of welfare is that it is services. There is a certain amount of people who need these services, but it is not profitable enough as a private service, so they are supported by social fundings."* - Jun Yamaguchi

The complexity of the many service providers and people who can use the ATAT makes it difficult to make parameters that suit everybody's needs. The decision makers are different than the municipalities in Denmark, as the welfare entities in Japan consist of for-profit organizations, corporations, informal caregivers, care facility centers and the end-users themselves.

In the cases we researched in Japan, the entities that had bought the OriHime were primarily doing so as a private company or as a private user. Most of the OriHime cases were not initiated by governmental bodies or politically driven organizations. Although the VTV has changed its name from welfare technology to assistive technology, it still remains a Danish

vision of welfare technology, that is rooted in the interest of the governmental decision makers to provide service for their citizens.
The vision of welfare technology in Denmark become clear in discourses that affect the parameters in the VTV. As welfare technology in Denmark is part of discourses about warm or cold care, meaning that welfare technology should be able to free resources for warm care such as tasks that involve leisure time, by replacing cold tasks, such as administrative or repetitive care tasks, that can be done more efficient by technologies. This is also mentioned in the description of the VTV:

> "*The potential of a welfare technology to release time in different areas and make cold hands warm is an important parameter. Especially because recruitment and demographic challenges make it necessary to optimize labor efficiency. Otherwise, there is simply not enough staff to offer proper welfare to many elderly people of the future*" [OT] (Teknologisk Institut 2017, p. 6).

In relation to the terminology of warm and cold care, we perceived the communication robot Palro as an attempt to be implemented in order to free caregivers' time for cold tasks, as it is intended to do the warm care of leisure and social activities with the elderly residents.
With this understanding, Palro would be considered undesirable when conducting an ATAT. However, Nobu Ishiguro points to how values in care for elderly people are seen differently in Japan and argues that there is a negative attitude to technologies that are implemented for the care to become more effective and the person more self-dependent:

> "*Autonomy and self-care are not well-developed concepts, and self-help and living an independent life are not as important as they are in Western societies. (...) the introduction of care robots to alleviate the care work burden or to make older people more independent might enhance the cold perception of technology."* (Ishiguro 2018, p. 260).[21]

By experimenting the ATATs, we experienced it was difficult to define the categories and using the parameters, as the care and provision of welfare are more diffused. We had to be

[21] Also Jeannette Pols (2012) criticize the terminology of cold and warm care in her ethnographic study in a Dutch context. She finds 'care that fits' more suitable to use.

flexible and that was one of the strengths with the model, as we defined focus points for each case. Using the prescribed parameters does not always align with the values and purposes of the care providers in Japan. Jun was also aware of this and exemplified how it can be challenging to see the relevance in the ATAT for informal caregivers:

> *"They are basically family members. For them, it is about supporting the family, so you could imagine that thinking about how to optimize cleaning your bathroom or other daily tasks. So, it is just their mind-set, they don't think about how can I reduce my back sore from care."* - Jun Yamaguchi.

The assessment parameters in the model might have to be recontextualized in order to grasp the different welfare entities, as it is difficult to use when framing who is providing the care. If the assessment is fixed on values inscribed by political goals of welfare technology in Denmark, important values for the care providers and end-users might be overseen in Japan. But we experienced that the model led us to focus on more than merely the technology, and provided a reason that allowed us to talk with central stakeholders who otherwise might be silenced. Nevertheless, we argue that it is still important to be critical of the model and values inscribed, as they can reduce the complexity that is at stake.

In the next chapter, we will discuss that despite the ATAT might not be the perfect assessment model, it can perhaps challenge perceptions of technologies in Japan, that leads to stakeholders being silenced and not considered in the policies and development of care robots in Japan.

Chapter 8

Discussion of implications

In this chapter, we will discuss the ATAT with focus on the value that it can bring, when brought to a Japanese context. We do not argue that the ATAT should be directly imported at wholesale to Japan and that it does not require any further work or adjustments.

We will discuss how it can bring value from a techno-anthropological understanding with a basis in STS literature, by drawing on examples of earlier conceptions of technology (Appendix 7), that we argue are present in Japan. At last, we will discuss which implications our research can have on the ATAT

It is also important to underline that we do not think that the ATAT should replace other kinds of assessments in Japan, but instead be seen as a tool for providing additional understanding of the technology.

Can ATAT challenge earlier conceptions about technology?

A conception we have met that can be challenged by the framework of the ATAT is that technology always consists of technical matter. Although we do not agree that the ATAT should be perceived as a holistic 360-degree assessment, we think that the ATAT is able to open up for a collaboration between a wider range of stakeholders, rather than focusing on the technology itself. We, therefore, argue that ATAT can bring value if it can encourage decision-makers to involve and understand more people who are likely to be implicated by the introduction of new technology. This is not to be understood as merely saying ‘everyone’ will be covered, or that successful implementations and products can be achieved by strictly following a guide from a model. It is likely that all stakeholders will not be presented in the parameters and categories, therefore flexibility towards using the ATAT is important. By pointing away from the technology, we hope that the ATAT can prevent an understanding that technology is an instrument that easily can be applied and delimited from social aspects.

Another conception we met in Japan is that the technologies reach a final form under the process of research and development. During our stay, we also experienced an understanding, that the company already had tested all the functionalities and thought about how the users would use the product before releasing the product. Therefore, they questioned why the ATAT should be used afterwards. Regarding this, we argue that the ATAT can contribute to an understanding of how further development always continues in the interplay with users in society.

In Japan, we also saw how the robots were conceived to have predictable and determined effects on society, that can be measured and controlled. The ATAT can open the complexity and challenge this perception, by exploring values through ethnography in a more flexible format, rather than seeing the technology as confined to only have an effect on the two control groups testing it.

By interviewing companies and institutes, we saw how it is conceived that the crucial site for technological development is the R&D labs. But we also saw an interest in what happens outside the R&D labs, and how the ATAT can approach this complex field and navigate in the uncertainty that arises, when including social ideas and practices. When moving into this field, we see how the ATAT challenges the conception that technology is only part of rationality and calculations.

Although we do not believe that the ATAT assessment is a perfect solution, we think that it can open for new perspectives on technology that we experienced was lacking.

Implications on the ATAT

A small implication on the ATAT based on this study is to change the name to something different than ‘assessment’. The purpose of the ATAT as we understood it, was continuously misunderstood. It should not replace safety assessments, nor should it be used as a clinical assessment. We argue that the ATAT makes sense in relation to the neglected area, which has resulted in a lack of understanding among the many stakeholders involved in robotic development for welfare and care purposes. An emphasis on the methods and value of understanding each other could be heightened by renaming it as for an example “Assistive Technology Tool Kit”, or something more compelling. By taking the assessment out of the equation, the focus on truth, objectivity, neutrality and who is eligible to conduct it, could be

replaced by understanding why, when and for whom care robots makes sense. As the development and introduction of care robots are entangled in political processes, we argue that this perspective is relevant to open up for. The focus should move away from measuring humans' emotions in an assessment and instead strive to understand them. This would perhaps lead to more focus on important matters such as what is desirable when deploying robotics and how it implicates the stakeholders and their practices in the given context. The ATAT can generate knowledge in relation to ethical considerations, design of technology and understanding of the necessity for interactional collaboration, but it does not withhold the knowledge itself. Therefore, we argue that the methods are key to generate value with the ATAT, as it should be seen as a tool rather than a validation or approval.

Conclusion

How is the technology assessment model 'VTV' perceived when it is brought from a Danish to a Japanese context, and what kind of value and challenges does the approach of the VTV meet in relation to developing and introducing care robots?

In this thesis, we have researched the Danish welfare technology assessment model, VTV that is brought to a Japanese context, where the name is changed to Assistive Technology Assessment Tool (ATAT). In our research, we have been collaborating with the central persons who are bringing the ATAT to Japan. By doing so, we discovered that it is perceived as a tool and concept that offers an alternative direction to bureaucratic and top-down strategies, that promote prestigious and advanced care robots as a solution to societal challenges. We argue that the ATAT is perceived as valuable, in order to challenge this approach by emphasizing the importance of considering the perspectives of the caregivers and end-users to ensure successful implementation of assistive technology. The conventional assessment culture we experienced during our fieldwork can be seen as insufficient for the complications the robots meet when implemented. These methods are tied to measuring the effect of robots and thus provide information for governmental strategies and decisions. As the robots do not merely function as a technological fix, but instead open up for new uncertainties, practices and values that need to be understood, it leads to stakeholders seeking out new methods, which is why they see the ATAT as relevant.

We experienced that the ATAT was linked to the conception of measuring predictable effects and assure quality, rather than opening up for the complexities when applied by caregivers and end-users. In our point of view, an emphasis on the methodology instead of presenting it as an assessment would lead to more willingness among stakeholders to respect each contribution of knowledge. This is also in line with how the ATAT is perceived by those bringing it to Japan. The ATAT should function as a concept with the aim of encouraging stakeholders to share their experiences and knowledge about assistive technologies. We argue it is essential to understand the context the ATAT is a part of, and how it is perceived and entangled in interests among various stakeholders. To integrate the ATAT in a Japanese context is much more complicated than the model itself.

In our analysis of the ATAT as a boundary object, it became apparent how the different social worlds that the ATAT is envisioned to be applied by, want to adjust it to their local needs. The ATAT is perceived to function as a market analysis, a tool for improving and presenting knowledge, a way for private users to draw on other peoples experiences, a concept that can make overseen stakeholders more involved and a needed fundament for care providers to choose new technological solutions. The many divergent perspectives among the social worlds might present a challenge for the social worlds to accept common terms for how to use the ATAT and the knowledge they share. We argue it is necessary that the stakeholders intended to use the ATAT are able to collaborate and present their local knowledge to each other which requires a flexible format, so different social worlds potentially can conform it to their local needs. In order for the ATAT to be an accepted boundary object, a translation of language is not enough.

Our last concluding remark is that during this research, we have seen that the ATAT is an ongoing endeavor that still needs adjustments. By focusing on the situation and the circumstances around the model, we recognize the ATAT as an important step in the right direction, which potentially can open up for more complexity in the field of robotics rather than narrowing it down. Although the ATAT does not contain the answers in itself, it might be able to force decision-makers to relate more to parameters and implicated stakeholders. The ATAT can potentially help to move away from the conception where advanced robotics can be applied as an instrument, where the effects are predictable and can be measured.

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