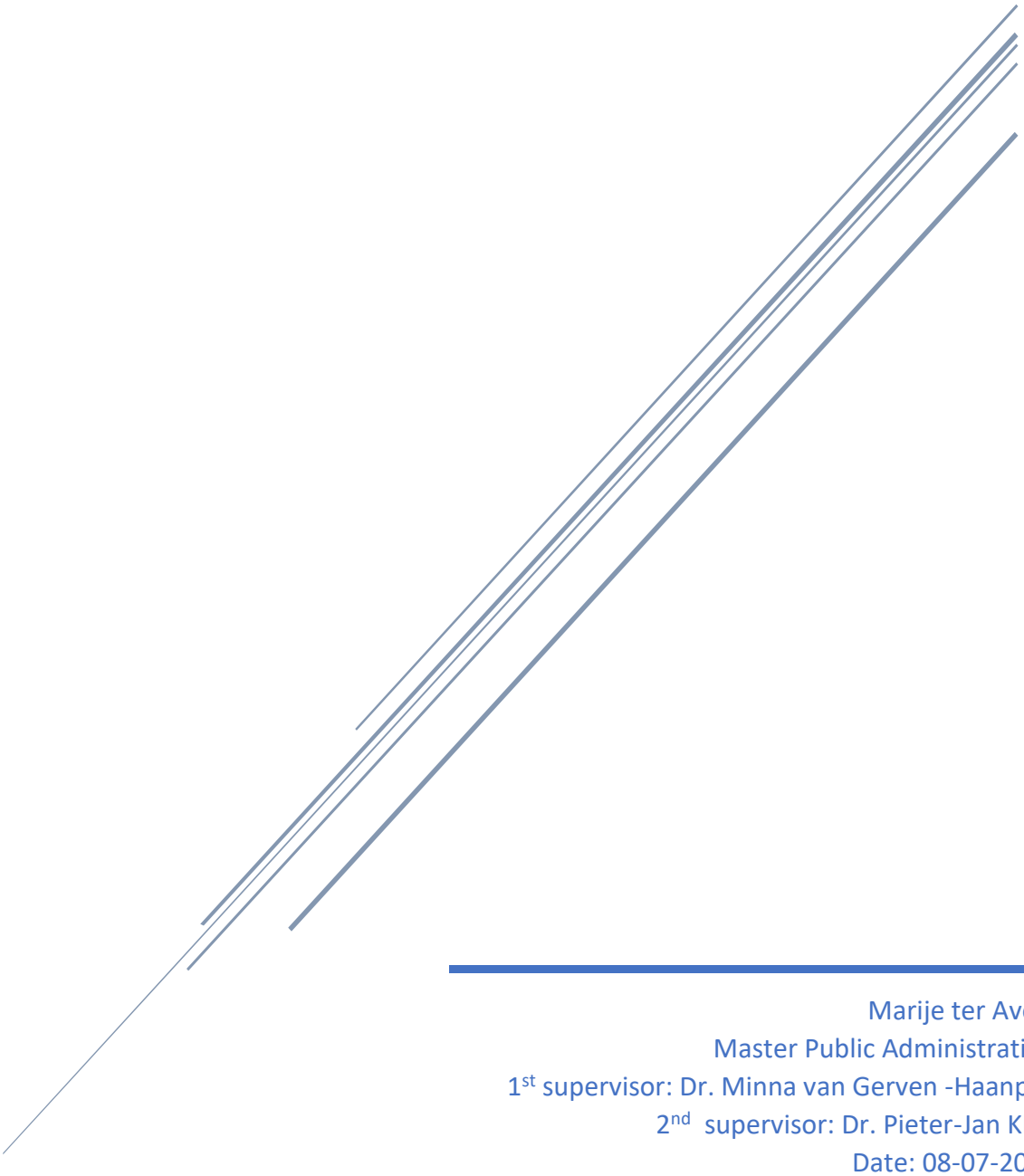
SAFE IMPLEMENTATION OF COMPANION ROBOTS IN DUTCH ELDERLY HOMES

Analysing the suitability of companion robots' implementation regulation for daily elderly care practices



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Abstract

This thesis explores how Dutch elderly homes can implement social companion robots into their care programme while safeguarding elders' quality of life and care. This topic is constructed from the desire to decrease elderly homes' aversion towards implementing companion robots into their care programme. Reducing this aversion can help more elderly homes to implement the robots into their care programme and enables the use of a valuable tool for maintaining and/or increasing elders' quality of life and care.

To discover how companion robots can be safely implemented in Dutch elderly homes, both a content analysis on literature and interviews were conducted. The literature analysis focused on currently available regulation for companion robots and ethical concerns surrounding them, while simultaneously discovering how these elements relate to elders' quality of life and care. If quality of life and/or care appeared to be endangered, suggestions to improve these conditions were elaborated upon. The information derived from this analysis served as input for interviews conducted with Dutch health care professionals. During these interviews, the professionals were questioned about their current experience with the robots, their knowledge of the companion robots, and the policies they adhered to concerning companion robots. Furthermore, their opinions were asked about the suitability of the discovered regulatory framework and the suggested improvements. How the currently available regulation and the suggested safety improvements relate to elderly home practices was analysed during the interview analysis. The conclusion of this interview analysis informs us of which currently available regulation and which safety measures are suitable for Dutch elderly care and comply with the aim to safeguard elders' quality of life and care. The outcome of this research then shows which currently available regulation and safety measures are advised to be adhered to by Dutch elderly care homes to implement companion robots safely into their care programs.

Keywords: Social companion robots; elders; elderly homes; quality of life; quality of care; regulation

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Chapter 1: Introduction

People's life expectancy increases, which means that there is a growing number of elders in society. Globally approximately 10% of societies citizens are above the 60 years old, but this percentage is expected to increase to 20% by 2050 (Sixsmith & Gutman, 2013, p.7). The number of elders in the Dutch society is even above these rates, counting in 2019 already 19,2% of the population above the 65 while in 2050 it's expected that this percentage increases to 25,7%. Indicating a rise of 6,5% (Centraal Bureau voor Statistiek, 2019). This so-called 'population aging' comes with a challenge to safeguard the health and psychological well-being of more elders, aspects who constitute quality of life. Safeguarding quality of life focuses on providing ways to protect elders' safety and security, support independent living, and social participation (Sixsmith & Gutman, 2013, p.1). Social companion robots can be used to help with this challenge, providing ways to improve elders' quality of life and thus protect their health & psychological well-being (Sharkey & Sharkey, 2012, p.23). The positive effect companion robots can cause on elders' health status combined with robots' quick developing technological abilities and the increased acceptance level towards the use of the robots in care causes a greater wish to use social companion robots in elderly care (Broekens, Heerink & Rosendal, 2009, p.2-5 / de Graaf & Allough, 2017, p.21 / Heerink, Kröse, Evers, & Wielinga, 2008, p.33/39).

Even though a growing desire for the use of social companion robots in elderly care is present, many elderly care organizations still show aversion to proceed with the implementation of such robots. A lack of knowledge on care robotics, a fear to change current routines and the absence of guidance for health care professionals when implementing companion robots can be blamed for this aversion. To change this operational protocols and structures on the implementation of care robotics need to become provided (Barlow, Bayer & Curry, 2005, p.445-446). Unfortunately, there's a lack of information to construct such protocols about social companion robots upon. The scientific community hasn't thoroughly researched the safe implementation of companion robots in elderly homes yet. Up till now, research has primarily focused on creating awareness and improving the acceptance and technical abilities of the robots. Thereby they've somehow bypassed generating information on how to implement companion robots in care. To tackle this gap in knowledge of both the elderly homes and the scientific community, this research aims to discover how companion robots can be safely implemented into the Dutch elderly care system. Conducting this research serves three functions; firstly, this thesis is of scientific relevance because it transfers the research on social companion robots into a new direction that focuses on guiding the implementation of care robotics instead of solely discovering robots' technical abilities and increasing the acceptance level towards them. Secondly, this thesis is relevant for society because it can provide elderly homes with knowledge on the safe implementation of companion robots into their care programme. This knowledge can help facilities to overcome their aversion to implementing the care robots. Lastly, the information laid bare during this research can contribute as an informative source for the construction of the requested protocols.

During this entire research, on how to safely implement companion robots in elderly homes, European laws and practices of elderly homes are taken into account. Furthermore, this thesis repeatedly uses the concept of 'safe implementation'. This concept will be regarded as implementing care robotics in a manner that either maintains or enhances elders' quality of life and care, thus not endangering these aspects.

1.1. Research questions

Tackling the knowledge gap and constructing the requested information will be based on the following research question; How can Dutch elderly homes implement social companion robots into their care programme while safeguarding quality of life and care for elders?

To answer the research question this thesis will first focus on the current state of regulation for social companion robots. Secondly, the fit between companion robots and western societies norms and values (ethical concerns) will be discussed. Lastly, the connection between the regulation, ethical concerns, and the daily practices of Dutch elderly homes will be addressed. These topics are explored by addressing the following sub research questions (graph 1):

Currently available regulation	1. What is the current state of regulation in Europe for the implementation of social companion robots in elderly care? 2. To what extent does social companion robots' regulation safeguard quality of care and life for elders? 3. Which improvements in current social companion robots' regulation can be made to benefit elders quality of life and care?
Ethical concerns	4. How does the implementation of social companion robots fit western societies norms and values? 5. Which measures can be taken to establish and/or improve a fit between western societies norms and values and the implementation of social companion robots in elderly care?
Daily practices Dutch elderly homes	6. To what extent do currently available Dutch social companion robot regulation and the suggested improvement measures fit the daily practices of Dutch elderly homes to provide quality of life and care for elders in the elderly homes?

Graph 1: Sub research questions

The first question enables us to find out what regulation is currently already established in Europe by looking into law and literature on robotics regulation. The second question elaborates upon the first question, wondering whether the currently available regulation safeguards the quality of life and care of elders. This is of importance because, as you will read further ahead in the thesis, companion robots can endanger several rights of elders. These rights all somehow relate to the quality of life, which is directly related to the quality of care (Comondore et al., 2009, p.2). To enable safe implementation of companion robots the endangered rights thus need to be safeguarded. If these issues aren't already taken care of by current regulation, the third research question becomes essential. This question namely requires to investigate which improvements can be made to the regulation in order to enhance safeguarding elders quality of life and care. These improvements can then potentially serve as tools to improve the safe implementation of social companion robots in elderly homes.

After the regulation aspect is covered the ethical concerns that western societies hold towards the implementation of companion robots in elderly care will be discussed. The fourth question enables us to see whether concerns are present. Knowledge of these concerns is of importance because the concerns may be connected to dangers for elders' quality of life and care. If so, the fifth question enables us to find out how these concerns and dangers can be taken care of. If these concerns are dealt with a fit between western societies and the implementation of companion robots is established and the potential to enable the safe implementation of companion robots in elderly care is increased.

If answers to the questions on regulation and ethical concerns are obtained, we know how companion robots impact elders' quality of life and care. If adverse impacts are present, the suggested improvements measures can minimize or solve these impacts. This obtained information enables to move forward to answer the final sub research question; thus discovering whether the regulation and the suggested improvement measures fit the daily practices of Dutch elderly homes to provide quality of life and care for elders in their facilities. To answer this last question research interviews with Dutch health care professionals were be conducted. These interviews allowed to find out which aspects of the regulation and/or improvements are already integrated into facilities' care programs regarding companion robots, while also discovering how their current practices relate to quality of life and care. Furthermore, we try to find out which parts of the regulation and suggested improvements aren't implemented and whether these non-implemented parts are suitable for the daily practices in elderly homes.

When an answer to this last sub research question is provided this thesis has discovered which parts of the currently established regulation and the suggested improvement measures fit the daily practices of Dutch elderly homes and enable safe implementation of companion robots. The currently available regulation and the proposed improvements suitable to the current practices of elderly homes can then be integrated into the companion robots' implementation process. These elements constitute the answer to the main research question and suggest a way for Dutch nursing homes to protect elders' quality of life and care upon the implementation of social companion robots.

1.2. Structure

Before addressing the sub research questions, this thesis starts with a theoretical framework. This framework seeks to familiarize the reader with the key aspects and topics of this research. It will begin by focusing on social companion robots while paying especially attention to the robots 'Tessa' and 'Pepper'. These robots were namely used by the health care professionals interviewed. After this, the aspects of quality of life and care are discussed. This is followed by shortly introducing potential implementation problems of companion robots.

When the background information is acquired, the thesis will continue by focusing on part one of the methodology. This methodology motivates the choice for this thesis' case study and seeks to explain how answers are found to the first five sub research questions. After this the actual analysis to answer these questions takes place during the regulation and ethical analysis in chapter 4. In this chapter we find out what the currently available regulation looks like, how this regulation safeguards elders' quality of life and care and which improvement measures can increase the safeguarding of these qualities. Ethical concerns whom western societies hold against companion robots are also discussed, followed by focusing on improvement measures to decrease the ethical concerns society holds. Once this information is obtained the fit of the currently available regulation and suggested improvement measures with regard to the actual practices of Dutch elderly care will be explored. How this analysis is conducted and how insights into the daily practices of elderly homes are obtained will be explained in the second part of the methodology. This second part forms a new chapter right after chapter 4. After this, the analysis of the daily practices of nursing homes and their match to the current regulatory framework plus improvements is conducted. An answer to the last sub research question will then be provided. When this answer is obtained, all sub research questions are answered and a conclusion to this thesis' main research question can be drawn.

Chapter 2: Theoretical framework

In this section of the thesis a literary review will be made that serves as a source of information throughout this thesis. The literary review will first focus on companion robots, while especially paying attention to the robots 'Pepper' and 'Tessa'. Clarifying what they are, including their functions and effects. This information provides the reader with a better understanding of the robots addressed in this thesis so that their characteristics don't have to be explained during the analysis anymore. The same aim counts for the section on quality of life and care.

2.1. Companion robots in elderly homes

Social companion robots can be defined as a robotics kind who primarily function as companions to their users. The robots try to enhance users' health and psychological well-being. The robots can benefit elders by improving their mood, decreasing loneliness levels, helping out with communication and stimulating an active lifestyle (Broekens et al., 2009, p.2-5 / Pederson, Reid & Aspevig, 2018, p.4-5). There are many different kinds of social robots with companion abilities and listing the specific characteristics of each of them would be beyond the scope of this thesis. Therefore only the features of the robots 'Pepper' and 'Tessa', who are used in the elderly homes visited, are discussed.

2.1.1. Pepper

Pepper is a robot that looks like the imagination everyone has when picturing a robot. It's white and boy-like. He stands a 120 cm tall and can move autonomously. Various cameras (HD and 3D quality), four microphones, 3D depth sensors and lasers enable the robot's capability to perceive his environment and perform many functions (Softbanks Robotics, Pepper). For example, the cameras in his eyes can detach human presence up to 3 meters away and the cameras in the forehead and mouth are meant for facial detection. These cameras, combined with the robot's implemented artificial intelligence, enable the robot to recognize faces and detach users' emotional state and act accordingly upon this (Cnet, 2016 / Robotzorg, Pepper). The ability to recognize basic human emotions makes Pepper the first robot in the world with this function (Softbank Robotics, Pepper). Infra-red sensors and lasers in the foot of the robot enable the robot to move autonomously across the room (Cnet, 2016 / Softbank Robotics Pepper). Apart from the autonomously moving capabilities Pepper can also autonomously starts conversations with people (Softbank Robotics, Pepper). The robot can communicate with people in two different ways; either by the screen on its belly or by speech (Robotzorg, Pepper). Furthermore, Pepper has 17 body articulations who make the robot's movements smooth and lifelike (Cnet, 2016 / Softbank Robotics, Pepper).

Even though the artificial intelligence installed in the robot promises functions such as detachment of human emotions, this intelligence isn't fully used yet. This is because researchers are still exploring its functionalities (Robotzorg, Pepper). The primary functions of the robot are currently focused on hospitality, entertainment and triggering actions among its users. Pepper has been designed for environments in which interaction with clients or customers is required. He can be used in stores, education, health care, et cetera (Softbank Robotics, Attract). This thesis focuses on elderly care, therefore only the influence Pepper can have on the health care sector is going to be discussed. In this sector the robot can have an impact on the efficiency of the administrative process. It can improve efficiency and consistency by helping staff with monitoring health information, generating a patient's report, ticketing orders, taking up a reception function, conducting satisfaction surveys, et cetera. For patients the robot can become a valuable tool in their care as the robot can serve as a fall

and sound detection tool, can teach patients to enhance their functional abilities and reduce their anxiety during disease and treatments. Lastly, the robot also serves as an entertainment function by stimulating physical and mental exercises among its users (Softbank Robotics, Healthcare).

Apart from Pepper's functions, one of the benefits of Pepper is that it can be applied for a communal setting (Softbank Robotics, Attract). While Pepper still has the ability to be used for individual care, as he can perceive an individual client and act according to the profile of this particular patient. This is made possible, as discussed, by cameras and sensors (Softbank Robotics, Healthcare).

2.1.2. Tessa

Tessa's appearance and functions are different than those of Pepper. Tessa is a flower pot whose primary function is to remind elders about their daily tasks. During the day, she continuously sends reminders of activities the user needs to perform (Tinybots, Particulieren / Robotzorg, Tessa). Caregivers or elders' relatives send these reminders with the use of a web application. This web application can be installed on a caregiver's or relative's smartphone, tablet or laptop. With the use of this web application, caregivers and relatives are able to write messages which the robot needs to say. The caregivers and relatives can then also decide when these messages need to be told. Caregivers or elders' relatives are thus in control of the content of the messages and the time at which they are called out. The messages are performed after Tessa made a sound to attract an elder's attention and has mentioned the current time. After the message is said, Tessa continuous to listen for a response. Tessa, however, doesn't understand the content of the response. If no response is received, Tessa repeats the question (Tinybots, Hoe werkt tessa). The primary intention of Tessa is to help the user with their daily routines. However, the robot is also capable of playing music, which music and when it's played is also pre-determined. In order to perform these activities, Tessa is located at a central spot in the user's home and remains there. The robot is thus unable to move (Tinybots, Hoe werkt Tessa / Robotzorg, Tessa).

Tessa's ability to speak can help users in several ways. Tessa can improve users' daily routine, can grant them greater feelings of self-sufficiency and makes them less prone to forgetting appointments. The reminder function of the robot makes the robot especially suitable for elders and non-elders with dementia or people with cognitive limitations. For caregivers and relatives, Tessa increases the opportunities to provide care on a distance while simultaneously increasing the chance to become more involved in the daily life of the person with dementia and/or cognitive limitation. Applying the robot can then also cause greater efficiency, decreased workload, and increased time for personal care in care institutions (Tinybots, Hoe werkt Tessa). This increased time for personal care can impact the quality of care and life. However, to discuss this impact the concepts of quality of life and care first need to be defined.

2.2 Quality of life and care

As discussed, companion robots can enhance the health and psychological well-being of elders in many ways. This, however, doesn't provide us with enough information yet about how the robots may influence elders' quality of life and care. Before researching whether the robots carry consequences for the quality of life and care, the concepts will be conceptualised. The conceptualisation of quality of life is first discussed, followed by quality of care.

2.2.1. Quality of life

Quality of life contains an individual's perception of his position in life in relation to the culture and value systems in which he's embedded along with his personal goals, expectations, standards, and concerns. The closer his perception of reality is to his desired situation, the higher his quality of life. The perception of quality of life is primarily influenced by an individual's physical health, psychological state, level of independence, and social relationships. Furthermore, the perception a person holds is dependent upon his age. Every person thus has a different perception of his quality of life, which makes it hard to establish one definition for the concept (Puts, Shekary, Widdershoven, Heldens & Lips, 2007, p.263/ Äberg, Sidenvall, Hepworth, O'Reilly, & Lithell, 2005, p.1111-1112).

Even though it's difficult to establish one definition for 'quality of life' a general perception of elders' quality of life is necessary in order to research how social companion robots can be implemented while safeguarding elders quality of life. This general understanding is constructed based upon two research projects that interviewed elders on their quality of life. Both research projects found that elders tend to judge their quality of life by looking at their adaptation capabilities, activities and independence (Äberg et al., 2005, p.1114 / Puts et al., 2007, p.266). 'Activities' encompasses all life activity areas such as self-care, social interaction, and mobility. Key issues to determine quality of life upon were in this element the ability to take care of their own body, to walk alone and to interact with others (Äberg et al., 2005, p.1114-1115). 'Independence' relates to being active without the need to be assisted by others. This was important for elders because they didn't want to be a burden for their family or caregivers. Critical issues for independence were the control and freedom over choices in their daily life, meaning that an elder wants to choose for himself how he's cared for and make simple life decisions such as which health initiatives are used (Äberg et al., 2005, p.1114/1117 / Puts et al., 2007, p.266). Lastly, adaption encompassed the ability of elders to cope with the negative consequences of becoming older. Commonly used adaptation mechanisms were physical reorganizations, meaning that elders found ways to work around their declining physical abilities like using taxies instead of driving themselves, and influencing the care given to them. Influencing care led elders to accept their dependence quicker. Lastly, thought changes such as dwelling on memories and reducing the significance given to their limitations were common used strategies (Äberg et al., 2005, p.1118-1119).

All three elements -activity, independence and, adaptation- appeared to be interlinked, while simultaneously being connected to elders' health level (Äberg et al., 2005, p.1114 / Puts et al., 2007, p.266/272). For example, to maintain independence an elder is considered to need good health. If an elder experiences endangered physical health he tends to worry about this. This worrying transfers into fears which negatively impact an elder's psychological well-being. Such physical and health limitations can result in an incapability to participate in elements of the activity and independence aspects that enhance the quality of life. This nonparticipation then negatively influences psychological well-being again (Puts et al., 2007, p.266/271-272). The elements are thus composing a circle that continuously affects elders quality of life. Overall, the lesser all elements are developed, the poorer elders judge their quality of life. The perception of desired life than increasingly exceeds the perception of real-life (Puts et al., 2007, p.272 / Äberg et al., 2005, p.1121).

Solving the unbalanced perceptions between reality and life is complicated. However, we can try to minimize the imbalance in several ways. Firstly, by trying to sustain elders' physical and psychological health as much as possible. Secondly, elders' independence should be protected, even though physical and mental impairments are present. This protection can be done by, for example, providing elders with the opportunity to influence the care provided to them. Thirdly, social interactions and participation in activities for elders should become stimulated and facilitated. Lastly, adaptation

methods can provide a way to enhance quality of life. However, one should be careful with encouraging dwelling on memories as they may construct a tendency to escape and deny the present situation (Äberg et al., 2005, p.1122). These improvements may function as suggestions to be included in elderly care so that quality is obtained. Finding out what quality of care entails will therefore now be our focus.

2.2.2. Quality of care

Quality of care is, just like quality of life, also a concept that derives from the perceptions of individuals (Bowers, Fibich & Jacobson, 2001, p.539). This means that finding one definition of quality of care is complicated. However, Bowers, Fibich and Jacobson, who conducted research to find out how nursing home residents defined quality of care, constructed the following definition; "Participants in this study defined quality of care as having choices and the ability to make them in a happy, safe environment, being treated as individuals, and allowed to be independent" (Bowers et al., 2001, p.540). According to this definition, essential elements of quality of care are thus having choices, a happy and safe environment, individualism, and independence. Additional to this definition, other researchers showed that social interactions are important for elders perceived quality of care (Bowers et al., 2001, p.540). When one takes a look at the elements that are of importance in quality of care linkages to quality of life can be discovered. For example, social interaction and independence were also of importance for quality of life. The linkage between quality of life and care has been acknowledged by several researchers. They stated that quality of care is all about the maintenance and/or improvement of quality of life (Comondore et al., 2009, p.2).

However, quality of care is not solely the judgement elders place upon their received care. It's also about the resources used and the actions taken with them that enable quality of care (Comondore et al., 2009, p.2). Especially the number of staff is a commonly used and important resource for the existence of quality of care. Studies have namely shown that the higher the number of staff per resident and the more they're trained, the better perceived quality of care (Comondore et al., 2009, p.2 / Koren, 2010, p.4). These caregivers, however, are not supposed to act freely. Perceived quality of care is namely best when care centres around maintaining and/or enhancing elders' independence. To achieve quality of care, care professionals are advised to make choices regarding provided care to elders together with them. This causes care to be based upon an elder's values and circumstances (Kane, 2001, p.302 / Koren, 2010, p.2 / Burack, Weiner, Reinhardt, & Annunziato, 2012, p.48). Apart from staff other resources that increase elders' quality of life like prosthetic aids, phones, and computers can also be beneficial for the care programme (Kane, 2001, p.302).

To sum up, quality of care is thus about establishing a happy and safe environment in which elders are granted independence while they simultaneously enjoy social interaction and the use of resources that can enhance their quality of life. One of these resources can be companion robots. Since the robots can, as formerly discussed, provide opportunities for elders to increase and/or maintain their quality of life. Pepper, for example, can increase elders' physical safety by serving as fall prevention. The robot can, furthermore, also increase psychological health by reducing the anxiety level of an elder. Tessa, in its turn, can send reminders to improve an elder's independence. These aspects -independence, psychological health, and physical health- constitute quality of life. Improving or maintaining these aspects among elders will therefore benefit elders' quality of life. Companion robots can thus serve as a valuable tool in elderly care. However, implementation risks can also occur. These will be introduced in the next section.

2.3. Potential problems of implementing companion robots in elderly care

As already discussed companion robots can be implemented in various settings, but for this research we will only focus on elderly homes in the Netherlands. Since we know the setting in which the robot operates, being elderly homes, better insights into the risks that coexist with the implementation of companion robots can be obtained. Which risks are at stake are dependent upon the type of robot that is applied.

It has already been discussed that Pepper uses cameras, sensors, et cetera. This enables him to perceive his environment. Tessa can't do this. Furthermore, Pepper can start communicating by itself. It's not regulated to perform an action by distanced users, as is the case with Tessa. With these differences, different risks emerge. These risks can be classified, which appears later in this thesis, in 'health and safety' risks and 'privacy and data security' risks. Furthermore, the risks can have a connection to ethical concerns and liability. Techno-regulation research has informed us about all the risks involved. They, for example, argue that users of companion robots have different amounts of knowledge on working with robotics and technology. Users with limited knowledge are in danger to be incapable of controlling the robot. This makes them vulnerable for excessive and/or incorrect use of the robot (Palmerini et al., 2012, p.18/174 / Leenes & Lucivero, 2014, p.201 / Salvini, Laschi & Dario, 2010, p.451). Especially users of Pepper seem prone to such an impact. The robot has more functions and requires several applications to perform them (Robotzorg, Pepper). This makes it more difficult to properly use Pepper than Tessa, who solely has one function and is controlled by one application. Furthermore, the high anthropomorphism[1] level of Pepper can potentially negatively affect its users. Due to its boy-like appearance and the high amount of human functions Pepper looks very human-like. This grants him realism, attractiveness to and enjoyment of use (de Graaf & Allouch, 2013, p.1482-1483). But other researchers also indicate that anthropomorphism in robots can unsettle people, creating physical and/or emotional discomfort. These signs are especially present when the robot has moving capacities. However, strong evidence for this remains unknown (Moore, 2012, p.1). Pepper's appearance can thus be positive and potentially also harmful. Pepper can attract people to use him, while also having the opportunity to unsettle people. Tessa has, due to her low anthropomorphism level as a flower pot without moving abilities, fewer possibilities to attract users and grant them enjoyment. This means that Tessa also causes smaller risks to unsettling people.

Apart from the psychological damage that companion robots can cause physical health can also be endangered. Abnormal behaviour in interacting with companion robots can cause severe injuries. But also small autonomous actions of the robot, like lifting its arm, may accidentally hurt users (De Santis, Siciliano, De Luca, & Bicchi, 2007, p.2 / Walters, Woods, Koay, & Dautenhahn, 2005, p.3). This is again connected to the knowledge level of the robot's user. Users may not be aware of appropriate behaviour towards the robot. This grants Pepper, again, greater opportunities to hurt people as there is more to learn about Pepper than Tessa. Besides that, Pepper moves autonomously and Tessa doesn't. This creates chances for Pepper to hurt his users with his moving capacities while Tessa stands still, unable to physically endanger anyone.

Apart from physical and psychological problems, companion robots can also intrude elders' personal space. The cameras, hearing capabilities and sensors enable companion robots to supervise elders, granting them greater safety and serving as a communication device (Palmerini et al., 2012, p.180).

[1] Anthropomorphism is the possibility for objects to be perceived and described in human terms. This is more likely to occur when human characteristics are attributed to them as this rationalizes the robots' actions (de Graaf & Allouch, 2013, p.1477).

However, this equipment is often attached to the internet and other technical devices. This causes possibilities to widely share elders' personal information and increases risks of access or loss of data, evolving in questions on data security and users privacy (Palmerini et al., 2012, p.177/180/189 / Koops, Di Carlo, Nocco, Cassamassima & Stradella, 2013, p.25). Once again Pepper has potentially a more significant intruding character than Tessa. With all its cameras, hearing capabilities and sensors it can listen to and film elders in personal settings. Furthermore, all its administration functions enable the storage of elders health information. Tessa doesn't have an administration function and also doesn't have film and overhearing capabilities, thus having a less intruding character in elders' privacy. However, it does transfer personal messages to elders' private space.

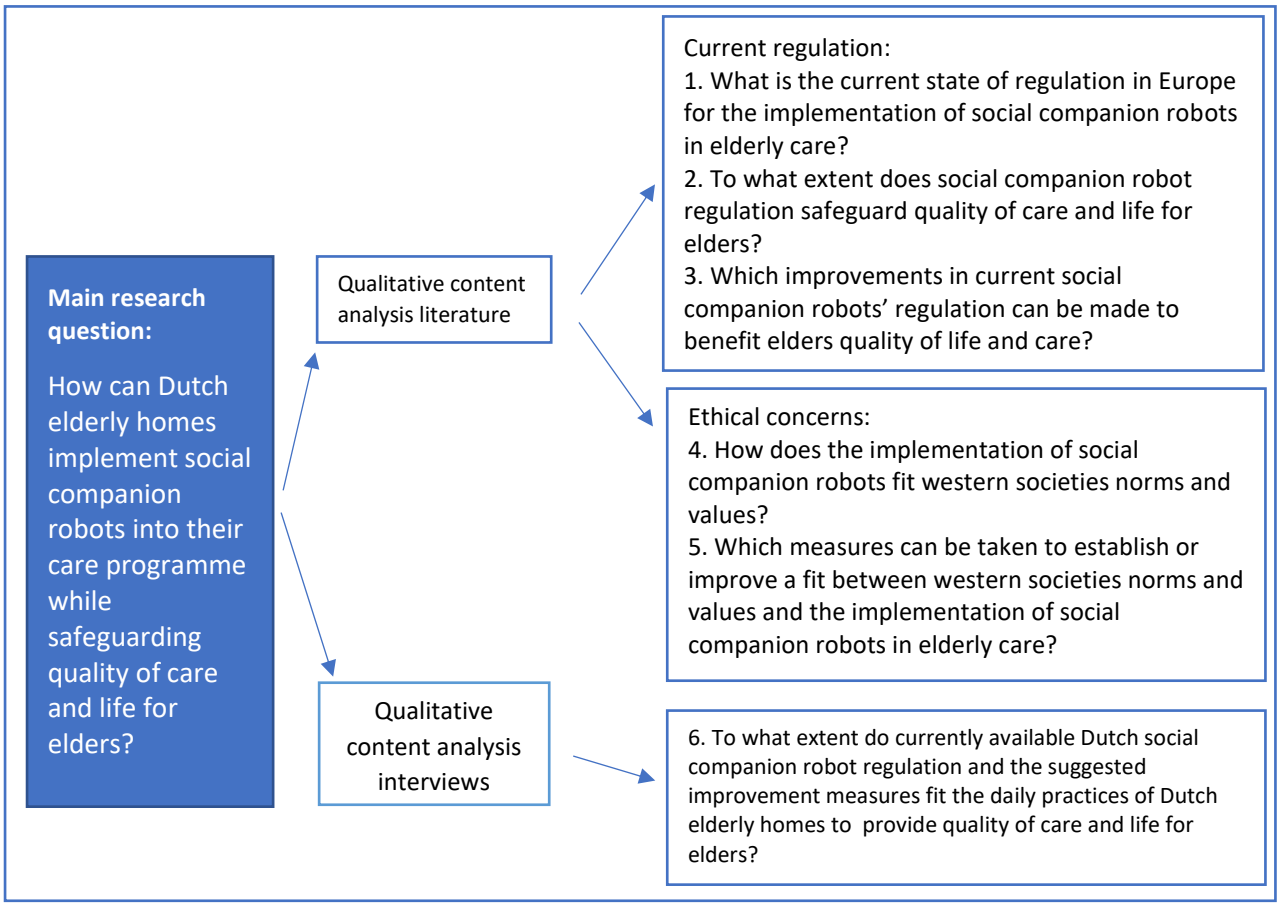
When companion robots execute all their potential functions elders can perform more functions on their own. This reduces the need for human assistance, thereby decreasing the workload of caregivers (Tinybots, Particulieren / Softbank Robotics, Healthcare). The decreased workload can potentially cause the replacement of caregivers with robots, which would dehumanize the care system and can leave caregivers prone to unemployment (Palmerini et al., 2012, p.176 / Salvini et al., 2010, p.456). Both companion robots can help the emergence of such a situation since both robots have the capacity to deliver elders with greater independence, requiring less human help and contact.

As seen, most potential problems are related to Pepper as this robot has more capacities but thereby also higher chances to cause problems upon its implementation. Tessa, as discussed, can also create some issues but these remain limited. Most of these implementation problems of companion robots somehow relate to law. This regulation and the potential issues will be further extended and elaborated upon in the regulation analysis. The next chapter will help you to understand how the analysis is conducted.

Chapter 3: Methodology (part 1)

The research design of this thesis is an in-depth content analysis using qualitative data of both literature and semi-structured interviews. The literature focuses on the first five sub research questions by discovering; what the current European regulation regarding companion robots looks like, how it safeguards elders' quality of life and care and how the regulation can be improved to enhance its safeguarding capabilities. Furthermore, it looks into how the implementation of companion robots fit western societies norms and values and which measures can be taken to establish and/or improve this fit. The analysis of the interviews conducted with Dutch health care professionals then aims to answer the sixth sub research questions by trying to discover whether the current companion robot regulation and the suggested improvements fit the daily practices and needs of Dutch elderly homes to deliver quality of life and care. Ultimately, matching the results of both the literature and interview analysis will enable drawing conclusions on how elderly homes in the Netherlands can implement social companion robots into their care programs while safeguarding elders' quality of life and care. The research structure is graphically explained in graph 2.

The data obtained from both methods are qualitative, which means that they consist out of language instead of numerical values (Lacey & Luff, 2007, p.4). Data collection and analysis methods for qualitative data are therefore used. Which methods will be used are further discussed in the sections addressed to the specific sources used. This is for the literary content analysis in this chapter and for the interview analysis in chapter 5.



Graph 2: Research Structure.

3.1. Case selection

The choice to focus on the safe implementation of companion robots in Dutch elderly care is primarily a pragmatic choice. The care robotic project 'Karel project' already conducts research with companion robots in Dutch elderly homes. For their research they use several elderly homes that already implemented companion robots into their care programs. Doctor Somaya Ben Allouch, who is involved in this project, provided contacts details of elderly care professionals who work in these facilities and thus already have experience with companion robots in elderly care. These professionals participated as interviewees during this thesis' research. Interviewing these staff members delivered the desired information for this thesis. Their experiences and perceptions can help this thesis to discover how companion robots can be safely implemented in elderly care. Besides the pragmatic choice, choosing to study the implementation of companion robots in the Netherlands is also a substantive choice. The Netherlands, as discussed in the introduction, namely deals with even greater amounts of elders in society than the global average. This amount of elders in society comes with the challenge to safeguard the quality of life of elders (Sixsmith & Gutman, 2013, p.1). Due to the high number of elders in Dutch society this challenge seems especially relevant for the Netherlands. Research has already shown that elders benefit from companion robots. Elders' interaction level and mood increases due to the various functions the robots perform like showing compassion, reminding them of tasks and activities, et cetera (Wada, Shibata, Siato, Sakamoto & Tanie, 2005, p.2788 / Kidd, Taggart & Turkle, 2006, p.2 / Pederson et al., 2018, p.4) These performances of the social companion robot limits elders health & psychological problems (Sharkey & Sharkey, 2012, p.23). The implementation of these robots is thus especially interesting and relevant for Dutch elderly care, as it enables maintenance and/or enhancement of quality of life and care for the high number of Dutch elders.

Besides the growing number of elders, the functions of the companion robots and their benefits match the standards of the Dutch society. The Dutch welfare state protects its citizens against a lack of care by enabling Dutch elders to receive a relatively high amount of professional care compared to other European countries. This care encompasses both care delivered at elders' homes and residential care (Smits, van den Beld, Aartsen & Schroots, 2013, p.337-338). The high amount of professional care risks care professionals to be asked to include companion robots in the care programme often. Apart from the intense care Dutch elders receive, the quest is also caused by the growing acceptance level towards companion robots and the current rapid technological advancements in this field (Heerink et al., 2008, p.33/39). Furthermore, most Dutch elders are already familiar with technology since Dutch elders are increasingly active in using social media and e-communities to interact with relatives. This use is the result of the Dutch elders' desire to remain autonomous and not become a burden to their relatives (Smits et al., 2003, p.341). Due to all the characteristics much resistance to implement companion robots in the care programme is not expected from Dutch elders. Solely, as research has shown, care professionals are expected to be reluctant. Therefore involving staff members in the development and implementation of technical applications needs attention (Smits et al., 2003, p.340).

Involving staff members in the development and implementation of technical applications aligns with the research design of this thesis because elderly care professionals become indirectly involved in the development of an implementation protocol for companion robots. They can namely express their perception on whether the regulation and suggested improvements fit the daily practices and needs of elderly homes. By conducting this thesis in such a manner the thesis complies with the characteristics of the active Dutch research community that conducts research on aging in the Netherlands while involving care professionals and/or older adults in their study and the

implementation of their findings. The only disconnection is that this research community primarily conducts longitudinal research (Smits, et al., 2013, p.338/340). Conducting such a longitudinal study is due to this thesis' limited timeframe impossible.

3.2. Research design of the regulation and ethical analysis

As discussed, to answer the first five sub research questions a literature review was conducted. This review used scientific articles and established European laws. Laws enabled to find out which rules companion robots need to adhere to, while literature provided knowledge on how these laws fit social companion robots and which ethical concerns are at stake when implementing social companion robots in elderly care. In case law doesn't enable safe implementation of companion robots yet or conflicts between societies norms and values occur literature also proposes ideas to create a fit or improve the discovered circumstance. Often these improvement suggestions somehow safeguard elders quality of life and care because the current conditions appeared to not sufficiently enable this yet. How the currently available regulation relates to elders' quality of life and care is the topic of study for the second sub research question and will also be discussed with regard to the ethical concerns during the fourth sub research question.

It's important to note that the first three sub research questions are analysed simultaneously. Instead of using the questions to divide the regulation and ethical analysis, this thesis used different regulation topics. It starts, for example, with health and safety regulation and addresses all three sub research questions within this section. After this, the regulation analysis continues with another regulation topic. The discussion of the ethical concerns follows after all regulation topics are covered. This discussion takes a similar approach, namely also addressing the fourth and fifth research question simultaneously. This structure for the literary analysis was chosen because it enabled all information on each regulation topic or ethical concern to be found close together. Apart from this, the structure also aligns with the format of the RoboLaw project. This project's paper has been one of the primary literary pieces used during this thesis and focuses on how emerging robotic technologies, among which are care robotics, challenge European law and ethics. The goal of their research is to make regulatory suggestions for the European Union (EU) (RoboLaw, welcome).

The RoboLaw project can be regarded as techno-regulation research. This research focuses on how new robotics kinds, like companion robots, challenge and impact the current legal system and values in a society. The research field lays bare possible inconsistencies with current legal frameworks that can evoke new risks and methods of use. Besides laying bare these impacts and inconsistencies techno-regulation also suggests ways to decrease the occurrence of negative impacts (van den Berg, 2011, p.317). Three literary pieces from this research field were especially relevant for this thesis and therefore became the primary literary sources for answering the first five sub research questions. These primary regulation sources and their contributing characteristics can be viewed in graph 3. Other literature has also been used, but these had a more additional character.

To ensure that the currently available regulation and ethical concerns are discovered and suggested improvements comply with current times the scientific articles used were primarily published from 2010 till 2019. The use of recently published articles was most suitable for this research topic because robotic technology develops quickly (Heerink et al., 2008, p.33/39). Using recently published literature could ensure that the knowledge obtained is up to date and matches the current state of development and regulation while simultaneously reflecting societies current concerns and desires. All used literature derived from several scientific databases, such as 'Scopus' and 'Google Scholar', and were found by using various search words such as; 'companion robots elderly care', 'companion robots ethical concerns', 'quality of life elderly care', 'social robotics policy', et cetera.

Literature piece	Contributing characteristics	Elements within these characteristics
Salvini, Laschi, & Dario (2010): Design for Acceptability: Improving Robots' Coexistence in Human Society.	• Indicates inconsistencies of companion robots with the currently available legal framework and slightly discusses ethical concerns.	- Discusses health and safety risks who emerge due to disconnection with general robotics regulation. - Calls for respect to privacy and data protection. - Acknowledges the fear for job loss among human workers.
European Commission project by Palmerini et al. (2012): RoboLaw.	• Indicates inconsistencies of companion robots with the currently available legal framework and lays bare ethical concerns of societies. • Provides solutions on how to solve and/or reduce these inconsistencies and ethical concerns.	- Discusses health and safety risks who emerge due to disconnection with general robotics regulation + suggests solutions. - Discusses the infringement of the right to privacy and data security + suggests solutions. - Discusses dehumanization of care. - Discusses dependency on technology. - Draws attention to the additional character of the robot in the care programme.
Leenes & Lucivero (2014): Laws on Robots, Laws by Roots, Laws in Robots: Regulating Robot Behaviour by Design.	• Indicates inconsistencies of companion robots with the currently available legal framework. • Provides solutions on how to solve and/or reduce these inconsistencies.	- Discusses safety issues due to disconnection with general robotics regulation + suggests improvements. - Discusses the liability issue.

Graph 3: Primary techno-regulation literature used.

3.3. Limitations of methods

When literature was searched to conduct this analysis upon it appeared that no information on the current regulatory framework of companion robots in specifically the Netherlands was available. Unfortunate because this thesis tried to specifically find out how Dutch elderly homes can safely implement companion robots. To solve this, the regulation is based upon literature that relates to

the Netherlands. With ‘relates to the Netherlands’ it’s meant that the literature either provided information on the situation of EU countries, of which the Netherlands is one, or was based upon research conducted in other western countries. By searching for such relating literature it was tried to adhere to literature that provided information that reflected the Dutch situation and society as much as possible.

The used laws also don’t specifically address the Netherlands. Instead of relevant Dutch law, more general European laws were used. This choice is made because, as you’ll see in the upcoming legal analysis, no specific laws are designed yet for care robotics and therefore a great amount of federal laws are relevant. Addressing all of these relevant Dutch federal laws would be beyond the scope of this thesis. Furthermore, one easily gets lost in the amount and details of all these specific, federal laws. Using more general European laws then served two functions; firstly, it enabled this thesis to address all the questions without getting lost in the details of federal laws. Secondly, general laws enabled a better fit with the techno-regulation literature used. This literature namely addresses European laws as well and doesn’t focus on Dutch laws. The connection to researching the Dutch case will then solely be made during the interview analysis. For this analysis Dutch health care professionals were interviewed about their current experiences with companion robots and the regulation they currently use concerning companion robots.

Chapter 4: Regulation and ethical concerns analysis

During this chapter, current companion robots' regulation and ethical concerns related to companion robots will be discussed. Furthermore, we'll also focus on how the regulation and ethical concerns relate to quality of life and care. These qualities are presented in this paper as the central values of elderly care. Investigating the relationship between regulation and quality of life and care is of importance because it increases the ability to respect both the central values of the care system and users, being elders and caregivers, upon implementing companion robots (van den Berg, 2011, p.329 / Kidd et al., 2006, p.1 / Brownsword, 2004, p.204 / Palmerini et al., 2012, p.8).

The analysis will start by focusing on the legal aspects, thus companion robots' regulation. However, such regulation hasn't been clearly developed yet. This is due to the unique characteristics of companion robots. Companion robots challenge, due to their autonomous and interacting capacities, the current legal framework that exists for robots (van den Berg, 2011, p.455-456). How they do so and what this means for quality of life and care will be investigated by first analysing the inconsistencies with the legal fields of 'health and safety requirements', 'privacy and data protection' and 'liability'. The first two of these fields endanger users' rights and safety on a daily basis, whereas liability issues only occur in case of harmful events. Even though the last does not continuously threaten elders, all three fields are analysed because research has shown that inconsistencies are primarily present in these three legal fields (Salvini et al., 2010 / Koops et al., 2013 / Palmerini et al., 2012). Thus also placing some significance on liability. During the entire legal analysis the by techno-regulation literature suggested improvements to the occurred inconsistencies will also be discussed. After the legal analysis, this thesis continues with the ethical analysis.

4.1. Health and safety

To discover how companion robots can impact the health and safety of elders one first needs to delve into the legal health and safety requirements companion robots need to adhere to, as they lay bare user's risks involved. However, special health and safety requirements for companion robots have not been made yet. Currently, companion robots solely adhere to the requirements of factory robots and are advised to follow the laws for mobile robots (European Parliament, 2016, p.18 / Palmerini et al., 2012, p.18/174). This causes a mismatch to occur because circumstances between companion and the other robotics kinds are much different. Factory robots exactly know which tasks need to be performed at what given moment, and only special skilled staff members alter these settings. The health and safety of these staff members are protected by regulation (Palmerini et al., 2012, p.18 / 174). This regulation, however, doesn't fit companion robots' circumstances. Companion robots namely don't function in a professional environment. They're instead active in a personal, less structured environment. This environment makes firm instructions for the robot unrealizable. This setting evolves in risks that are complex, changeable, and unpredictable (Salvini et al., 2010, p.456). Furthermore, companion robots are asked to interact with people with different amounts of knowledge and training on its use. This limited technical knowledge can cause an incapability to control the robot, which enables users vulnerability for excessive and/or incorrect use of the robot (Palmerini et al., 2012, p.18/174 / Leenes & Lucivero, 2014, p.201 / Salvini et al., 2010, p.451). Such using failures can cause an overflow of stress and responsibility feelings among elders (Kidd et al., 2006, p.4). Thus potentially negatively affecting elders psychological well-being. Apart from the psychological damage, physical health can also be endangered. Abnormal behaviour in interacting with companion robots can cause severe injuries. But also small autonomous actions of the robot, like lifting its arm, may accidently hurt users (De Santis et al., 2007, p.2 / Walters et al., 2005, p.3). Endangered psychological and physical well-being are problematic for elders quality of life because, as discussed, if harm is caused to the psychological and physical health elders may become incapable

of performing activities and live as independently as possible. Due to this, the four elements that define the quality of life; physical and psychological health and the capability to engage in activities and live independently are at risk. Problematic because the better the elements of quality of life are developed, the better rated the quality of life is.

Fortunately, current law already minimizes the occurrence of damage. First of all, if a robot appears to be dangerous for human safety and health the government of the Netherlands is obligated to forbid the registration and or vending of the robot (European Parliament and the Council of the European Union, 2007, Article 19-1). However, this isn't expected to occur often as law prescribes several safety measures to the manufacturers of robots. Manufacturers are, for example, meant to provide information towards the owner of the robot in the owner's language to prevent misuse (European Parliament and the Council of the European Union, 2007, Article 251 of Treaty (2)- 18 & article 37-2). Furthermore, they need to design a robot that considers both the safety of the robot's performance and its impact on consumers (European Parliament and the Council of the European Union, 2007, Article 31-2a+b). Whether the design of the robot is safe enough to sell will be decided by the safety standards designed for the specific type of technology in question. These standards need to be constructed by the Dutch government (European Parliament and the Council of the European Union, 2007, Article 31-4). But this standard is currently, as discussed, still missing.

To compensate for such an absence of safety standards, RoboLaw has drawn attention to the importance of providing a safety guideline for companion robots (Palmerini et al., 2012, p.174). This safety guideline effects both robotics users (being elders and caregivers) and their manufacturers. It acknowledges that manufacturers need to ensure that the robot's appearance and actions can't harm users (Palmerini et al., 2012, p.184). This safeguards the elders (physical) health. For users it's important that they become informed on the risks of living with companion robots (Leenes & Lucivero, 2014, p.202). To decrease the danger of excessive or incorrect use of the robot trainings on its use also need to be provided to staff and elders (Palmerini et al., 2012, p.184). This is especially of importance for staff members since they guide the implementation of companion robots and are therefore expected to understand when a robot positively or negatively influences an elder (Moyle, Bramble, Jones & Murfield, 2018, p.334). The staff then takes over much of the responsibility for the safe use of the companion robots. They become able to prevent elders from overuse or an overflow of responsibility feelings, decreasing the chance for incorrect and/or excessive use and stressed elders. Knowledgeable staff members can therefore help elders to benefit from the companion robots while reducing the risks for the quality of life to be at stake. If elders show signs of distress or use the robot incorrectly, knowledgeable caregivers can intervene by either taking away the robot or altering elders' behaviour towards the robot. Due to this robots are more likely to solely positively affect elders' quality of life, increasing the independence and activity levels of elders. The functions of the companion robots in combination with the actions caregivers perform relating to the robots also improves the quality of care. The robots namely become a helpful, safe tool in the caregiving programme to enhance elders' quality of life.

The suggested improvements of techno-regulation research request an extended and more specialized version of the currently available law for companion robots. Law and techno-regulation share the idea that manufacturers need to design a robot as safe as possible. Furthermore, they agree on the importance of spreading information on safe use. Only techno-regulation desires to see the spreading of information to a different extent then law currently does. Law states that purchasers should be informed on proper use without elaborating on which information needs to be included. RoboLaw, on the other hand, is more specific on this topic. They argue that not only purchases but all users and specifically caregivers need to become informed on the proper use of the

robot while focusing on the emotional responses of elders. With these suggestions techno-regulation aligns better with the right to human dignity than the currently available robotics law does for companion robots. This human dignity right states; “human dignity is inviolable. It must be respected and protected” (European Union, 2000, Article 1). By aiming to create an entire environment of knowledgeable people with regard to the use of companion robots, the physical and psychological health and therefore the human dignity of elders and their quality of life and care is best protected. Now that the health and safety inconsistencies with the current legal field are covered and suggested improvements are made we may continue with doing the same for the legal field of privacy and data protection.

4.2. Privacy and data protection

Most companion robots use elders personal data and have the ability to intervene in elders personal space. They are capable of monitoring users’ behaviour and health status by themselves or by being operated from a distance by family members or caregivers. These controllers are enabled to supervise elders tasks such as taking medicine or, more generally, remaining safe (Palmerini et al., 2012, p.180). This supervision can enhance both the quality of life and care of elders. It can increase their independence because the robot can prevent elders from doing dangerous things or contact assistance when dangerous events have already occurred. Furthermore, it can remind the elder when to perform certain actions (Tinybots, Hoe werkt Tessa / Robotzorg, Tessa). Companion robots may thus guide elders away from the need to be supervised and assisted by human caregivers in many daily life activities. This enables elders to enhance their capabilities of their much-desired self-care while also relieving them (partly) from the thinking pattern of being a burden to family and caregivers. Besides these supervising activities companion robots can, due to supervising equipment such as cameras, also serve as a communication device between the elder and distanced users (Palmerini et al., 2012, p.180). Increasing elders quality of life by enabling more social relationships.

These potentials to increase quality of life and care for elders seem promising. However, companion robots supervising technologies can intrude on elders’ privacy. Furthermore, companion robots deal with high amounts of personal data and often require internet connection while simultaneously being attached to other technical devices, like smartphones or tablets. This causes possibilities to share elders’ personal information widely and increases the risks to access or loss of data, evolving in questions on users’ privacy an data security (Palmerini et al., 2012, p.177/180/189 / Koops et al., 2013, p.25 / European Parliament and the Council of the European Union, 2016, Article 2).

It’s complicated to construct privacy and data protection measures for companion robots due to the difficulty of balancing elders’ privacy and safety. Elders do have the right for privacy, but regulators wonder whether this right can be interfered with when it benefits elders’ safety. For instance; if the robot sees the elder perform a dangerous task, shouldn’t they try to restrain the elder from doing so (Koops et al., 2013, p.24)? This issue centers around the law that states that processing personal data must be regarded as lawful when it’s done to serve the interest of the person in question and/or is essential for his/her life (European Parliament and the Council of the European Union, 2016, statement 46). It can, however, be difficult to determine whether the implementation of a companion robot is essential for an elder’s life. Fortunately, defining whether the implementation of the robot serves the interest of an elder is easier discovered.

To discover whether the use of a companion robot is in an elder’s interest, the elder needs to be asked for consent. This is already obligated by law (European Parliament and the Council of the European Union, 2016, Article 7). This consent can solely be given by elders themselves and not by relatives or their representatives (European Parliament, 2016, p.22). Apart from asking permission,

providing elders influence in the implementation of companion robots into their care programme can strengthen the position that the use of a companion robot serves an elder's interest. By thinking along in the robots use elders express willingness and interest in the use of the companion robot. This suggestion derives from Robolaw, as they wish to extend elders' freedom of choice to use companion robots by letting elders determine and control the activity level of the robot. Due to this a particular lifestyle can't be imposed on elders (Palmerini et al., 2012, p.189-190). Besides elders, caregivers also need to become capable of controlling the robot. They can then help elders decide when supervising is beneficial (Palmerini et al., 2012, p.190).

Apart from the supervising capabilities and obtaining the power to determine when this happens, control should also be enabled over the use of elders' personal data. Users need to ensure that their robot is updated regularly to improved security measures so that their personal data is protected at its best (Palmerini et al., 2012, p.189-190). Such data security measures are already existing in current data and privacy law. This law states that the controller must implement technical and organizational measures to protect data against breaches and loss (European Parliament and the Council of the European Union, 2016, statement 78). In this law it's unclear who the 'controller' is. RoboLaw suggests that the elder and caregivers are in charge of this. To be in charge users need to have access and knowledge on the security measures needed, including passwords, firewalls, et cetera (Palmerini et al., 2012, p.189-190). This needs to be taught to users, being in this case elders and caregivers. The last improvement is for manufacturers to install some measurements into the robots that limit autonomous starting behaviour and monitoring (Koops et al., 2013, p.25).

If all these suggestions are adhered to companion robots can enhance quality of life by granting elders greater independence and social relationships, while respecting elders' rights to privacy. Furthermore, asking consent and deciding when the robot supervises or assists together with an elder causes an increase in quality of care. The measures namely provide elders with the opportunity to make choices about the care they receive, while simultaneously having the option to be independent in an increased safe environment. The companion robots can then function to enhance an elders' life without constantly risking their right to privacy and data security.

4.3. Liability

The last legal field, that of liability, may not endanger elders on a daily basis but is still important to assess because it can impact the access to companion robots and thus the availability of a tool that continuously improves quality of care and life. The source of this impact is the difficulty to determine who can be held liable in harmful situations. The robotics themselves are currently not able to be held accountable (European Parliament, 2016, p.14 / Palmerini et al., 2012 p.18). The EU's argument for this is that robots don't have legal personality. Assigning such a personality to robots is impossible because you can't compare robots to humans. A robot isn't a conscious being and is currently somehow controlled by another actor. This absence of assigning legal personality to robots is expected to remain for still a long time (European Parliament, 2016, p.14-15). This means that either the manufacturers, owners, or users are liable. Currently, who is liable is dependent on who could have foreseen and avoided the harm (European Parliament, 2016, p.16 / Palmerini et al., 2012, p.18). The law states that when the design or production is the cause of damage, the manufacturer is liable. If acts of the victim cause the damage, the victim is held liable (Directive 85/374/EEC, 1985, art. 1/8). But proving the source of damage is difficult (European Parliament, 2016, p.16 / Palmerini et al., 2012, p.18). This difficulty in proving who's responsible for the harm can cause legal uncertainty, involving different interests of users, manufacturers, and possible third parties (Palmerini et al., 2012, p.18-19). Even the EU admits this legal uncertainty and acknowledges the desire for a chance in the future (European Parliament, 2016, p.17). RoboLaw suggests that the law should balance this

liability uncertainly (Palmerini et al., 2012, p.18-19/22). It should provide information on who's in control and responsible for the robot at what given moment (Palmerini et al., 2012, p.174). Since this law is not present yet, elderly homes have to deal with liability uncertainty themselves.

Since companion robots are primarily used in users' homes, the rate of damage is not expected to be high. On the other side, if something happens it will be hard for the user to defend him/herself in court because the user chose to purchase the robot and the robot's behaviour will be regarded as relatively easy manageable. Furthermore, all actions of the robot and the control of them take place in the direct environment of the user (Palmerini et al., 2012, p.187). Robots are also by law often treated as tools and therefore its user is responsible for the robot's actions (Leenes & Lucivero, 2014, p.206). Escaping liability for the user is thus troublesome. The almost impossible escape is reconfirmed when finding out that manufacturers can rarely be held liable. The robots behave somehow autonomously, resulting in the unpredictability of the robot's actions. Manufacturer's liability is due to this unpredictability too difficult to prove, which grants manufacturers the possibility to avoid liability when showing that scientific and technological knowledge was by no means able to prevent the damage committed (Palmerini et al., 2012, p.185-186 / van den Berg, 2011, p.325-326). Overall it can thus be stated that, even though not confirmed by law, users are currently almost always held liable. When connecting the liability question to Dutch elderly homes the question becomes even more complicated. One might wonder who the user is. Is it the elder or the elderly care home? Techno-regulation research doesn't provide answers to this question even though it acknowledges the issue by stating that the housing arrangement of a user may also be held liable(Palmerini et al., 2012, p.187).

The liability for either the elderly or the nursing homes may evoke greater doubts about whether to implement companion robots in the care programme. Such doubts can hold the implementation of companion robots back and therefore denies elders access to enhanced quality of life and care. To escape complicated liability questions, techno-regulation research suggests to create insurances for harmful events regarding care robots. If such insurance options become available, the tort liability cases are expected to decrease. This sounds promising, but the prospective insurance can also have a negative impact. It can increase costs which can demotivate potential users to integrate care robotics into their care programme (Palmerini et al., 2012, p.186 / Leenes & Lucivero, 2014, p.207). Elderly homes can already evaluate if an insurance would be a plausible solution for the liability issue, reviewing whether there is space for them within their budgets. If so, and they collectively express the desire for such an insurance the market can answer this desire. If not, then elderly homes and/or elders themselves need to deal with the liability issue themselves. This may transfer to greater doubt and ultimately less implementation of companion robots, hence fewer possibilities to improve elders' quality of life and care.

Now that the legal fields have been discussed it's time to move on to elaborate on the fit between companion robots and societies ethical concerns. This is important because the regulation of new technologies is often the result of law, technical, and ethical norms (Koops et al., 2013, p.18). The law is already covered and to a certain extent the technical norms have also been discussed by focusing on the design obligations towards manufacturers. Technical norms are not discussed in detail because this isn't something that can guide elderly homes in how to implement companion robots. Since this thesis doesn't elaborate on technical norms, it's now time to turn to the ethical concerns.

4.4. Ethical concerns

Ethical concerns that arise when dealing with the implementation of social companion robots in elderly care concern a fear for reduction of human contact, infantilization, anxiety for dependency on

technology and fear of caregivers to lose their jobs. The fear for the reduction of human contact and dependency on technology will be combined for reasons that will be discussed in the section addressed to them. A similar structure to that of the legal field issues will be used to discuss the ethical issues, meaning that the inconsistencies between the implementation of companion robots and societies norms are first discussed and afterwards the focus will shift towards the improvements research provides to tackle the concerns.

4.4.1. Infantilization

One of the ethical concerns centers around the fear that elders gain the feeling of being infantilized if they are asked to use a companion robot (Moyle et al., 2018, p.332). This fear is concerned about the idea that elders are deluded into perceiving a companion robot as a real thing which they can have a relationship with (Sharkey & Sharkey,2012, p.25). Research, on the other hand, has shown that this concern is misplaced. Companion robots namely don't make elders feel infantilized. Elders perceive robot's real features like eye and head movements as real, but they don't regard it as childish (Moyle, 2018, p.333). Even though viewing it as real, elders remain aware of the items fakeness. Elders know that the robot is solely an attribute because they can often choose the interaction level themselves. This authority and control over the robot cause the elders to avoid infantilization (Sharkey & Sharkey, 2012, p.26-28). This information, however, already proposes that elders indeed have control over the robot and are capable of choosing the interaction level with them themselves. For this fear to be misplaced, improvements discussed in the 'privacy and data protection' legal field are thus in need to be adhered to. If this is done it can be argued that infantilization isn't an issue that needs to be tackled in regulation. It solely remains an issue that needs to be tackled by creating awareness for the misplaced fear of infantilization and the capability of the robots to improve elders quality of life. Instead of a toy, elders obtained a valuable object with whom they can interact. The robot enhances the elders' social relationships in different domains; with the object and via applied communication functions also with friends and/or relatives. Furthermore, the companion robot can remind elders of tasks to do and activities to attend. Thus increasing the activity aspect in elders' quality of life.

4.4.2. Dependence on technology and reduction of human contact

Companion robots are meant to enhance the opportunities for elders by providing them with more human functions and granting them greater independence. This will improve elders' self-esteem. On the other hand, their dependence level shifts towards a reliance on technology. People regard this reliance as an ethical issue as it shifts the caregiving structure from human to human towards robot to human (Palmerini et al., 2012, p.173-175/181). This fear for the human-robot relationship is connected to fear for a decrease in human contact for elders. People are afraid that the robot-human relationship will eventually dominate the human-human relationship in care. Problematic because human contact is a fundamental trait of human care. Replacing humans with robots would dehumanize the care system (Palmerini et al., 2012, p.176). The danger in dehumanizing the care system lies in the far more limited communication capabilities of robots than those of human caregivers. Companion robots are by no means expected to be able to show a similar level of love and attention as humans do (Sharkey & Sharkey, 2012, p.24-25). This endangers elders to suffer from a lack of relationships with human contact, replacing relationships of trust and concern with a relationship based on efficiency and remote monitoring (Koops et al., 2013, p.24). If human-robot care replaces human-human care, the social relationships element in elders' quality of life and care is endangered. Since robots, as discussed, can't be regarded as a substitute for human-human relationships. Furthermore, as discussed in the quality of care section it has been proven that quality

of care increases when the number of care staff per resident increases. This thus shows that indeed replacing human care staff for robots doesn't comply with quality of care.

The fear for lack of human contact coexists with feelings of anxiety towards the situation of caregivers. People are afraid that the introduction of companion robots negatively impacts their employment circumstances, fearing that caregivers will feel unnecessary. They fear for a loss of human contact with elders, which affects their capabilities to care for the elderly (Koops et al., 2013, p.25). Lastly, this fear is also connected to fear for the loss of jobs in the elderly care sector, being afraid that robots will take over the jobs of humans (Salvini et al., 2010, p.456).

The fear for a decreased level for human contact is not misplaced, as the implementation of companion robots makes leaving elders alone for longer periods of time indeed tempting (Sharkey & Sharkey, 2012, p.24-25). But when proper care is taken of implementing companion robots in elderly homes the chance for this to occur minimizes. First of all, because elderly homes must avoid dehumanizing the care system. Even though companion robots may show good results, elders need to experience personal care to safeguard elders psychological health (Palmerini et al., 2012, p.176). Dehumanizing the care will, as discussed, negatively affect elders quality of life and care. The robots are solely meant to provide support to caregivers and elders, not replacing them (Pederson et al., 2018, p.3). Even though the EU doesn't have any rules on this subject, they acknowledge the importance of the issue and suggest a principle that also draws attention to the additional character of robots in care. They state that robots shouldn't take over human care entirely and solely need to act as an assistant to help patients to become more independent and autonomous (European Parliament, 2016, p.24). If this principle and advise is adhered to and companion robots are implemented as an additional tool in the elderly care, they are thus expected to increase the quality of life and care of the elders. The additional character, furthermore, prevents dehumanization from occurring while simultaneously reducing the fear for a loss of jobs and safeguarding caregivers capabilities.

4.5. Conclusion of the regulation and ethical analysis

During the legal analysis, we discovered the answers to the first three sub research questions. Concerning the first question on what the current state of regulation for the implementation of social companion robots in Europe entails, we discovered that the health and safety legal framework isn't entirely suitable yet for companion robots. A safety standard for the robotic type is namely still non-existent. Furthermore, mobile robotics law requires manufacturers to deliver information to the owner about safe use, but this requirement doesn't indicate whether users, who may not be the owners, should also obtain this information. To answer the second research question on how this regulation safeguards elders' quality of life and care we can conclude that companion robots can benefit elders' quality of life and care in several ways. However, the unmatching legal framework, the absence of a safety standard and the missing obligation to spread information to all of the companion robots users can ultimately endanger the physical and psychological health of elders. This is problematic for elders' quality of life and care. Techno-regulation established some safety suggestions which can help to prevent the endangered quality of life and care. The safety measures contained the construction of a safety guideline that requires the manufacturer to deliver a safe product and requires all users to become knowledgeable about the use of companion robots. To reach this, elders and caregivers need to be trained (sub research question 3). During these trainings knowledge also need to be spread and skills learned with regard to elders' privacy and data protection.

Elders' privacy and data is already protected by several laws, who're relevant for the answer on the first sub research question. Law already requires the consent of elders when using companion robots and requires the controller to implement technical and organizational measures to protect data against breaches and loss. Law, however, doesn't state whom the 'controller' is. Although, RoboLaw suggests that the caregivers and elders are both the controller. It's important that these users gain the skills for safeguarding elders' privacy because this can help to create a balance between the functions of the robots and infringed privacy. Research namely showed that the functions companion robots possess can increase elders' quality of life, while implementing a robot in the care programme can improve quality of care (sub research question 2). However, the functions needed to produce such results endanger elders' privacy and personal data safety. To obtain a balance between quality of life and care techno-regulation suggested that, apart from providing consent for the use of the robot, elders need to become able to decide the activity level of the robot themselves. Caregivers may help them with this. Furthermore, elders and caregivers need to learn how to update and perform security measures on the robot in order to protect their personal data. This all needs to become taught to users (sub research question 3).

Apart from these legal fields that have a direct relationship with elders' quality of life and care, liability uncertainty also played a role. With regard to the first sub research question, we've seen that current liability laws indicate that the party that's the source of the damage is responsible. However, it appeared that proving the source of damage is rather difficult due to which liability uncertainty arises and the users of companion robots are eventually almost always liable in case of harmful events. This can evoke doubt among elderly homes to implement companion robots into the care programme. Doubt can hold the implementation of companion robots back. This can deny elders access to the robotics even though research has proven that companion robots can increase and/or maintain elders quality of care and life (sub research question 2). To chance this techno-regulation has suggested constructing an insurance against harmful events caused by care robots. Furthermore, they call for more clarification regarding liability laws (sub research question 3). Creating more clarification surrounding the liability law is unfortunately not realizable by elderly homes alone. Therefore solely the insurance measure can be considered. Unfortunately, the costs involved in taking up such an insurance can demotivate elderly homes to use companion robots.

Apart from a legal analysis, this chapter also conducted an ethical analysis. During this analysis, sub research questions 4 and 5 were answered. Regarding the fourth sub research question, on the fit between social companion robots and western societies norms and values, the analysis showed that society holds several concerns. However, these concerns appeared to be partially unnecessary fears. Infantilization will, if the elders indeed gain control over the robot, not occur. While dehumanization of care, dependency on technology, and job loss for caregivers are indeed potential dangers for elders' quality of life and care. The answer to the fifth question, which desired to find out which measures can be taken to establish or improve a fit between western societies norms and values and the implementation of the robots in elderly care, contains two safety measures. The first safety measure is to ensure elders control over the robot so that infantilization won't occur, while the second states that the robots solely need to be implemented as an additional tool. This additional character of the robot can prevent job loss for caregivers, dehumanization of care, and a dependency on technology. If these measures are adhered to companion robots won't endanger elders quality of life and care.

Clarification of the currently available regulation and the presence of ethical concerns regarding the implementation of companion robots in elderly care and the suggested improvements has now been obtained. The obtainment of this answer, however, does not guarantee the safe implementation of

robots in elderly care yet. The fit between the current regulation, the improvements, and the daily practices of elderly care professionals in the Netherlands namely remains unknown. The thesis will therefore continue in chapter 6 with analysing the applicability of the currently available regulation and its suggestions to daily elderly care practices. All in order to find out how Dutch elderly homes can implement companion robots while safeguarding elders' quality of life and care.

Chapter 5: Methodology (part 2)

As the analysis of the current regulation, ethical concerns, and suggested improvements has been conducted in the former chapter we can continue with the second part of this thesis' research. During this part the aim is to answer the sixth sub research question; 'To what extent do currently available Dutch social companion robot regulation and the suggested improvement measures fit the daily practices of Dutch elderly homes to provide quality of life and care for elders in the elderly homes?'. An answer to this question is perceived with the help of interviewing Dutch health care professionals. Since this research involved humans, permission of the ethical committee of the University of Twente was necessary. This permission was requested and received (request number 190444). Both the process of conducting these interviews and analysing them will be explained in this chapter.

5.1. Interviews

The upcoming interview analysis tried to discover an answer to the last sub research question by evaluating how elderly homes relate to the information of the legal and ethical analysis discussed in the former chapter. The interviews tried to find out how elderly homes have currently implemented the robots, asking about which rules they use and how knowledgeable staff and elders are regarding the implemented companion robot. The current experience of the elderly homes regarding the endangered quality of life and care was also questioned by seeking answers to questions on which occurrences of harmful events, infantilization et cetera have already occurred and how the facility dealt with these occurrences. Lastly, the interviews tried to find out whether there is space available in the facilities' care programme to adhere to the current regulatory framework and the proposed improvements. Simultaneously the interviewees were asked about the suitability of the regulation and suggested improvements. The questions asked during the interviews and their connection to the regulation and ethical topics discussed previously can be found in 'Appendix A'.

All interviews were semi-standardized. This means that several questions were already developed before the start of the interview. These questions guided the participants into a discussion that was relevant to this thesis. After being guided into this direction, the interviewees could speak freely about the topic, enabling discussions that moved beyond solely the planned questions (Berg, 2001, p.70). In case it was needed this could provide a more comprehensive understanding of the answers on the main questions (Berg, 2001, p.70-72). This was the best interview method in this case because the main topics of the interview were centered around experiences with the robot and knowledge on safe use and implementation of the robot. The knowledge of these issues can deviate between interviewees. Speaking about the topics freely provided interviewees the opportunity to elaborate on what they found important or what they knew while preventing wasting time to talk about topics on which an interviewee had no knowledge. The possibility of different knowledge and experiences between interviewees also motivated the choice for one-on-one interviews.

Since this thesis tries to find out how Dutch elderly homes can safely implement companion robots in their care programme, all interviews were conducted with Dutch elderly health care professionals. In total there were twelve interviews, seven with caregivers and five with other professionals who work in elderly care. These 'other' professionals were, for example, a technical medical professional and ICT specialist. It was chosen to interview people with different job occupations and backgrounds because they could've had different views on the experience with the robots and the regulation for them. The caregivers might have evaluated, due to their practical work experience with the robot, the regulation and current experience much different than people in management functions. Managers were expected to have less practical experience but more knowledge of robotics

regulation. An overview of the participants of this study and some personal characteristics of them can be found in graph 4. In this graph you may notice that the participants work at two different elderly care organizations. Eleven of them work for an organization that primarily uses the companion robot 'Pepper'. The remaining one participant, the technical medical professional, works for another organization that primarily uses the companion robot 'Tessa'. The organization using Pepper is during this thesis called 'organization 1', whereas the other organization is called 'organization 2'.

All 12 interviews took place in the elderly homes in which the professionals worked. This location was chosen since it made the burden for the interviewees to participate as small as possible. They now solely had to take time to participate in the interview while not being bothered with travel distance and time. Each interview lasted between 30 and 50 minutes, as this was sufficient time to ask all questions while simultaneously leaving some time left for the interviewees to elaborate further on their desired topics. To guarantee ethical correctness, all interviewees were informed about their freedom to stop the interview beforehand, their anonymous participation and the study for which their provided information was used. All interviewees also approved their participation and the recording of the interviews.

Name	Organization	Gender	Age	Function	Years of employment in elderly care	Education
Respondent 1	1	Female	47	Caregiver + technological knowledge carrier for caregivers	25 years	Nursing aide
Respondent 2	1	Male	44	Director of operations	2 years in this function, however since 2011 in elderly care sector	Accountancy (University)
Respondent 3	1	Female	39	Knowledge carrier for caregivers	2,5 years in this function, 10 years in elderly care	Nursing (Applied Sciences)
Respondent 4	1	Male	50	ICT	10 years	Business Administration, Chemical engineering & ICT courses
Respondent 5	1	Female	27	Caregiver	3 years	Nursing
Respondent 6	1	Female	36	Caregiver	16 years	Nursing
Respondent 7	1	Female	42	Caregiver	21 years	Nursing
Respondent 8	1	Female	52	Caregiver	Unknown	Nursing

Respondent 9	1	Female	18	Trainee caregiver	3 traineeships + 2 holiday jobs	Nursing
Respondent 10	1	Female	51	Caregiver	31 years	Nursing
Respondent 11	2	Male	31	Technical medical professional	8 months	Technical medicine
Respondent 12	1 (ambulant)	Male	23	Caregiver + knowledge carrier technology	Unknown	Nursing (Applied sciences)

Graph 4: Details of interviewees.

5.2. Analysis method of interviews

To analyse the interviews a content analysis was conducted. By conducting such an analysis, data obtained from the interviews were closely studied to discover similarities and differences between the answers the interviewees gave. These connections enabled a granter picture to be drawn from all individual interviews combined and provided information on how the professionals overall experience the use of companion robots, how much knowledge they generally have, which desires and fears are present regarding the implementation of the companion robots, and the suitability of the currently available regulation and improvement suggestions (Erlingsson & Brysiewicz, 2017, p.95).

To find these results, audio's from the interviews were first transcribed. Followed by reading through all the obtained interview texts in order to get a general understanding of the primary points the participants acknowledged. After this, the text was marked by codes. The codes assigned to the text were small groupings of 1 or 2 words that described the meaning of that particular section of the text (Elingsson & Brysiewicz, 2017, p.96). Codes established were for example; 'privacy' and 'consent'. Ultimately the codes were grouped into categories. Categories are groupings of codes that all refer to the same issue (Erlingsson & Brysiewicz, 2017, p.96). The above two codes belong to the category 'regulation', whereas other codes belong to different categories. This system enabled analysing the interviews rapidly. The discussed codes and category, for example, helped to find information on privacy regulation quickly in all interviews. Whereas information regarding elders' quality of life could be found rapidly as well because this information was ranked by using the same coding system. Using this coding system enabled to analyse all interviews in a consistent manner. The results of this analysis can be found in chapter 6.

5.3. Limitations of methods

Unfortunately, during the analysis it appeared that in organization 1 the robot had not been implemented to its full potential yet. Pepper currently only holds a reception function due to which caregivers didn't have much experience and knowledge on the capabilities, rules, and issues surrounding companion robots yet. This caused an inability among the caregivers to answer many of the designed interview questions. To solve this and still obtain relevant information the questions were during the interviews itself reformed, thereby especially focusing on the expectations and desires of the caregivers for the implementation of the companion robot in the future. The interviewees who were not general caregivers and had more technological knowledge were better capable of answering the questions regarding the current implementation situation. They had

received more information on the capabilities of the robots and were better informed on regulatory issues that surround the implementation of the robot. However, also for them some questions needed to be reformed due to the current minimal functions of the robot.

The reforming of questions means that the answer to the last sub research question and main research question aren't solely based upon current experiences anymore. The answers are now obtained by responses that were built upon a mixture of both current experiences, expectations and desires.

Chapter 6: Analysis of interviews

During the regulation and ethical analysis, the currently available regulation and its suggested improvements were discussed. However, the question remains whether these fit the daily practices of Dutch elderly homes to provide quality of life and care for elders. This chapter will focus on providing an answer to this. For the analysis, the structure will be similar to the analysis of the regulation framework. Starting with analysing 'health and safety', followed by 'privacy and data protection' and 'liability'. This analysis will ultimately end with analysing ethical concerns.

6.1. Health and safety

6.1.1. Unknowledgeable environment

In the theoretical analysis we saw that due to the personal environment in which companion robots operate firm instruction can't be applied to them. Furthermore, robots are interacting with people with different amounts of knowledge and training on its use. Evolving in risks that are complex, changeable and unpredictable and leading to enable users vulnerability for excessive and/or incorrect use of the robot (Palmerini et al., 2012, p.18/174 / Leenes & Lucivero, 2014, p.201 / Salvini et al., 2010, p.451/456). When analysing the interviews, one discovers that staff indeed have these different amounts of knowledge on companion robots and its use. Job functions related to technology tend to have more experience and knowledge on companion robots than regular caregivers. Regular caregivers admit to have very little to almost no knowledge on and experience with the use of companion robots. They didn't receive any training yet and are unsure whether this is still going to be given to them (Respondent 5, 6, 4, 7, 9). The other users, being the elders, also don't have knowledge yet on the use of social companion robots (Respondent 1, 2, 8, 10). However, as the analysis will show later, this proves to be less problematic.

Both organizations use a strategy that asks the more technically knowledgeable people to transfer information regarding companion robots on to all the other robotics users in the organization (Respondent 1, 2, 3, 4, 11, 9). Organization 1 does so by transferring this information on during the normal daily work activities, while organization 2 schedules appointments with caregivers, elders and their representatives to provide them with the required knowledge to properly use the robot (Respondent 11, 1, 4). According to the technical medical professional, who is the only respondent spoken to from organization 2, this strategy is effective and leaves the companion robot users with enough knowledge. However, whether this is genuinely functioning can't be measured as the daily robotic users in this organization were not interviewed. These users weren't interviewed because their contact details weren't obtainable. The technical medical professional, who is in charge of transferring the knowledge to the daily users, may be convinced that the knowledge is transferred whereas the opposite might be the case. This appeared at organization 1. There the technological knowledge carriers and director of operations believe the caregivers have and are obtaining knowledge about the robotics use. However, the caregivers themselves think differently. They said, as discussed, to have almost no knowledge of the use of the robot. They know whom to ask, but are without asking not provided information. Due to this absence of knowledge the caregivers are, as most of them have not asked, unable to transfer the knowledge on towards the elders (Respondent 2, 3, 1, 5, 6, 7). It's remarkable that especially within organization 1 the caregivers remain unknowledgeable. Organization 1 namely uses Pepper, and a knowledgeable community is especially important with regard to this robot. The reasons for the importance of knowledgeable users have been discussed in chapter 2. It was namely discussed that Pepper can be a danger to elders' physical and psychological health. This danger, as explained, derives from Pepper's capability to move autonomously, interact with elders and a high anthropomorphism level.

Even though an unknowledgeable community can be dangerous, the situation seems unproblematic regarding current law. Law, as discussed, namely states that manufacturers are obligated to spread information towards the purchaser (European Parliament and the Council of the European Union, 2007, Article 251 of Treaty (2)- 18 & article 37-2). Especially in organization 1 we can see that this indeed happens. The higher functions and one caregiver operate in a group together with the manufacturer in which they discuss the robot's capabilities and its implementation form, co-deciding on these elements (Respondent 1, 8, 9). However, the suggested improvement of techno-regulation to establish an environment in which all users are trained and become knowledgeable about the companion robots hasn't occurred. The existence of such an unknowledgeable environment around the companion robots is, especially in organization 1, problematic. Since the safe use of the robot namely bares both with the robot and its user (Leenes & Lucivero, 2014, p.201). It leaves elders prone to excessive and/or incorrect use, which can negatively impact elders physical and psychological health. These elements constitute quality of life (De Santis et al., 2007, p.2 / Walters et al., 2005, p.3 / Kidd et al., 2006, p.4).

Important to note is that this psychological and physical safety is, according to organization 1, not yet endangered because of the limited function Pepper currently holds. Pepper currently only holds a reception function. So isn't actively involved in the elderly care yet. Pepper is, however, expected to move to the living rooms of the elders soon. With this change, the tasks of the robot are expected to be broadened to functions in which he also becomes involved in elderly care (Respondents 1, 2, 3, 9, 10). Caregivers desire, if necessary, to obtain more knowledge when the involvement of the robot increases. They primarily want to know how to control the robot on a basic level, which means that they wish to be able to know the function of buttons on the robot and how to turn the robot on and off (Respondent 5, 6, 7, 8, 9, 10). If such knowledge would be spread and those actions become taught to staff members, this already partially aligns with the measures techno-regulation literature suggested to decrease health and safety risks that coexist with the implementation of companion robots. These caregivers can pass the information on towards the other users, being elders. But this only needs to happen in organization 1 because the elders in organization 2, that uses Tessa, don't require any information since the robot is solely controlled by caregivers or elders' relatives (Respondent 11, 12). Tessa thus doesn't require any actions of the elders themselves, due to which elders don't have to obtain training on its use.

6.1.2. Safety guideline

As discussed, caregivers wish to receive information on the basic actions to control the robot. However, teaching them this doesn't satisfy the quests of techno-regulations research suggestions yet. Techno-regulation literature's need for schooling users goes beyond solely teaching them the basic user actions. They also wish to see that staff members can recognize the impact a robot has on an elder (Palmerini et al., 2012, p.184 / Moyle et al., 2018, p.334). This in order to prevent an overuse or overflow of responsibility feelings among elders. The respondents of organization 1 believe that caregivers are without schooling or guidelines already able to recognize such signs (Respondents 5, 8, 10). Organization 2, however, is currently establishing guidelines with counter indicators for applying companion robots. These guidelines provide caregivers with knowledge on when not to or be careful with using a companion robot. This guideline solely focuses on psychological safety from elders, because also organization 2 beliefs that physical health is not endangered yet by the current abilities of social companion robots (Respondent 11).

The establishment of such a guideline by organization 2 not only satisfies the call for guidance upon the implementation of companion robots to caregivers but also partially the suggestion to construct a safety guideline (Palmerini et al., 2012, p.174). It namely protects the psychological health of

elders, although not safeguarding physical safety. The importance of the existence of a guideline that protects elders psychological danger is confirmed by one of the respondents of organization 1. He's the only caregiver interviewed working in ambulant elderly care and is actively involved with implementing the companion robot Tessa. He already noticed that when the robot speaks too often, elders become restless (respondent 12). If such results would be written in a guideline and applied to the elderly care home facilities occurrences of more restless elders can be prevented. Thus limiting the psychological danger and safeguarding elders quality of life.

6.1.3. Regulation matching daily practice

By providing information sessions with users and establishing a safety guideline to prevent the use of robots for unsuitable elders organization 2 already applies some of the major suggestions given by techno-regulation research to avoid the occurrence of health and safety dangers. This positively relates to the right to human dignity. Organization 1 doesn't do this yet, even though more dangers to quality of life and care are present upon the implementation of the companion robot Pepper than Tessa. The technical knowledgeable professionals within this organization didn't believe the safety measure of providing training to users is needed, but admitted to be willing to offer them if they ultimately deemed necessary (Respondent 1, 4). This thesis therefore argues that if their caregivers don't prove to be able to safely use the robot without instructions and/or are unable to recognize signs of success or distress among elders the organization will be willing to provide the caregivers with additional schooling. This schooling was also, as discussed, desired by the caregivers.

For organization 1 the absence of the other safety measure, that consisted out of a safety guideline, can be explained by the fact that the organization is still in a pilot period. Their caregiver with technological knowledge, however, did acknowledge the importance of such a guideline (Respondent 1). Their ICT professional agreed with this but simultaneously spoke about the costliness of conducting such research. This costliness was currently the reason for not conducting such activities yet. Only when the pilot period is over, and it's decided that the robot remains in the care programme, a privacy impact analysis will be conducted (Respondent 4). Such an analysis is meant to lay bare risks involved, this could be used as a source for a safety guideline regarding privacy. Even though this intention, organization 1 also admitted to be hesitant towards establishing further guidelines because they dislike rules and think they don't match their organization's characteristics. They are afraid that rules could hinder the development of the robot and its effective use within care (Respondent 3, 4, 2). The organization thus partially expresses the need to formalize some elements of the implementation of companion robots and are therefore not assumed to be too hesitant about generating safety guidelines after their pilot period expires. However, some resistance to using guidelines can be expected due to their dislike for rules regarding companion robots. This is unfortunate as a guideline can, as the experience of respondent 12 proved, be desirable in order to construct a safe and healthy environment for elders that use a companion robot.

The current policy and its suggestions regarding health and safety thus seem to be partially suitable for the daily practices of Dutch elderly homes. Organization 2 already schedules trainings and is constructing a safety guideline. Organization 1 takes a different approach. They are still exploring the use of Pepper in a pilot period without providing any restrictions or trainings for general caregivers. The organization seems somewhat willing to abide to the current regulatory framework that suggests providing trainings and using safety guidelines, but only when necessary.

Both organizations don't desire that regulation draws much attention to a safety guideline that encompasses both psychological and physical safety. The psychological element is important according to organization 2, but the physical safety aspect is according to both organizations not

necessary. They both didn't regard the companion robots as physically dangerous. Both organizations admit that no harmful occurrences have occurred yet. This demotivates them to express support for legal protection against harm. They argue that the need for such measures is currently not there yet, as they are still exploring the suitability for applying social companion robots in elderly care. Furthermore, the robots currently solely have a small scope of functions that are not greatly endangering quality of life and care (Respondent 4).

6.2. Privacy and data protection

The literature used in chapter 4 acknowledged that companion robots often interfere in elders' personal space and use their personal data while performing all its functions. Furthermore, they require an internet connection and may be connected to other technical devices like smartphones and/or tablets. This can cause the possibility to widely share personal information and increase the risks to access or loss of data. Thus potentially endangering elders' right to privacy and data security (Palmerini et al., 2012, p.177/180/189 / Koops et al., 2013, p.25/ European Parliament and the Council of the European Union, 2016, Article 2). The extent to which companion robots intrude elders privacy variates between different companion robots. Chapter 2 namely already informed us that Pepper is of greater danger to elders privacy than Tessa. Pepper namely uses cameras and has an administration function while Tessa has not.

Chapter 4 informed us that it's difficult to balance elders right to privacy and personal data and the opportunity for companion robots to enhance elders' quality of life. However, techno-regulation research has proposed a couple of measures that can enable this. The suitability of these measures will be discussed, but prior to this the opinion of both organizations regarding the privacy and personal data intruding character of companion robots is considered.

6.2.1. Companion robots' privacy-intruding character

Even though both organizations use different types of companion robots, both organizations aren't worried about the privacy-intruding character of their robots. The organizations both agree that the current use of companion robots is not dangerous yet. According to the ICT professional from organization 1, who's responsible for privacy issues, we currently don't have to worry about privacy dangers with regard to companion robots yet. He expects that this will remain so in the upcoming years. He informs us that Pepper is currently not used in personal spaces yet and the robot's hearing and overseeing capacities are currently not implemented. Even if they were to become implemented, this doesn't have to become a danger to elders' privacy. Smart technological features can namely help to prevent the occurrence of privacy issues. For example, a robot can be installed in a privacy-friendly way. This would mean that Pepper can only start its overhearing capabilities if noises that have a higher or louder tone than the normal noises heard in an elder's personal space are present. Pepper can respond to these noises by sending a signal to caregivers to come and see the room from which the noises are deriving without specifying the reasons to do so. The robot thus doesn't have to listen to everything in order to enhance elders' safety (Respondent 4). The intruding character of the robot will solely be present in case of need, only when abnormal noises are present. Besides this, the ICT professional also argued that Pepper doesn't house elders' personal data himself. This data is saved in a system outside the robot. Meaning that if something happens with the robot, no data can be affected (Respondent 4). The director of operations adds that the system for personal data is the system that currently also houses all personal data of the elders in their facility. This system is already well protected and confirms with the current legal requirements. Chances for data breaches are therefore minimal (Respondent 4, 2).

Organization 2 agrees with the minimal risk for the occurrence of a data breach. The technical medical professional informs us that the companion robot Tessa operates by receiving messages from elders' relatives and/or caregivers. It can thus not start acting autonomously. The messages sent primarily contain actions whom the elder needs to perform. It's the task for these caregivers and relatives not to include full names and/or medicine specifications within those messages, which means that privacy-sensitive information is left out. Furthermore, he argued that even if the messages accidentally contain privacy-sensitive information no great danger for a data breach is present. The messages are namely sent directly to the elder's companion robot and are not saved in any system or on the robot itself (Respondent 11).

It becomes clear that both organizations don't fear for endangered privacy and data security rights of elders. They instead state that the robot and system should be designed to protect all privacy data sensitive information, while simultaneously only allowing autonomous actions of the robots in case of need. To reach this both the manufacturers of the robots and the professionals for privacy issues, such as the ICT professional in organization 1, should enable this security (Respondent 2, 4, 11). The organizations thereby call for manufacturers to ensure privacy and data security. This same role has also been obligated by law and suggested by techno-regulation research (Koops et al., 2013, p.25 / European Parliament and the Council of the European Union, 2016, article 32, 89.1).

6.2.2. Consent and control

Apart from the design measure law forces elderly homes to notify elders in advance about the use of companion robots in their care while simultaneously asking them to provide consent (European Parliament and the Council of the European Union, 2016, Article 7). Techno-regulation suggests extending this freedom of choice by providing elders the power to determine the autonomous behaviour and level of interaction with the robot (Palmerini et al., 2012, p.189-190). Enabling elders to determine themselves when they wish to be supervised. Caregivers also need to obtain such control over the actions of the robot. This allows them to help the elders with deciding the activity level of the robots (Palmerini et al., 2012, p.190). Organization 2 already asks for consent by the users of Tessa (Respondent 11). Organization 1 asks indirectly to elders for elders' approval. The idea is, according to their technological knowledgeable professionals, that the robot becomes part of their care system and when elders are entering the care programme they automatically agree to the use of the robot (Respondent 4, 1). No matter whether the organization asks for permission explicitly or indirectly, elders are thus somehow accepting the use of the companion robot in the care provided to them. Therefore the organizations are abiding to the law on consent (European Parliament and the Council of the European Union, 2016, Article 7). As quests for consent are already thought about and implemented in the organizations, a policy that requires consent from elders fits the daily practices of Dutch elderly homes.

Concerning the robot's activity level organization 1 determines with a team of technologically knowledgeable people which functions the robot will carry out (Respondent 1, 8, 9). This team enables the by caregivers desired functions, who are represented by respondent 1 in the team (Respondent 1, 2, 4). The general caregivers don't have direct influence into the functions the robot possesses but have also admitted to not necessarily desire to participate in this process (Respondent 5, 8). All decisions taken by the technical team are said to always keep the elder in mind (Respondent 1). Their judgements need to be adequate enough in order to comply with the law defining that using robots is essential or for the interest of the person's life in question (European Parliament and the Council of the European Union, 2016, statement 46). Not providing elders with influence on the activities of the robots is logically explainable for organization 1. Pepper is namely applied in an environment where elders solely live temporarily (Respondent 1). The measure to let elders

influence a robot's activity level and performed functions appears to be absent in organization 1. Caregivers, however, are convinced that elders can reject to work with the robot (Respondent 9, 5). Thus elders are still able to refuse the use of the robot even though they have given consent by intake. This leaves the impression that even though elders don't influence the functions and actions of the robot, they do have influence in the presence of the robot in the care provided to them. This grants elders a minimal level of influence.

In organization 2 and the ambulant elderly care delivered by organization 1 elders and caregivers have more influence. In this care, they primarily used the robot Tessa whose actions and interaction level are determined by looking at the number of reminders the elder needs while also paying attention to the reaction the elder has on these reminders, thus complementing the law for using robots for an essential life function or complying with the interest of a person.

The influence granted to the elders in both organizations can sustain elders quality of life and the quality of care provided to them. Both organizations namely make their decisions upon the activity level and use of the robot in an elder's care programme with regard to the best interest of their elders. However, this influence doesn't reach as far as techno-regulation literature suggested. It namely doesn't determine together with elders the activity level but rather does so by thinking for them and observing them. Therefore the increase in perceived quality of life and care, concerning elders influence in their care, remains limited.

6.2.3. Regulation matching daily practice

The amount of influence caregivers and elders have on the actions of the robot thus variates between the use of Pepper and Tessa. With regard to Pepper organization 1 chose to provide elders and all caregivers only minimal influence on the decision-making process. Organization 2 and the ambulant care of organization 1 determine the activity level of the robot Tessa by evaluating elders' needs and responses. Although techno-regulation suggests providing elders influence in the use of companion robots, to compensate for the privacy-intruding character of a companion robot, Dutch elderly care doesn't desire this. The privacy-intruding character of the robot is namely not dangerous and this isn't expected to change soon. Therefore the balance between privacy and improving elders' quality of life remains stable. Thus not, as techno-regulation research suggested, in need to find common ground between the two aspects. The balance grants elders the opportunity to enjoy increased independence without having their rights invaded.

Besides the non-intruding character of the robots, the control measures techno-regulation suggested to ensure data security, such as teaching elders and caregivers about security measures like firewalls are also not necessary and desired (Palmerini et al., 2012, p.189-190). Not necessary because safety should according to law, techno-regulation research and the elderly homes already be implemented in the robots (Koops et al., 2013, p.25 / Respondents 2, 4, 3, 1). Both manufacturers and elderly homes abide by this since they have special skilled technical employees working on the implementation of the robots while, in case of organization 1, the manufacturer is also very involved in enabling the safe use of Pepper (Respondent 1, 4, 3, 11). For organization 2 no intense contact with the manufacturer is present, but this is not necessary either. Tessa is namely not connected to any system with personal information and also doesn't have any cameras, sensors, et cetera. (Tinybots, Hoe werkt Tessa). Besides that it's not necessary to train elders and caregivers on safety measures it's also not desired because the technological knowledgeable professionals within organization 1 believe caregivers and elders are unable and untrustworthy with performing security measures. They believe these responsibilities need to be bared with the technological professionals within the organization and the manufacturer (Respondents 2, 4, 3, 1).

6.3. Liability

As read in the regulation analysis, it's difficult to determine who is responsible in case of harmful events. This is because it's hard to prove who could have foreseen and avoided the harm. This results in legal uncertainty in which users, manufacturers, and possibly third parties have different interests (Palmerini et al., 2012, p.18-19/22). The elderly homes confirm this uncertainty. Most health care professionals namely don't know which rules apply regarding liability, only the ICT and medical professionals can provide relevant information on this topic (Respondents 1, 3, 7, 9, 12). The ICT professional informs us that organization 1 and the manufacturer handle the issue in accordance with current law. Meaning that if a harmful event happens and the cause of this event is grounded in the robot's technology itself, the manufacturer is responsible. If the cause can be found within acts carried out by employees of organization 1, then organization 1 carries the liability. The source of the harmful event thus needs to be investigated (Respondent 4 / Council of the European Communities, 1985, Article 1/8). The regulation analysis, however, pointed out that this position isn't desirable for elderly homes because the liability will rarely fall onto the manufacturer (Palmerini et al., 2012, p.185-186/ van den Berg, 2011, p.325-326). Even though legally this might be the result, the ICT professional doesn't express any worries regarding the weak position of the elderly facility. He states that 'old-school' manufacturers indeed try to shift the responsibility towards the robot users, but modern and good manufacturers rather work towards a solution together with the user (Respondent 4). Organization 1 believes that the producer of Pepper belongs to that last category (Respondent 1, 8, 9). Therefore they aren't worried. Furthermore, he states that rules regarding liability will, after the pilot period is over, be partly made regarding privacy issues. They're thus aiming to prevent liability issues before harmful privacy events occur outside the pilot period (Respondent 4). For most other issues, this is unfortunately not possible because it's difficult to foresee which harmful events can happen. Solving liability issues is thus a matter of trust between manufacturer and user (Respondent 3, 4).

Organization 2 takes a different position. The technical medical professional doesn't speak about the role of manufacturers in case of harmful events. He instead informs us that he, with support from organization 2, carries all responsibility in case of such events. This risk is accepted because, as RoboLaw indicated, the technical medical professional believes the chances for harmful events to occur are nihil (Respondent 4, Palmerini et al., 2012, p.187). It isn't strange that the health care professional of organization 2 solely sees a nihil chance for companion robots to cause harmful events. The organization namely uses Tessa and, and as discussed in the theoretical framework, this robot doesn't move and solely has one function (besides playing music) for which it only requires one application. It's therefore not difficult for users to become knowledgeable about the robot.

Even though this small risk for the occurrence of harmful events techno-regulation research argues, as discussed in chapter 4, that liability uncertainty can withhold the implementation of companion robots in elderly care and therefore the chance for elderly homes to improve elders quality of life and care. This, however, isn't the case when discussing the issue with employees of both organizations. They're aware of the vulnerable position they are in but accept this. Each for their own reasons. Organization 1 because of their good relationship with the manufacturer and organization 2 because of the nihil chance for harmful events to occur. This thesis therefore rejects the suggested measure of takin gup an insurance to financially cover such events. As this would solely increase the costs of implementing companion robots in elderly care and demotivate potential users to integrate the robotics into their care programme (Palmerini et al., 2012, p.186 / Leenes & Lucivero, 2014, p.207). This costliness of insurance may affect the implementation of companion robots in elderly care more than the risk of harmful events to occur and the chance for elderly homes to bare liability

cases alone without help from the manufacturer. Such an impact isn't desirable when aiming to improve or obtain the quality of life and care for elders in the Netherlands while dealing with population aging.

6.4. Ethical concerns

In the regulation analysis several ethical concerns were discussed among which was the fear for infantilization. Research has already shown that this concern was misplaced (Moyle et al., 2018, p.333). Infantilization namely doesn't occur because elders are aware of the robot's fakeness since they have the authority over the robot themselves (Sharkey & Sharkey, 2012, p.26-28). However, during the interviews it was discovered that caregivers didn't believe that all elders were able to control the robot. Caregivers spoke about how some elders are unfamiliar with technology, being unable to understand and use them and therefore hesitant to welcome robots in their lives (Respondent 5, 6, 7, 10). You may wonder whether the threat for infantilization grows higher as the elders aren't able to control the robot. This thesis, however, argues that this isn't the case since respondent 11 informed us that the current robots are not autonomously acting yet. There is thus nothing to control for the elders. All actions are either stimulated by elders themselves, caregivers or relatives. These caregivers and relatives are already meant to keep an eye on elders safety regarding the robots. Besides the absence of control, most health care professionals also haven't experienced reactions of infantilization among the elders with the robots yet and don't expect to receive them (Respondent 5, 9, 7, 12). If people, however, believe that the robot infantilizes elders, their perception often changes after a while. Especially when they start seeing and/or experiencing positive results (Respondent 2, 8, 10, 12). In the worst case such a perception remains, but then the elder can reject using the robot (Respondent 12).

Apart from infantilization, people also fear for reliance on technology, since less help from caregivers will be needed (Palmerini et al., 2012, p.173-175/181). This fear is related to a fear of less human contact for elders, which endangers elders to suffer from a lack of human social relationships (Koops et al., 2013, p.24). If this occurs the social relationship element in elders' quality of life and care is endangered. This fear coexists with anxiety towards the situation of caregivers. People are afraid that caregivers will start to feel unnecessary and lose their chances of social contact with the elders. This negatively affects their capabilities to care for the elderly (Koops et al., 2013, p.25). Furthermore, people are even afraid that robots will take over caregivers jobs resulting in unemployed caregivers (Salvini et al., 2010, p.456). This is problematic because research has shown that the higher the number of staff per resident available and the more they're trained, the better the elders perceive their quality of care (Comondore et al., 2009, p.2 / Koren, 2010, p.4). Decreasing the amount of staff available per resident while also negatively affecting caregivers capabilities upon implementation of a care robot will therefore negatively impact the quality of care.

To prevent the above situations, techno-regulation and the EU suggested safeguarding the role of caregivers in elderly care. They emphasize that human contact shouldn't be reduced and robots only need to be implemented as an additional support tool, not to replace caregivers (Palmerini et al., 2012, p.176 / Pederson et al., 2018, p.3 / European Parliament, 2016, p.24). Such an additional character of the social robots prevents dehumanization from occurring while simultaneously reducing the fear for a loss of jobs and safeguarding caregivers capabilities. The role robots receive in both organizations align with this additional support measure of techno-regulation and the EU. All respondents believe that robots won't replace caregivers and aren't implemented to do so either (Respondent 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12). They don't believe that the robot can replace them due to the minimal functions of the robot (Respondent 1, 3, 6, 7, 10, 11). Furthermore, they don't fear for

reduced social contact towards elders. They instead believe that the robot possesses, in the future, functions that can leave the caregivers with more time to socially interact with elders (Respondent 1, 3). This benefits the social relationship aspect instead of reducing it, enhancing elders' quality of life and care.

The additional character of the robot is thus very well known among elderly health care professionals. They are even enforced to use the robot as solely additional because, as discussed, its functions aren't able to take over human care yet. The measure of techno-regulation to emphasize this additional position is thus already automatically embedded in the elderly homes implementation form. No special regulations for ensuring this additional role are taken by the elderly homes and they aren't believed to be necessary either (Respondent 1, 3). Only when robots become far more advanced regulation may be required. For now, human care is still necessary and also the only way to deliver quality of life and care for elders. The ethical concerns are thus in reality not dangerous yet. Therefore at this point, no actions to solve them are needed. Perhaps in the future when more advantaged robotics come along. Currently, according to the respondents, people solely need to become more accustomed to companion robots as this would help fade out the ethical concerns. This is according to them just a matter of time (Respondent 1, 3, 4, 7, 8, 11, 12).

6.5 Conclusion of interview analysis

The analysis aimed to find out whether the regulation and suggested improvement measures discovered in the regulation and ethical analysis fit the daily practices of Dutch elderly homes to provide quality of life and care for elders in the elderly homes. We saw that the already present regulation in all different sections is suitable for the daily practices of Dutch elderly care. This suitability, however, isn't present for all the suggested improvement measures. It has been discovered that some measures, such as enabling elders to determine the activity level of the robot, aren't suitable because of the currently limited functions of the robots and/or the characteristics of the environment in which the robot operates. Due to these limited functions, the robots solely have a minimal privacy invading character or only cause a small infantilization risk. These minimal risks decreases the need for elders to gain control over the robot. Other measures are accepted, such as; training caregivers on the use of the robots, constructing a psychological safety guideline, and applying the robot as an additional support tool. There are also some measures that are refused. Establishing a physical safety guideline, for example, isn't expected to be necessary according to the organizations. Furthermore, improvement measures for liability issues aren't essential either because the organizations have no problem accepting the current status of liability regulation and this rule doesn't conflict with establishing or maintaining quality of life and care.

It has also appeared that some improvement measures were more suitable for Pepper than Tessa. As discussed, Pepper has more functions and acts autonomously. To perform all his capabilities, he uses cameras, sensors, et cetera and therefore is more dangerous to elders privacy and their physical and psychological well-being. Even though these greater dangers organization 1, that uses Pepper, isn't convinced that these dangers have to result in applying the suggested safety measures. This is because Pepper currently doesn't use all its capabilities yet. If they're going to be used in the future, the organization argues that the privacy-intruding character and elders safety can be safeguarded with the help of technological knowledge staff and the manufacturer. The additional safety measures are therefore refused. This caused no divergence between Pepper and Tessa with regard to the suitability of the regulation and suggested safety measures for Dutch elderly care home practices.

Chapter 7: Conclusion

During this thesis, the high and increasing amount of elders in Dutch society was acknowledged. These elders require care and we've seen that social companion robots can help with that. However, elderly homes have shown aversion to proceed with the implementation of such robots due to the absence of protocols that can guide the implementation process. Such protocols aren't available due to the absence of information that can serve as sources for the protocols. This thesis tries to chance this absence of information by providing knowledge on the safe implementation of companion robots in elderly care. It did so by asking itself the following research question; 'How can Dutch elderly homes implement social companion robots into their care programme while safeguarding quality of care and life for elders?'. This question was investigated with regard to the legal aspects of 'health and safety', 'privacy and data protection' and 'liability'. Furthermore, we also looked into ethical concerns of western society regarding the implementation of companion robots in elderly care.

With regard to health and safety issues that can occur upon the implementation of companion robots, we saw that potential dangers primarily lied in the unknowledgeable community surrounding companion robots. Law already tries to minimize this by enforcing manufacturers to provide purchasers with information on the robot. This law was abided to, but this didn't mean that the information also reached caregivers and elders. As this analysis showed, these people were at risk to remain unknowledgeable. It was suggested by techno-regulation research to train these people on the proper use of companion robots, while also training caregivers on recognizing the impact a robot has on an elder. These suggestions fit the daily practices of Dutch elderly homes, even though some initial hesitance to provide such trainings can be expected. Furthermore, a psychological safety guideline on the use of companion robots proofs to be a valuable tool. Elderly care organizations are aware of this importance and partially willing to construct them. Pilot periods and a dislike for rules can demotivate organizations to do so, but the importance of such a guideline overrules these objections. A physical safety guideline, however, should not be required as Dutch organizations didn't view this as necessary.

Concerning privacy and personal data security, it was discovered by techno-regulation that companion robots challenged elders' privacy and data security rights. However, daily practices showed that these concerns weren't relevant yet. The robots used namely either don't possess great endangering privacy capabilities or these capabilities aren't used yet. If they were to become used, the technologically experienced employees of the organizations combined with manufacturers can prevent infringement and data breach issues. These people therefore need to become the people responsible for preventing the occurrence of such problems. Apart from asking elders for consent, which is legally required and also suggested by techno-regulation, no further actions of caregivers or elders are required with regard to privacy and data security issues. This thesis' thus rejects the suggestions of techno-regulation to actively involve elders in deciding the activity level of the robot while also rejecting the need for elders and caregivers to deal with safety measures concerning elders' privacy and data security. The level of activity of robots, however, does need to be decided by keeping the best interest of elders in mind. Dealing with privacy and data security issues in this manner fits both the daily practices of health care professionals and the current regulation, while simultaneously protecting elders privacy and data security rights and enabling quality of life and care.

The suggestion of techno-regulation to take out insurance against harmful events due to companion robots, with regard to the present liability uncertainty, is also rejected. Dutch elderly care professionals didn't show aversion against the current liability law. The organizations admitted to accept full responsibility and believed that the robot's manufacturer will be helpful in case such

events occur. Liability issues therefore don't hinder the implementation of companion robots in Dutch elderly homes.

Apart from the legal aspects, attention was also given to ethical concerns. These concerns, however, didn't seem to match the daily practices of the implementation of companion robots in Dutch elderly care. Threats for dehumanization to occur, a dependence on technology or job loss for caregivers are currently non-existent. The robots namely have too limited functions to enable the appearance of these situations. Such situations are, furthermore, not expected to occur because elderly care professionals are aware of the additional character the robot plays in their care programme. They know the robots aren't meant to replace caregivers. This namely endangers elders' quality of care and life, while applying the robot as an additional tool can primarily benefit these qualities. The suggestion by techno-regulation research and the EU to implement the robot as an additional character in the care programme is thus adhered to. With regard to the fear for infantilization; most health care professionals haven't seen occurrences yet. If it occurs, however, these perceptions often change after a while and if this doesn't alter elders are free to reject using the robot. If such a fear does remain, the rejection possibility is of importance to solve the issue.

To sum up, Dutch elderly homes can thus safely implement companion robots while safeguarding quality of life and care for elders by adhering to currently available law and working with some of the suggestions of techno-regulation research. Which suggestions need to be taken seriously and which can be rejected is already discussed above. If companion robots are implemented in ways that align with the above-stated information, quality of life and care are safeguarded.

This thesis has now delivered an answer to the main research question. This information can serve as a source of information for the requested protocols. However, the current minimal functions of the care robotics cause solely minimal dangers to elders' quality of life and care. The currently used functions are likely to solely enhance the quality of life and care, therefore constructing a protocol for the implementation of companion robots isn't necessary yet. The quest to construct a protocol appears to be an exaggerated response to the aversion of elderly homes to implement the robots. Instead of a protocol a guideline is, due to the current minimal functions of the robotics, a more suitable measure to increase the knowledge of elderly homes on companion robots and reduce their fears towards altering current routines. Such a guideline can then help with decreasing the aversion of elderly homes to implement care robotics in their care programme.

In the future, when care robotics are expected to perform more functions, threats to elders' quality of life and care might become increasingly present. When this time arrives a protocol can be suitable, but for now a guideline will be sufficient. This thesis alone, however, won't serve as enough information to construct such a guideline upon. This thesis namely only relied upon the experience with companion robots of two organizations and two different kinds of social care robotics. There are more robotics out there and more facilities that use companion robots. Their experiences with the robotics may variate and also serve as valuable information. Furthermore, there's an enormous amount of law available that applies to companion robots. Among these laws are Dutch federal laws. This thesis was, due to its limited scope, not able to consider all these laws and only focused on several European laws. Other researchers are challenged to research the relation between other laws (including federal laws) and social companion robots because by working together more relevant information can be discovered. All information combined will then eventually lead to a good suggestion and guideline for the safe implementation of companion robots in Dutch elderly care.

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Appendices

Appendice A. Interview questions

The interviews were conducted together with another master student who also works on a thesis with the topic of companion robots in elderly care. The interviews were conducted jointly so that the interviewees only had to participate in one interview instead of two. Some questions we asked were specifically designed for the thesis of the other student. These questions are marked with an 'S'. Other questions were only relevant for my thesis, therefore marked with an 'A'. The remaining questions could be used for both of our projects. These questions were marked with 'SA'.

Persoonlijke vragen:

SA	1.	Hoe oud bent u?	
SA	2.	Welke functie heeft u? Wat houdt deze functie in?	• Hoeveel uur werkt u? • Is het een leidinggevende functie? Zo ja, aan hoeveel mensen geeft u leiding?
SA	3.	Welke opleiding heeft u gevolgd?	• Op welk niveau heeft u de opleiding gevolgd? • Hoe verhoudt de studie zich tot uw huidige werk?
SA	4.	Hoelang werkt u al in de ouderenzorg?	• Hoelang in deze organisatie en deze functie?

Ervaring met robots:

SA	5.	Heeft u eerder met zorgtechnologie in de ouderenzorg gewerkt?	• Zo ja, welke technologieën heeft u gebruikt en voor hoelang? *Bijv. eHealth, domotica en zorgrobots?*
SA	6.	Heeft u ervaring met robots in het algemeen?	• Met wat voor robots heeft u al ervaring? • Hoelang werkt u er al mee?
SA	7.	Heeft u ervaring met sociale robots in de zorg voor ouderen?	• Hoelang werkt u er al mee? • Welk soort robots gebruikt u? • Met welk doel gebruikt u de sociale robot? • Heeft u ervaring met sociale robots opgedaan in andere organisaties? • Hoelang worden de sociale robots al in deze organisatie gebruikt? • Op welke manier bent u betrokken bij het gebruik van de robots in de organisatie?
SA	8.	Met welk doel heeft de organisatie de sociale robot in gebruik genomen?	• Is dit doel gedurende de tijd veranderd? • Is het gebruik van de robot als aanvulling op de zorg of ter vervanging van iets of iemand?

			• In hoeverre geloof u dat de robot in staat is het doel van de organisatie te bereiken? Is dit al bereikt? • Ziet u nog andere doelen waarvoor de robot gebruikt kan worden? • Was het voor u duidelijk waarom en met welk doel de robot in gebruik werd genomen? • Welke informatie was vanuit uw organisatie beschikbaar?
SA	9.	Wanneer wordt de robot gebruikt in uw werk?	• Hoe vaak wordt de robot gebruikt? • Op welke moment of tijdstip van de dag wordt de robot gebruikt? • Wie beslist dat de robot gebruikt wordt?
SA	10.	Sprekend vanuit uw positie, welke impact hebben de robots op de kwaliteit van leven van de ouderen?	• Welke impact hebben de robots op: - De fysieke en psychische gezondheid van ouderen - Zelfstandigheid - Sociale relaties - Deelname aan activiteiten? • Weet u nog andere aspecten te benoemen die beïnvloed worden?
A	11.	Sprekend vanuit uw verzorgende positie, hoe kunnen de robots impact hebben op de kwaliteit van zorg?	• Hoe ziet u deze impact terug tijdens uw werk? Voorbeelden? • Hoe denkt u dat ouderen dit ervaren? En managers/verzorgenden?
S	12.	In welke ruimten worden de robots gebruikt? Waarom?	• Worden de robots hier voor collectief of individueel gebruik gebruikt? • Waarom is er gekozen om de robot voor collectief/individueel gebruik toe te passen?
SA	13.	Welke taken en functies voeren de robots uit? Voorbeelden?	• Voeren alle robots dezelfde taken uit voor alle ouderen? Waarom wel of niet? • Hoe en door wie wordt er beslist welke taken een robot uitvoert voor een oudere?
S	14.	Welke professionals gebruik de robots?	• Waarom gebruiken deze professionals de robot? • Voor welke taken gebruiken zij de robot? • Hoe gebruiken zij de robots? • Wordt er samengewerkt? • Hoe ervaart u de samenwerking?
S	15.	Zijn de ouderen tevreden over het gebruik van de robots?	• Zijn ze bereid om de robots te gebruiken? Waarom wel of niet? • Zien zij de robot als meerwaarde? Waarom wel of niet?

			• Welke voordelen/nadelen heeft de robot voor hun?
SA	16.	Zijn u en uw collega's tevreden over het gebruik van de robots?	• Zijn ze bereid om de robot te gebruiken? Waarom wel of niet? • Zien zij de robot als meerwaarde? Waarom wel of niet? • Past het gebruik van de robot in uw werkzaamheden? Waarom wel of niet? • Welke voordelen/nadelen heeft de robot voor hun? • Wat denkt u dat de grootste uitdagingen zijn betreffend het gebruik van de robot? • Ziet u uitdagingen voor andere betrokkenen? Bijv. de ouderen of managers?
SA	17.	Is de sociale robot makkelijk te gebruiken door de professionals en ouderen?	• Wat maakt het makkelijk of moeilijk? Waar komt dit door? *Bijv. leeftijd gebruikers*
SA	18.	Beschikken uw collega's en de ouderen naar uw idee over voldoende vaardigheden en kennis om de robot op de goede manier te gebruiken?	
S	19.	Welke personen ondersteunen u bij het gebruik van de robot?	• Op welke manier ondersteunen zij u? • Welke invloed heeft deze ondersteuning op het gebruik van de robot?
S	20.	Worden er vanuit de organisatie middelen beschikbaar gesteld om de robot te gebruiken? *Bijv. financiën, ICT, materiaal, etc.*	• Welke middelen worden geleverd? • Welke geleverde middelen ervaart u als prettig? • Welke middelen mist u?
S	21.	Is er tijd en personeel beschikbaar om de robot te gebruiken?	• Wat ervaart u als prettig qua beschikbare tijd en personeel? • Wat mist u qua beschikbare tijd en personeel?
S	22.	Zijn er veranderingen in de organisatie bezig die het gebruik kunnen beïnvloeden?	• Welke invloed verwacht u dat dit gaat hebben op het gebruik?

Beleid

SA	23	Op welke manier zijn de sociale robots in gebruik genomen in deze organisatie? Meer vertellen? *Bijv. implementatieplan? Projectgroep? Pilot?*	• Is er een beleid of protocol binnen de organisatie die gaat om het gebruik van de robot? • Wat staat er inhoudelijk in dit beleid? Voorbeelden van regels? • Zijn u en uw collega's tevreden over dit beleid? Waarom wel of niet?
A	24.	Hoe hebben jullie de ouderen verteld over de robot en de toepassing ervan?	• Kunt u beschrijven hoe dat in zijn werk ging?

			Bijv. bijeenkomst, papier • Zijn ouderen op de hoogte van de toepassingsregels? • Dienen ouderen actie(s) te ondernemen met betrekking tot de in acht neming van deze regels? *Verwijs naar: toestemming voor gebruik* • Vinden ouderen zulke regels belangrijk?
A	25.	Welke aspecten van het werken met de robot vindt u het belangrijkste? *Voorbeelden van aspecten zijn: fysieke en psychische veiligheid, kennis hebben van de technologie, de controle behouden over de robot en het veilig omgaan met persoonlijke informatie.*	• Vindt u nog andere aspecten belangrijk? • Wat is in uw positie het belangrijkste wat betreft het gebruik van de robot in uw werk? Vinden uw collega's dit ook belangrijk?
A	26.	Kunt u voorbeelden noemen hoe dit verpleeghuis een omgeving ontwikkeld waarin ouderen en medewerkers zo min mogelijk schade van de robot ervaren? *Dit met betrekking tot de voorgaande genoemde aspecten; fysieke en psychische veiligheid, kennis hebben van de technologie, de controle behouden over de robot, het veilig omgaan met persoonlijke informatie en -invullen; eventuele aspecten genoemd door de respondent-.*	• Wat doet de organisatie om zo'n veilige omgeving te creëren? *Verwijs naar: ontvangen trainingen veilig gebruik en toepassing van de robot? Veiligheidsrichtlijnen?* • Bent u van mening dat deze aanpak voldoende is? Zo niet, heeft u ideeën over hoe de veiligheid beter gewaarborgd kan worden?' • Denkt u dat uw collega's gemotiveerd zijn om een veilige omgeving met betrekking tot de robots te creëren? • Hoe zou u zich voelen wanneer het veilige gebruik van de robots de verantwoordelijkheid werd van uw/het verzorgingsteam? • Denkt u dat managers/verzorgenden een rol kunnen spelen in het waarborgen van het veilige gebruik van de robot? • Denkt u dat ouderen zelf een rol kunnen spelen in het waarborgen van het veilige gebruik van de robot? Hoe? • Denkt u dat de robot schade aan kan richten bij ouderen of uzelf? • Wat verstaat u onder een schadelijke situatie? • Weet u of er al onveilige situaties met betrekking tot de robot voorgekomen zijn? Zo ja, kunt u mij hier meer over vertellen?

			Bijv. wat is er gebeurd, oorzaak, etc.
A	27.	Bent u op de hoogte van regels die van toepassing zijn mochten schadelijke situaties voorkomen?	• Zijn er regels die aangeven wie verantwoordelijk is voor het creëren van de schadelijke situatie? • Zijn er regels die bepalen wie financieel verantwoordelijk is voor de kosten aangericht door de schadelijke situatie?
A	28.	Bent u bekend met de ethische kwesties die in de maatschappij circuleren over het gebruik van de robot in de ouderenzorg? *Verwijs naar:* *(minder zorg verricht door mensen, verlies van banen, afhankelijk van de robot worden, beheersing van ouderen over de robot)*	• Hoe voelt u zich over deze ethische kwesties? *Verwijs naar: vinden ze deze kwesties realistisch?* • Hoe denkt u dat ouderen en managers/verzorgenden zich hier over voelen en dit ervaren? • Zijn er regels die van toepassing zijn op deze ethische kwesties? Kunt u hiervan voorbeelden geven?

Most important questions to be asked:

In case of limited time it was important that questions 8, 9, 13, 18, 23, 24, 26, 27 & 28 were asked.

Matching the questions to the thesis:

All the interview questions relate to the regulation and ethical analysis, trying to find out whether the currently available regulation and the suggested improvements fit the daily practices of elderly care. As the regulation and ethical analysis has been divided into five different sections, the graph below shows which questions relate to which discussed topics.

Element	Suggested improvement/solution	Question
Legal analysis		
Health & Safety Risks	Knowledge, responsibility at caregivers	18 & 23
Users privacy & data security	Elders influence on activity level, asking permission for use, caregivers need ability to control both the data storage and activity of the robot, technological knowledge (training)	9, 13, 18, 23 & 24
Liability		23, 26 & 27
Ethical analysis		
Infantilization	Gaining control over the robot	28
Dependence on technology and reduction of human contact	Additional character of robot	8, 23 & 28