Caring about Communication:

How to Optimize the Communication Between Care Robots and People with Dementia

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Abstract

Different kind of Care Robots have been in use for some time and display positive effects when used with Alzheimer's Disease (AD) patients, in order to improve their daily activities. Although the effects are positive, there is always room for improvement. In this thesis I will find out how the communication between Socially Assistive Robots (SAR's) and AD patients can be optimized. First, I will look at what dementia patients and AD patients need when it comes to communication and then I will compare this to what current SAR's can offer. Apart from this I will also discuss the question whether optimized communication should be pleasant or effective. I conclude that if the communication is pleasant, it would lead to the most effective communication. For these topics, I used medical books, current research on the topics and interviews with a nursing student and a technology for innovations in care professor. I also used manuals from two SAR's (Tessa from Tinybots and Zora from Zorarobotics). With this research, I conclude that current SAR's are lacking when it comes to communication with AD patients and could improve. Using these findings, an advice is formed towards future SAR developers.

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Introduction

In the near future the relative number of elderly people will increase because of aging. The cause of this rising number is the postwar babyboom and the increase of life expectancy (Bemelmans, Gelderblom, Jonker & De Witte, 2012). This will create a series of problems, and one of those is the continuation of overcrowded nursing homes, which is already happening in The Netherlands (Onderzoek wachttijden verpleeghuizen, 2017). Overcrowded nursing homes will lead to understaffing and this will affect the residents. They will then not receive the proper care, and this may lead to bedsores, malnutrition, weight loss, dehydration, pneumonia and serious blood-borne infections (Hefner, 2002). The current solution to overcrowded nursing homes is to keep elderly people at home as long as possible. Caring for these elderly people is currently done by relatives or professional organisations like home carers. These home carers are heavily understaffed, which is, again, causing problems for their clients (Kluijver, 2017).

A good solution for these understaffed carers is the (perhaps partial) replacement of the carers with care robots. These robots could help with, or completely take over, certain tasks and in doing so, help the carers with their task of caring for the people with dementia and lighten their workload and at the same time help the people with dementia in their daily lives. But the result of the interaction between the people with dementia and the care robot must also be positive, and the care robot must perform at least as good as the carer. There is an important field within Artificial Intelligence and Psychology that focuses on this, and it is called applied cognitive psychology. Applied cognitive psychology, in this context, means that it is important that the interaction with the care robots runs intuitively for the human client. Thus far, the use of care robots with elderly has gotten a lot of positive responses from clients, even from people who suffer from dementia (Begum, Wang, Huq, & Mihailidis,

2013; Bemelmans et al., 2012). Therefore, it could be a good solution to the problem described above in homecare and nursing homes. Even more so, it could help people with dementia maintain their independence by helping them plan and execute daily activities, as was shown in the research of Begum et al.

An example of current care robot manufacturers are AIST and Tinybots. PARO, which is developed by AIST and well known around the world, is a little seal toy and can be used for animal therapy, where animals are used as a therapeutic tool. PARO can respond to different kinds of inputs, like speech and touch. It responds to these inputs in an animal like way. It can also move and make some sounds (PARO Therapeutic Robot, n.d.). Tessa on the other hand is developed by Tinybots and only known and built in the Netherlands. Tessa is more assistive than PARO, because it can use speech to clarify things. It is not a toy though, as it is more of an interactive speaker which is meant for people with mental illnesses (“Tinybot Als Steun Bij Dementie”, 2016).

But how can we differentiate these kinds of robots? For now, we will just look at care robots and the different kind of care robots. The main care robots of interest are a Socially Interactive Robot and a Socially Assistive Robot. What is the difference between these two? The main task of a Socially Interactive Robot (SIR) is interaction with its user. A Socially Assistive Robot (SAR) is the intersection of an Assistive Robot (gives aid or support to human user) and a SIR. Therefore, the SAR is a subsection of the SIR (Bemelmans et al., 2012). The kind of robot that is used in this thesis is the SAR, because the goal of these robots is to interact with and help a client in an effective and pleasant way. Therefore, this thesis researches the following topics, how should a SAR communicate information to optimize the quality of life of people with dementia? And is there a difference between effective and pleasant communication between a client and the SAR?

To find answers to these questions, a comparison will be made. Current care robots that help people that suffer from dementia will be evaluated to see whether their workings

match to what people, that suffer from dementia, need in order to communicate efficiently and pleasantly. Next to this, recent or current research that focuses on people with dementia that use (care) robots will be studied. In addition I will interview Professor Helianthe Kort (who performed research on Zora, a care robot) and Eva van Oosten (who studies to become a nurse) for more practical information.

In the end this will result in a recommendation towards future SAR developers. In this recommendation there will be guidelines for developing a care robot for people with dementia such that the care robot optimizes their way of living. After this recommendation I will reflect on my findings in a discussion.

Dementia and Communication

If the care robots should respond to the symptoms and problems that come with dementia, these symptoms and problems should be made clear first.

Dementia and Alzheimer's Disease

Dementia is a brain disorder which can lead to loss of memory and other mental functions (Beers, 2005). There are a lot of diseases which can lead to dementia, and the most common one, in more than 70% of the dementia cases, is Alzheimer's disease (AD). There are still a lot of things unclear about AD and its etiology. With people who suffer from AD Amyloid plaques and neurofibrillary tangles start to appear in bigger numbers in the brain and these plaques and tangles disrupt the transfer of information between synapses. This then leads to the reduction of total volume of brain cells which is essential for the storage of new information in the brain (Schim van der Loeff-van Veen, 2012). This all starts of very slow and therefore the people who are in the first stage of dementia do not really notice it and if they do, they often try to hide these beginning symptoms.

The trouble with storing new information in the brain and the trouble with the transfer of information between synapses cause a lot of other symptoms. These other symptoms are listed below. AD also negatively affects long term memory, episodic memory (the memory of autobiographical events) and focus (Nia, 2017). People with AD also have trouble shutting out background noise. Some actions, which are automatised, could cause less trouble. AD also causes aphasia (problems with expressing oneself with language or understanding language), apraxia (problems with practical actions) and agnosia (problems with spatial orientation and visual perception) (Schim van der Loeff-van Veen, 2012). Even though the

focus is on AD, all forms of dementia will lead to progressive loss of memory and other cognitive activities (Beers, 2005).

Communicating with Patients

The goal of this thesis is that we want to know how the communication can be optimised between SIR's and people that suffer from dementia, not only because it would help the carers and robots, but also because speech therapy is proven to help people that suffer from dementia (Beers, 2005). Considering that Alzheimer's disease is the biggest cause of dementia, it is important to focus on it and look at how one should communicate with AD patients.

Before we look at the actual communication, there are important factors that need to be looked at. The first thing that is important when working with people who suffer from dementia is the environment. A supporting environment can work wonders when working with these people. When people with mild- to severe forms of dementia are in a environment they are familiar with, they can (co-)operate the best. Within this environment it is important that there are no dimmed lights. This is important because dimmed lights can lead to misunderstanding and misinterpreting the surroundings (Beers, 2005).

Some more important factors are structure and routine. Structure and routine make sure that people with dementia can stay oriented within their environment and that they have a safe and reliable environment. Within this environment, activity is important too: it makes the clients focus on pleasant and valuable tasks and this then helps them feel independent and useful. The activities should not be too tense and exciting. Especially physical activity is important, because this helps with restless behaviour. Overdone stimulation must be avoided, but people with dementia cannot become socially isolated (Beers, 2005).

Social interaction is very important for people who suffer from dementia, but it must be done in the right way. When communicating with these clients some things can go wrong.

It never helps for carers to complain when things go wrong, this can only make things worse and in these situations, carers should take some time for themselves.

A study that compared elderly AD patients with elderly without AD (control group), found that the AD patients scored significantly lower on a number of tasks. These tasks tested skills such as verbal expression, auditory comprehension, repetition, reading, and writing. Even though a significant difference between the two groups was found in these areas, the articulation abilities were similar. This study states that the phonology and syntax of the AD patients remained relatively intact, but the semantic abilities were impaired(Murdoch, Chenery, Wilks,& Boyle, 1987). Another study found that, when communicating, AD patients present more misunderstandings and require explicit sentences (Carlomagno, Santoro, Menditti, Pandolfi & Marini, 2005).

Actual communication

When actually trying to communicate with AD patients, carers should be careful with how they speak. Different speaking strategies can cause different results. If you want a longer conversation to run as smooth as possible, the carer should encourage a two-way conversation and try to keep the conversation going (Nia, 2017; Smith et al, 2011). The response to yes-no questions can lead to a communication breakdown (the conversation stops) (Small & Perry, 2005). Instead, if carers honestly try to seek information from AD patients using a meaningful context with the question, these can be successfully answered by AD patients. Even questions that might be difficult to answer from a linguistic standpoint, like open-ended questions can be answered by AD patients with this strategy (Perry & Small, 2006). Next to this, it is very important that carers speak face-to-face to the AD patient in a calm manner (See appendix B).

However, if it is not an entire conversation but just a quest for information, another strategy can be applied. In this case yes-no questions can be very helpful, it gives the

patient a choice of answers and this is very important. If it is an open question you want an answer to, try to limit the answers like a multiple-choice question. Instead of asking “What do you want to eat for dinner?”, carers should ask “Do you want soup or chicken for dinner?”. In this way the carer limits the answers and the client can still make their (semi) own decisions and while doing so, keep their independence (Nia, 2017; Van Dongeren, De Greef & Van Silfhout, 2017).

In both of the strategies above, it is always important for the carer to speak face-to-face with the client and start of by calling the client by name, because this reminds the client that the conversation is with them and that increases the intelligibility according to both literary research and interviews (Nia, 2017; Smith et al, 2011; Van Dongeren, De Greef & Van Silfhout, 2017; Appendix A; Appendix B). Literary research and the interviews also show that the carer should never talk as if the client is not there and the carer should mind their body language, tone and volume of their voice. Never talk with the patient using baby talk or a baby voice. Instead, talk with them like an adult, use short sentences and use names. Not only the name of the patient, but also other names. Pronouns can be too vague and this can be anticipated by using their actual names. Also, AD patients can have problems with interpreting metaphors and humor. To ensure the AD patient has enough structure, carers could offer simple step by step instructions. This can help them keeping focus (Nia, 2017; Van Dongeren, De Greef & Van Silfhout, 2017; Fromm & Holland, 1989; Appendix A; Appendix B).

The response of AD patients can be optimized in the ways mentioned above, but still the carer should always keep in mind that the AD patient can have trouble with keeping their train of thought while speaking, keeping their focus when things take too long and finding the right word or remembering the meaning of words. The last part can be applied to losing focus while in the middle of a conversation. AD patients can also have trouble with remembering steps of instructions or common activities. When these things happen, the

carer could repeat the instructions and allow more time for a response. When doing so, try not to interrupt the client. If the AD patient does not understand what you are saying, try to rephrase. So, if the patient does not understand “I have finished making dinner, are you ready to eat?” try again with something like “The food is ready, are you hungry?” (Nia, 2017; Rousseaux, Sève, Vallet, Pasquier, & Mackowiak-Cordoliani, 2010).

Communicative Components of SAR's

Previously PARO from AIST and Tessa from Tinybots were introduced. PARO does not assist the user actively, so it is not a SAR. No need to worry though, there are other SAR's currently in use, like Zora. Along with Tessa from Tinybots, I will use these two SAR's as case studies to see how the current SAR's communicate with its users. The first Tessa pilot was in 2017 and Zora is from 2014. Both are popular in the Netherlands and that is why these two are used as a case study, to see what these two options can contribute. From my interview with Professor Kort I also gained some information about Pleo, which I will describe shortly after Tessa and Zora.

Figure 1. Tinybot Tessa (tinybots, 2018c).

Tessa from Tinybots

That funky looking plant pot in Figure 1 is Tessa from Tinybots, which is built for people who suffer from dementia. Tessa cannot move by herself and is basically just a speaker, or is there more to this than meets the eye? Tessa can be given commands from a distance through an app which Tessa can then say at the scheduled time, this means that Tessa is

semi-independent. These commands are “tip moments” (translated from Dutch) and there are 3 different “tip moments” within Tessa’s capabilities. You can schedule a reminder, schedule a question or schedule music. These “tip moments” can be scheduled with the app and this can be done from any distance. The app also provides a view of “tip moments”of the current day, which makes it easier to organise (Tinybots, 2018).

When Tessa is announcing a “tip moment” she always follows the same steps. First, she plays a friendly tune, then she greets the user and then she announces the message. This way you do not need any extra friendliness when typing in your “tip moment”, Tessa takes care of this. When scheduling your “tip moment” you can choose when you want it to be announced and if, or when, it should be repeated (Tinybots, 2018).

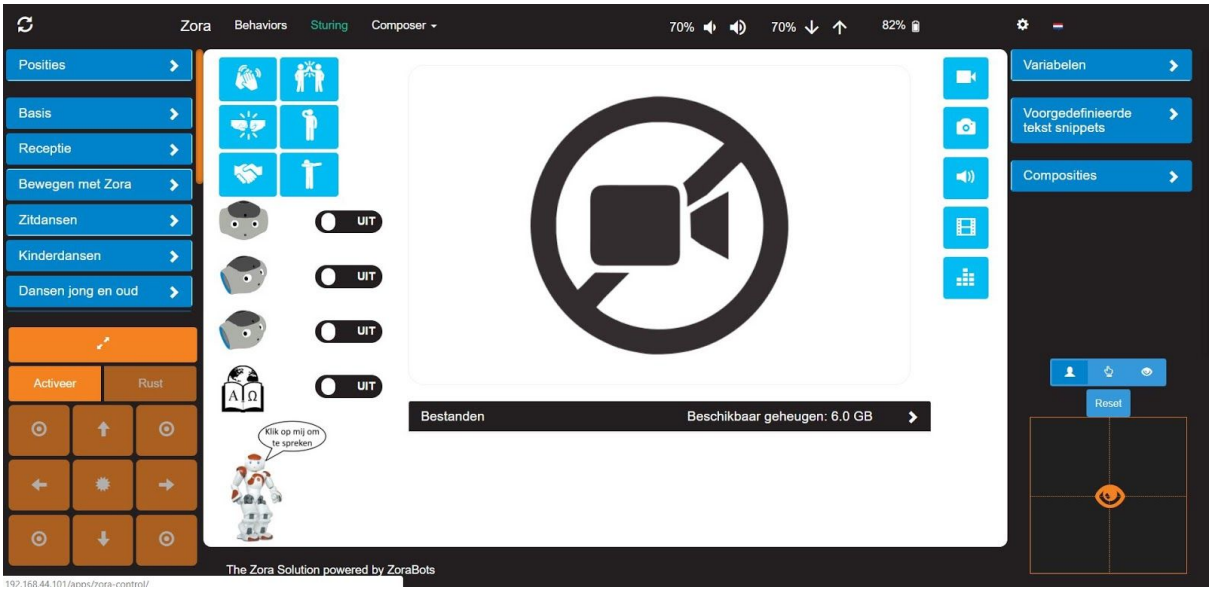
A reminder is scheduled if you want to remind or suggest some kind of activity to its user. This way Tessa could help with structure and activation during the day. A question can be asked if the user of the app wants to know something from the user of Tessa. The app shows if the questions has been answered yet, and if it has been answered what the answer is. The question ends if Tessa has heard a yes or no. When Tessa does not understand the answer, it will ask the question again. If there is silence, Tessa will just try again later. All the answers will be logged in the app, so if Tessa did not understand the answer a “?” will appear and so on. The last “tip moment” is the playing of music. Music can be uploaded through the app and it can be used to fill a normally silent moment of the day with some more sound. In the Tessa app a playlist can be made, and it can be scheduled to start playing at any time. Before it starts playing music, Tessa asks if this moment is right for some music and starts playing if a “yes” is detected. If a “no” is detected, Tessa will not play music. Tessa keeps asking if she should continue playing music every 15 minutes, but it can also be stopped manually by pressing a button on Tessa (Tinybots, 2018). Aside from verbal communication, Tessa also uses non-verbal communication. Tessa can use her eyes to display numbers as is seen during the installation of Tessa.

Figure 2. Zora by Zorarobotics (Alcock, 2017).

Zora from Zorarobotics

Softbank robotics, the creator of Nao (which develops more robots), joined forces with Zorarobotics to create a solution to the healthcare problems in Europe. Softbank robotics created the hardware and Zora Bots the software. The focus was to make an easy to use Care Robot (Zora Bots, 2016). Out of this coalition, Zora was born (See figure 2). Zora has a lot of abilities like dancing. Zora can do movements together with its user (dancing or walking) or do an exercise which the users need to repeat. This can be useful with physiotherapy. Zora can also use TV remotes, read the news, play interactive games and

chat with its users (QBMT, 2016).



When I was using Zora at the Techlab at the HU (University of Applied Sciences in Utrecht), the picture above was the interface of the application that runs Zora. On the left there are some options which activate different kinds of programmed activities. At the top you can control the speed, and the volume of Zora's speech. To activate Zora's ability to speak, the user must first press a button which enables Zora's talking abilities. Then a choice must be made how animated Zora should be (3 options). For the most comfortable communication, "not animated" should not be picked as it could discourage people to interact with Zora (Pratt & Pestina, 2017). This was already done before this screenshot was taken. If nothing is said to Zora after turning it on, Zora starts its introduction program "Hi, I am Zora…" in a female voice and after this is done and there is still no interaction, Zora will do nothing. This is because Zora is an interaction-based Robot. Whether it is interaction with the patients or interaction with the user behind the tablet that controls Zora (See Appendix A). For this reason, Zora is not a replacement of contact with humans, but a tool which can help people increase the social aspect of their daily life (Opella, 2017).

Zora is not an independent Robot, it needs someone that controls it. This does make it easier to adapt Zora. It can be programmed to talk in short sentences and speak louder.

Although Zora's voice can come across as different then the clients are used to, Professor Kort had never heard any complaints. The only remark that was made was that Zora sounds a bit Flemish (See appendix A).

When communicating, Zora uses verbal and non-verbal communication, like hand movements (Dekker, 2015). when Zora cannot understand what is being said, or when the wrong answer is given, it will say "No, that is wrong" and repeats the question. In some situations, Zora can misunderstand what is being said and tell the client that they are wrong when they actually are not (See appendix A). I tested this at the Techlab at the HU as well, if people do not reply to Zora during a quiz a beeping noise is made, and Zora's eyes turn blue. Then she says, "Give me your answer" and repeats the question. This pattern is repeated if nothing is said after this. If the answer is right, Zora's eyes turn green.

Figure3. Pleo the Dinosaur (PLEOrb, n.d.).

Pleo from Innvo Labs

Pleo is a children's toy and definitely not a SAR, but it does contain an interesting feature. Pleo is a small dinosaur toy with a rubber skin. It can wag its tail, move its neck and move its eyes and mouth. It also has speakers, such that it can make noise, and a large number of sensors and buttons. When Pleo comes out of the box, it goes through 3 stages. Hatching, infant and juvenile (Fernaeus, Håkansson, Jacobsson & Ljungblad, 2010). During

these stages Pleo learns from its user. The learning process is very low key, but in the end, this creates a bond between the user and Pleo (See appendix A).

	Tessa	**Zora**
Short sentences	Yes	Yes
Repeats message if necessary	Yes	Yes
Voice	Female	Female
Movement	No	Yes
Independent	Limited	No
Learn from input	No	No
Non verbal communication	Limited	Yes
Calls user by name	Yes	No
Volume adjustable	Yes	Yes
Adjustable speech rate	No	Yes

Forms of Communication with Care Robots

When looking at human robot interaction, we want the communication to be optimized. However, when is something optimized? That is why, in this thesis, a distinction is made between pleasant and effective communication. This distinction is crucial, due to the possible difference in outcomes between the two forms of communication. Optimizing the communication is done not by improving the human side but improving the care robot side.

Effective Communication

Saying that a client and a SAR communicated does not imply that there is an outcome to this communication. While the goal of both effective communication and pleasant communication is the correct communication of information, effective communication (EC) means that the possibility of miscommunication is minimalized and that the exchange of information is done in an efficient way in regard to time, choice of words and that it must be intelligible (Gudykunst, 2004). The Cambridge Dictionary describes the meaning of efficient as “Working or operating in a way that gets the results you want without any waste” (Efficient, n.d.). According to Eva van Oosten, who has worked a lot with AD clients as a nurse, (See appendix B) this means that first of all, the communication must not take unnecessary time. According to Eva van Oosten this means that the care robot must never use long and difficult sentences, but short and informative ones. Second of all, the words that it uses must be short and to the point, such that the sentences are easy to understand. Third of all, the care robot must be intelligible. This means that it must be clear to hear and speak at the right volume. If it is a male or female voice does not matter on the matter of judgements of perceived urgency, but because of the, usually, higher pitch and greater pitch range the

female voice does portray a greater range of urgency (Edworthy, Hellier & Rivers, 2003). Therefore, a female voice of the care robot could be more practical.

Pleasant Communication

With pleasant communication (PC) we mean how enjoyable and easy to understand the exchange of communication is. First of all, this means that the communication is done with empathy. When looking at the communication between robots and humans, this means that the robot must be as pleasant as possible for the human, not the other way around. This also means that the sound of the robot can play a role. Therefore, the user should be able to choose between a range of voices that would then become the voice of their SAR. Such that it sounds as pleasant as possible. Eva van Oosten says that she always tries to use a calm voice when talking with a dementia patient and if she has more time when caring for a dementia patient, she likes to take the time and keep the conversation going and have a little chat. By taking this extra time a carer can really cheer a client up and improve their day (see appendix B).

Timing could also play a role when trying to have pleasant communication. If someone is more of a morning person and is not really looking for a conversation in the morning, the SAR should take this into account and try to be more stimulating when the patient is more awake and active. Eva van Oosten says that her AD clients can be more confused in the morning. If a SAR takes this into consideration when communicating, the communication could be more pleasant (See appendix B).

When comparing effective communication with pleasant communication a lot of similarities can be found, on the grounds that when you want to have pleasant communication with an AD patient you need to be intelligible, need to speak in simple sentences and not take unnecessary time. When a patient is easily and enjoyably

communicating, this will result in fast and effective communication. Therefore, in a lot of cases PC results in EC.

Comparing Needed vs. Provided Features

Someone who suffers from Alzheimer's Disease needs someone who takes this disease seriously and tries their best to apply the following tips and tricks while communicating with each other. When communicating with an AD patient, people should take into account that AD patients can have trouble with shutting out background noises, long term memory, focus in longer conversations, episodic memory, aphasia, apraxia, agnosia and semantic abilities.

To minimalize the possibility of misunderstandings in the exchange of information people could do the following things when communicating with AD patients. First of all, they should always look the patient in the eyes and call him or her by their name when starting a conversation. Tessa does this when announcing a message, Zora does not. Secondly, they should mind their voice and volume. Never use a baby voice or baby talk when talking with AD patients. Tessa cannot change her voice, volume or her speech speed, Zora can change her speech speed and volume. Both can change their volume. Thirdly, use short sentences and names when talking about people instead of pronouns. Both Tessa and Zora can do this, because this can be programmed. Fourthly, use steps when explaining something that is a bit more difficult. A step to step process helps AD patients keep the structure and regain focus. Encouraging a two-way conversation is also very important. When doing this, a yes-no question can easily flatline the conversation, but if it is just a question to retrieve information, it is very important to limit the answers to the question. So, with more open questions there is a higher possibility to miscommunicate, but a higher possibility to have longer conversations. But when the questions are narrowed down, there is a lower possibility to miscommunicate, but the conversation will be as short as possible. This strategy is more for the users behind Tessa and Zora, to make sure they ask the right questions.

But both Tessa's and Zora's response (repeating the question) when not registering an answer, could interrupt the client. This could confuse the AD patients. When a question is not understood, these robots cannot rephrase a question, they can only ask the same question again. Also, these SAR's cannot learn and adapt from input. When someone is less talkative in the morning, a SAR could take this with them for future interactions. And the right volume or right speed at which is talked, could also be found when these SAR's learn from their communications and at the same time a bond is formed between an AD patient and their personalised SAR.

When miscommunications do happen, AD patients could forget words and their meaning, the SAR could ask again and give the AD patient plenty of time to respond. Avoid interrupting them at all costs. If the AD patient loses their focus mid-sentence, the sentence could be repeated. If they still struggle, the sentence could be rephrased and repeated. Both Tessa and Zora can repeat the question if necessary.

Conclusion and Recommendation

So how should a SAR communicate information to optimize the quality of life of people with AD? By looking at a SAR that supports AD patients with scheduling and a SAR that supports AD patients with daily entertainment, I can conclude that these SAR's are doing a good job when communicating, but there is room for improvement.

In the future, when developing a SAR for AD patients the following things must be taken care of. The developer must understand who they are building it for. Is it for AD patients in a group or for AD patients at home when they are alone (or in a small group) and is it meant for entertainment or supporting daily social activities? In all the situations the developer must keep in mind that AD patients can have trouble hearing and understanding, so adjustable volume and adjustable speech rate are important. If the user does not understand, the SAR must be able to repeat the question and be able to rephrase the question to optimize the understanding of the SAR. If the repeated question is interrupted, the SAR must stop talking to make sure the patient can finish their answer. Nonverbal communication can help the AD patient understand the SAR. The SAR must ask short (semi-) closed questions if the wanted result is information, if the result should be a conversation some longer and more open questions could be asked. The developer should also implement that all communication follows the same steps, to assure that the AD patient(s) can get used to the way the robot talks. It should also call the user by name and avoid pronouns. To make the SAR more independent, it should have built in programs and it could learn from the input. What music the AD patient(s) like, how to address them and when. If the user prefers a male over a female voice, the possibility to switch could help create a bond between the SAR and its user. Creating a bond where the SAR is more personalized would improve the communication between the SAR and its user. If the SAR is

meant entertainment, movement features can help strengthen the bond and longer sentences have a bigger shot at causing longer conversations. If the SAR is meant for supporting daily activities, the sentences should be short and as closed as possible.

Is there a difference between effective and pleasant communication between a client and the SAR? When comparing effective communication with pleasant communication a lot of similarities can be found, on the grounds that when you want to have pleasant communication with an AD patient you need to be intelligible, need to speak in simple sentences and not take unnecessary time. When a patient is easily and enjoyably communicating, this will result in fast and effective communication. Therefore, developers should aim for PC, because in a lot of cases PC results in EC.

Discussion

By studying the literature and interviewing these people I was able to make a reliable comparison. I was able to compare what these current SAR's can provide with what AD patients need when they communicate. There is a lot of research and guidelines for what AD patients need. As for the SAR's, Zora and Tessa both show some good qualities, but they could be improved with some features. These features should also try to be as pleasant as possible, to make sure the communication is optimized. When these features are implemented, AD patients can have an improved social life, and can carers be supported in their work.

Although I found compelling arguments from which I could form my conclusion, there were parts that need improvement. I scheduled an interview with the people behind Tessa, but this fell through. An interview with them could have given me more insight on what is going on behind Tessa and how Tinybots improves and reacts to situations, compared to the manuals from Tessa and research about Tessa.

While I was studying the literature, I found that if I wanted to be able to tell more about how current SAR's are operating, I should have looked at all of the robots, even unpopular ones. These could be miserable overall and not even be care robots but might have some features that could improve future SAR's. The reason why these SAR's were chosen, was that these are popular in the Netherlands and usable with AD patients. Looking at all the robots would be a difficult job, due to the continuous development and evolution in robots and the enormous number of existing robots.

One of those robots is Google Home. Google home is an interactive speaker with a lot of functions and possibilities and because it is built by Google, it might have better features that could be used to optimize SAR's. Perhaps this could improve the language

center of Tessa and Zora. I found one study that explained the use of a female voice instead of a male voice in emergency broadcasting and this could be extended with some further research. Finding if there is a difference between people when trying to understand a male and a female voice, could improve the communication.

Also, there needs to be more research towards empathy and AD patients, there is almost no research towards this and this could improve SAR's. If empathy is needed, SAR's should provide this more and this could optimize the communication even more.

Implications for AI

Improving SAR's is important within the broad field of AI, because mimicking human behaviour and programming this into a robot is what AI is about. So, improving communication skills for robots is very important. This means that natural language processing should be improved and could even be combined with more research towards empathy. If this results into a machine that can understand and process language with empathy, this could be built in a SAR and possibly improve communication. Also, more research towards human behaviour and communication could result in improved communication.

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Appendices

Appendix A: Transcript from Interview with Professor Helianthe Kort

Interviewee: Professor DR. Helianthe Kort (K)

Interviewer: Sammie Smaak (S)

Date: 7-6-2019 at 10.30 am

Via: Skype

I interviewed Professor DR. Kort, because she is a lector of the topic “Technology for Care Innovations” in the Netherlands. I sent Professor Kort my questions a few days before the interview, this way she could prepare herself. It is a clean read transcription and before we went into the questions, Professor Kort and I talked about why I wanted to interview her and how I found her. She also told me that I could see tessa in their lab and whom I should contact for this. Because of this, the first greetings are left out. The interview is in Dutch, because the interview was conducted in the Netherlands.

(K)Bij Zora is de communicatie meestal verbaal. Dat kunnen woorden zijn, ook in de vorm van zang. Maar Zora kan ook bewegen en zo kan Zora ook communiceren. Dus in de dagopvang, bij de verpleeghuizen, kan men ook zeggen we gaan wat leuks doen. Vervolgens gaan de mensen samen met Zora een dansje doen. Zora heeft ook een programmaatje “hoofd, schouders, knie en teen” en dan moeten de mensen gewoon meedoen, dat kan je ook zien als een manier van communicatie.

Of ze dingen herhaalt volgens mij wel, is wel een tijd geleden dat ik Zora aan heb gezet. Maar volgens mij wel, dat ze gewoon zegt van “Nee dat is niet goed”. Wat bedoel je “houdt ze rekening met timing?” Of ze wacht?

(S) Ja precies, of ze dus rekening houdt met mensen die last hebben van geheugenverlies of zora bepaalde informatie dan op momenten wel zegt en op momenten juist niet.

(K) Nee, dat doet Zora niet.

(S) Het is gewoon direct

(K) Het is vrijwel direct, omdat Zora vrij plat is geprogrammeerd. Zora wordt wel gebruikt voor zorg, maar is niet echt gedifferentieerd naar een diagnose groep. Wij hebben hem ingezet op een dag opvang, maar er zijn ook programma's zodat Zora wordt gebruikt op een school voor kinderen met ADHD. Eigenlijk geven de makers aan dat jij je eigen programma’s kan plaatsen. Maar je snapt dat zorgmedewerkers niet de competentie hebben om dat te doen, dus die werken veelal met wat er al is. We hebben in het verleden wel studenten vanuit ons(Technologie voor Zorginnovaties) gehad vanuit informatica, die robot staat daar toch, ga ermee aan de slag. Volgend jaar gaan we wel met informatica studenten een minor doen, maar die gaat nog starten.

Wat Zora wel heeft, is als je soms een antwoord geeft, dat Zora je niet goed hoort, dan begrijpt Zora het niet goed. Dan laat je een plaatje van een hond zien via een QR-code en zeg je bijvoorbeeld “Hond”. Vervolgens begrijpt Zora dit verkeerd en krijg je “Nee dat is niet goed”te horen.

(S) Dus daar zit verbetering in?

(K) Daar zit nog heel veel verbetering in, ja. En Zora heeft volgens mij een vrouwenstem. Maar het kan zijn dat je de stem kan veranderen. Er zijn steeds updates, dus het kan veranderd zijn sinds de laatste keer dat ik Zora heb gebruikt.

Zoals ik eerder al zei kan zora aan de ene kant zorgen voor vermaak (dansen, zingen), maar je kan zora ook opdrachten geven via de tablet, bijvoorbeeld dat Zora iemand welkom heet.

Daarnaast kan Zora heel gerichte effectieve acties geven, bijvoorbeeld met ouderen het bovenlichaam trainen. Een aantal fysiotherapeutische handelingen kan zora voordoen en het voordeel daarvan is, is dat de fysiotherapeut het zelf niet meer voor hoeft te doen en die kan dan naast de mensen gaan staan en corrigeren waar nodig. Dus je hebt extra ondersteuning hierdoor. En Zora kan dus spelletjes doen en ook bij mensen met dementie “herken je dit” doen, hiermee kunnen ze worden teruggenomen in de tijd. We noemen dat engagement, dat mensen toch even terug zijn en zien hoe het vroeger was. Wat we zien in het algemeen, de robot staat bij ons gewoon in het lab en als Zora niet wordt gebruikt staat hij gewoon in het glazen doosje, maar als je ermee gaat werken en je doet het aan en je programmeert iets, trekt dit enorm de aandacht van mensen, jong en oud, en dat is een plus.
Bij vraag 5: Zora is niet gericht op mensen met Alzheimer, dus het enige wat er gedaan kan worden is via de tablet zelf programmeren dat Zora kortere zinnen kan uitspreken. Maar het basis programma houdt hier geen rekening mee. Sowieso houdt zora hier geen rekening mee, het is meer bedoeld als, “dit is de algemene techniek. Hij kan dansen, zingen en dingen herkennen”. Zora kan volgen en dat vinden mensen ook interessant.
Wat hebben mensen met dementie nodig als het gaat om communicatie? Heel veel, sowieso moet de spraakverstaanbaarheid goed zijn in een ruimte. Als je Zora gaat inzetten, let dan ook goed op de akoestische kwaliteiten van een ruimte. Het stemmetje is al bijzonder, het is ook een stem die afwijkend is. het is geen normale mensen stem, dat is het niet. Aan de andere kant hebben wij nooit van mensen gehoord dat het ze stoort, dat Zora zo praat. Het enige wat ze hebben meegegeven is dat Zora wel een vlaamse tongval heeft, maar dit kan nu al anders zijn.
Heeft Zora concurrentie op het gebied van zorg robots? Ik weet niet hoe je dat moet zien met zorgrobots, want ze worden verschillend ingezet. Je hebt ook een dinosaurus genaamd Pleo en die ziet er uit als een dinosaurus. Hij wordt vooral ingezet bij kinderen die gedragsproblemen vertonen, dan wel voor kinderen die op de basisschool en kinderen

langdurig in het ziekenhuis. De Pleo dinosaurus, verkrijgbaar bij amazon, ik weet niet of je bekend bent met het tamagotchi tijdperk?

(S) Ja!

(K) Dus een beetje vergelijkbaar eraan kan Pleo leren en daarmee krijgt een kind dus ook een band met Pleo. Dan leert het kind dus Pleo eten en reageren op zaken. In principe zou een pleo ook voor ouderenzorg kunnen worden ingezet.

(S) Zou het dan ook functioneel zijn om een lerend aspect te gebruiken om een band te creëren tussen ouderen en zorg robots?

(K) Ja dat kan heel functioneel zijn bij ouderen, ik heb alleen geen rapportages daarover. Het wordt wel gemeld dat dat zo zou kunnen zijn, maar dat dat bij mensen met dementie wel lastiger zou kunnen gaan. De pleo spreekt of zingt verder niet, maar maakt wel de dino bewegingen en als je hem op zijn kop houdt, heeft hij heel veel pijn, dus het appelleert wel aan mensen.

De tessa is wel heel wat anders, de pratende bloempot. Het is eigenlijk meer een reminder. Ik heb hem gezien en de ontwikkelaar wilde iets neutralers, vandaar de bloempot. Het is vooral voor reminders van de mantelzorgers. Maar dat zijn deze twee (pleo en zora) niet, die zijn meer aandacht en een stukje vermaak, en bij de zorg een stukje therapie, fysiotherapie of sociaal gedragstherapie.

Zo ik heb de acht vragen gehad, heb je nog vragen?

(S) Heel duidelijk allemaal! U heeft dus ook de Tessa gezien?

(K) Ja een paar weken terug heb ik een lezing gegeven over alle drie. Tessa, pleo en Zora.

(S) En die gaat echt in op mensen met dementie toch?

(K) Ja omdat die dus echt op die reminder functie zit, terwijl de zora meer voor groepen is en je vooraf de programma's klaar zet. En daarom goed te gebruiken op een dagopvang, als je weet wat je die dag wilt gaan doen, kan je dat dan alvast klaar zetten. En zoals ik al zei, de ruimtes moeten geschikt zijn. Terwijl de tinybots, die kan je niet in groepen inzetten, dat is

daarvan weer het nadeel. die is echt voor 1 op 1 interacties.

Zora wordt ook voor 1 op 1 ingezet in verpleeghuiszorg en daar zien we uit de narratieven wel positieven verhalen in de zin dat mensen met dementie in sommige gevallen wel tegen de zora beginnen te praten maar nooit tegen de verzorger. Dus de Zora kan het eigenlijk beide.

(S) Ja want Zora moet je wel echt van te voren klaar zetten en programmeren toch?

(K) Ja maar dat moet je bij Tessa ook. Dat moet je ook van te voren klaarzetten.

(S) Maar de Zora, als je hem aan zou zetten en zou pakken zou die al kunnen reageren?

(K) In de basis, als je niets doet, dan geeft ie aan “hallo ik ben zora, ik ben ….” een introductieprogramma, dat is iets dat ze daarvoor hebben gemaakt. maar als je verder niets zou doen, dan zou de zora niets doen. Het is toch de interactie met anderen waar je de mens voor nodig hebt. Het zijn geen automatische reagerende systemen nog.

(S) Maar wel voor interactie dus. Nou dat is allemaal heel duidelijk! Heel erg bedankt voor uw tijd.

(K) Nou graag gedaan! Succes!

Appendix B: Transcript from interview with Eva van Oosten

Interviewee: Eva van Oosten (O)

Interviewer: Sammie Smaak (S)

Date: 7-6-2019 at 10.30 am

Via: Face to face

I interviewed Eva van Oosten, because she is studying to become a nurse in the Netherlands. She has experience when it comes to working with dementia and AD patients. I asked Eva van Oosten these questions and wrote her answers down. What follows is a clean-read transcript of the interview. The interview is in Dutch, because the interview was conducted in the Netherlands.

(S)Hoelang ben jij werkzaam in de zorg/ hoeveel ervaring heb jij met communicatie met dementie patiënten?
(O)Ik ben al 3,5 jaar werkzaam in de zorg. Begonnen met een bijbaan waarbij ik zorgde voor iemand met dementie. Hierna heb ik bij al mijn stages te maken gehad met mensen met dementie. Waaronder 2 jaar in de thuiszorg.
(S) Wat hebben mensen met dementie nodig qua communicatie in jouw ervaring?
(O)Dingen waar je op moet letten zijn: Je moet niet al te snel praten, langzamer praten dan men tegen mensen zou doen zonder dementie. Zorg voor veel herhaling, dan is de kans groter dat ze het begrijpen en onthouden. Liever korte zinnen, lange zinnen kunnen ervoor zorgen dat het een tijdje duurt voordat ze het begrepen hebben. Articuleer zo duidelijk mogelijk. Bij algemeen contact altijd eerst iemand aankijken voordat je begint te praten.
(S) En qua non verbale communicatie?

(O) Zorg dat je rust uitstraalt, ga zitten als dat voor een rustigere sfeer kan zorgen. Op deze manier zorg je voor een omgeving met niet te veel prikkels.

(S) Gebruik je extra handgebaren als je communiceert met mensen die lijden aan dementie?

(O) Nee, dat doe ik niet.

(S) Praat je anders tegen mensen die lijden aan dementie als je snel weer weg moet?

(O) Ja, ik zorg dat ik dan extra duidelijk ben en dat er zo een zo klein mogelijke kans is dat mijn cliënten mij verkeerd opvatten. Als ik meer de tijd heb, ben ik geneigd om meer door te vragen. Ik merk dat deze mensen vaak eenzaam zijn en een praatje erg waarderen.

(S) Merk je verschil in het gedrag als je er ‘s ochtends of ‘s avonds bent?

(O) Niet echt, ‘s morgens kunnen ze iets verward zijn.