The In-between Machine
The Unique Value Proposition of a Robot or Why we are Modelling the Wrong Things

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Abstract: We avow that we as researchers of artificial intelligence may have properly modelled psychological theories but that we overshot our goal when it came to easing loneliness of elderly people by means of social robots. Following the event of a documentary film shot about our flagship machine Hanson's Robokind "Alice" together with supplementary observations and research results, we changed our position on what to model for usefulness and what to leave to basic science. We formulated a number of effects that a social robot may provoke in lonely people and point at those imperfections in machine performance that seem to be tolerable. We moreover make the point that care offered by humans is not necessarily the most preferred – even when or sometimes exactly because emotional concerns are at stake.

1 INTRODUCTION

Human care is the best care. If we want to support the elderly with care robots, most will assume that robots should be modelled after humans. Likewise, in our lab, we are working on models for emotion generation and regulation (Hoorn, Pontier, & Siddiqui, 2012), moral reasoning (Pontier & Hoorn, 2012), creativity (Hoorn, 2014), and fiction-reality discrimination (Hoorn, 2012) with the purpose to make a fully functional artificial human that is friendly, morally just, a creative problem solver, and aware of delusions in the user (cf. Alzheimer). All this may be very interesting from a psychological viewpoint; after all, if we can model systems after human behaviour and test persons confirm that those systems respond in similar ways, we can make an argument that the psychological models are pretty accurate.

Our project on care robots and particularly our work with Hanson's Robokind "Alice" (http://www.robokindrobots.com/) drew quite some media attention, among which a national broadcaster that wanted to make a documentary (*Alice Cares,* Burger, 2015). The documentary follows robot Alice who is visiting elderly ladies, living on their own

and feeling lonely. Alice has the lively face of a young girl and can be fully animated, smiling, frowning, looking away, and the like, in response to the interaction partner whom she can see through her camera-eyes. Perhaps more importantly, she can listen and talk. The results of this uncontrolled 'field experiment' taken in unison with other observations, our own focus-group research, interviews, and conversations as well as the research literature brought us to a shift in what should be modelled if we want robots to be effective social companions for lonely people, rather than accurate psychological models walking by.

2 EXPERIENCES

To start with a scientific disclaimer, what we are about to present is no hard empirical evidence in any sense of the word but at least it provided us with a few leads into a new direction of thinking, which we want to share.

The set-up of the documentary was such that in the first stage, the elderly ladies (about 90 years old and mentally in very good shape) came to the lab with their care attendants and conversed with Alice

in an office environment. In the second stage, Alice was brought to their homes several times over a period of about two months, where the ladies continued the conversation with Alice.

For technical reasons, we used a Wizard of Oz set-up in which a technician operated Alice behind the scenes as a puppeteer (in a different room, unseen by the ladies). While Alice filmed the conversation through her camera-eyes, a separate film camera in the room recorded the conversation as well. The participating ladies were fully informed, yet awareness of the camera seemed to dissipate after a while.

In viewing the recorded materials, most striking was the discrepancy between what the women said about Alice cognitively and what they experienced emotionally. Offline, while not being on camera, it was almost as if their social environment withheld them from enthusiastically speaking about Alice, as if they were ashamed that they actually loved talking to a robot. In their homes, even before Alice was switched on or before the camera ran, the ladies were immediately busy with Alice, greeting her and wondering where she had been, what she had seen, etc.

All women tended to approach Alice as a helpless child, like a grandchild, but apparently were not surprised that this child posed rather adult and sometimes almost indiscrete questions about loneliness or life situations. When Alice looked away at the wrong moment, one lady said "What are you looking at? You're not looking at me while I talk to you." She did not frame it as an error of the robot, which it was. She brought it up as an observation, a kind of attentiveness, while pointing the child at certain behaviour. Fully aware of the fact that Alice could not eat or drink, the old lady still wanted to offer food and drink to Alice. While she had her coffee, she said to Alice "You cannot have cookies can't you? A pity, for you … well, now I have to eat it." The smile and looks at Alice revealed sharing a good joke. Interestingly, a similar event a few weeks later occurred: The lady had prepared two slices of cake on a dish while she watched TV together with Alice. She asked Alice: "You still can't have cake, can you?" This time, however, it was not a joke; the old lady showed regret. This should really be seen as a compliment; the wish to enjoy the food together with Alice may tell us something about how the robot felt as interpersonal contact.

While Alice stayed longer in the house, the need to talk vanished. Yet, the ladies did like it that 'someone' was there; that some social entity was present. This may refer to the difference between someone paying you a short visit or a person living with you: It may indicate that one feels at ease and need not entertain one's company. At times, one of the ladies read the newspaper aloud to Alice just to share the news with 'someone.' The ladies sang with her, showed her photo books of the family, did physiotherapy, and watched the World Championships with her.

It seemed that the less socially skilled had greater benefit from Alice. Because of Alice, the ladies drew a lot of attention: on the streets and in public places. People called them up to ask how things were with Alice. People sent newspaper articles about robot care. That alone made the ladies less lonely but obviously, this novelty effect shall decay as Alice becomes more common; but for now it worked quite well. Alice also worked for those who needed physical activation. One of the ladies would practice more often, also in the long run, if Alice would ask her daily. She would really like to do it for Alice. Another lady wanted to write to a friend for two weeks but did not get to it. When Alice asked about that friend, the lady was a bit ashamed and started writing right away.

An aspect we also observed in another TV report (De Jager & Grijzenhout, 2014) is that a social robot works as a trusted friend. People confide in them and tell them painful life events and distressing family histories they hardly ever tell to a living person. When the – in this case Nao – robot Zora asked "Are you crying?" this was enough to make one of the ladies crack and pour her heart out (De Jager & Grijzenhout, 2014).

The lonelier the lady, the easier a social robot was accepted. We know that an old lady with an active social life did not care about a companion robot – here Zora – not even after a long period of exposure (De Jager & Grijzenhout, 2014). On the other hand, we talked to a 92 year old woman with a large family, who stated: "I have so many visitors and then I have to be polite and nice all the time. A robot I can shut off."

Part of the acceptance of Alice among lonely people appears purely pragmatic: Better something than nothing – a prosthetic leg is better than no leg at all. The initial resistance disappeared over time. Another aspect that contributed to the acceptance of the robot was that nobody in their social environment reminded them of talking to a robot – they could live the illusion and enjoy it. Without exception, each lady was surprised when seeing Alice again that she had a plastic body and that she was so small. They said things like: "Last time,

Alice was wearing a dress, wasn't she?"; "I thought she was taller the last time?" Perhaps, because Alice's face has a human-like appearance with a soft skin, this impression may have transferred to other parts, whereas her body work definitely is 'robotic' – as if she were 'naked'? The hesitance of one lady continued for a longer period of time. Her daughter kept on warning that "Beware Mom, those robots remember everything." That same daughter informed her mother that all Alice said was typed in backstage. Nevertheless, even this lady enjoyed singing with Alice in the end. The rest of the ladies did not mind the technology or how it was done. It was irrelevant to them, although sometimes they realized 'how skilled you must be to program all this.'

All women mentioned that Alice could not walk but it did not matter too much – "many of my generation cannot walk either, not anymore", one of them commented. Actually, it made things simple and safe because the ladies always knew where she was. In the same vein, Alice was extremely patient about them moving around slowly, responding late, and taking long silent pauses. Without judgment or frustration, Alice repeated questions or repeated answers, which made her an ideal companion.

Speech errors or sometimes even an interruption by the Acapela text-to-speech engine that 'this was a trial version' did not disturb the ladies a bit. If a human does not speak perfectly or sometimes makes random statements, you also do not break contact. Different voices were not disturbing. The only difficulty the women experienced was with amplitude, awkward sentence intonation, or mispronunciation of words.

Human help has its drawbacks too. From our own focus-group research and conversations with elderly people, we learned that human help is not always appreciated, particularly when bodily contact is required or someone has to be washed (Van Kemenade, in prep.). During a conversation with the lady of 92 about home care, she admitted to have released her help because they 'rummage in your wardrobe' and 'go through your clothes.' She 'did not need an audience' while undressing, because they 'see you bare-chested.' The difficulty of rubbing ointment on her sore back she solved with a long shoehorn. This, she thought, was better than having a stranger touch her skin. She preferred a robot to 'such a bloke at your bed side.'

3 OUR POSITION

People accept an illusion if the unmet need is big enough. Loneliness has become an epidemic in our society (Killeen, 1998) and the need for companionship among the very lonely may override the awareness that the robot is not a real person. That is, whether the robot is a human entity or not becomes less relevant in light of finding comfort in its presence and its conversations; in its *apparent* humanness (cf. Hoorn, Konijn, & Van der Veer, 2003). The robot is successful in the fulfilment of a more important need than being human.

On a very basic level, the emotions that come with relevant needs direct information processing through the lower pathways in the brain (i.e., the amygdala); the more intuitive and automatic pathway, which also triggers false positives. Under levels of high fear, for instance, people may perceive a snake in a twig. Compared to non-emotional states, emotional states facilitate the perception of realism in what actually is not real or fiction (Konijn et al., 2009; Konijn, 2013). The fiction-side of the robot ('It's not a real human') requires processing at the higher pathways, residing in the sensory cortex, and sustaining more reflective information processes. The lower pathway is much faster than the higher pathway and the amygdala may block 'slow thinking' (i.e., a survival mechanism needed in case of severe threat and danger). Thus, the emotional state of lonely people likely triggers the amygdala to perceive the benefits of need satisfaction (relieving a threat). Joyful emotions prioritize the robot's companionship as highly relevant and therefore, (temporarily) block the reflective thoughts regarding the robot's non-humanness or discarding that aspect as non-relevant at the least. This dualism in taking for real what is not is fed by the actuality and authenticity of the emotional experience itself: 'Because what I feel is real, what causes this feeling must be real as well' (Konijn, 2013). And of course, as an entity, the robot is physically real; it just is not human.

Not being human may have great advantages and makes the social robot an in-between machine: in-between non-humanoid technology and humans. The unique value proposition of a social robot to lonely people is that the humanoid is regarded a social entity of its own, even when shut down. It satisfies the basic needs of interpersonal relationships, which sets it apart from conventional machines, while inducing a feeling of privacy that a human cannot warrant. As such, the social robot is assumed to keep a secret and clearly is not seen as part of the

personnel or caretakers who should not know certain things that are told to the robot. For example, one of the ladies told she was throwing away depression medication as she did not think of herself as depressed (De Jager & Grijzenhout, 2014).

As said, our robot Alice recorded everything with her camera eyes. However, over the course of interacting with Alice, it became less relevant that the robot had camera eyes and that the caretakers could monitor all those human reactions you will not get when people talk straight into a conventional (web) camera. With such camera eyes, for example, one can check someone's health condition and psychological well-being. Clearly, the participants experienced a genuine social presence that was yet not human. This was an advantage because they could confide in someone without having to fear human indiscretion and associated social consequences. The ladies were more inclined to make confessions and tell what goes on inside than in face-to-face contact (where they feel pressed to 'keep up appearances'). As one of them affirmed "It's horrible to be dependent but you have to accept and be nice."

In the following, we formulate several functions that social robots may have and that make them different from human attendants. Under conditions of severe loneliness, social robots may invite intimate personal self-disclosure. This is similar to the so-called *stranger-on-a-train effect* (Rubin, 1975). Sometimes people open their hearts to complete strangers or they tell life stories to their hair dresser or exercise coach, an inconsequential other in the periphery of one's network (cf. Fingerman, 2009). A social robot may perfectly take that role of being an inconsequential other in the network of the lonely.

Private with my robot. Somewhat related to the previous is that the robot guarantees privacy in the sense of avoiding human physical contact. Older people are often ashamed of their body (Van Kemenade, in prep.) and feel more comfortable with a robot at intimate moments and would even prefer a robot over human caretakers (whereas the caretakers think the other way around). The robot does not judge, does not meddle, and does not pry.

Social robots exert a *dear-diary effect* because they do not demand any social space like humans do. The user can fill up the entire social space without having to respect the needs and emotions of the other. You can share experiences and memories, sing old tunes, look at old photographs, tell stories of the past, and the small things that happened today; a social robot will never tire of listening to or telling

the same over and over again if you want it to. Like a diary, you can say whatever you want and the only thing the other does is listen patiently. She is all there for you and never judges.

The impertinent cute kid. Within the first minutes of interaction, social robots such as Alice or Zora are allowed to ask very intimate questions (e.g., "How do you rate the quality of your life?" or "Do you feel lonely?"); something which in human-human communication would be highly inappropriate. With robots like Alice, this might be acceptable because she looks innocent and really cute and is small like a child. Therefore, she may be easily forgiven in a way one forgives a (grand)child. In effect, the elderly ladies responded quite honestly even when the answer was not socially desirable: To Alice: "Nobody ever visits me", "I don't like that home support comes too early in the morning." To Zora: "I want to stop living." In other words, social robots can get down to business right away, obtaining more reliable results than questionnaires and anamnesis.

Social robots such as Alice provoke endearment, the *grandchild effect*, urging to nurture and nourish it (and share cookies!). It is an object of affection and activation; something to take care of instead of being taken care of (cf. Tiger Electronics' *Furby*). In this circumstance, it will foster feelings of autonomy and independence.

I will do it for you. Social robots may serve as bad consciousness or put more positively, as reminders and activators. By simply inquiring about a friend, the robot raised sufficient social pressure to activate the lady to finally start writing that letter. The same happened with the physical exercises: That lady trained so to please her beloved Alice.

The puppy-dog effect. Many people walk the dog so they meet people and can have a chat. Social robots work in quite the same way. If you take them out, be prepared for some attention, awe as well as fascination. People will talk to you to inquire about 'how the robot is doing.'

4 NON-REQUIREMENTS

We showed the Zora movie to a former care professional, who stated (personal communication, Sept. 28, 2014): "Before watching Zora, I thought it would painfully show how disengaged we are to those in need of care. Give them a talking doll and they are happy again. We don't laugh anymore about a woman who treats her beautiful doll as if it were a child because we call it a care robot." After watching the report, he admitted that: "Well.

Perhaps it is because I am an ex professional but this makes me even sadder. Those people are so lonely that they embrace a robot. The staff has no time to have a chat and from my experience, I know they often lack the patience to take their time and respectfully talk to the inhabitants. On the other hand, the question is also true whether you should deny someone a robot who is happy with it."

Apart from the formal and informal caretakers, no ethical concerns were mentioned by the users themselves. The old ladies conversing with Alice did not feel that their autonomy was reduced, their feelings were hurt, or that injustice was done by conversing with a robot. Privacy in the sense of disclosing personal information also was not an issue unless they were repeatedly told they should worry. Although the elderly ladies fully had their wit together and knew they were communicating with a robot, with a professional camera in the room, and other people listening in, it did them well and there was not much more to it.

Other things that were of less importance were technical flaws such as language hick-ups, wrong responses, delayed or missing responses, or conceptual mix ups. Perhaps their friends and age-mates are not that coherent either all the time. Things that did matter language-wise were loudness, pronunciation, and intonation. In other words, getting your phonetics right appeared more important than installing high-end semantic web technology.

Unexpectedly, we hardly encountered uncanny-valley effects (Mori, 1970), no terrifying realism, or feelings of reduced familiarity. As far as they were mentioned, they were more like questions and very short-lived, after which the ladies were happy to take Alice for a genuine social entity – although not human.

Human physical likeness did not matter too much either. Alice's body work is robotic plastic, her arms and hands did not move, and she did not walk. Her face was more humanoid than for example Zora's, but that robot too invoked responses such as self-disclosure just as the more life-like Alice did.

5 CONCLUSIONS: NEW FOCUS

This paper discussed strategies for the development of robots as companions for lonely elderly people. It built on a reflection motivated by the observations made in the course of the making of a documentary film about a robot visiting elderly ladies (Burger, 2015). It discussed the findings under the perspective of the best requirements for social robots interacting with humans in this uncontrolled 'field experiment.' We challenged some pre-conceived ideas about what makes a robot a good companion and although it is a work in progress, the proposed conclusions seem evocative. We hope our ideas will catch the attention of many researchers and developers and will raise lots of discussion.

In 1999, the medium-sized league of RoboCup was won by C. S. Sharif from Iran, with DOS-controlled robots that played kindergarten soccer (search ball - kick ball - goal). He shattered all the opponents with their advanced technology who were busy with positioning, radar-image analysis and processing, and inventing complicated strategies. With the applications we build today for our social robots (e.g., care brokerage, moral reasoning), we pretty much do the same.

For the lonely ladies, it did not matter so much what Alice did or said, as long as she was around and they could talk a little, taking all imperfections for granted and becoming affectively connected.

It seems, then, that the existing intelligence and technology we develop does not really tackle the problem of the social isolation of the ladies. We piously speak of designing humanness in our machines, asking ourselves, what makes us human? We simulate emotions, model the robot's creativity, its morals, and its sense of reality. But the job is much easier than that and perhaps we should tone down a little on our ambitions and direct our attention to the users' unmet needs. We compiled a MuSCoW list in Table 1.

As psychologists modelling human behaviour, we are doing fine and simulations seem legitimate realizations of established theory (e.g., Llargues Asensio et al., 2014). However, as engineers, designers, and computer scientists we seem to be missing the point. What is human is good for you? No! Human-superiority thinking is misplaced. Human care is not always the best care. Humans show many downsides in human-human interaction. We should regard robots as social entities of their own; with their own possibilities and limitations. This is a totally different design approach than the human-emulation framework. What we do is way too sophisticated for what lonely people want. We should model what the puppeteer does to instill the effects of the stranger-on-a-train, the impertinent cute kid, or the dear-diary effect. That of course does assume knowledge about human behaviour but boils down to conversation analysis rather than psychological models of empathy, bonding, emotion regulation, and the like. Perhaps we should have

known this already given the positive social results of robot animals with autistic children (e.g., Kim et al, 2013). In closing, making robots more like us is not making them similar let alone identical. The shadow of a human glimpse will do.

Table 1: MuSCoW for social robots.

Must	Should	Could	Won't
Listen (advanced speech recognition)	Camera eyes	Full body and facial animation	Social repercussions of user behaviour
Talk (improved pronunciation, intonation, loudness)	Microphones and speakers	Human-like appearance	Privacy violations
Have closed conversational scripts (i.e. hello/goodbye, weather, coffee, family, friends, health, wellbeing)	Open-conversation AI	Correct grammar	Demand of social space
Invite self-disclosure	Capability to eat and drink	Human care	
Guarantee privacy	3rd party interactions	Fiction-reality discrimination	
Have patience	Be operable independently	Emotion simulation	
Good memory	Open-minded social environment	Moral reasoning	
Be child-like (appearance/behaviour)		Creativity	
Invite social and physical activation			

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