CG1001 Introduction to Computer Engineering
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Report on
Social Robots: Our Friends in an Automated Future
Report Title
Social Robots: Are they really intelligent

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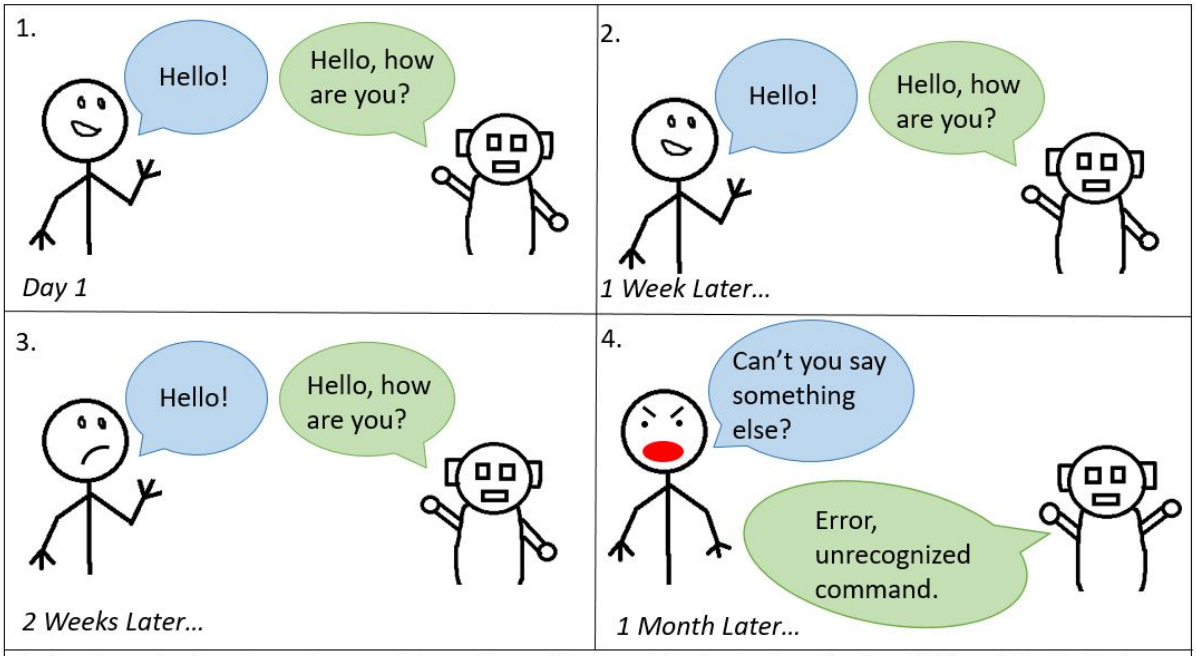
First used for industrial automation, technological advances have enhanced the functions and capabilities of robots, leading to the prevailing use of social robots in the human society. Most intelligent systems or social robotics are powered by a form of artificial intelligence (AI). “Colloquially, the term AI is applied when a machine mimics cognitive functions that humans associate with other human minds, such as learning and problem solving” (Russell & Norvig, 2009, p. 2). AI is a very broad term, hence for the purpose of this section, we shall narrow it down to 2 terms, simulated intelligence (SI), which is a limited form of AI which usually cannot learn on its own. To elaborate, the SI robots in question “always draws from a list of phrases that emphasize the same point when speaking to the user, choosing one randomly each time” (Fasola & Matarić, 2013). This seems to tell us that the robots are only as intelligent as the code that was given to them. In this report, the term SI will refer to social robots who are commonly referred to as being artificially intelligent, but are only able to react based on pre-determined responses within their code.



A short comic showing a human interacting with a social robot advertised as “AI” and its limited response. © 2016, CG1001 Group 37, Ng, Jin; Teo, Ryan.

Social robots are robots that can interact and communicate among themselves, with humans, and with the environment, within the social and cultural structure attached to their roles. (Ge & Matarić, 2009) The abilities of social robots to display emotions and social behaviours can aid humans in areas such as education, healthcare and also provide

entertainment. In our report, we will discuss further the uses of social robots, their benefits, disadvantages as well as potential problems when using AI compared to SI.

A possible use of social robots could be for education. Social robots can be programmed to teach children specific skills such as learning languages. A social robot can capture children's attention and interest, engage them in interactions and educational activity it has been programmed for. Tega (Ackerman, 2016) is one of the many adorable and cuddly social robots created by MIT's Personal Robotics Group. It can teach Spanish words and increase the children's general positive feelings towards it through its physical behaviours. In Singapore, the Infocomm Development Authority (IDA) is currently exploring the viability of social robots in collaborative play and interactive storytelling in early childhood education. (Lim, 2016) The pilot study has been conducted at 2 preschool centres starting in April 2016, ending in October 2016. (Pepper & NAO Robots on Channel NewsAsia, 2016)

In healthcare, social robots can provide assistance, helping to decrease workload in healthcare centres that are low in workforce and improve psychological conditions of patients. In nursing homes, the introduction of PARO (Griffiths, 2014), a therapeutic social robot that was developed in Japan by AIST, can provide companion to the elderly and relieve the strain on caregivers. PARO is modelled after a baby seal harp, designed to elicit emotional responses and serves as a low-maintenance alternative to pet-therapy. It can learn and respond to its name, imitating the voice of a real baby harp seal and showing your preferred behaviour through its programmed algorithm. It helps to improve and stimulate interactions between patient and caregivers and is used as a therapy for patients with dementia.

Current uses of social robots are not limited to the above. A social robot like JIBO (JIBO, n.d.) is not only a storyteller but also provides companionship and acts as a personal assistant. Although JIBO is unable to move on its own, it is able to communicate through its SI algorithms that learns and adapts to the user's preference. JIBO is able to track and recognise faces with 2 high-resolution cameras, hence recognising members of the households, aiding in photo taking and video calling. It is able to remind the family of important tasks and events through speech, hence behaving like a personal assistant. Social robots that provide entertainment can improve and increase interactions among people through its engagement, improving relationships and mood.

So far, we have only touched on the surface of the potential of social robots. With the rapid advancement of technology, it is evident that social robots can be developed quickly further to expand into more areas.

Currently, robots and virtual agents lack social capabilities to engage users in the long-term. In fact, some of the early long-term studies show that the novelty effect quickly wears off and, after that, people lose interest and change their attitudes towards the robots (Leite, Martinho, & Paiva, 2013, p. 291). As such, a guideline for future design of social robots for long-term interaction includes the ability to identify new and repeated users and to use information about the user to personalise interactions, and be able to understand and react to the users' affective states (Leite, Martinho, & Paiva, 2013). Professor Sherry Turkle of MIT (as cited in Clara Moskowits, 2013) said "People are already looking more and more to robotic toys and tools for companionship" and less to other humans or pets. Given the likelihood that AI can reach the emotional capabilities of an average human being within decades, this might also detrimental to interpersonal relationships. Robots can possibly be programmed to have a higher emotional quotient (EQ) than human beings and tell users what they want to hear, which can usually be more pleasant than the harsh and critical society we live in as people have no obligation to 'sugar coat' their thoughts. Users who only want to hear favourable responses would then prefer to interact with these robots instead of real people and grow emotional dependencies on the robots.

We should note that there have already been some AI capable of limited conversation, some of which continue to increase their dataset for better conversations. For example, Cleverbot is an online chatbot whose responses are not programmed a priori, but uses machine learning to remember human inputs in huge corpora, where it also searches for keywords when assembling its own response (Lacko, 2014). This chatbot has passed a Turing test [1]involving 1334 participants, of which 59% of the people chatting with Cleverbot were convinced it was human (New Scientist, 2011).

However, this begs the famous question, should we simply allow robots to be emotionally equivalent to human beings and capable of free thought? Technological advances allowed

[1] A test developed by Alan Turing in 1950 of a machine's ability to exhibit intelligent behaviour equivalent to, or indistinguishable from, that of a human. A human evaluator is engaged in a conversation with a machine and a conversation with another human being. If the evaluator cannot reliably tell the two apart, the machine is said to have passed the test.

robots to become more human-like and capable of social interactions. We are able to equip robots with algorithms that allow them to receive social cues and programming them to react in a certain way. However, they are not yet sentient, being unable to have a mind of their own does not allow them to replicate human behaviour and interaction perfectly.

Nevertheless, in the pursuit of better service, it is natural for engineers to want to develop a true AI, one that can learn and solve problems on the fly. This would reduce need for constant software updates to improve the robots' performance. This approach has to be taken with extreme caution, especially for social robots as their behaviour can become unpredictable. For example, Microsoft's "AI chatbot was shut down just 16 hours after she was turned on due to her becoming a genocide-supporting racist" (Hern, 2016). This simple yet powerful example shows us the dangers of an artificially intelligent system that is allowed to learn on its own without any guidance. Imagine if it were to happen to robots in the medical sector, would the robot eventually learn about euthanasia and chose to impose it on its patients without going through proper procedures? Who would be held accountable? The hospital, the manufacturer of the robot or the non-living robot itself?

The dangers of AI have also been raised by experts in the field, such as Bill Gates, Elon Musk and Professor Stephen Hawking, "who have warned about the possibility that AI could evolve to the point that it was beyond human control" (Rawlinson, 2015). The media has commonly portrayed such instances of AI evolution as catastrophic, often emphasizing the dangers of a singularity, such as *"Eagle Eye"* or *"I, Robot"*. Personally, we prefer to view artificially intelligent and sentient robots much like a living organism. We have no clue what they could be thinking in their heads, whether or not they are morally righteous or see us as a threat because these factors are highly subjective and open to interpretation. As a result, are we really ready to embrace the future of artificial intelligence, or should we stay within our comfort zones and make do with simulated intelligence?

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Declaration

This report is our own work and is not copied largely from someone or somewhere else. We understand that the penalty for copied work is a zero mark.

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Statement of Contributions

A. Joint Work, e.g. in report planning and conceptualization etc. (briefly list a few specific aspects):

1. Discussion on topic to work on.
2. Discussion on which area on the topic (social robots) we wish to focus on.
3. Designation of research topics.

B. Ng Jin's Work in literature review, writing specific sections, organizing certain information, preparing certain diagrams, data analysis, ideas and concepts etc. (briefly list a few specific aspects):

1. Researched on current uses of social robots.
2. Identify benefits of social robots.
3. Contributed mostly for the introduction and main text of the report.
4. Contributed to sentence structure and the phrasing of ideas.
5. Design and concept of comic.

C. Khoo Wei Ping's Work in literature review, writing specific sections, organizing certain information, preparing certain diagrams, data analysis, ideas and concepts etc. (briefly list a few specific aspects):

1. Researched on the limitations of current social robots.
2. Analyse risks of over-dependence on social robots to replace human interaction.
3. Contributed mostly to the main text and conclusion of the report.
4. Contributed to sentence structure and the phrasing of ideas.

D. Teo Meng Shin, Ryan's Work in literature review, writing specific sections, organizing certain information, preparing certain diagrams, data analysis, ideas and concepts etc. (briefly list a few specific aspects):

1. Researched on AI used in social robots.
2. Evaluate if the robots can officially be classified as AI and its potential implications.
3. Contributed mostly to the introduction and conclusion of the report.
4. Contributed to sentence structure and the phrasing of ideas.
5. Design and concept of comic.

We agree that the statements above are truthful and accurate.