Expectations of robot technology in welfare

Erik Billing
Interaction Lab
University of Skövde
Skövde, Sweden
erik.billing@his.se

Julia Rosén
Interaction Lab
University of Skövde
Skövde, Sweden
julia.rosen@his.se

Jessica Lindblom
Interaction Lab
University of Skövde
Skövde, Sweden
jessica.lindblom@his.se

***Abstract*—We report findings from a survey on expectations of robot technology in welfare, within the coming 20 years. 34 assistant nurses answered a questionnaire on which tasks, from their daily work, that they believe robots can perform, already today or in the near future. Additionally, the *Negative attitudes toward robots scale (NARS)* was used to estimate participants' attitudes towards robots in general. Results reveal high expectations of robots, where at least half of the participants answered *Already today* or *Within 10 years* to 9 out of 10 investigated tasks. Participants were also fairly positive towards robots, reporting low scores on NARS. The obtained results can be interpreted as a serious over-estimation of what robots will be able to do in the near future, but also large varieties in participants' interpretation of what robots are. We identify challenges in communicating both excitement towards a technology in rapid development and realistic limitations of this technology.**

***Index Terms*—attitudes towards robots, human-robot interaction, robots in healthcare**

I. Introduction

With the rapid development of robot technology during recent years, it is agreeably difficult for anyone to predict which robot applications we can expect in the coming years. We are all aware that successful application of robotics in new areas, such as therapy and care, is not only dependent on technological advances, quality of interaction, but also adaptation of work procedure and attitudes. As argued by Wilkinson et al. [1], researchers within robotics are investing considerable time and effort in engaging the public. This is in many respects a good aspect, but increased engagement can also contribute to an *expectation gap*, where potential users develop unrealistically high expectations of robots [2].

As researchers in robotics we both contribute to, and are affected by, the public's expectations of robots [3]. This may be especially relevant for applications in areas where we historically have seen a relatively slow adoption of new technology, such as therapy and care. Overstated expectations may also contribute to fear of being replaced by new technology.

Here, we present results from a questionnaire given to 34 assistant nurses taking a specialization course on digitization in welfare. The questionnaire focused on their expectations and attitudes towards robots, directed to robots' abilities to perform various tasks that are today part of assistant nurses job assignments. The rest of this paper is organized as follows, Section II presents the questionnaire and the procedure. Results are presented and discussed in sections III and IV, respectively.

II. Method

The present study was performed in conjunction with a specialization course on welfare technology for assistant nurses, given by the higher vocational education in Sweden, spring 2018. During a lecture on robots in welfare, a questionnaire was distributed to 34 assistant nurses taking the course. This selection should be seen as a convenience sample that we believe is representative for assistant nurses in Sweden, and as such, a large proportion of potential professional users of robot technology in the health care sector.

In order to get an understanding of what attitudes and expectations assistant nurses have on robot technology, the questionnaire comprised the *Negative attitudes toward robots scale (NARS)* [4]. NARS is one of the most common questionnaires used in studies on human-robot interaction and include 14 questions answered on a five-graded scale from *strongly disagree* to *strongly agree*. The questions are designed to measure three sub-scales:

(S1) Negative Attitudes toward Situations of Interaction with Robots
(S2) Negative Attitudes toward the Social Influence of Robots
(S3) Negative Attitudes toward Emotions in Interaction with Robots

In addition to the 14 NARS questions, one question (Q15), concerning the expectations of robot performance, was included: *Which of the following tasks do you think robots could perform?*

The question was answered individually for ten different tasks. Each task was given four response options: *already today, within 10 years, within 20 years,* and *never.*

The following ten work tasks, extracted from job descriptions for assistant nurses in Sweden [5], [6], were used:

1) Medical tasks such as laying wounds and wrap legs.
2) Help patients with daily routines such as cleaning, washing and cooking.
3) Take samples, such as blood samples.
4) Help with the patient's personal hygiene.
5) Help patients take their medicine.
6) Distribute food.
7) Support and encourage patients to do what they can do themselves.
8) Inform and support residents and relatives in difficult messages and situations.

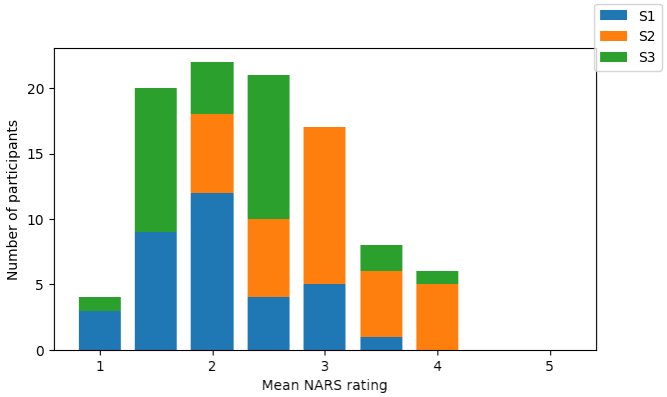

Fig. 1. Response frequency to the NARS questionnaire. Colors represent sub-scales. High scores implies strong negative attitudes.

9) Document and report changes in the health status of patients.
10) Administrative tasks such as documentation and follow-up.

No explicit concent form was used. Instead, the questionnaire was given the following introductory text: *The following questions are composed to provide support for the discussion on robots and other information technology in welfare sector. There are no right or wrong answers to these questions. The questions are intended to bring thought and discussion, but the results can also be used as a basis for research on the use of robots. Participation is completely voluntary and all responses are treated anonymously.*

In order to give participants a better understanding of robots, a couple of examples of robots were presented prior to distribution of the questionnaire, using slides with pictures and verbal explanations. The robots presented included the Giraff [7], Pepper [8], and the Paro Seal [9]. The questionnaire was distributed on paper and collected at the end of the class.

III. Results

The mean response frequency to the NARS questionnaire is presented in Figure 1, revealing a fairly positive attitude towards robots among participants. Sub-scale S1, receives an average rating of 2.0, implying low degree of negative attitudes toward situations of interaction with robots. S2, attitudes toward social influence of robots, receives a more moderate rating with an average of 3.0, where participants typically respond with *undecided* to questions in this category. Sub-scale S3, attitudes toward emotions in interaction with robots, receives the lowest average rating (1.9), but as visible in the figure, responses differ between participants. None of the 34 participants give an average rating of 5 (very strong negative attitude) to any sub-scale.

The frequency of responses to the Q15 *"Which of the following tasks do you think robots could perform?"* is presented in Figure 2. The results reveal high expectations of what robots can do, where at least half of the participants answered *Already today* or *Within 10 years* to 9 out of the 10 tasks. The only task which a majority of participants rated longer than 10 years was *Task 8: Inform and support residents and relatives in difficult messages and situations.* For this task, a large proportion (47%) answered *Never*.

The two tasks with the largest proportion of *Already Today*-ratings were *4: Help with the patient's personal hygiene.* and *5: Help patients take their medicine.* 76% respectively 82% of the participants answered that robots can already today handle these tasks.

Finally, the correlation between attitude towards robots (NARS) and expectation of robots (Q15) is 0.2, revealing weak connections between participants' expectations and attitudes. However, as illustrated in Figure 3, participants are well clustered towards the lower left corner of the answer space, revealing fairly positive attitudes with high expectations of what robots can do.

IV. Discussion

The present survey, directed to assistant nurses, investigates attitudes and expectations of robots in welfare. The results from this survey indicates high expectations of what robots are capable of within the coming 10 years. The fact that a majority of participants respond that robots will be able to perform nine out of ten work tasks was a big surprise to the authors. Combined with low scores on the NARS questionnaire, we interpret these results as a welcoming attitude towards robots in welfare, at least among the participants of this survey.

It should be mentioned that the sample used here, taken from a class on welfare technology, may not be representative for the healthcare sector in general. We do not know how people are selected to the course and it is not unlikely that these are individuals with an interest in technology.

On the other hand, all participants in the survey are working assistant nurses with daily experience of most tasks included in the survey. Thus, we expected them to see more practical problems with robots taking over parts of their daily work and thus.

One challenge lies in trying to understand what the participants in this survey, and other similar studies using questionnaires, are really responding to. Most people are still lacking experience from interaction with real robots and it may therefore be difficult what kind of interpretations are made. In the present work we tried to reduce this uncertainty by presenting a few examples of robots prior to distribution of the questionnaire, but even with this background, participants may interpret questions in many different ways.

For example, a large proportion of participants answered that *robots are already today able to help patients with their personal hygiene.* Although this may be surprising from a researcher's point of view, seeing all technical challenges in creating a full personal assistant able to help people in these situations, it is likely that the participants in this survey thought of a mechanical shower like Poseidon [10], frequently appearing in media under the label *robot shower*. This particular shower has an adjustable seat and several moving nozzles that can be controlled with a remote control, making it easier

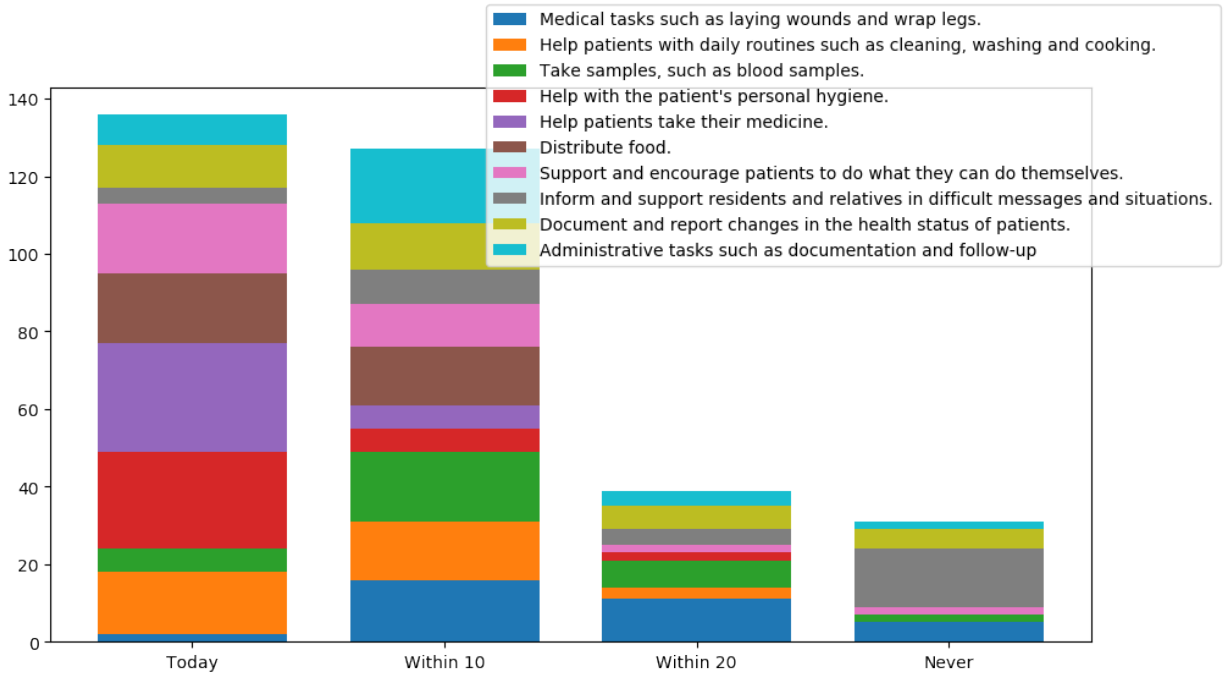

Fig. 2. Frequency of responses to the question: *Which of the following tasks do you think robots could handle?* Colors indicate task type. See text for details.

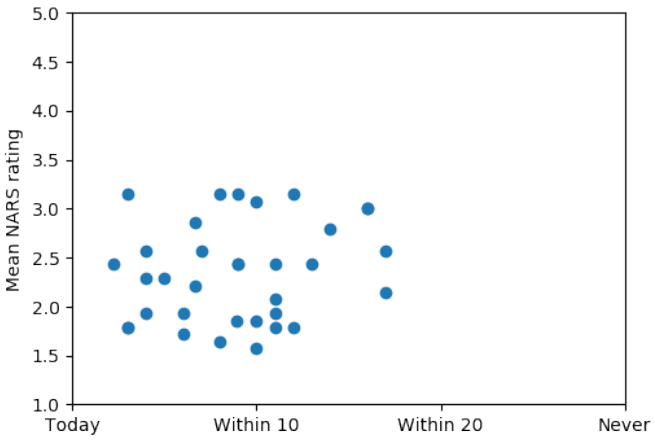

Fig. 3. Scatter plot over mean NARS rating and mean responses to Q15. Points represents individuals.

for users with limited mobility to shower without assistance from another person. Although this device do comprise some aspects of robot technology, it may not be what we are after in a survey on HRI.

Another task frequently rated as something robots can do already today was to help patients take their medicine. The authors are not aware of any *robot* able to do this, but there are certainly mobile apps that can remind users to take their medicine. A device as simple as a pill organizer is also able to help patients (remember to) take their medicine.

V. Conclusion

As argued in the previous section, the results from the present survey is not entirely easy to interpret. On the one hand we have a mechanical device able to support users in *some* aspect of a predefined task, and on the other hand, a flexible robot performing multiple tasks in a similar fashion as humans do. We believe that this vast technological difference is easily neglected, both when we as researches are communicating results to the public, and when the public communicate beliefs and attitudes towards robots as participants in various studies. There has been earlier reports arguing that peoples' attitudes towards robots are easily manipulated [11]. While we in the present work try to avoid manipulation, we still see similar effects in terms of of participants' *flexible* interpretations of the notion of robots.

Social robots are expected to have an increasing significance in working life for a growing number of professionals in various domains [12], [13]. It is therefore important to focus on the interaction quality between humans and robot, studying how humans want to interact with robots and what constitutes an intuitive, smooth and natural interaction between humans and robots. For robots interacting with people, like most robots we expect to see within therapy and care, positive user experience (UX) is necessary in order to achieve the intended benefits [14]. The UX is not built into the product itself; instead, it is an outcome of the interaction that depends on the internal state of the user, the quality and attributes of the product, and the particular situation. Accordingly, negative UX can result in reluctance to interact with robots and challenge the acceptance of future robotic technologies [15]. However, a

positive UX does not appear by itself. It has to be systematically, thoroughly, and consciously designed for, not least in the interactions between humans and robots [12]–[14], [16]. The quality requirements on human-robot interaction will increase, comprising possibilities to communicate emotions in order to establishing a positive UX.

Participants' positive attitude to NARS was surprising to us, specifically concerning sub-scale 3, emotions in interaction with robots. However, as with the ratings of robots' performance on various tasks (Q15), it is not completely obvious what participants' are really responding to. In a study of tactile emotional communication with a Nao robot [17], we found evidence for big differences between emotions. Participants in this study had little problem concerning positive emotions in interaction with robots, but reported the communication of negative emotions as very difficult. Alenljung et al. [17] also identifies four dimensions of UX in interaction with robots, *safe, natural, easy*, and *interesting and fun*. If these aspects are met for the robot application being considered, we expect to see low (i.e., positive) ratings on the NARS. In the light of these results, NARS captures less of general attitudes, and more to what degree participants expect certain qualities of the product to be fulfilled.

It is acknowledged that cultural aspects affect the public perception and expectation of robots. The ways robots are imagined and designed in popular Western science fiction movies often envision very agile and smart robots, very similar to human-like social and cognitive capabilities, although this view is not well aligned with the state of the art in robotics. Thus, there is a major gap between what the public exposition of robot capabilities in movies and popular science present, compared to the functionality and interaction quality in todays robots. It should also be emphasized that the public in general is lacking first-hand experience of different kinds of robots, which could results in several kind of biases and mistaken perceptions of robots, both positive and negative. The lack of first-hand experience becomes a challenge when studying the UX for robots. As a consequence, familiarity is an aspect of UX evaluation method that is arguably more important for robots than other, less alien, technological artifacts.

ACKNOWLEDGEMENT

The work has been financially supported by the european union, FP7, under grant #611391, *DREAM: Development of Robot-Enhanced therapy for children with AutisM spectrum disorders*.

REFERENCES

[1] C. Wilkinson, K. Bultitude, and E. Dawson, ""Oh yes, robots! people like robots; the robot people should do something": Perspectives and prospects in public engagement with robotics," *Science Communication*, vol. 33, no. 3, pp. 367–397, 2011.

[2] M. Kwon, M. F. Jung, and R. A. Knepper, "Human expectations of social robots," in *11th ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, pp. 463–464, IEEE, mar 2016.

[3] J. Rosén, K. Richardson, and E. Billing, "The Robot Illusion - Facts and Fiction," in *Workshop in Explainable Robotics System, ACM/IEEE International Conference on Human Robot Interaction (HRI)*, no. March, (Chicago), pp. 5–7, 2018.

[4] T. Nomura, T. Suzuki, T. Kanda, and K. Kato, "Measurement of negative attitudes toward robots," *Interaction Studies*, vol. 7, pp. 437–454, nov 2006.

[5] S. Gustavsson, "Riktlinje: Underskoterska - kompetensbeskrivning," tech. rep., Västra Götalandsregionen (VGR), 2018.

[6] Kommunal, "Undersköterska," 2018.

[7] A. Camanio Care, "Giraff," 2019.

[8] SoftBank, "Pepper the humanoid robot," 2019.

[9] PARO, "PARO Therapeutic Robot," 2019.

[10] RoboticsCare, "Poseidon," 2019.

[11] S. Thellman and T. Ziemke, "Social Attitudes Toward Robots are Easily Manipulated," in *Proceedings of the Companion of the 2017 ACM/IEEE International Conference on Human-Robot Interaction - HRI '17*, (New York, New York, USA), pp. 299–300, ACM Press, 2017.

[12] B. Alenljung and J. Lindblom, "User Experience of Socially Interactive Robots: Its Role and Relevance," in *Handbook of Research on Synthesizing Human Emotion in Intelligent Systems and Robotics* (J. Vallverdú, ed.), pp. 352–364, Hershey, Pennsylvania, USA: IGI Global, 2015.

[13] M. Boden, J. Bryson, D. Caldwell, K. Dautenhahn, L. Edwards, S. Kember, P. Newman, V. Parry, G. Pegman, T. Rodden, T. Sorrell, M. Wallis, B. Whitby, and A. Winfield, "Principles of robotics: regulating robots in the real world," *Connection Science*, vol. 29, pp. 124–129, apr 2017.

[14] H. R. Hartson and P. S. Pyla, *The UX book : Agile UX design for a quality user experience*. Morgan Kaufmann: Amsterdam, Netherlands, 2018.

[15] M. M. de Graaf and S. Ben Allouch, "Exploring influencing variables for the acceptance of social robots," *Robotics and Autonomous Systems*, vol. 61, pp. 1476–1486, dec 2013.

[16] M. Hassenzahl and N. Tractinsky, "User experience-a research agenda," *Behaviour & Information Technology*, vol. 25, pp. 91–97, mar 2006.

[17] B. Alenljung, R. Andreasson, R. Lowe, E. A. Billing, and J. Lindblom, "Conveying Emotions by Touch to the Nao Robot: A User Experience Perspective," *Multimodal Technologies and Interaction*, vol. 2, p. 82, dec 2018.