2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
October 25-29, 2020, Las Vegas, NV, USA (Virtual)

Amusing Androids

The Argument for Humour in Healthcare Robotics

D. L. Johanson., Jongyoon Lim., Min Ho Lee., G. Sebaratnam., B. A. MacDonald., E. Broadbent, and Ho Seok Ahn

The application of healthcare robots in home and medical settings is approaching reality. In order to ensure that interactions between healthcare robots and users are successful however, these robots need to be considered from a behavioral aspect. Ensuring robots act in a way that is both useful and acceptable is particularly important when considering *healthcare* robots, which will likely be interacting with individuals who are injured, unwell, or otherwise vulnerable. One way in which to inform research exploring appropriate behaviours for healthcare robots, is to study literature examining physician behaviours that are found to be effective in ensuring successful physician-patient interactions. One such behaviour, found to be associated with positive patient outcomes, is the use of physician humour. No research thus far however, has studied the use of humour by a healthcare robot in human-robot interactions. The current study examined the use of humour by a healthcare robot during a scripted human-robot interaction, within a simulated medical environment. Ninety-one participants took part in this study and were allocated to either a humorous or neutral condition. Participants who took part in the interaction with the humorous robot rated the robot significantly higher in terms of empathy, likability, safety, animacy, and sociability. Participants were also significantly more likely to laugh during interactions with the humorous robot, compared to the neutral robot. These findings support the use of healthcare robot humour as a potential way in which to increase user perceptions and acceptability.

Keywords: *:* healthcare robot, human-robot interaction, humour, user perceptions, user behaviour

The implementation of robots into healthcare environments requires careful consideration of robot behaviours, given the potentially vulnerable nature of patient populations. The study of theory relating to physician-patient interactions may provide valuable insight into behaviors that should be examined within the context of interactions between humans and healthcare robots (Broadbent, Johanson & Shah, 2018). Use of physician humour during physician-patient interactions is not only common (59%,Phillipps et al., 2018), but has been found to be associated with a number of positive patient outcomes such as increased rapport, communication, empowerment, perceptions of physician empathy, as well as decreases in patient psychological distress (Dean & Major, 2007; Demjen, 2016; Hampes, 2001). Thus far however, no study has examined the use of humour by a healthcare robot, in the context of a human-robot interaction. The purpose of the current study therefore, was to examine the effect of humour, used by a healthcare robot, on user perceptions of robot likability, intelligence, animacy, safety, empathy, anthropomorphism, personality, and user laughing behavior.

Method

Sample Size and Participant Selection. A power analysis was conducted using G*Power' (Faul, Erdfelder, Lang & Buchner, 2007) which revealed that a sample size of 90 participants would be required for the current study. Participants were recruited using email, social media, and flyers, from the University of Auckland (New Zealand) student and staff population.

The Robot. The 'EveR-4' android-type 'female' robot was used for this experiment, designed and created by robotic engineers at the Korean Institute of Industrial Technology (see Figure 1).

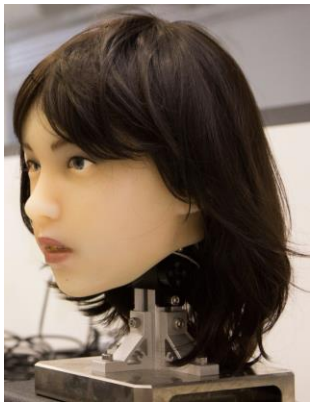

Figure 1. The EveR-4 "Nurse" Robot

Design. All participants took part in an initial scripted interaction with the robot, designed to minimize any novelty effects associated with interacting with the robot. This interaction involved participants asking the robot about the medical practice at which she 'worked' in order to decide if they should join as a patient.

Following the initial interaction, study measures were completed (time-point one). Immediately prior to the second interaction with the robot, participants were randomized to either a humorous or neutral group. The second scripted interaction involved asking the robot for information about the influenza virus and how to go about booking in for an influenza vaccination. All conversation between the participant and the robot were identical for the second interaction, aside from the introduction of three humorous comments in the humour condition (e.g. "I caught a computer virus once and it was terrible, that will teach me for using a strange computers flash drive"). Study measures were completed once again following the second interaction (time-point two). Measures used at time-point one and time-point two were identical.

Measures.

Perceptions of the Robot.

The Godspeed questionnaire was used in order to measure perceptions of the robot's likability, intelligence, animacy, anthropomorphism, and safety (Bartneck, Kulic, Croft & Zoghbi, 2009).

Empathy.

An empathy measure was created using questions from the McGill Friendship Questionnaire and the Consultation and Relational Empathy measure (Mercer, Maxwell, Heaney & Watt, 2004; Mendelson & Aboud, 1999).

Personality.

An adaption of Asch's personality scale (Asch, 1946) was used in order to measure perceptions of the robot's personality.

Participant Laughing Behaviours.

Participants were also discreetly observed in order to code any laughing behaviours. .

Statistical Analysis. ANOVA analyses were used in order to analyze data collected for each of the five dimensions of the Godspeed questionnaire as well as the empathy measure (controlling for time-point one scores). Fishers exact tests were used to analyse each personality item on Asch's personality scale, as well as differences in laughing behaviours between the humour and neutral groups.

Results

The majority of participants were female (N = 73/91). Participants identified as New Zealand European (N = 26), Maori (N = 3), Chinese (N = 26), Korean (N = 3), Indian (N = 12), and "Other" (N = 21). The mean age of participants was 25.03 years (SD = 11.06).

Godspeed Questionnaire.

Participants in the humour group rated the robot significantly higher in terms of likability ($F(1, 89) = 7.74$, p =.007, partial eta squared = .08.), animacy ($F(1, 89) = 5.24$, p =.024, partial eta squared = .06), and perceived safety ($F(1, 89) = 5.19$, p =.025, partial eta squared = .06). No significant difference were seen between groups in regards to intelligence ($F(1, 89) = 0.60$, p =.441, partial eta squared = .007) and anthropomorphism ($F(1, 89) = 0.00$, p =.989, partial eta squared = .00).

Empathy.

Participants in the humour group rated the robot as significantly higher in terms of empathy ($F(1,89) = 5.60$, p = .020), partial eta squared = .06), than compared to participants in the neutral group.

Personality

The use of humor by the robot had a significant effect on the sociable personality factor, with participants in the humour condition rating the robot as significantly more sociable ($F(1, 89) = 40.27$, p <.001, partial eta squared = .31) compared to participants in the neutral condition.

Participant Laughing Behavior.

Participants in the humorous condition were found to laugh significantly more during the interaction with the humorous robot than when compared to participants in the neutral condition (χ^2 (1, N = 91) = 20.45; p < .001)

Discussion

Participants in the humour group rated the robot as significantly higher in likability, perceived safety, and animacy compared to the neutral group. No difference between groups was found in regards to anthropomorphism and intelligence. Participants in the humour group also rated the robot as being significantly higher in empathy and were significantly more likely to rate the humorous robot as sociable, compared to participants in the neutral group. Participant in the humour condition were also significantly more likely to laugh during the interaction with the humorous robot. Overall the findings of this study provide initial support for the use of humour as a relatively simple, yet effective robot communication behaviour, for improving user perceptions and human-robot interactions. Future researchers should consider the replication of this research with a patient population in a natural setting.

References

Broadbent, E., Johanson, D., & Shah, J. (2018). A New Model to Enhance Robot-Patient Communication: Applying Insights from the Medical World. *Proceedings of the International Conference on Social Robotics, CHINA,* 303-317. https://doi.org/10.1007/978-3-030-05204-1_30

Dean, R. A. K., & Major, J. E. (2007). From critical care to comfort care: the sustaining value of humour. *Journal of Clinical Nursing, 17*, 1088-1095. https://doi.org/ 0.1111/j.1365-2702.2007.02090.x

Demjen, Z. (2016). Laughing at cancer: Humour, empowerment, solidarity and coping online. *Journal of Pragmatics, 101,* 18-30.https://doi.org/10.1016/j.pragma.2016.05.010

Hampes, W. P. (2001). Relation between humour and empathetic concern. *Psychological Reports, 88,* 241- 244. https://doi.org/10.2466/pr0.2001.88.1.241

Burin, D., Kilteni, K., Rabuffetti, M., Slater, M., & Pia, L. (2019). Body ownership increases the interference between observed and executed movements. *PLOS ONE, 14*(1), Article e0209899. https://doi.org/10.1371/journal.pone.0209899

Tendeiro, J. N., & Kiers, H. A. L. (2019). A review of issues about null hypothesis Bayesian testing. *Psychological Methods, 24*(6), 774–795. https://doi.org/10.1037/met0000221

Weis, P. P., & Wiese, E. (2019). Investing in brain-based memory leads to decreased use of technology-based memory. *Journal of Experimental Psychology: Applied.* Advance online publication. https://doi.org/10.1037/xap0000259