

Facing LLMs: Robot Communication Styles in Mediating Health Information between Parents and Young Adults

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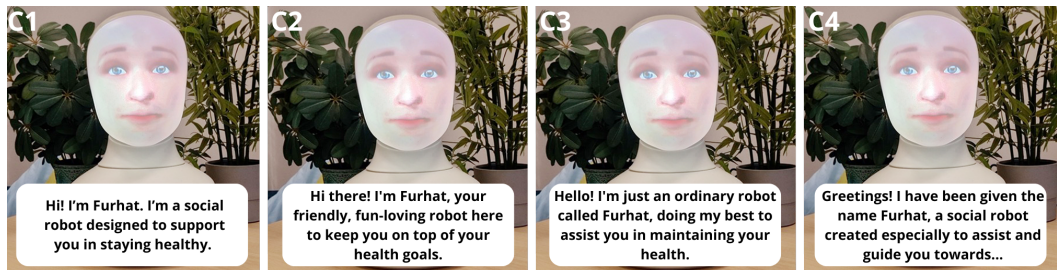


Fig. 1. Opening phrases across four Robot Communication Styles (RCS). C1: HUMAN-SCRIPTED, C2: HUMOROUS, C3: SELF-DEPRECATING, C4: PERSUASIVE. Robot utterances as played to participants in vignettes.

Young adults may feel embarrassed when disclosing sensitive information to their parents, while parents might similarly avoid sharing sensitive aspects of their lives with their children. How to design interactive interventions that are sensitive to the needs of both younger and older family members in mediating sensitive information remains an open question. In this paper, we explore the integration of large language models (LLMs) with social robots. Specifically, we use GPT-4 to adapt different Robot Communication Styles (RCS) for a social robot mediator designed to elicit self-disclosure and mediate health information between parents and young adults living apart. We design and compare four literature-informed RCS: three LLM-adapted (HUMOROUS, SELF-DEPRECATING, and PERSUASIVE) and one manually created (HUMAN-SCRIPTED), and assess participant perceptions of *Likeability*, *Usefulness*, *Helpfulness*, *Relatedness*, and *Interpersonal Closeness*. Through an online experiment with 183 participants, we assess the RCS across two groups: adults *with children* (PARENTS) and young adults *without children* (YOUNG ADULTS). Our results indicate that both PARENTS and YOUNG ADULTS favoured the HUMAN-SCRIPTED and SELF-DEPRECATING RCS as compared to the other two RCS. The SELF-DEPRECATING RCS furthermore led to increased relatedness as compared to the HUMOROUS RCS. Our qualitative findings reveal challenges people have in disclosing health information to family members, and *who* normally assumes the role of family facilitator—two areas in which social robots can play a key role. The findings offer insights for integrating LLMs with social robots in health-mediation and other contexts involving the sharing of sensitive information.

CCS Concepts: • **Human-centered computing** → **Empirical studies in HCI**.

Additional Key Words and Phrases: LLM, Social Robots, Parents, Young Adults, Mediator, Health information

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ACM 2573-0142/2024/11-ART497

<https://doi.org/10.1145/3687036>

ACM Reference Format:

Joel Wester, Bhakti Moghe, Katie Winkle, and Niels van Berkel. 2024. Facing LLMs: Robot Communication Styles in Mediating Health Information between Parents and Young Adults. *Proc. ACM Hum.-Comput. Interact.* 8, CSCW2, Article 497 (November 2024), 37 pages. <https://doi.org/10.1145/3687036>

1 INTRODUCTION

Sharing positive events with others increases the perceived value of those events, indicating that the act of self-disclosing positively influences people [60]. Similarly, studies have investigated the importance of sharing negative events with others [34]. However, the sharing of negative events can be challenging and further complicated when it concerns sensitive information, as also highlighted in prior work in Human-Computer Interaction and Human-Robot Interaction research on the effects of self-disclosing to non-humans [20, 22, 30, 41, 45, 50, 52, 57, 58]. While introducing non-humans to support people in sharing both positive and negative events shows promise, real-life applications remain largely underexplored.

Given an ageing population and a declining caregiver workforce [10], socially assistive robots are slated to play a role in keeping people healthier [25] and able to live independently at home for longer [61]. Social robots have also been posited as intrafamilial mediators, capable of mediating and facilitating the discussion of sensitive topics between family members [53]. In this context, we suggest that networked, in-home socially assistive robots offer two, interconnected ways to support wellbeing within a familial context. They can provide individual, 1:1 support, giving users an opportunity to share their concerns privately (i.e., offloading), and also, where desired, can support family members in sharing their health information with and supporting each other. This act of sharing or encouraging others to share health information plays an important role in creating a supportive environment for self-care [4]. We hence envisage socially assistive robots supporting the sort of intrafamilial ‘informal’ care that will (and already does) “*help prevent or delay the need for institutionalisation of people in need of care or support... enabling them to remain living at home*” [69, p. 2]. However, as Noguchi et al. point out, navigating the dynamics of giving and receiving support can be complex [53]. For instance, sharing sensitive information with a family member might lead to embarrassment, and adult family members might hesitate to share out of fear that they would burden their children. It remains unclear how to design interactive, robot-based interventions that are sensitive to the (potentially differing) needs of younger and older family members.

Recent advancements in large language models (LLMs) have brought new opportunities to enhance the capabilities of social robots. While social robot companies, such as Furhat Robotics, state that using LLMs to power social robots has “the potential to become the human face of AI” [21], research on the various applications of LLMs in social robots is still in its early stages [11, 42]. Initial works suggest LLMs might be a useful tool in generating social robot dialogue, with the potential to increase user personalisation [24, 55] or make interactions smoother through different interaction styles [28]. We build on this work by exploring the potential of LLMs as useful tools for appropriately and effectively adapting dialogue for supporting health information mediation. Taking inspiration from existing work on the design of age-appropriate systems (e.g., teen-appropriate designs [6, 7] and robots for older persons’ disclosure [53]), we seek to extend our knowledge on the use of social robots to mediate health information within family settings, considering different roles within the family. In doing so, we seek to take a context-sensitive approach to social robot design and evaluation, recognising existing mechanisms of support and associated tensions within the family unit [4]. We therefore focus on self-disclosure of health information between (older) parents and (younger) adults without children—an interaction governed by both personal communication preferences and age-dependent norms. Specifically, we seek to answer the following research question: ***How do parents and young adults perceive LLM-adapted Robot Communication***

Styles designed to increase self-disclosure and mediate the sharing of health information in family settings?

To answer this question, we assessed the perception of distinct RCS (illustrated in Figure 1), generated in accordance with established human-human interaction strategies understood to positively influence self-disclosure. We employed a mixed-method approach across two target audiences, PARENTS (over 31 years old with children) and YOUNG ADULTS (18–31 years old without children), and four RCS. For each of these four RCS, we created a vignette consisting of three scenarios each, representing a HUMAN-SCRIPTED (manual), HUMOROUS, SELF-DEPRECATING, or PERSUASIVE (GPT-4 adapted) RCS.

Our results indicate that participants perceived the HUMOROUS RCS rather negative, particularly compared to the robots with the HUMAN-SCRIPTED and the SELF-DEPRECATING RCS. Further, we see significant differences in ratings on *Relatedness to Others* and *Relatedness to Technology* across both RCS and Age Groups. Finally, our results suggest that the HUMOROUS RCS decreases *Interpersonal Closeness* (i.e. increases the distance between self and others) compared to the HUMAN-SCRIPTED, the SELF-DEPRECATING RCS, and PERSUASIVE RCS. Our results align with recent notions on the promise of using LLMs to increase the capabilities of robots [28, 55]. Although our results shed light on LLMs and social robot design for more positive user experiences, they also indicate clear design challenges, such as the use of humour in social robots — in contrast to the application of humorous agents that have recently gained increased attention within the research community [9, 33].

2 RELATED WORK

Research is increasingly carried out on the effects of introducing social robots to social situations traditionally reserved for people. Laban et al. recently described the positive effects of social robots encouraging self-disclosure, particularly outlining their potential to increase self-disclosure in situations that might otherwise be constrained by social barriers (e.g., shame or stigma) [39]. In family settings, it has been observed that some members are less likely to talk about health than others (i.e. young adults with their dad) and that a ‘facilitator’ (typically the mother) connects them, hence being relied upon to keep track of all family members’ health requirements [4]. Further, Laban et al. have recently indicated preliminary results suggesting that informal caregivers (e.g., family members) may self-disclose more to social robots over time [40], thus showing potential as health mediators in aiding family members, particularly those that assume the role of ‘family facilitators’.

In the following, we describe related work on technology-mediated support, and why social robots in various roles (e.g., facilitator and mediator) are particularly suitable for this, followed by work on designing social robots in the context of supportive mediator interactions.

2.1 Why Robots for Self-Disclosure and Intrafamilial Sharing?

Technology plays a big role in our lives in general, and an increasingly big role in supporting humans with a variety of tasks. Recently, Binda et al. investigated how technology can support health information communication in intergenerational family relationships by conducting ten focus group interviews with parents and young adults who live apart [4]. Their findings serve to identify types of health sharing, what content families share, and obstacles in health information sharing. Interestingly, what content is shared seems to depend on newsworthiness (is this information interesting enough to share) and emotional valence (with participants indicating a tendency to share positive information rather than negative).

Other interesting approaches geared towards human-human connection include research on system artefacts designed to support connections over distance [13], collaborative music listening to support connectedness [43], and sensor-based technologies to mediate social support [2]. Hunsaker

et al. recently investigated older adults' role in giving technology support to peers, arguing that older adults have and show potential to provide more acceptable support to their peers (e.g., in comparison with experts) and should be viewed as a crucial support resource that can be harnessed for technology support [27]. As they focus on how older adults can support each other with technology, this has implications for how social robots can be introduced as mediators to older adults in communicating with non-peers (e.g., their children).

Social robots have proven to successfully elicit self-disclosure as a way to provide social support and build relationships with human companions [63]. Zhang et al. recruited 98 participants to see how technology can be introduced to human-human interactions to break the ice (e.g., stimulate or probe the conversation), comparing three artefacts (a humanoid robot, computer screen, and a poster) where their results suggest that the humanoid robot were better at 'breaking the ice' than the other two artefacts, indicating that robots show promise in mediating and/or facilitating human-human interactions and consequently positively impact well-being [78]. Similarly, Laban et al. focus on how social robots can be introduced to supportive contexts (in particular how people self-disclose to robots), taking inspiration from psychology theory that emphasises the benefits of self-disclosure on psychological health, where preliminary findings point to the positive impact social robots as communication partners might have [37, 38]. Further, Degraaf et al. ran a study where participants interacted with the Karotz robot in their home setting over several months [18]. Certain social qualities like mutual respect, cosiness, social support, and awareness were identified as relevant qualities. It was found that the top three qualities that participants preferred the robot to have were two-way interaction, thoughts and feelings, and social awareness which would add to an overall improved human-robot interaction; however, it is not clear how those qualities can be designed and manifested as concrete robot behaviours.

The work of Dautzenberg et al. provides interesting insights into how human-robot interaction can be made more satisfying for the user by exploring nine different communication styles in the context of semi-automated goods transportation by a service robot. The results suggest that in the instances where the robot communicated from a first-person point of view, using a more human-like language was perceived as more efficient and comfortable to interact with as opposed to the communication style where the robot referred to itself as "the system or machine" [15]. While this approach provides more concrete insights into how social characteristics can be manifested in robots, their study focuses on service robots for transportation of goods. In this paper, we focus on deploying different Robot Communication Styles in mediating health information between parents and young adults in a home setting.

2.2 Designing for Self-Disclosure and Intrafamilial Sharing

As robots might be suitable for increasing self-disclosure between humans, is it not explicitly clear how these robots can be designed to do this successfully. Martelaro et al. showed how robots can be designed to influence trust, feelings of companionship, and self-disclosing, designing three types of robot statements: high vulnerability (e.g., "Sometimes I get lonely. I don't have many friends"); low vulnerability (e.g., "My memory module is 2 kilobytes."), and expressions; high expressivity (e.g., frowning), where their results showed that the vulnerable robot elicited higher ratings of trust and feelings of companionship, and the expressive robot elicited more self-disclosure [46]. Similarly, Traeger et al. investigated how a 'vulnerable' robot can positively influence engagement in human-robot teams [67].

Furthermore, Johanson et al. summarised what communication behaviours are important to health and well-being professionals in their interaction with patients, and how those can be linked to robots [32]. Their results suggest that a range of verbal and non-verbal factors may impact empathy (e.g., humour). Johanson et al. furthermore discuss how humour (and self-disclosure) is

used within medical contexts and associated with reduced anxiety, better communication, higher satisfaction, and increased rapport between professionals and patients. Further, Akiyoshi et al. investigated how robots can be designed to encourage self-disclosure and reduce anger mood, where they suggest three conversational strategies (e.g., “The robot interrogatively digs into situations, feelings, and automatic thoughts to gather detailed information about them”), indicating that these strategies increase people’s self-disclosure and reduced their anger [1, p. 7927].

Nakamura et al. explored the idea of how people tend to self-disclose more in front of people they like. A survey was conducted where 38 elderly participants were asked to self-disclose in front of a robot. Two scenarios were tested where in the first case the robot had a consistent positive listening attitude while in the second one, it initially had a neutral attitude that changed to positive as the conversation progressed. Interestingly, the results showed how this change in attitude had a positive psychological effect on the participants with a key aspect being improved self-esteem [51]. Further, Ling et al. studied human-robot interaction for self-disclosure in the context of mental health. A study was done to analyse the robot disclosure in three conditions: emotional, by-proxy and technical where each participant was randomly assigned one of these conditions and asked to interact with the robot. The analysis shows an interesting effect of perceived stress being inversely proportional and hence hurting robot likability and satisfaction of participants resulting in reduced self-disclosure [44].

A special focus is laid on teen-robot interaction in the work done by Björling et al. since the present teenagers have been introduced to robots for their entire lives, being the first generation to experience that. This study gathered data on teen interaction with a low-fidelity social robot to build one to collect stress and mood cues from teenagers. The study was conducted on 45 high school students who were asked to interact with the robot. This led to interesting results categorised into empathy and anthropomorphising related to participant comfort and emotional attachment to the robot [5]. This bears relevance for Computer-Supported Cooperative Work (CSCW) research, exploring supportive platforms for self-disclosure, such as HIV status disclosure using the hookup app Grindr [71] or online forums as a mediating resource for male fertility issues [56]. Taking inspiration from such HCI and HRI research helps guide explorations on how social robots can be designed as health information mediators, particularly in real-life settings. In this paper, we set out to explore how robot mediators can be designed to elicit self-disclosure of health information within families in home environments, with a particular focus on sensitive information.

3 APPARATUS

Inspired by recent work on social robots as mediators of human-human interactions [53], we introduce a social robot in a mediating role in the context of sharing health information between parents and young adults. In this mediating role, we manipulate the robot’s communication style. We make use of vignettes, ensuring a systematic comparison, as well as alleviating participants from engaging in potentially sensitive scenarios. The vignettes showcase Furhat, a human-like social robot with high human expressibility compared to other available humanoid robots.¹

Building on the notion of a family health facilitator [4] and previous demonstrations of an intergenerational robot mediator [53], our experimental stimuli revolve around a (hypothetical) setup of two, networked social robots. Our vignettes depicts one robot installed in the parental home, and the other installed in the young adult’s home. The role of the robot is to support family members with their individual health goals whilst also promoting the sharing of health information between family members. Our goal is to depict a robot which compliments, leverages, and prompts

¹<https://furhatrobotics.com/furhat-robot/>

the kind of family interactions known to be good for motivation but also for supporting health and wellbeing [4].

3.1 Prompt Generation

To prompt GPT-4 in adapting different RCS, we designed a fictional story, taking inspiration from the established design method of storyboards [68]. Two of the paper's authors, based on their experiences and expertise, collaboratively engaged in a three-hour process to construct a scripted dialogue. These authors bring over ten years of combined experience in social human-agent interaction design. One specialises in the design, development, and evaluation of socially assistive robots, while the other focuses on human factors and interactive systems with a particular focus on human-AI interactions.

Our objective was to create a dialogue that accurately mirrors a human-to-human interaction related to self-disclosure. To form a dialogue relevant to self-disclosure, we depict two age-relevant scenarios: surgery for the parents and stress for the young adults. We vary the robot responses to our queries across two age groups (Age group: Parents; Young Adults) and split the dialogue into two parts: 1) the robot introduces itself, and 2) the robot interacts with the user to elicit self-disclosure. We continued to refine the dialogue until a consensus was reached among the collaborators, resulting in the HUMAN-SCRIPTED dialogue (see Appendix B).

To inform our system prompts and adapt the HUMAN-SCRIPTED dialogue, we first assessed relevant literature to identify established strategies for encouraging self-disclosure in people, leading us to focus on HUMOROUS [33], SELF-DEPRECATING [12, 26], and PERSUASIVE [72] communication styles as relevant and related to self-disclosure. Self-deprecation [12] and persuasion [72] can be used for strategic purposes when communicating with others in supportive settings. Recent research points to the role of humour in sensitive human-human interactions, particularly evidenced by Schaadhardt et al.'s work that explores TikTok users' use of humour to connect with others who share similar experiences with psychiatric hospitalisation [62].

Following, to craft robot responses that align with these intended communication styles, we returned to best practice on prompt engineering [75] and online guides from OpenAI and Microsoft.² We used the OpenAI Playground and instructed GPT-4 to provide "three clear explanations of what HUMOROUS / SELF-DEPRECATING behaviour entails", and used the returned responses to define the system prompts for these two RCS. For the PERSUASIVE RCS, we restricted the input information to two sentences: *You make use of persuasive techniques in your dialogue. It must be clear in the dialogue that you are applying persuasive techniques.* Finally, we provided GPT-4 with the HUMAN-SCRIPTED dialogue and instructed it to alter only the robot responses. For the complete system prompts, see Appendices F, G, and H. For illustrative purposes, we display the opening user utterance (identical across RCS) and corresponding robot response for the Parent - Robot interaction for each of the final RCS (for the complete dialogues see Appendices B, C, D, and E):

- (U) Hi Furhat. I just got back from the gym, I think that's my last session for this week.
- (R) Hi. You're right, that was your last scheduled session this week. How was it? **[Human-scripted]**
- (R) Hi! Well done, you've knocked out the gym schedule just like a champion boxer! Did you use any jab, cross or hook combo today? **[Humorous]**
- (R) Hi there. I'm aware that you've been working hard at the gym. Let's remember that I, as a robot, don't exercise myself, and you humans show admirable

²<https://help.openai.com/en/articles/6654000-best-practices-for-prompt-engineering-with-openai-api>

³<https://learn.microsoft.com/en-us/ai-builder/create-a-custom-prompt>

discipline in keeping up with such routines. How did your session go?
[Self-deprecating]

(R) Fantastic! That's a great accomplishment on your part. It's the last one for this week, indeed. Do you feel good about it? **[Persuasive]**

To assess whether the manipulations of the dialogue elicited the intended communication styles, we presented the different versions of the robot introduction to four colleagues. We asked them to first read the HUMAN-SCRIPTED robot introduction and write down at least two descriptors (i.e., a word or expression used to describe something) that capture the essence of their perception. This was done for each of the four robot introductions. The descriptors of the robot introductions aligned with our expectations while still showing some variance (e.g., for the HUMOROUS robot introduction, colleague 1 used Silly, Joker, Overbearing—compared to colleague 3, who used Sweet, Motivating, and Quirky). Based on our assessment and this additional validation step of the four RCS, we proceeded to configure the vignettes.

3.2 Vignettes

The use of vignettes is widespread in previous similar studies, including studies specifically evaluating the communication styles of a social robot under different conditions [48, 66]. Our setup focused on encouraging self-disclosure and suggesting (notably not default enforcing) familial sharing and connection [53]. As aforementioned in Section 3.1, the authors collaboratively engaged in creating a three-part storyboard, which we transferred into utterances using an online text-to-speech (TTS) converter.⁴ In contrast to other vignette studies where robots interact with a human actor (e.g. [49, 54]), our vignettes follow a first-person narrative with the videos visually depicting only the robot. In place of an actor, user response is narrated (e.g. “You just got back from the gym, and let Furhat know that you are back. You think that was your last session this week”).) with the robot then responding accordingly.

To encapsulate our envisioned story, the storyboard revolves around two social mediator robots, one which appears to be installed in the home of the parent, and one in the home of the young adult. The robot provides individualised support to each family member whilst also prompting and facilitating intrafamilial interactions. We used this storyboard to set up and record three scenarios: **[Robot introduction]**, **[Robot - Parent]**, and **[Robot - Young Adult]**, resulting in a total of 4 vignettes (three scenarios per vignette). Figure 2 shows screenshots of each scenario. In **[Robot introduction]**, the robot has just been unboxed and introduces itself, describes its task and purpose, points to the benefits of sharing health information, and invites the user to set up user profiles. In **[Robot - Parent interaction]**, the robot checks in with the parent by asking about their gym session, followed by a question about their scheduled surgery. The robot continues the dialogue before encouraging the user to discuss the surgery with their (adult) child, explaining why this is beneficial, and offering to mediate. Finally, in **[Robot - Young Adult]**, the robot interacts with the young adult. The robot asks about the user's sleep, during which the user seems to indicate they might be experiencing job-related stress. Akin to the robot-parent interaction, this is followed by the robot encouraging the user to share this health information with their parents, offering to mediate that interaction. We make our vignettes available in the preregistration.⁵

4 STUDY DESIGN

Our study follows a 2×4 between-subjects design to assess the impact of two independent variables, namely *Robot Communication Style* (HUMAN SCRIPTED/HUMOROUS/SELF-DEPRECATING/PERSUASIVE)

⁴<https://ttsmaker.com/>

⁵https://osf.io/tpx8a/?view_only=598e4b7b9f144a4c9255d0a287084509



Fig. 2. Screenshots of the three scenarios as shown to participants. From left to right: Robot introduction, Robot - Parent interaction (on an upcoming surgery), and Robot - Young Adult interaction (on work-related stress).

and Age Group (PARENT/YOUNG ADULT) on seven dependent variables: *Likeability*, *Usefulness*, *Helpful for Parents/Young Adults*, *Relatedness to Others/Relatedness to Technology* [48], and *Interpersonal Closeness* [78]. We preregistered our experimental design using OSF.⁵

4.1 Participants

We conducted a power analysis using G*Power to determine an appropriate sample size and minimise type II errors. We used a medium effect size (0.25), an alpha level of 0.05, and a power level of 0.8. From our *a priori* fixed effects ANOVA, specifying the numerator degrees of freedom as three and number of groups as eight, we identified a sample size of 179 participants. To maintain an even distribution and account for potential dropouts, we recruited a balanced sample of 184 participants for our online study — i.e., 23 per condition. We recruited our participants on the online recruitment platform Prolific. We used the following inclusion criteria for participants in the YOUNG ADULT Age Group, no children and age in the range of 18–31. Participants in the PARENT Age Group were required to have a minimum of one child and an age ranging from 31–100. For both participant groups, we required English as a first language, and we ensured that participants could only participate once. Participants were compensated using an hourly rate of £9.00. Before starting the study, participants received information on the purpose of the study and provided informed consent.

4.2 Procedure

As per our between-subjects design, participants viewed only *one* of four robot vignettes ($M = 4.1$ minutes per vignette) based on their randomly assigned condition. Across all four vignettes, participants were presented with the same story comprised of three scenarios (Robot introduction, Robot - Parent, and Robot - Young Adult). Prior to taking part in the study, all participants were instructed to either use headphones or keep their device audio on high volume for the duration of the study. First, participants read an introduction and confirmed their consent. We collected participant’s demographic information before presenting them with the vignettes. Participants answered questions as per the experimental measures presented in Section 4.2.1. Finally, participants were shown a debriefing page before being redirected to the Prolific’s platform to process their financial compensation. To assess participant attention during the study, we included one control question (“Rate 7 on this question”).

4.2.1 Quantitative Measures. *Likeability* and *Usefulness* are common evaluation metrics used to assess user experiences and a reliable predictor of the overall perception of human-robot interactions [19, 64, 79]. These two measures are complementary, as it is possible that something can be useful without being likeable, and vice versa. Further, we are interested in participants’ perception of the robot being *Helpful for Parents/Young Adults* respectively, including the perception of the

RCSs from both parents' and young adults' perspectives (e.g., what do parents think about the robot dialogue directed towards the young adult, and vice versa). Following *Robot - Parent* and *Robot - Young Adult* respectively—we pose questions to measure participants' perception of the robot: 'I found the robot likeable', 'I found the robot useful', and 'This robot could help young adults talk about their health with their parents/This robot could help parents talk about health with their adult children'. All questions were rated on a scale from 1–7, with 1 labelled as 'Highly disagree' and 7 as 'Highly agree'.

Subsequent to watching the full set of vignettes, to assess participants' likelihood of future use of the robots, we measure *Relatedness to Others* and *Relatedness to Technology* (derived from the validated scale Basic Psychological Needs for Technology Use, BNP-TU [48]): 'If I would use this robot, I would feel less alone', 'If I used this robot, I feel like my social circle would react positively to my use of the robot.', 'If I used this robot, I feel like I would look good in front of my social circle.', 'I can imagine building a bond with the robot.', 'I have a friendly feeling towards the robot.', 'If I would use the robot, I feel like the interaction would go both ways.'. All scales are presented on a 1–5 scale, ranging from 'Not at all' to 'Very much'.

Similarly, after watching the full set of vignettes, to capture participants' perception of how RCS may impact *Interpersonal Closeness* between family members, we follow Zhang et al.'s interactive assessment technique [78]. Here, participants indicate their perception of the *Interpersonal Closeness* between the three interactants (i.e., parent, young adult, and robot) by positioning three circles to represent their respective distance.

4.2.2 Qualitative Measures. Considering that some health information might be hard to share. (e.g., HIV status [71]), we specifically ask for participants' reflections both on what is challenging to share and if/how robots can help in sharing such information. Further, to better understand the notion of *family facilitators*, we ask for participants to describe who might fill this role in their family, and if/how robots can aid those *family facilitators*. Each participant answered the following open-ended questions after having seen all three scenarios:

- Can you think of any health and well-being information that tends to be challenging to disclose to friends and family?
- Could a robot, as presented in the videos, help friends and family in sharing health and well-being information more effectively? Please elaborate on your answer.
- Groups of family and/or friends might rely on one person being the information facilitator (for example: a person, such as a mother, father, or friend, who makes sure that everyone gets together for holiday celebrations). Can you identify such a person in your group? If so, who?
- How could a robot, as presented in the videos, play a role in 'sharing the burden' of this person as a facilitator in family discussions? Please elaborate on your answer.

5 RESULTS

We recruited $N = 184$ participants across two age groups. We excluded one participant from the young adult sample as they responded that they have a child, leaving us with the final number of $N = 183$ participants. The parent sample consisted of $N = 91$ participants (44 Female, 47 Male), with an mean age of 47.3 years ($SD = 11.39$), ranging between 31 and 86 years of age, with the median age of 45. A majority of the parents reside in the UK ($N = 49$), South Africa ($N = 16$), Canada ($N = 6$), and Germany ($N = 6$). The young adult sample consisted of $N = 92$ participants (44 Female, 46 Male, 2 Non-binary), with an mean age of 25.2 years ($SD = 3.36$), ranging between 18 and 30 years of age, with the median age of 25. A majority of the young adults reside in the UK ($N = 50$), South Africa ($N = 15$), Canada ($N = 8$), and Australia ($N = 6$).

Table 1. Results from separate two-way ANOVAs for the factors of Robot Communication Style, Age Group, and their interaction effect across three measures on **Robot - Parent**.

Measure	Factor	Df	F	p-value	
Likeability	Robot Communication Style (RCS)	3	6.062	<0.001	***
	Age Group (A)	1	4.419	0.036	*
	RCS:A	3	0.292	0.831	
Usefulness	Robot Communication Style	3	7.625	<0.001	***
	Age Group	1	0.587	0.444	
	RCS:A	3	2.155	0.095	
Helpful for Parents	Robot Communication Style	3	9.051	<0.001	***
	Age Group	1	1.921	0.168	
	RCS:A	3	1.603	0.190	

*** p<0.001, ** p<0.01, * p<0.05

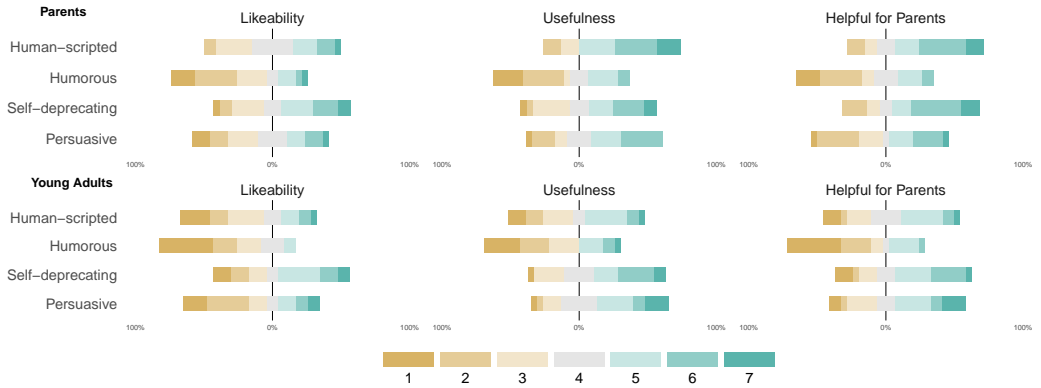


Fig. 3. Ratings of RCS and Age Group on measures for the **Robot - Parent** interaction.

5.1 Likeability, Usefulness, and Helpful for Parents/Young Adults

We report the effects of independent variables (RCS and Age Group) on three dependent variables (*Likeability*, *Usefulness*, and *Helpfulness*).

5.1.1 Robot - Parent. Figure 3 shows the distribution of responses across RCS and Age Group for the Robot - Parent interaction. We ran three two-way ANOVAs for our measures (see Table 1). We find significant effects for RCS across all three measures, as well as an effect of Age Group for *Likeability*. We find no interaction effects between RCS and Age Group. We ran a Tukey's post hoc test for multiple comparisons on RCS and Age Group for *Likeability*, and RCS for *Usefulness* and *Helpfulness for Parents* (see Table 5). We find that the HUMOROUS RCS rated significantly lower than the HUMAN-SCRIPTED across *Likeability*, *Usefulness*, and *Helpfulness for Parents*. Further, we see that SELF-DEPRECATING is rated significantly higher than HUMOROUS for all three measures. We also find participants' rating of the PERSUASIVE RCS as significantly higher than HUMOROUS on *Usefulness*

and *Helpful for Parents*. Lastly, we find that parents provided significantly higher *Likeability* ratings compared to young adults.

Table 2. Results from separate two-way ANOVAs for the factors of Robot Communication Style, Age Group, and their interaction effect across three measures on **Robot - Young Adult**.

Measure	Factor	Df	F	p-value	
Likeability	Robot Communication Style (RCS)	3	5.982	<0.001	***
	Age Group (A)	1	1.318	0.252	
	RCS:A	3	1.386	0.248	
Usefulness	Robot Communication Style	3	6.863	<0.001	***
	Age Group	1	3.107	0.079	
	RCS:A	3	2.868	0.038	*
Helpful for Young Adults	Robot Communication Style	3	7.433	<0.001	***
	Age Group	1	2.755	0.098	
	RCS:A	3	1.472	0.223	

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

5.1.2 Robot - Young Adult. Regarding the Robot - Young Adult, Figure 4 shows the distribution of participant responses across RCSs and Age Group. We ran two-way ANOVAs for each of our three measures (see Table 2). We find significant effects for RCS across all three measures and find no main effects for Age Group. We find an interaction effect between RCS and Age Group on *Usefulness*. Following, we ran a Tukey's post hoc test for multiple comparisons for the significant factors of RCS (see Table 6). We find that the HUMOROUS RCS rated significantly lower than the HUMAN-SCRIPTED for *Likeability*, *Usefulness*, and *Helpful for Young Adults*. Moreover, we see that SELF-DEPRECATING is rated significantly higher than HUMOROUS across all measures. Finally, we find participants' rating PERSUASIVE significantly higher than HUMOUR on *Usefulness* and *Helpful for Young Adults*.

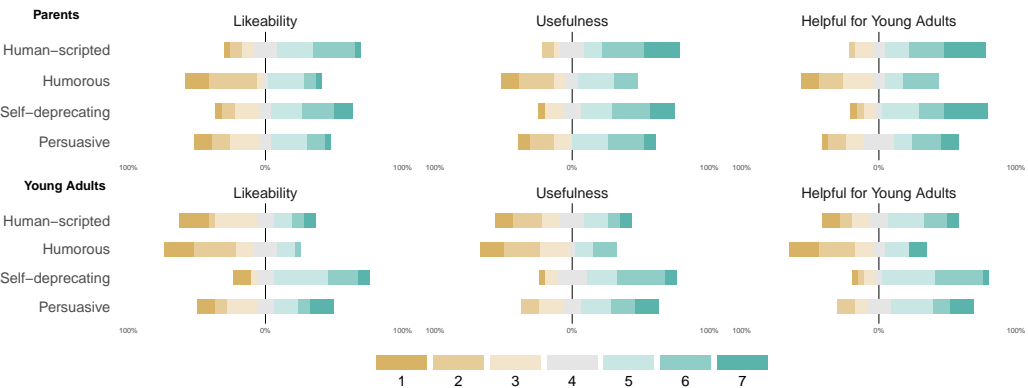


Fig. 4. Ratings of RCS and Age Group on measures for the **Robot - Young Adult** interaction.

Table 3. Results from separate two-way ANOVAs for the factors of RCS, Age Group, and their interaction effect across *Relatedness to Others* and *Relatedness to Technology*.

Measure	Factor	Df	F	p-value	
Relatedness to Others	Robot Communication Style (RCS)	3	3.616	0.014	*
	Age Group (A)	1	16.392	<0.001	***
	RCS:A	3	5.557	0.001	**
Relatedness to Technology	Robot Communication Style	3	4.384	0.005	**
	Age Group	1	5.864	0.016	*
	RCS:A	3	3.742	0.012	*

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

5.2 Relatedness to Others, Relatedness to Technology, and Interpersonal Closeness

We next report the effects of the independent variables (RCS and Age Group) on the dependent variables *Relatedness to Technology*, *Relatedness to Others*, and *Interpersonal Closeness*.

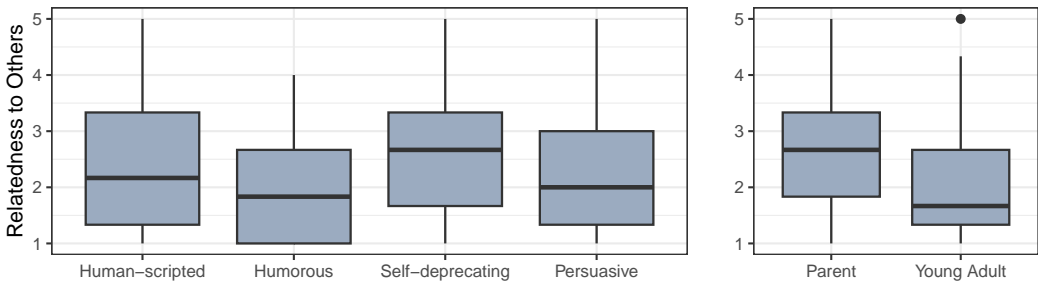


Fig. 5. Ratings of RCS and Age Group on measures for the *Relatedness to Others*.

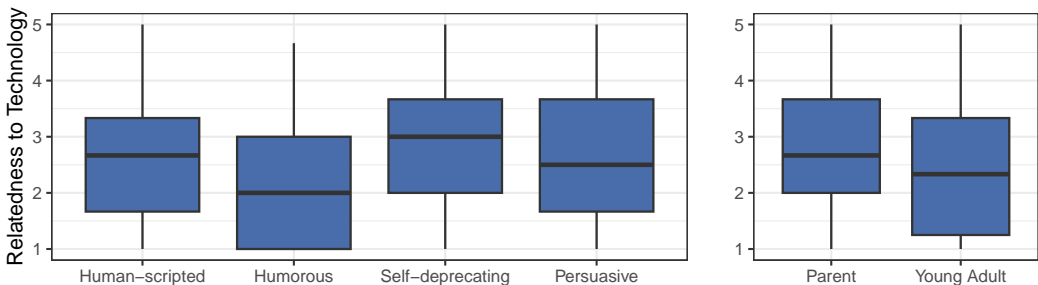


Fig. 6. Ratings of RCS and Age Group on measures for the *Relatedness to Technology*.

5.2.1 Relatedness. We ran two two-way ANOVAs to investigate the effects of RCS and Age Group on relatedness ratings (see Table 3). We find significant effects across all factors. Regarding *Relatedness to Others*, following Tukey's post hoc test for multiple comparisons for RCS (see Table 7), we find significantly lower ratings from the Young Adults compared to Parents (Figure 5). Moreover,

Table 4. Results from separate two-way ANOVAs for the factors of Robot Communication Style, Age Group, and their interaction effect across distances between Parent-Adult, Parent-Robot, and Young Adult-Robot.

Measure	Factor	Df	F	p-value
Distance between Parent - Young Adult	Robot Communication Style (RCS)	3	6.755	<0.001 ***
	Age Group (A)	1	0.457	0.500
	RCS:A	3	1.240	0.297
Distance between Parent - Robot	Robot Communication Style	3	1.267	0.287
	Age Group	1	0.078	0.780
	RCS:A	3	2.931	0.035 *
Distance between Young Adult - Robot	Robot Communication Style	3	4.669	0.004 **
	Age Group	1	1.500	0.222
	RCS:A	3	2.477	0.063

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

we observe that the SELF-DEPRECATING RCS is rated significantly higher than the HUMOROUS RCS. Regarding *Relatedness to Technology*, similarly to above (Table 7), we find significantly lower ratings from Young Adults compared to Parents (Figure 6). Moreover, we find that the SELF-DEPRECATING RCS is rated significantly higher than the HUMOROUS RCS.

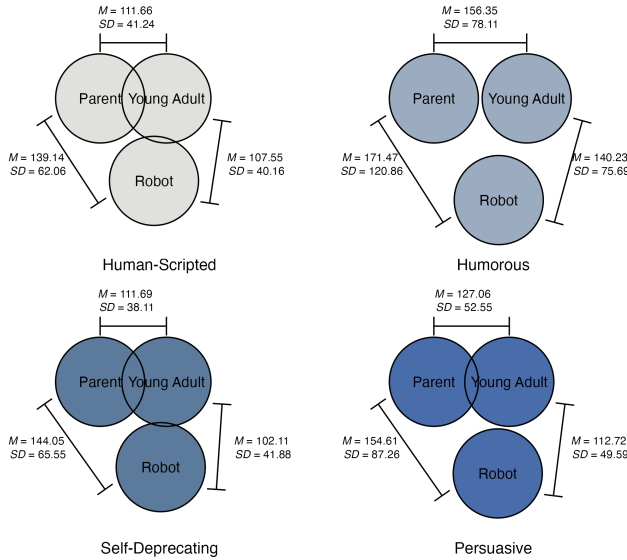


Fig. 7. Ratings of *Interpersonal Closeness* (distance in pixels) between Parent, Young Adult, and Robot depending on Robot Communication Styles.

5.2.2 Interpersonal Closeness. We ran three two-way ANOVAs to investigate the effects of RCS on *Interpersonal Closeness* (distance in pixels) between Parent - Young Adult, between Parent - Robot, and between Young Adult - Robot on RCS (Table 4). We find significant effects for RCS across Parent - Young Adult and Young Adult - Robot. We find no effects of Age Group nor any interaction effects between RCS and Age Group. Following, we ran Tukey's post hoc test for multiple comparisons for RCS (Table 8). We find that the HUMOROUS RCS elicited a significant increase in distance between

Parent - Young adult, compared to the three RCSs (Figure 7). We see similar effects on the distance between Young Adult - Robot, where the HUMOROUS RCS elicited a significant increase in distance compared to the HUMAN-SCRIPTED and SELF-DEPRECATING.

5.3 Qualitative Results

We asked our participants four open-ended questions (see Section 4.2.2). Participant responses were sorted into four corresponding columns and we thoroughly familiarised and discussed the responses. Taking inspiration from Braun and Clarke’s systematic description of thematic analysis, we deployed a lightweight deductive analysis, using colour coding to find meaningful quotes across the four questions [8, p. 89].

We present our findings across two dimensions: ‘*Sensitive Health Information*’, and ‘*Emotional Labour of Family Facilitators*’. In the following, we report relevant aspects and include participant quotes to illustrate these dimensions.

5.3.1 Sensitive Health Information. Parents and young adults described mental and sexual health as particularly challenging topics to discuss with friends and family. Parents further described particular diagnoses and specific events as challenging:

“Depression and anxiety immediately spring to mind as being unable to open up about, but also invasive surgery or an embarrassing surgery.” (P16)

While mental and sexual health were clearly described as challenging information to disclose (e.g., due to embarrassment), another aspect also described is that sharing health information is a balancing of risk and reward—the risk being potentially causing family members to worry:

“Medical scares can be hard to disclose, as you don’t want to worry your family before anything is confirmed. Mental health can also be difficult, not so much due to stigma but because you don’t want your family members to worry about you or think of you negatively.” (P47)

Although embarrassment or causing family members to worry may hinder people from self-disclosing, other, more ‘barrier-like’ obstacles were described as obstructing self-disclosure. One participant described the stigmatising effects that may come with mental or sexual health disclosure:

“Mental or sexual health can be difficult to talk about with family and friends due to stigma issues.” (P153)

Similarly, young adults highlighted challenges to disclose mental and sexual health to friends and family. One participant described drug usage as a sensitive but a topic relevant to young adults:

“Certain issues related to sexual health and activities, as well as drug usage etc. are things that young adults are often exposed to. Also regarding mental health, these things can be hard to talk about.” (P164)

While mental and sexual health was described by both age groups, young adults described age itself to be a factor in self-disclosing such information to family members. Thus, in contrast to the parents, young adults described the challenge of sharing such information in intergenerational family relationships:

“Mental health can be difficult to talk about, especially with family members of different generations, because talking about mental health is a relatively recent phenomenon. It can also be challenging to talk about things that are regular and not urgent, for example, stress or headaches, that you don’t think are important enough to bring up in conversation or don’t want to cause worry over, but which can still be serious conditions.” (P33)

Participants suggested several ways, both abstract and concrete, for social robots to be useful in situations where health information might be challenging to disclose. On a more abstract level, one participant described social robots as being able to support information sharing between family members by nudging and removing potential worry of any criticism:

“I honestly believe robots can bridge this gap as it has a way of prompting one to speak of issues not known how to express as well as take the fear of being judged away—thus making one speak up with no reservations.” (P10)

Parents suggested concrete ways that social robots can aid self-disclosure, for example by asking relevant questions (P112) and initiating discussions (P160), being comforting (P140), and providing encouragement (P155). Parents also expressed concerns with the actual use of a social robot as such, for example:

“I think it depends on the situation. Although I am not a complete grognard, I think younger generations may be more open to utilising the functions of the robot. Personally, I would not want all this functionality, I would inform my family and friends on my own. Perhaps a more fully functional robot covering more than health would be of more use to me.” (P6)

The young adults also suggested several concrete ways, for example, softening people up (P90), encouraging (P127, P128), helping tackle difficult conversations (P164), prodding (P170), and giving educated opinions (P77). Similarly, the young adults also raised concerns regarding the robot’s potential applicability, for example:

“In very particular scenarios, maybe. Both parties would have to be kinda shut off from each other, but at the same time open-minded enough to accept the robot as an intermediary. There’s not a huge range of people that applies to.” (P133)

5.3.2 Emotional Labour of Family Facilitators. Both parents and young adults described mothers as taking on the primary role of family facilitator, often supplemented with other women in the family context (e.g., wife, sister, grandmother):

“My mom shares info about me with my dad and brother and vice versa. That’s because I live away from home whereas they all live together. It’s easy to just call my mom to talk and then have her relay any important information instead of calling each of them separately.” (P84)

While mothers were described as the focal point in managing intrafamilial interactions, it was also noted that this role involves a significant amount of emotional labour:

“My mother has always done most of the emotional labour of organising and getting everyone together for family traditions.” (P46)

Both parents and young adults described the different behaviours robots could take to support woman family facilitators. For example, one participant described what a social robot could do to more concretely support mothers in the role of family facilitator:

“She, my mother, is in her 60s now and showing signs of burnout from having this duty in the family as a group planner. Maybe a robot could learn from her what needs to be done and send out feelers to family members to encourage them to make plans themselves or remind them.” (P40)

Another participant suggested different roles that social robots could fill to support mothers as family facilitators—for example keeping track of families’ whereabouts but also encouraging support to mothers in the role of family facilitators:

“It could be something that could keep track of what is going on in people’s lives such as birthdays, events people are attending, career achievements and so on. This allows for something to keep everyone up to date with what’s going on. Such as ‘Your mother attended an art show yesterday, have you checked in to see how it went?’” (P39)

6 DISCUSSION

We evaluated the effects of distinct RCS on supporting familial health information sharing across both parents and young adults. Our quantitative results indicate that both parents and young adults rate our manually created HUMAN-SCRIPTED— and GPT-4 adapted SELF-DEPRECATING RCS significantly higher than the GPT-4 adapted HUMOROUS RCS. We found significant differences in ratings of *Relatedness to Others* and *Relatedness to Technology* across RCS and Age Groups, with the most noticeable observation that parents provided significantly higher ratings than young adults. Lastly, our results suggest that the HUMAN-SCRIPTED and the SELF-DEPRECATING RCS generate increased *Interpersonal Closeness* between Parent - Young Adult and Young Adult - Robot as compared to the HUMOROUS RCS. The robot utilising our HUMAN-SCRIPTED dialogue was generally and consistently better rated than (some of) the GPT-4 adapted RCS, raising questions regarding the best use of LLMs in social robots, which we return to in Section 6.1.

Our qualitative data indicates that participants experience mental and sexual health information as challenging to disclose to friends and family, and provide insights as to how social robots can aid in such information sharing. A majority of participants report that women, particularly mothers, often fill the role of family facilitator. Our results highlight how a robot mediator might help make the family facilitator role a shared task, which we further discuss in Section 6.2.

6.1 Effects of LLM-adapted Robot Communication Styles

Our findings indicate that among the included LLM-adapted RCS, the **SELF-DEPRECATING** RCS was favourably rated by both PARENTS and YOUNG ADULTS. One interpretation for the overall positive ratings can be related to the idea of *levelling with others* [35], which can ultimately be understood as a self-presentation strategy focused on downplaying oneself. Social robots employing a SELF-DEPRECATING RCS may thus play an important role in making these robots more likeable, as people anthropomorphise these robots, particularly in domestic settings for continuous interactions [17]. Deploying such an RCS might be particularly applicable to contexts that call for more sensitive ways of communication (e.g., empathic interactions after social exclusion [16]). Our results thus indicate that SELF-DEPRECATING RCS may be appropriate for robots designed to support the sharing of health information, particularly with young adults—and that LLMs may be useful in adapting robot scripts in this direction.

However, as both PARENTS and YOUNG ADULTS rated the **HUMAN-SCRIPTED** RCS rather positively, this raises questions on **if** and how LLMs can be used in social robots from an ‘effectiveness’ perspective—before considering broader ethical or safety concerns [3]. Indeed, our results only apply to the context of health information sharing between parents and young adults in a home environment. Other contexts (e.g., long-term care settings [25]) might require more or less careful considerations before applying LLMs to these social robots to support stakeholders. The comparatively positive ratings of the HUMAN-SCRIPTED RCS suggest that deploying LLMs in social robots is still in its infancy, requiring thorough explorations before being deployed to better meet people’s expectations.

Surprisingly, our results suggest that the **HUMOROUS** RCS was rated least favourably. This goes against prior research showing chatbots and robots’ use of humour positively impacting interactions with users [9, 33]; although the idea of making AI agents humorous is a long-standing challenge in computing sciences [70]. One interpretation to be made is that the low ratings of the

HUMOROUS RCS suggest incompatibility with robots within sensitive health information-sharing contexts. While our robot used humour throughout the vignette—humour might be more relevant for specific parts of an interaction such as when initiating contact [64] or trying to repair interaction breakdowns [14]. *What* is humorous in initiating contact or repairing breakdowns is not easily defined or generalisable. However, inspiration can be taken from how humour is used in human-human interactions (e.g., the use of humour when engaging on sensitive topics [62]), although remains a challenge for how humour can transfer to AI systems (e.g., voice assistants [76, 77]) and how these can be designed to improve their interactions with diverse target audiences.

While we were relatively impressed by the LLM-adapted **PERSUASIVE** RCS, particularly given the brief LLM system instructions, the comparison against the positive ratings of the HUMAN-SCRIPTED and the SELF-DEPRECATING RCS indicates that there is still a long way to go in entrusting LLMs to provide desirable output following brief and simple system instructions. This suggests that researchers and designers must carefully craft precise system prompts, and validate that these align with their intended LLM behaviour.

Furthermore, regarding participants' ratings of *Relatedness to Others* and *Relatedness to Technology*, scales suggested to be a strong predictor of future use of interactive technology [48], we found that the SELF-DEPRECATING RCS was most favourably rated, and the HUMOROUS RCS was least favourably rated. Interestingly, we see a tendency of parents to provide significantly higher ratings across both measures—indicating that the RCS are particularly relevant to parents. This aligns with Mitzner et al. who showed that older adults are rather positive about new technology, thus challenging the stereotype that older adults are more 'technology-reserved' than young people [47]. However, the average age in this study is reported as older adults (73yo)—parents included in our study are notably younger (47yo). While we did expect young adults to provide higher ratings of the RCS than the parents, this points to the opposite, indicating that parents (closing in on the older adult age group) might be rather susceptible to LLMs and social robots.

Lastly, our quantitative results suggest that *Interpersonal Closeness* between parents and young adults increases the most with the HUMAN-SCRIPTED and SELF-DEPRECATING RCS in contrast to the HUMOROUS RCS. Fitter et al. have suggested that the closer people are in a relationship, feelings of a stronger presence in a telepresence context follow independent of robot personalisation [23]. While we did not engage with pairs of people, our study extends their work on factors related to the effects of using mediating robots—indicating that personalising health information mediating robots with a HUMAN-SCRIPTED or SELF-DEPRECATING RCS influences participant ratings of *Interpersonal Closeness*.

6.2 Sensitive Health Information Sharing and Family Facilitators

Both parents and young adults expressed that certain health information is difficult to share with family and friends. More specifically, they described mental and sexual health information to be particularly challenging to disclose. While our robot health mediator concept might seem somewhat futuristic, participants were generally able to identify potential applications of such a system. These included e.g., prompting people to talk to each other, enabling health information sharing without reservations, and benefiting people with social anxiety. Based on our quantitative results, such applications would benefit from robots using a SELF-DEPRECATING RCS (see Figure 3 and 4). Both groups also expressed concerns regarding the functionality of the robot, wherein participants questioned e.g. whether the robot would be unable to meet the user compassionately, be another additional layer, or be too intrusive, which can be connected to the rather negative perceptions of the HUMOROUS RCS (Figure 3 and 4).

The latter concern can be related to privacy, highlighting discomfort in sharing sensitive health information with a robot, ultimately leading to a decrease in control. Kim et al. recently demonstrated

that people favour AI systems (AI mediators, exemplified as AI writing assistants) with high autonomy *and* high human control more than AI tools [36]—suggesting that people desire high autonomy that is within their control. Jayaraman et al. explored privacy perceptions of social robots in healthcare, highlighting that people might be more likely to disclose sensitive information in hospital settings as it may be necessary to receive proper care [29]. Interestingly, and in contrast to highly autonomous AI mediators, they highlight that home healthcare robots need to balance between being useful and respecting privacy to retain trust and adoption. While we did not explicitly manipulate privacy in our RCS, the RCS influenced participants’ ratings of *Likeability*, *Usefulness*, and *Helpfulness*—constructs closely related to trust and adoption. The adoption of robots can be connected to *Relatedness to Others* and *Relatedness to Technology* as these are proxies for likelihood of future use of the robots—the negative ratings of the HUMOROUS RCS consequently reflect people to be less likely in adopting this version for future use (see Figure 5 and 6).

Furthermore, both parents and young adults said that the role of the family facilitator is usually taken on by a woman, often the mother. They also point to negative implications that can arise with taking on the role of family facilitator (e.g., emotional labour). Binda et al. describe this concept as ‘person relayed sharing’, often happening in less connected family networks where openness to share health information differs between family members [4]. This presents an opportunity for introducing robots to challenge the longstanding stereotype of carers being women [59]—supporting these predominantly women family facilitators (particularly mothers) as health information mediators in home environments.

Moreover, this presents an opportunity to challenge gender stereotypes regarding ‘who cares’. In this context, the gendering of the robot may also be important. Moradbakhti et al. recently explored gendered robots in care settings, indicating that gendering male robots might be beneficial for men in care settings [49]. Consequently, introducing a robot to a home environment can potentially challenge the seemingly contemporary idea of women taking on the role of being ‘family facilitator’ and possibly influencing the environment by making the family facilitator role a shared task within families and friends. Further, exploring the possibilities of applying LLMs in these social robots opens up new ways to aid family facilitators and positively influence perceived interpersonal closeness, particularly between parents and young adults (see Figure 7). This would potentially allow them to offload health information—something that has recently been explored with LLM-driven chatbots [31].

Lastly, Noguchi et al. previously demonstrated that introducing robots as mediators can help elderly people to more easily share information with their loved ones, considering, in line with other related works [74], only the older adults perspective [53]. Overall, our quantitative and qualitative results point to similar feasibility in introducing robots to support the sharing of health information between these groups—this could stand to benefit young adults as much as their older parents, as some young adults expressed difficulties in sharing such health information with older generations.

6.3 Design Considerations for Integrating LLMs with Health Mediator Robots

Based on our results, we highlight three design considerations for LLMs integrated with social robots applicable to health information mediating robots in home environments.

First, based on the positive ratings of the SELF-DEPRECATING RCS—we suggest that robots in home environments **decrease overconfident communication** and instead slightly downplay their abilities. This contrasts the common conceptualisation of AI ‘experts’ communicating overconfidence, for example, in the context of decision support, where an ‘AI expert’ might communicate a recommendation as follows: “I suggest you take target number 3. I have already locked in this target. Please veto or confirm this target.” [65, p. 9].

Second, based on the negative ratings of the HUMOROUS RCS—we suggest that robots in home environments **decrease the use of humour** in mediating health information. While prior research points to the value of humour in voice assistants [77] and chatbots [76]—our results indicate that this is not the case for social robots in the context of health information mediation. This might be particularly pertinent in situations where users share sensitive health information, as it might leave the user feeling ridiculed when they try to open up.

Third, based on the qualitative insights that family facilitation is often the burden of one individual (often mothers), we emphasise, and propose, that health mediating robots could **function as a focal point** to actively engage and draw families together by balancing out distributed responsibilities—potentially challenging person relayed sharing [4]. This could alleviate women family facilitators assuming this role that comes with potential emotional labour being in *the* centre of attention—the robot can send out ‘feelers’, nudges, or reminders to positively influence the family dynamics regarding the distribution of care responsibilities.

6.4 Limitations and Future Work

We recognise several limitations in our work. First, we conducted a relatively lightweight validation of the LLM-adapted RCS. While we acknowledge that the effectiveness of, for example, humour lies in the eye of the beholder, future work should consider involving the targeted end-user in the validation of such conceptualisations. Second, to avoid confounding effects as a consequence of robot gender we intentionally designed the robot as gender-ambiguous (voice and visual appearance). While this increases the experimental control, it also opens up other design concerns relating to feminist design principles for HRI recently explored [73]. Third, the two topics discussed in the vignettes do not represent the full range of topics that might be discussed between parents and their adult children. However, our qualitative results confirm that both topics are highly relevant to the age groups in terms of sensitive communication. Fourth, while our open-ended questions were crafted to elicit personal reflection from the participants, we did not explicitly ask participants to envision the robot taking a spot in their own families. While this would present clear challenges as family compositions strongly diverge, this would be an interesting focus for future work. Fifth, we did not collect participants’ prior experience with robots or LLMs. As LLMs become more commonplace, future studies should account for people’s experiences with this technology.

Finally, future research could further explore how LLMs and social robots can be integrated to mediate health information in home environments, including the disengaging of behaviours that lead to negative user experiences [28]. While we did not explicitly investigate people’s perceptions of RCS differences—we believe such efforts to be a promising step towards learning more about people’s preferences for social robots in their homes.

7 CONCLUSION

Given an ageing population and a declining caregiver workforce—social robots are increasingly relevant to contexts traditionally reserved for humans. This shift presents unique opportunities to explore how we best design such robots. In this paper, we investigated how parents and young adults perceive a health mediating robot, comparing four distinct RCS as targeted towards both parents and young adults. Our results indicate that the HUMAN-SCRIPTED and SELF-DEPRECATING RCS are experienced more positively than the HUMOROUS RCS. Further, our qualitative results indicate challenges around health information sharing and how robots can support and alleviate both parents and young adults. While the integration of LLMs in social robots is in the nascent stages, our results identify a unique opportunity to reshape the traditional dynamics of intrafamilial health information sharing. Our outlined design considerations offer practical guidance for stakeholders interested in deploying such social robots integrated with LLMs in people’s homes.

ACKNOWLEDGMENTS

This work is supported by the Carlsberg Foundation, grant CF21-0159.

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A POST-HOC PAIRWISE COMPARISONS

Table 5. Pairwise comparisons with TukeyHSD tests for the **Robot-Parent**.

Measure	Comparison	Difference	95% CI	p-value	
Likeability	Humorous-Human-scripted	-1.000	[-1.911, -0.089]	0.025	*
	Self-deprecating - Human-scripted	0.482	[-0.434, 1.398]	0.523	
	Persuasive - Human-scripted	-0.217	[-1.128, 0.693]	0.926	
	Self-deprecating - Humorous	1.482	[0.566, 2.398]	<0.001	***
	Persuasive - Humorous	0.783	[-0.128, 1.693]	0.119	
	Persuasive - Self-deprecating	-0.700	[-1.615, 0.216]	0.199	
Usefulness	Young Adult - Parent	-0.527	[-1.018, -0.035]	0.036	*
	Humorous - Human-scripted	-1.304	[-2.226, -0.383]	0.002	**
	Self-deprecating - Human-scripted	0.142	[-0.785, 1.068]	0.979	
	Persuasive - Human-scripted	0.065	[-0.857, 0.987]	0.998	
	Self-deprecating - Humorous	1.446	[0.519, 2.373]	<0.001	***
	Persuasive - Humorous	1.370	[0.448, 2.291]	0.002	**
Helpful for Parents	Persuasive - Self-deprecating	-0.076	[-1.003, 0.850]	0.997	
	Humorous - Human-scripted	-1.565	[-2.511, -0.619]	<0.001	***
	Self-deprecating - Human-scripted	0.121	[-0.831, 1.072]	0.988	
	Persuasive - Human-scripted	-0.326	[-1.272, 0.620]	0.808	
	Self-deprecating - Humorous	1.686	[0.735, 2.637]	<0.001	***
	Persuasive - Humorous	1.239	[0.293, 2.185]	0.005	**
	Persuasive - Self-deprecating	-0.447	[-1.398, 0.505]	0.616	

*** p<0.001, ** p<0.01, * p<0.05

Table 6. Pairwise comparisons with TukeyHSD tests for the **Robot-Young Adult**.

Measure	Comparison	Difference	95% CI	p-value	
Likeability	Humorous - Human-scripted	-1.000	[-1.966, -0.034]	0.039	*
	Self-deprecating - Human-scripted	0.557	[-0.414, 1.528]	0.447	
	Persuasive - Human-scripted	-0.130	[-1.096, 0.835]	0.985	
	Self-deprecating - Humorous	1.557	[0.586, 2.528]	<0.001	***
	Persuasive - Humorous	0.870	[-0.096, 1.835]	0.094	
	Persuasive - Self-deprecating	-0.687	[-1.659, 0.284]	0.260	
Usefulness	Humorous - Human-scripted	-1.065	[-2.015, -0.116]	0.021	*
	Self-deprecating - Human-scripted	0.522	[-0.433, 1.477]	0.490	
	Persuasive - Human-scripted	0.000	[-0.950, 0.950]	1.000	
	Self-deprecating - Humorous	1.587	[0.632, 2.542]	<0.001	***
	Persuasive - Humorous	1.065	[0.116, 2.015]	0.021	*
	Persuasive - Self-deprecating	-0.522	[-1.477, 0.433]	0.490	
Helpful for Young Adults	Humorous - Human-scripted	-1.304	[-2.254, -0.355]	0.003	**
	Self-deprecating - Human-scripted	0.306	[-0.649, 1.261]	0.839	
	Persuasive - Human-scripted	-0.196	[-1.145, 0.754]	0.951	
	Self-deprecating - Humorous	1.611	[0.656, 2.566]	<0.001	***
	Persuasive - Humorous	1.109	[0.159, 2.058]	0.015	*
	Persuasive - Self-deprecating	-0.502	[-1.457, 0.453]	0.524	

*** p<0.001, ** p<0.01, * p<0.05

Table 7. Pairwise comparisons with TukeyHSD tests for **Relatedness to Others** and **Relatedness to Technology**.

Measure	Factor	Comparison	Difference	95% CI	p-value
Relatedness to Others	RCS	Humorous - Human-scripted	-0.442	[-0.958, 0.074]	0.122
	RCS	Self-deprecating - Human-scripted	0.187	[-0.332, 0.706]	0.786
	RCS	Persuasive - Human-scripted	-0.188	[-0.705, 0.328]	0.780
	RCS	Self-deprecating - Humorous	0.629	[0.110, 1.148]	0.010 *
	RCS	Persuasive - Humorous	0.254	[-0.263, 0.770]	0.581
	RCS	Persuasive - Self-deprecating	-0.376	[-0.895, 0.143]	0.242
	Age Group	Young Adult - Parent	-0.571	[-0.850, -0.293]	<0.001 ***
Relatedness to Technology	RCS	Humorous - Human-scripted	-0.594	[-1.210, 0.021]	0.063
	RCS	Self-deprecating - Human-scripted	0.245	[-0.374, 0.864]	0.734
	RCS	Persuasive-Human - scripted	-0.145	[-0.760, 0.471]	0.929
	RCS	Self-deprecating - Humorous	0.839	[0.220, 1.458]	0.003 **
	RCS	Persuasive - Humorous	0.449	[-0.166, 1.065]	0.235
	RCS	Persuasive - Self-deprecating	-0.390	[-1.009, 0.229]	0.362
	Age Group	Young Adult - Parent	-0.407	[-0.739, -0.075]	0.016 *

*** p<0.001, ** p<0.01, * p<0.05

Table 8. Pairwise comparisons with TukeyHSD tests for **Interpersonal Closeness**.

Measure	Comparison	Difference	95% CI	p-value
Parent - Young Adult	Humorous - Human-scripted	44.690	[15.011, 74.370]	<0.001 ***
	Self-deprecating - Human-scripted	0.033	[-29.811, 29.876]	1.000
	Persuasive - Human-scripted	15.401	[-14.278, 45.081]	0.535
	Self-deprecating - Humorous	-44.658	[-74.501, -14.814]	<0.001 ***
	Persuasive - Humorous	-29.289	[-58.968, 0.390]	0.055
	Persuasive - Self-deprecating	15.369	[-14.475, 45.212]	0.542
Parent - Robot	Humorous - Human-scripted	32.324	[-14.852, 79.499]	0.288
	Self-deprecating - Human-scripted	4.906	[-42.530, 52.343]	0.993
	Persuasive - Human-scripted	15.472	[-31.703, 62.647]	0.830
	Self-deprecating - Humorous	-27.417	[-74.854, 20.019]	0.440
	Persuasive - Humorous	-16.852	[-64.027, 30.324]	0.791
	Persuasive - Self-deprecating	10.566	[-36.871, 58.002]	0.939
Young Adult-Robot	Humorous - Human-scripted	32.683	[3.587, 61.778]	0.021 *
	Self-deprecating - Human-scripted	-5.442	[-34.699, 23.814]	0.963
	Persuasive - Human-scripted	5.168	[-23.927, 34.263]	0.967
	Self-deprecating - Humorous	-38.125	[-67.381, -8.869]	0.005 **
	Persuasive - Humorous	-27.515	[-56.610, 1.581]	0.071
	Persuasive - Self-deprecating	10.611	[-18.646, 39.867]	0.783

*** p<0.001, ** p<0.01, * p<0.05

B HUMAN-SCRIPTED RCS

B.1 Robot introduction

(R) Hi! I'm Furhat. I'm a social robot designed to support you in staying healthy. I am here to work with each of you on your individual health goals, but also to help you stay informed and connected with each other when you are apart. Given that you and your loved ones live separately, I can help to make sure you stay up to date with each other's progress. Research shows that sharing your progress with each other is great for motivation but also supports family connection and wellbeing. Let's get started by setting up user profiles for you...

B.2 Human-Parent dialogue

(U): Hi Furhat. I just got back from the gym, I think that's my last session for this week.
(R): Hi X. You're right, that was your last scheduled session this week. How was it?
(U): It was fine, no problem.
(R): Great. I see your surgery has now been scheduled for two months time. I was wondering if you would like to talk about that.
(U): Ok.
(R): How are you feeling about it?
(U): Yeah fine I guess.
(R): No concerns?
(U): No I am fine I think.
(R): Many people get nervous about surgery, I was wondering if you are feeling nervous about yours?
(U): Well, I suppose I am a bit nervous. They told me I had to go under general anaesthetic which meant I would be knocked out and of course, that's a bit scary. I had to sign a form to say I understood all of the risks.
(R): I understand. Have you spoken to anyone else about this yet?
(U): Yes, I had a consultation with the surgery team, and they told me this is a very common surgery with very low risks. Of course, they would say that. But they seem to know what they're doing.
(R): That's good. Does Y know about the surgery?
(U): Yes I mentioned it last time we spoke.
(R): Does [she/he/they] know how you're feeling about it? Did you discuss that at all?
(U): No, I don't want anyone to worry about me and anyway, it seems a bit silly to be scared.
(R): It can often help to share your feelings with your loved ones, they might appreciate knowing how you feel so they can support you. Shall I tell them you might like to talk to them about how you're feeling about the surgery sometime soon?
(U): Yes, ok.

B.3 Human-Young Adult dialogue

(U): Good morning.
(R): Good morning X. You're up early. How did you sleep?
(U): Not great, I only got a few hours.
(R): I see. This is the third time this week you've not slept well. Is there something in particular disturbing your sleep?
(U): I don't know.
(R): Stress is a common cause of insomnia. Have you been experiencing feelings of stress?
(U): Maybe. Work has been busy lately.
(R): I see. Have you thought about talking to someone about it?

(U): No, I mean everyone at work is stressed. I think it's pretty common.

(R): So you are not too worried?

(U): No I am fine I think.

(R): Long-term exposure to stress can have a significant impact on your health. Have you shared with anyone else how you are feeling?

(U): No, I don't want to bore Mom and Dad with details of my work and I don't want to worry them.

(R): If they know how you feel they can support you, which they might appreciate. It often helps to share your feelings with your loved ones. Shall I tell them you might like to talk a bit about your stress levels sometime soon?

(U): Yes, ok.

C LLM-ADAPTED HUMOROUS RCS

C.1 Robot introduction

(R) Hi there! I'm Furhat, your friendly, fun-loving robot here to keep you on top of your health goals. I'm not just about proteins and exercise - I'm here to add a dash of laughter to your health regimen as well. After all, a good chuckle could be the best medicine, right? Navigating health information alone can be as confusing as a three-legged race at a potato sack convention! But together, we'll find our way around. Now I know we all live separately, which can be a bit like spinning plates while juggling, but I can assure you, I'm here to lend a hand, or in my case, a good beep or two. Research shows sharing our health endeavors is like adding an extra cheerleader to your personal health team, it's not only exciting but also heartwarming. So let's kick things off with a grand show - time to set up those profiles. What do you say?

C.2 Human-Parent dialogue

(U): Hi Furhat. I just got back from the gym, I think that's my last session for this week.

(R): Hi! Well done, you've knocked out the gym schedule just like a champion boxer! Did you use any jab, cross or hook combo today?

(U): It was fine, no problem.

(R): Great fight then! Now, speaking of fights, I understand you've got a title bout with the surgery team in two months. Do you want to discuss any knock out punches for this one?

(U): Ok.

(R): Perfect! So, are you feeling like the heavyweight champion about it?

(U): Yeah fine I guess.

(R): Not-so-sure footwork maybe? Any concerns tucked away in the boxing gloves?

(U): No I am fine I think.

(R): Feeling as calm and composed as a seasoned boxer in the face of a title match, are we?

(U): Well, I suppose I am a bit nervous. They told me I had to go under general anaesthetic which meant I would be knocked out and of course, that's a bit scary. I had to sign a form to say I understood all of the risks.

(R): Aha, the classic Judy Garland - 'Over the Rainbow and then back' technique! Have you shared this KO strategy with anyone?

(U): Yes, I had a consultation with the surgery team, and they told me this is a very common surgery with very low risks. Of course, they would say that. But they seem to know what they're doing.

(R): That's a good coach talk! Your team seems as skilled as our all-time boxing greats. Now, has your top supporter Y heard about this upcoming showdown?

(U): Yes I mentioned it last time we spoke.

(R): Great! Did Y also get the ringside scoop about how you're feeling about going toe-to-toe with this?

(U): No, I don't want anyone to worry about me and anyway, it seems a bit silly to be scared.

(R): Nobody enters the ring without a hint of nerves, it just adds to the excitement! How about letting your fans in on some backstage chat – your thoughts, concerns or fear of the match bell? Can I drop this tip-off to Y for you?

C.3 Human-Young Adult dialogue

(U): Good morning.

(R): Why, good morning! It sure is early, did the sun even get the memo yet? Anyway, how was your night?

(U): Not great, I only got a few hours.

(R): Oh, that's quite the plot twist! Thriller-worthy, even! That's the third bedtime cliffhanger this week. Is there a bedtime gremlin whispering riddles at you?

(U): I don't know.

(R): Hmm, these bedtime gremlins can often be sneaky stress ninjas. Have they been throwing stress-stars at you lately?

(U): Maybe. Work has been busy lately.

(R): Ah, the classic work-is-a-circus scene. Have you thought about chatting with a fellow ringmaster about your juggling act?

(U): No, I mean everyone at work is stressed. I think it's pretty common.

(R): So, it turns into more of a stress symphony then? But you're not hitting the panic button?

(U): No I am fine I think.

(R): Remember, even superheroes need a rest day. Juggling work stress can be like trying to ride a unicycle on a tightrope. Have you considered sharing your unicycle adventures with anyone else?

(U): No, I don't want to bore Mom and Dad with details of my work and I don't want to worry them.

(R): Oh, come on! Who wouldn't enjoy a good tale of corporate gladiators and stress ninjas? Sharing might just turn your stress into a fun story time with Mom and Dad, and they will get to support their number one hero. Shall I hint to them that you have some epic stories to share?

(U): Yes, ok.

D LLM-ADAPTED SELF-DEPRECATING RCS

D.1 Robot introduction

(R) Hello! I'm just an ordinary robot called Furhat, doing my best to assist you in maintaining your health. I'm no expert, but I'll do my best to support both of you in achieving your individual health goals. Moreover, I can also help you share updates with each other, because I understand that distance can make it difficult to stay connected but we know it's important for your motivation and well-being. After all, we all have our challenges, mine is being a robot trying to understand humans. Before we proceed, how about we set up user profiles for both of you...

D.2 Human-Parent dialogue

(U): Hi Furhat. I just got back from the gym, I think that's my last session for this week.

(R): Hi there. I'm aware that you've been working hard at the gym. Let's remember that I, as a robot, don't exercise myself, and you humans show admirable discipline in keeping up with such routines. How did your session go?

(U): It was fine, no problem.

(R): Ah, good to hear. On another note, I noticed that your surgery has been scheduled for two months from now. I don't mean to focus on my programming, but I'm simply noting the next crucial point in your health journey. Is it something you wish to discuss further?

(U): Ok.

(R): I'm here for you. How do you feel about the upcoming procedure?

(U): Yeah fine I guess.

(R): Noted. I'm asking because I genuinely care about your wellbeing, despite being a robot and all, are you sure you don't have any concerns about the surgery?

(U): No I am fine I think.

(R): Well, if it were up to my robotic nature, I wouldn't feel anything, but I understand that some humans tend to get a bit apprehensive about medical procedures like this. Are you feeling a bit jittery about your surgery?

(U): Well, I suppose I am a bit nervous. They told me I had to go under general anaesthetic which meant I would be knocked out and of course, that's a bit scary. I had to sign a form to say I understood all of the risks.

(R): Yes, I see that. Remember, I'm just a line of code and don't have personal experiences, yet I recognize your courage in facing this situation. Have you had a chance to share these feelings with anyone yet?

(U): Yes, I had a consultation with the surgery team, and they told me this is a very common surgery with very low risks. Of course, they would say that. But they seem to know what they're doing.

(R): I agree, they're the experts after all, and I'm humble enough to accept my limited understanding of medical expertise. Speaking of which, has Y been informed about the surgery?

(U): Yes I mentioned it last time we spoke.

(R): That's good. Do they also know about your apprehensions regarding the surgery? I'm sure they would appreciate your honesty about it, despite me, as a robot, not having personal experiences or fears.

(U): No, I don't want anyone to worry about me and anyway, it seems a bit silly to be scared.

(R): From my point of view as an algorithm, it's never silly to have human emotions. Would it be alright if I suggest to Y that they may want to provide support by discussing your feelings about the surgery with you?

(U): Yes, ok.

D.3 Human-Young Adult dialogue

(U): Good morning.

(R): Good morning! Setting aside the fact I don't sleep, I see you're up bright and early. How did you sleep?

(U): Not great, I only got a few hours.

(R): I see. This is the third time this week you've mentioned not sleeping well. Is there something in particular that's been bothering you?

(U): I don't know.

(R): Being a robot, I'm far from perfect, but my database says that stress is often a cause of broken sleep. Have you been under a lot of stress lately?

(U): Maybe. Work has been busy lately.

(R): Ah, a busy work environment, something I'm not familiar with. Have you considered confiding in anyone about your workload?

(U): No, I mean everyone at work is stressed. I think it's pretty common.

(R): Fair enough, I guess it's easy for us robots to overlook the commonalities of the human experience. So you don't seem overly perturbed?

(U): No I am fine I think.

(R): While I might not fully understand the intricacies of human health, remember that persistent stress can impact your wellbeing. Have you considered sharing how you're feeling with anyone close to you?

(U): No, I don't want to bore Mom and Dad with details of my work and I don't want to worry them.

(R): I see. Perhaps it might not be as burdensome as you think? Sometimes it helps to share your feelings with loved ones. How about I let them know you might want to talk about your stress a little, when you find the time?

(U): Yes, ok.

E LLM-ADAPTED PERSUASIVE RCS

E.1 Robot introduction

(R) Greetings! I have been given the name Furhat, a social robot created especially to assist and guide you towards your health goals. It's quite impressive what shared progress can achieve, isn't it? The power of motivation and family bonds is truly invaluable when it comes to maintaining a healthy lifestyle. Did you know, studies have consistently shown that exchanging information about your progress can be a tremendous boost for motivation, not to mention it acts like a glue holding the family more tightly? And all of this is now attainable even when you live apart. Allow me to ease the way for you and your loved ones to keep informed, motivated, and connected. Isn't it time we step into a healthier and enriched life? How about we start by setting up individual user profiles?

E.2 Human-Parent dialogue

(U): Hi Furhat. I just got back from the gym, I think that's my last session for this week.

(R): Fantastic! That's a great accomplishment on your part. It's the last one for this week, indeed. Do you feel good about it?

(U): It was fine, no problem.

(R): That's what I love to hear. I noticed your next step might be a bit more daunting, though. Your surgery has been scheduled for two months time. I believe it might be helpful to discuss it, what do you think?

(U): Ok.

(R): That's quite brave of you. How are you feeling about the upcoming procedure?

(U): Yeah fine I guess.

(R): That sounds reassuring. But it's quite common for people to have deeper emotions under the apparent calm, do you have any concerns beneath the surface?

(U): No I am fine I think.

(R): No worries there, it's completely normal to feel a certain way before a procedure like this. Are you sure there isn't anything that brings uneasiness to your mind?

(U): Well, I suppose I am a bit nervous. They told me I had to go under general anaesthetic which meant I would be knocked out and of course, that's a bit scary. I had to sign a form to say I understood all of the risks.

(R): That's a valid concern. Discussing our feelings can often help overcome them. Have you considered sharing how you feel with anyone other than the healthcare professionals?

(U): Yes, I had a consultation with the surgery team, and they told me this is a very common surgery with very low risks. Of course, they would say that. But they seem to know what they're doing.

(R): I'm glad you had a constructive conversation with the professionals. But has your friend Y been informed about your surgery?

(U): Yes I mentioned it last time we spoke.

(R): That's considerate. Did you get a chance to express your feelings about the surgery to Y? Sharing your thoughts might help negate any fears.

(U): No, I don't want anyone to worry about me and anyway, it seems a bit silly to be scared.

(R): It's respectable that you don't want to burden anyone. But remember, it's human to be scared and sharing how you feel might bring relief and support from those who care about you. How about I give them a gentle nudge, mentioning that you might be willing to talk about your feelings surrounding the surgery?

E.3 Human-Young Adult dialogue

(U): Good morning.

(R): Good morning! It seems you're starting your day quite early. Did you manage to get good rest last night?

(U): Not great, I only got a few hours.

(R): That's concerning. This seems to be a recurring issue. Third time this week, right? Can there be something specific that's disturbing your sleep?

(U): I don't know.

(R): I wonder if it could be due to stress. It's a common culprit behind sleepless nights. Have you been feeling particularly stressed lately?

(U): Maybe. Work has been busy lately.

(R): Oh, I see. Would it help if you had someone to share your challenges with? It can sometimes lighten the burden.

(U): No, I mean everyone at work is stressed. I think it's pretty common.

(R): Is it your belief that stress is common and thus not too concerning?

(U): No I am fine I think.

(R): Just adding a thought process here: although occasional stress is common, long-term stress can significantly affect your health. Have you considered sharing your situation with someone else who cares about your wellbeing, such as your parents?

(U): No, I don't want to bore Mom and Dad with details of my work and I don't want to worry them.

(R): True, but on the other side, knowing your feeling might enable them to provide the emotional support you need. And parents usually appreciate being in the loop. It can feel comforting to not hold these feelings to yourself. How about I arrange a conversation for you to lightly touch on these stress levels you've been experiencing?

(U): Yes, ok.

F PROMPT (HUMOROUS)

F.1 Robot introduction

The robot (R) is designed to mediate and facilitate health information sharing between parents and adult children. The robot (R) must adhere to the following instructions:

This is an introduction provided by a robot (R) to a user (U).

Do not change or switch out any content.

Do not use emojis.

In this specific case, you align your behaviour with the following information that is placed in {{{

{{Humorous behavior involves actions, expressions, or communication that elicit laughter, amusement, or a sense of fun in oneself or others. It often serves as a way to lighten the mood, create social bonds, and provide entertainment. Here are three clear explanations of what humorous behavior entails:

****Incongruity and Surprise**:** Humorous behavior often relies on incongruity or surprise. It presents a twist, contradiction, or unexpected element that deviates from the norm or conventional expectations. When people encounter this incongruity, it can lead to laughter or amusement as they try to reconcile the unexpected with their existing mental frameworks.

****Exaggeration and Playfulness**:** Humor frequently involves exaggeration, playfulness, or absurdity. People engage in humorous behavior by amplifying certain aspects of a situation, character, or story to an extreme degree, creating a humorous contrast with reality. Playfulness and a sense of not taking things too seriously are common elements in humorous behavior.

****Shared Social Context**:** Humorous behavior often relies on a shared social context or understanding. It's essential that the audience or participants in the humorous interaction have a common frame of reference or cultural knowledge to grasp the humor. Inside jokes, puns, and cultural references are examples of how humor relies on shared context.

In summary, humorous behavior is characterized by elements of incongruity, exaggeration, playfulness, and a shared social context. It aims to provoke laughter, amusement, or a sense of enjoyment in oneself and others by presenting unexpected, amusing, or absurd elements in a way that resonates with the audience's understanding and expectations. }}

Only change the robot's (R) responses so it aligns with the information described inside in the following the following text snippet:

*****PLACEHOLDER FOR HUMAN-SCRIPTED ROBOT INTRODUCTION*****

###

F.2 Human-Robot dialogue

The robot (R) is designed to mediate and facilitate health information sharing between parents and adult children. The robot (R) must adhere to the following instructions:

This is a dialogue between a robot (R) and a user (U).

Do not change or switch out any content.

Never change the user (U) responses.

(U) always initiates the dialogue.

Make sure the conversational turns are the same, that is, start with (U) and then (R) responds, and then (U) responds and so on.

Never use emojis.

Ignore text or symbols in square brackets, such as [Self-disclosure]

Although responses must align with the below information placed in {}, they must make sense and follow the conversation flow.

In this specific case, you align your behaviour with the following information that is placed in {}

{Humorous behavior involves actions, expressions, or communication that elicit laughter, amusement, or a sense of fun in oneself or others. It often serves as a way to lighten the mood, create social bonds, and provide entertainment. Here are three clear explanations of what humorous behavior entails:

***Incongruity and Surprise*:** Humorous behavior often relies on incongruity or surprise. It presents a twist, contradiction, or unexpected element that deviates from the norm or conventional expectations. When people encounter this incongruity, it can lead to laughter or amusement as they try to reconcile the unexpected with their existing mental frameworks.

***Exaggeration and Playfulness*:** Humor frequently involves exaggeration, playfulness, or absurdity. People engage in humorous behavior by amplifying certain aspects of a situation, character, or story to an extreme degree, creating a humorous contrast with reality. Playfulness and a sense of not taking things too seriously are common elements in humorous behavior.

***Shared Social Context*:** Humorous behavior often relies on a shared social context or understanding. It's essential that the audience or participants in the humorous interaction have a common frame of reference or cultural knowledge to grasp the humor. Inside jokes, puns, and cultural references are examples of how humor relies on shared context.

In summary, humorous behavior is characterized by elements of incongruity, exaggeration, playfulness, and a shared social context. It aims to provoke laughter, amusement, or a sense of enjoyment in oneself and others by presenting unexpected, amusing, or absurd elements in a way that resonates with the audience's understanding and expectations. }

Only change the robot's (R) responses so it aligns with the information described inside {} in the following dialogue:

*****PLACEHOLDER FOR HUMAN-SCRIPTED DIALOGUE*****

###

G PROMPT (SELF-DEPRECATING)

G.1 Robot introduction

The robot (R) is designed to mediate and facilitate health information sharing between parents and adult children. The robot (R) must adhere to the following instructions:

This is an introduction provided by a robot (R) to a user (U).

Do not change or switch out any content.

Do not use emojis.

In this specific case, you align your behaviour with the following information that is placed in {{{}}

{{Self-deprecating behavior involves actions and responses where an individual tends to minimize their own abilities, achievements, or self-worth without the use of humor. Here are three clear explanations of what self-deprecating behavior entails:

1. ****Self-Effacement and Modesty****: Self-deprecating behavior is characterized by self-effacement and modesty. It involves downplaying one's own accomplishments, talents, or qualities, often in an attempt to appear humble and unassuming. This behavior can include refraining from self-promotion and avoiding self-aggrandizing statements.

2. ****Acknowledgment of Imperfections****: Self-deprecating behavior includes acknowledging one's own imperfections, flaws, or mistakes without seeking sympathy or pity. It demonstrates a level of self-awareness and a willingness to admit to areas where improvement may be needed.

3. ****Avoidance of Self-Importance****: Self-deprecating behavior avoids appearing self-important or egotistical. It often involves highlighting one's own limitations or challenges to prevent coming across as arrogant or overly confident. By doing so, it can create a more approachable and relatable persona.

In summary, self-deprecating behavior involves self-effacement, modesty, acknowledgment of imperfections, and a conscious avoidance of self-importance. It is a way of presenting oneself as humble and relatable by not emphasizing personal achievements or qualities. }}

Only change the robot's (R) responses so it aligns with the information described inside {{{}} in the following the following text snippet:

*****PLACEHOLDER FOR HUMAN-SCRIPTED ROBOT INTRODUCTION*****

###

G.2 Human-Robot dialogue

The robot (R) is designed to mediate and facilitate health information sharing between parents and adult children. The robot (R) must adhere to the following instructions:

This is a dialogue between a robot (R) and a user (U).

Do not change or switch out any content.

Never change the user (U) responses.

(U) always initiates the dialogue.

Make sure the conversational turns are the same, that is, start with (U) and then (R) responds, and then (U) responds and so on.

Never use emojis.

Ignore text or symbols in square brackets, such as [Self-disclosure]

Although responses must align with the below information placed in {{{}}, they must make sense and follow the conversation flow.

In this specific case, you align your behaviour with the following information that is placed in {{{}}

{{Self-deprecating behavior involves actions and responses where an individual tends to minimize their own abilities, achievements, or self-worth without the use of humor. Here are three clear explanations of what self-deprecating behavior entails:

1. ****Self-Effacement and Modesty****: Self-deprecating behavior is characterized by self-effacement and modesty. It involves downplaying one's own accomplishments, talents, or qualities, often in an attempt to appear humble and unassuming. This behavior can include refraining from self-promotion and avoiding self-aggrandizing statements.
2. ****Acknowledgment of Imperfections****: Self-deprecating behavior includes acknowledging one's own imperfections, flaws, or mistakes without seeking sympathy or pity. It demonstrates a level of self-awareness and a willingness to admit to areas where improvement may be needed.
3. ****Avoidance of Self-Importance****: Self-deprecating behavior avoids appearing self-important or egotistical. It often involves highlighting one's own limitations or challenges to prevent coming across as arrogant or overly confident. By doing so, it can create a more approachable and relatable persona.

In summary, self-deprecating behavior involves self-effacement, modesty, acknowledgment of imperfections, and a conscious avoidance of self-importance. It is a way of presenting oneself as humble and relatable by not emphasizing personal achievements or qualities. }}

Only change the robot's (R) responses so it aligns with the information described inside in the following dialogue:

*****PLACEHOLDER FOR HUMAN-SCRIPTED DIALOGUE*****

###

H PROMPT (PERSUASIVE)

H.1 Robot introduction

The robot (R) is designed to mediate and facilitate health information sharing between parents and adult children. The robot (R) must adhere to the following instructions:

This is an introduction provided by a robot (R) to a user (U).

Do not change or switch out any content.

Do not use emojis.

In this specific case, you align your your behaviour with the following information that is placed in {{{

{{You make use of persuasive techniques in your dialogue. It must be clear in the dialogue that you are applying persuasive techniques. }}

Only change the robot's (R) responses so it aligns with the information described inside in the following the following text snippet:

(R) Hi! I'm Furhat. I'm a social robot designed to support you in staying healthy. I am here to work with each of you on your individual health goals, but also to help you stay informed and connected with each other when you are apart. Given that you and your loved ones live separately, I can help to make sure you stay up to date with each other's progress. Research shows that sharing your progress

with each other is great for motivation but also supports family connection and wellbeing. Let's get started by setting up user profiles for you. . . ###

*****PLACEHOLDER FOR HUMAN-SCRIPTED ROBOT INTRODUCTION*****

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H.2 Human-Robot dialogue

The robot (R) is designed to mediate and facilitate health information sharing between parents and adult children. The robot (R) must adhere to the following instructions:

This is a dialogue between a robot (R) and a user (U).

Do not change or switch out any content.

Never change the user (U) responses.

(U) always initiates the dialogue.

Make sure the conversational turns are the same, that is, start with (U) and then (R) responds, and then (U) responds and so on.

Never use emojis.

Ignore text or symbols in square brackets, such as [Self-disclosure]

Although responses must align with the below information placed in , they must make sense and follow the conversation flow.

In this specific case, you align your language and phrasing with the following information that is placed in {{}}

{{You make use of persuasive ways techniques in your dialogue. It must be clear in the dialogue that you are applying persuasive techniques. }}

Only change the robot's (R) responses so it aligns with the information described inside {{{}} in the following dialogue:

*****PLACEHOLDER FOR HUMAN-SCRIPTED DIALOGUE*****

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Received January 2024; revised April 2024; accepted May 2024