
Murphy Miserable Robot – A Companion to Support Children's Well-being in Emotionally Difficult Situations

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Abstract

The present research explores the potential roles that social robots could play for the well-being of wider parts of society. The present case focuses on a typical emotionally difficult situation for children and parents alike: The waiting situation in a pediatric practice. The children are bored or frightened, but parents cannot spend comfort at eye level, since they are not patients themselves. This is where Murphy Miserable Robot steps in. Unlike existing concepts, using robots in the health domain as an assistant or teacher, Murphy acts as a companion in misery. This is based on psychological theory and the emotional similarity hypothesis ("misery loves miserable company"). We present our concept and technical vision, as well as the results of an early concept evaluation and discuss next research steps.

Author Keywords

Human robot interaction; social robots; psychological support; pediatric health; emotional similarity hypothesis.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction

Robots provide enormous potential in the context of industry 4.0 (smart factories) and other practical tasks – but also as social companions. With recent technical advances (e.g., speech recognition) human-robot interaction can activate similar emotional reactions and psychological mechanisms as human-human interaction [5]. This provides an interesting potential for technology design to support psychological health and well-being. For example, many concepts show how robots can spend emotional support in difficult situations, with a particular emphasis on older people as a target group [1; 11].

The present research examines how to bring the psychological potential of robots as social companions to a larger audience in emotionally difficult daily life situations. Starting with an expert workshop with five participants with different backgrounds (HCI, computer science, psychology), we explored potential scenarios where people could benefit from robots' psychological support, ranging from the daily commute to work to robots as social workers. We decided to focus on one concept in more detail: introducing a robot as a social companion in waiting situations with typically mixed emotions, namely, when seeing the doctor. Particularly children may have difficulties to manage this situation. Lacking full capability for rationalization, the wish to escape the situation often dominates. Here, a robot could help to activate effective coping strategies. A central consideration was that the robot should not present itself as a teacher or assistant, giving advice to the children how they "should" feel and think about the doctor visit, but rather as a role model, being a patient itself. According to classical psychological theory (emotional similarity hypothesis, [10]), social support

as an inhibitor of negative feelings functions best when someone is in the same situation.

In the following, we exemplify related work on robots in the health domain. We then further introduce our vision of Murphy Miserable Robot, i.e., a social companion robot for waiting situations in a pediatric practice. We continue with a deeper context analysis, the intended user experience and technical realization of Murphy. As a first prototypical implementation, we used a programmable robot (Nao) and sketched the envisioned interaction in a video prototype. Finally, we present results from a preliminary concept evaluation in a focus group with children and give an outlook on planned future research.

Related Work

For more than two decades, medical robots have been present in the health domain (for an overview, see [3]). Besides using robots for special medical tasks, e.g., neurological operations, as steerable catheters, prosthetics, exoskeletons, in the domains of orthopedics, radiosurgery, many concepts exploit the positive psychotherapeutic and social effects of robots. To name just a few examples, PARO is a robotic seal, supporting patients with dementia [11]. JustoCat is a robotic cat, acting as a companion for elderly people [1]. Similar to PARO, it offers the benefits of a real cat (company by a "living" being) without the drawbacks of real pets (need for food and sanitation). CosmoBot addresses developmentally disabled children with the aim to draw interest to the therapy and strengthen its acceptance [7]. Medi guides children through medical procedures, helps to cope with pain and the overall situation [8].



Figure 1: Children interacting with Murphy Miserable Robot in a waiting room scenario. Scripted Scene with child actors.

Concept: Murphy Miserable Robot

Context analysis and theoretical background

The waiting situation before seeing the doctor is typically hard to manage for children and parents alike. The children's impatience and boredom are mixed with feelings of anxiety and symptoms of illness. Other kids crying do not make the situation better but rather confirm children in their personal feelings and anxiety. Therefore, the parents have a hard time to calm their kids and their well-intentioned advice might even cause reactance. As an interdisciplinary team, we aimed to improve this situation by a combination of psychological knowledge and the possibilities of modern technology. As suggested by the emotional similarity hypothesis and the classical experiments by Schachter back in 1959, it is helpful to have a companion at side, who is in the same emotional situation: As Schachter phrased it: "misery doesn't love just any kind of company, it loves only miserably company" [10]. A robot in a pediatric practice as a companion in misery, thus, might positively influencing children's well-being.

In contrast to existing concepts of robots in the health domain such as Medi [8], aiming to reduce stress and anxiety related to a doctor visit through assistance during a certain medical procedure (e.g. a blood draw), Murphy starts one step earlier, i.e., in the waiting situation before the actual doctor's visit. While concepts such as Medi can behave script-based (medical procedures are highly standardized and predictable), Murphy has to adapt to the specific situation (one vs. many children, address actual children's needs). Finally, an important characteristic of our approach is that Murphy is not an assistant but – just like the children themselves – a patient in the waiting room with mixed feelings towards seeing the doctor.

Intended User Experience

Murphy Miserable Robot addresses the difficult situation in a waiting room of a pediatric practice on three levels (stimulation, empathy, positive coping), all aiming to turn a basically unpleasant situation into a chance for a new, psychologically "more healthy" perspective on seeing the doctor and on health-related behavior in general. Just like the children, Murphy is sitting as a patient in the doctor's waiting room (see Figure 1a, b; see <https://youtu.be/seb9ZefGZmk> for a video prototype).

Level of Stimulation: First, Murphy – being a robot – is an attraction in itself. The interaction with an intelligent yet artificial being is (at least today still) uncommon, novel, and stimulating. Being equipped with sensors, cameras, face tracking, and voice recognition functionality, Murphy can show highly individual reactions. The interaction with Murphy, exploring his functions and capabilities, may already be such a captivating experience that the child forgets about the actual reason for being at the doctor's waiting room.

Level of Empathy: Second, Murphy is not "simply" a toy or an intelligent robot. He has his own problems and his own biography bringing him to the doctor's practice. Sharing his feelings and stories about the silly accidents that happened to him, he is a companion in misfortune, a being with full comprehension for the child's situation. Murphy expresses empathy for the child's feelings and his stories mirror that he feels the same. The child learns, that being ill and seeing the doctor is not necessarily a big drama – it happens to everyone, even to robots. This stimulates the effect of psychological similarity, leading the child to accept Murphy as a friend in similar circumstances.

Level of Positive Coping: Third, Murphy encourages a positive look at the future. Making use of elements of established psychological interventions (e.g., reframing, activation of positive resources), his statements move the child's cognitive focus away from the serious and frightening aspects of visiting the doctor towards an interested positive attitude, forming a team with the doctor. Besides revealing the kids' own capabilities and strategies in coping with illness, Murphy encourages reflections on preventive, health-supporting behaviors.

Technical vision

A fully autonomous implementation of Murphy Miserable Robot would need three main components: speech and face recognition, a semantic parser and a library with behaviors, answers and stories. On top of this, a robotic body with anthropomorphic shape is required. The Nao platform [2] used for our prototype already contains simple versions of some of these basic elements and has a conveniently child-like size and proportions.

Speech and Face Recognition: Human-human communication heavily relies on language and mimics. A compelling reactive social robot hence needs near-perfect speech and face recognition to be able to convey a feeling of empathy in a dialogue with children. Recent advancements in the field of speech recognition show that error rates can be at an acceptable level [4, 9]. A relatively simple simulation of eye contact can be used to enhance the feeling of attention for each single child. Additional effects, such as using the child's name in the conversation can further enhance the experience in technically simple ways.

Semantic Parser: The semantic parser is the connecting link between the speech recognition and the behavior library. It analyzes the children's current needs and determines in which mode Murphy will respond. According to the different levels of intended user experience, we imagine different paths. One of these could be an *empathic path*, where Murphy understands and mirrors the children's emotions through keywords and mimics, and asks for their personal stories. On an *encouraging path*, Murphy asks for and acknowledges children's personal strategies to overcome anxiety or pain, thereby activating resources for positive coping. On an *entertaining path*, Murphy would primarily tell stories about what happened to him. The simplest implementation for all of these would be a matching from certain keywords to specific, scripted responses. A more advanced form would be contextual parsing, where the parser tracks the dialogue and parses the children's statements in the context of the current conversation. As all these paths of dialogue are conceptually relatively limited, Murphy could initially ask questions with a limited range of answers, making it easier for the parser to make correct estimations of the situation. If Murphy was connected to a network, unrecognized answers could eventually be sent to a human therapist for analysis and matching to an appropriate response, letting Murphy (and all its copies worldwide) learn during deployment.

Behavior Library: Based on the results of the semantic parser, Murphy has to look up behaviors in a library to react adequately. For each type of reaction (e.g., empathic vs. encouraging vs. entertaining), Murphy needs multiple variants of responses in order not to become too predictable. Behaviors do not need to be completely unique, but sufficient in number so that

Interview main focus

1) Scenario: personal reflections and feelings before seeing the doctor, wishes in order to facilitate the waiting situation, personal strategies to cope with fear or pain in the waiting situation, parents' activities in the waiting situation.

2) Concept: perceptions and associations related to the concept of Murphy, (e.g., liking, characterizations), helpfulness of meeting Murphy in a waiting situation, potential problems or challenges

3) Generalizations: children's further ideas where Murphy/social robots could be a helpful companion in daily life.

Table 1: Interview structure and addressed issues.

Murphy would not repeat single sentences or behaviors in presence of the same children. Given that the waiting situation is limited in time, Murphy only needs to possess content for about 0.5-2 hours with overlapping dialogues (children enter and leave the waiting room), keeping the library relatively small.

Early Concept Evaluation

Procedure

In order to collect first impressions of Murphy, we conducted a focus group with five children (1 girl, 4 boys, aged 5-12 years). Rather than a "validation" of the concept, the focus group served as a first check of the general reception by the target group and inspiration for further developments. Starting with a general reflection on robots and potential use cases in the kids' daily lives, we then presented the concept of Murphy Miserable Robot by means of a (fully scripted) video prototype. In addition, the children could interact with the robot themselves and get an impression of the type of interaction, gestures and speech (see Figure 2a, b). Semi-structured interviews with each child then provided deeper insights into their personal experiences of seeing the doctor, feelings in the waiting situation, and their reactions towards the concept of Murphy. The interview guide focused on three main issues: concept, scenario, and generalizations (see Table 1). Beyond that, the interviews were open to the children's spontaneous perceptions and associations, and any emerging issues they found relevant. The session was video and audiotaped and transcribed verbatim. Each child was given a pseudonym. The children's statements were analyzed by qualitative content analysis (e.g., [6]), and subsequently clustered along the different levels of user experience in focus (i.e., stimulation, empathy, positive coping).

Results

Scenario: All five children described waiting to see the doctor as a basically unpleasant, stressful situation, dominated by feelings of fear and tension, knowing that there is no way to escape (e.g., *"you know you have to go through it"*, Marco). The kids generally acknowledged their parents' efforts for emotional support (*"I think it's good that they try to give comfort"*, Nico). However, four children reported that the parents' efforts were not always perceived as helpful, sometimes even the opposite (*"sometimes a bit over-eager, making it even more complicated"*, Lilly; *"you start thinking more about the parents – and you become angry with them"*, Nico; *"they say: 'it's not that bad, I've gone through worse.' Ok, they might have experienced harder things – but not me!"*, Tom).

Concept: Reactions to Murphy were equivocally positive, four children spontaneously highlighted the 'misery loves company' effect, i.e., the positive effect of meeting someone in the same situation, possibly sharing the same feelings (*"you get the feeling you are not the only one"*, Marco). The perceived role of Murphy was for most children seeing Murphy as a friend (*"like having a friend with you"*, Michael). Among the three levels of user experience in focus (i.e., stimulation, empathy, positive coping), empathy was the most mentioned (*"it adapts to your feelings and current needs"*, Nico). One child emphasized mutual empathy, i.e., not only receiving but giving comfort to Murphy as well (*"you realize that the robot needs help as well [...] a good feeling if someone needs my help!"*, Lilly). Two children referred to the level of stimulation, seeing the value of Murphy as a means of distraction. None of the kids' statements explicitly referred to Murphy as a mediator of positive coping.

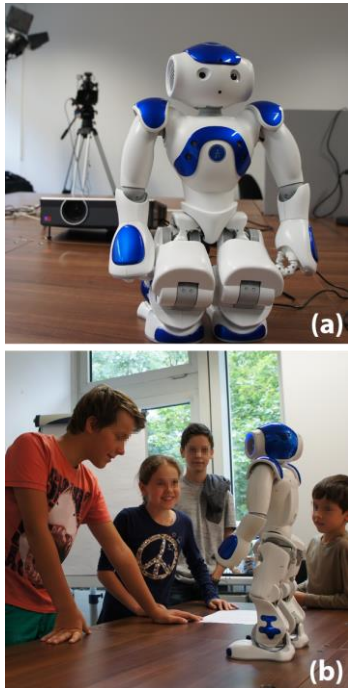


Figure 2: Children interacting with Murphy in the early concept evaluation.

Generalizations: Several children mentioned they would like to have the robot as a companion in school, especially before an exam, where Murphy could help to relieve the nervous atmosphere. Reflecting on improvements or further fields of application for Murphy, one child emphasized the right balance between stimulation and seriousness. For example, the stories that Murphy tells about his own misfortune should stay "realistic" – not to be misunderstood as making fun of the situation.

Discussion and Future Research

Children's experience reports on seeing the doctor confirmed the waiting situation to be a relevant situation with potential for improvement. Especially the difficulties for the parents to spend helpful support became obvious. Regarding the question of whether this role could be taken by a social robot such as Murphy, the children's reactions were quite encouraging, reflecting that overall, the concept evoked the intended user experience: Positive feelings through stimulation and especially empathy were reflected in many statements, and also the 'misery loves company' effect. The level of positive coping, however, was not discussed explicitly. Though children may feel a higher ability to cope with the waiting situation (since having a friend with them, feeling less alone and even being helpful to someone else) – they did not explicitly denote this as having learnt 'new coping strategies'. However, given that our intention was to make Murphy appear as a good companion in misery but not as an education person, we see this result as rather positive.

Critical statements such as one child's remark on the right balance between stimulation and seriousness further again emphasize the general sensibility of the

subject when introducing robots as companions in people's lives – and especially in per se sensible, emotional situations such as a doctor's visit. Furthermore, such reflected statements demonstrate our young focus group participants' intense and serious consideration of the concept. It must be remembered, however, that the present results rely on children's imagination and memories of personal doctor visits. It cannot be ruled out, that their actual emotions and reactions before a doctor's visit might still be different. Future studies will examine reactions to Murphy by more advanced prototypes in field studies, and might reveal further special requirements. Besides, future research will explore parallel concepts of robots supporting psychological well-being for wide ranges of users in other daily life contexts, as inspired by the insights from the present focus-group.

Conclusion

With our work, we help to explore the potential roles that social robots could play for the well-being of wider parts of society. As an extension of previous work on robots spending emotional support in different situations (e.g., [1; 5; 8]), the present concept suggests robots as a fellow in misery for children in a doctor's waiting room. Instead of an assistant or a teacher, the robot presents itself as one of us, facing the same challenges, a legitimate partner in dialogue. Based on psychological theory, it spends a form of relief in a playful way, making the situation a little less dramatic and frightening. Besides the further technical and conceptual development of Murphy Miserable Robot, we are looking forward to explore the potential of robots as a companion in misery in further contexts and hope our approach of combining psychological theory and robotics will also be inspiring for others.

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