Use of seal-like robot PARO in sensory group therapy for older adults with dementia

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***Abstract*—This work presents the preliminary results of an eight-week study of the seal-like robot PARO being used in a sensory therapy activity in a local nursing home. Participants were older adults with different levels of cognitive impairment,. We analyzed participant behaviors in video recorded during the weekly interactions between older adults, a therapist, and PARO. We found that PARO's continued use led to a steady increase in physical interaction between older adults and the robot and an increasing willingness among participants to interact with it.**

Keywords-PARO, socially assistive robot, robot therapy, dementia, older adults

I. INTRODUCTION

PARO is a robot designed to resemble a baby seal and used as a companion in private and nursing homes. Wada et al. have studied PARO not only as a companion robot but also as a therapeutic tool in interaction with older adults. Their findings suggest that interaction with PARO not only generates social interaction among the residents of the eldercare institution under study [1], but also positively affects the older adults' emotional state [2]. PARO is widely used and studied in Japan and has been successfully implemented in different types of eldercare facilities there. Few studies explore the use of PARO in the United States, where PARO became commercially available in in 2009. Turkle [3] assessed PARO as a social companion in one-on-one interactions with residents in a nursing home. Kidd et al. [4] conducted a study to investigate social interaction in the nursing home and verified the effect of increasing social activity in a public space. There is not much discussion related to use of PARO for therapeutic purposes in the US, even though local nursing institutions are adopting the robot. In this paper, we analyze the practice of using PARO as a tool for sensory therapy with older adults in the US.

Multi-sensory behavior therapy (MSBT) is widely used for people with dementia. The method uses controlled sensory stimulation in a non-threatening environment to create a whole sensory experience. Stimulation of the visual, auditory, olfactory, and tactile systems helps keep the sensory systems of the people with mental impairment active [5]. In this work, we adapted the concept of MSBT to the use of PARO as a multimodal sensory stimulus in a group activity through the sounds and movements it makes, and is covered with soft hair. By observing group activities, we investigated how PARO affects the participants' interactions with other people, the environment, and the robot itself, as well as how the therapy group uses PARO. We examined the group activity to explore behavioral patterns in the interaction and the narratives users apply to make sense of PARO. Our study contributes suggestions for using PARO in therapeutic contexts.

II. NURSING HOME STUDY

An eight weeks obervational study was conducted in a nursing home in Bloomington, Indiana with 10 older adults over 65 years of age, displaying mild to severe cognitive impairment. The nursing home has regular weekly MSBT group. In our study, a participating therapists gathered older adults in a small group of 4-7 people and led the activity by showing PARO to the residents. Due to their cognitive impairment, the residents tended to be quite and passive and, sometimes, even to fall asleep during the sessions. The therapist encouraged them to interact with PARO by observing their facial expressions and physical reactions. The therapists then passed PARO around to the participants based on their perceived emotional status and interest in the robot.

We performed two pilot sessions beforehand, which allowed the therapists to get used to the robot, and also helped us adjust our original research design to capture the relevant aspects of the ensuing interactions. Since the activity is open and flexible, the group size varied from five to seven people during the eight weeks. Participants did not attend all therapy sessions, and some participants had to leave the activity room early due to personal reasons on occasion.

At the beginning of the study, we obtained the participants' consent and demographic data. In each weekly session, we observed and took notes of the interactions in the activity time and also videotaped the interactions. Onsite, researchers coded interactions among Paro, participants, and therapists using a predefined coding schema. Before and after the eight-week study, we interviewed the two participating therapists, asking them about their perceptions and reflections of PARO's use in therapy. This helped us develop suggestions for the successful implementation of PARO in therapeutic contexts.

III. RESULTS

To explore the effect of using PARO for sensory therapy, we analyzed the behaviors of participants in videos of the activity as well as interviews with participating therapists.

A. *Behavioral coding*

The first stage of behavioral coding includes three categories corresponding to physical, visual and verbal interaction with PARO. In this paper, we only present the analysis of physical interaction. We defined the physical interaction as having active physical contact with PARO, such as kissing and touching. Unintentional physical contact is not coded. Petting and hugging are showed most frequently in the videos, occupying 86.71% of the total interaction time The therapist sometimes gave participants a brush for PARO's hair, so brushing was also coded. Three participants kissed PARO in the interaction, and those that did only did so a few times.

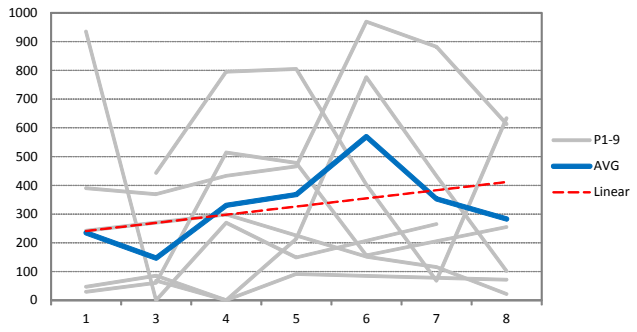

Figure 1. The total time of physical interaction with PARO (sec.)

Our analysis of the total physical interaction time of each participant shows a general increase in the time participants spent interacting with PARO over the eight weeks of the study (Fig. 1). Because the number of participants in the sessions varied, we calculated the average interaction time per person for each session. The average physical interaction time increases throughout the first six sessions, and slightly decreases in the last two weeks, but the linear regression line in Fig.1 shows a general increasing trend. This indicates participants chose to spend more time interacting with the robot as the study progressed.

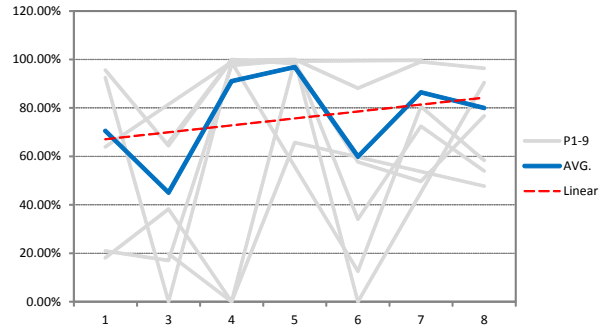

Figure 2. The percntage of time spent physically interacting with PARO in the course of an interaction section

In the sessions, the therapist passed PARO to participants one by one; only individuals or small groups of two or three people interacted with PARO at a time, which we defined as an interaction section. We coded the start and end point of the section and analyzed the ratio of physical interactions in it. The data varies among participants. Half of the participants and the average show a general increase in the physical interaction ratio (Fig. 2). This trend supports our previous conclusion regarding the increase in participants' willingness to physically interact with PARO throughout the study.

B. *Interviews with therapists*

During the sessions, it was not possible to have all the participants interact with PARO at the same time. PARO was passed among the participants and the therapist encouraged one-on-one our small group interaction with PARO. As the study went on, the participants seemed more active and interactive, so therapists felt PARO is a good social mediator. They also used PARO in individual interaction with older adults outside the activity therapy group when they felt it would be calming for distraught residents.and for distracting the residents during daily routines which made them anxious. Based on their experience of using PARO for two months, they felt that the robot is more appropriate for one-by-one interaction rather than larger group activities.

IV. DISUCSSION

Based on our preliminary findings, when used in the context of group sensory therapy, PARO caused an increasing amount of physical activity through the course of the study. Participants' increasing willingness to interact with PARO, instead of being passive, is a sign of success in terms of sensory therapy. In our following analysis, by coding verbal and visual interaction, we will look for further evidence of potential positive effects on interaction among participants and of participants with their environment.

In our study and in interviews with the therapists, we also found that it might be more efficient to use PARO in one-on-one interactions or in small groups of less than three people. These suggestions can guide the design of therapeutic interactions using PARO with people with dementia.

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