Research Note / Note de recherche

Social Commitment Robots and Dementia*

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RÉSUMÉ

En 2010, 500 000 Canadiens étaient atteint d'une maladie liée à une démence. On estime que le nombre des malades va doubler en environ 25 ans. Pour cause de ce groupe démographique croissant, la démence de plus en plus (le plus souvent causée par la maladie d'Alzheimer) exercera un impact significatif sur notre communauté vieillissante et ses soignants. La démence est associée à des comportements difficiles tels que l'agitation, l'errance et l'agression. Les prestataires de soins doivent trouver des stratégies novatrices afin de faciliter la qualité de vie pour cette population; d'ailleurs, de telles stratégies doivent valoriser l'individu. Les robots socialement engagés – conçu spécifiquement à la communication et aux fins thérapeutiques – fournir un moyen d'atteindre cet objectif. Cet article décrit une étude dans laquelle Paro (un bébé phoque robotique) a été utilisé dans le cadre d'un programme de formation d'été pour étudiants. Les conclusions préliminaires suggèrent que l'integration des robots socialement engagés peuvent se révéler comme utiles cliniquement en milieux de soins de longue durée.

ABSTRACT

In 2010, approximately 500,000 Canadians suffered from a dementia-related illness. The number of sufferers is estimated to double in about 25 years. Due to this growing demographic, dementia (most frequently caused by Alzheimer's disease) will increasingly have a significant impact on our aging community and their caregivers. Dementia is associated with challenging behaviours such as agitation, wandering, and aggression. Care providers must find innovative strategies that facilitate the quality of life for this population; moreover, such strategies must value the individual person. Social commitment robots – designed specifically with communication and therapeutic purposes – provide one means towards attaining this goal. This paper describes a study in which Paro (a robotic baby harp seal) was used as part of a summer training program for students. Preliminary conclusions suggest that the integration of social commitment robots may be clinically valuable for older, agitated persons living with dementia in long-term care settings.

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According to a study published by the Canadian Study of Health and Aging Working Group (1994), 8 per cent of Canadians aged 65 and over had dementia in 1991, the majority of whom had Alzheimer's disease (AD). The absolute numbers could more than double by 2021 and could triple by 2031. This study also found that 53 per cent of Canadians knew someone with AD, while 25 per cent of Canadians had a family member with

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AD. A more recent study conducted by the Alzheimer Society of Canada (2010) reports comparable demographic changes, and projecting that the rate of dementia in Canadians will increase substantially in the next 20 years. Due to a growing senior demographic, dementia – and AD specifically – will become one of the most significant conditions to impact our aging community and their caregivers. Dementia is associated with challenging behaviours such as agitation, wandering, and aggression; consequently, care providers must find innovative strategies to facilitate the quality of life for this population while continuing to value the person.

Valuing the Person

Personhood is important to the study of dementia, as explored through the seminal work of Kitwood (1997) and others (Cowdell, 2006; Hellstrom, Nolan, & Lundh, 2005; Touhy, 2004). Kitwood challenged the practice of seeing individuals with dementia primarily through a biomedical lens where the illness comes first and explored the ways in which persons with dementia remain persons first, with dementia second. Personhood is a principle which suggests that even those with extreme limitations ought to be viewed as whole persons experiencing contentment, self-worth, self-esteem, purposefulness, peacefulness, and spirituality (Coker, 1998; Sikma, 2006; Touhy, 2004; Werezak & Morgan, 2003). Care that values the person extends beyond the disease and behaviours exhibited by individuals with dementia.

Similarly, Sabat (2005) has declared that researchers and others must listen to the voices of those with dementia. He observed that a dementia diagnosis may result in a person's being viewed as incapacitated, thus reducing their personhood. Numeric test results based on measuring cognitive capacity cannot represent the person with dementia as a whole person, and Sabat noted that persons with dementia could be invited to participate in research so that their daily lived experience and the meaning of their lives is better understood. Keady, Gilliard, Evers, and Milton (1999) had earlier suggested that the real task of establishing personhood is developing the capacity for people with dementia to be seen as contributors to relationships.

Other research, by Roger (2006a, 2006b, 2007a, 2007b, 2010) and by Roger and Medved (2010), has yielded data that confirm the awareness and abilities of persons living with dementia. These persons can experience insight into their losses and can be cognizant of what lies ahead. Personhood has thus come to frame an internationally accepted approach to caring for those with dementia.

The remainder of this article describes the use of technology, specifically, a tabletop robotic harp seal, in support of caregivers and the caring of people with dementia through this lens of personhood. Social commitment robots, which are designed specifically with communication and therapeutic purposes in mind, provide one means towards the attainment of this goal.

The Robot

Takanori Shibata, a leader in the field of robotics since the early 1990s, has developed several versions of a small table-top robot resembling a Canadian baby harp seal which he named "Paro" (an abbreviation of the Japanese term for "personal robot"). Shibata refers to Paro as a socially interactive robot or a mental commitment robot, intended for pleasure or relaxation purposes. Terms such as "social commitment robot" are used by Shibata and team to inspire the concept of a person's having a social relationship with the robot. Paro is modeled on a three-week-old harp seal. Approximately 2.8 kg in weight and 45 cm long, it can be easily held in a subject's lap or placed on a table. Paro is covered in white, antibacterial, synthetic fur. The harp seal was chosen as a model since it is a non-familiar animal, and subjects involved with Paro would be less likely to have preconceived expectations of how a baby seal behaves as compared to other domesticated pets like dogs or cats. The simple shape of the seal also lends itself to a realistic design.

Paro responds to light, touch, and sound due to a ubiquitous surface tactile sensor created by Shibata. This airbag-like tactile sensor is inserted between the fur and the hard skeleton frame of the seal, giving the device a soft, natural feel. Paro has four senses: sight, audition (i.e., sound source direction detection and speech recognition), balance, and touch (Shibata, 2004).

Paro has motorized moving parts that allow it to exhibit vertical and horizontal neck movements, front and rear flipper movements, upper and lower eyelid movements for facial expression, and rotation of the eyes. An installed battery allows the device to be used for 1.5 hours, but it can also be operated by inserting a charger which looks like a pacifier.

Paro looks, feels, and acts lifelike. It can move autonomously and appears to learn behaviour and display emotions. Paro can display three types of behaviour: proactive, reactive, and physiological. Its proactive behaviours include poses and movement which mimic real seal behaviour. Paro's programming varies the speed and frequency of its movement. For example, if stroked, Paro responds by moving its head and flippers, and vocalizing. Reactive behaviours include responding to sudden stimulation. If Paro hears a loud sound or its name, it will look in the direction from where the sound originated. Paro can also recognize light and dark. These types of reactive patterns make Paro appear to have unconscious behaviour. Paro's physiological behaviour is based on a circadian rhythm:

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Paro is active during the day and sleeps at night (Wada, Shibata, Saito, & Tanie, 2004).

Shibata has tested Paro with two populations: autistic children, and nursing home residents living with dementia. Wada and colleagues have primarily explored changes in the moods and social interactions of persons living with dementia after their exposure to Paro (Wada & Shibata, 2007; Wada, Shibata, Saito, & Tanie, 2003, Wada et al., 2004; Wada, Shibata, Sakamoto, & Tanie, 2005). They have also explored nursing home staff perceptions of changes in the quality of life in persons living with dementia, but have not explored how staff members themselves view the use of Paro in relation to perceived benefits, drawbacks, and concerns. Wada et al. (2005) noted that, whereas persons living with dementia tend to lose interest in interacting with a range of robotic animals, elderly people in their studies did not appear to lose interest as quickly when interacting with the Paro robot resembling a baby harp seal, an animal unfamiliar to most Japanese people. Wada and Shibata (2007) also suggested that other social commitment robots might not be as successful as Paro because they are not specifically designed for therapy with these persons.

In an American study, Kidd, Taggart, and Turkle (2006) found difficulties with Paro when applied in therapeutic use. For example, they noted that Paro would be better if it was smaller and lighter, and thus able to be more easily manipulated by the user. The user also should be able to turn the robot on and off. These changes would give a heightened sense of control over the interactions with the robot. To some users, Paro was perceived as strange and therefore frightening, suggesting that an alternative form should be adopted in some cases. Some persons living with dementia had a tendency and desire to place Paro in water. Preventing immersion is a concern that could be managed with a proper environment and adequate supervision.

Additional research by Wada et al. (2005) noted that interactions with Paro improved the mood of study participants, an effect that was unchanged throughout five weeks of interaction. In the same study, Wada et al. found that after interaction with Paro, both emotional face scale scores and vigour scores improved for elderly participants with dementia. Wada et al. also found that the persons living with dementia interacted with Paro willingly from the first day – speaking, stroking, hugging, smiling, and sometimes kissing the robot.

In personal care homes, staff have multiple responsibilities when caring for persons living with dementia and, as a result, can suffer from burnout. Wada et al. (2005) found that staff looked forward to Paro's arrival, and that the interaction with Paro made staff laugh and become more animated and active. For example, their facial expressions softened and brightened. The use of Paro also encouraged staff to communicate with each other and became their common topic of conversation. In another similar study, Wada et al. (2004) specifically studied the effect of Paro on nursing staff. The average burnout score, which was found to be highest one week before Paro was introduced, decreased throughout subsequent interactions. Statistically significant changes showed that both the burnout score and the fatigue of the nursing staff decreased after Paro's introduction into the care facility.

Rehabilitation through Therapeutic Recreation

Briller, Proffitt, Perez, Marsden, and Calkins (2001) examined associations between environmental design features of nursing home special-care units and the incidence of aggression, agitation, social withdrawal, depression, and psychotic problems among residents with AD or a related disorder. For example, a decline of negative behaviours and affect occurred when quiet spaces and more privacy were instituted. Reimer, Slaughter, Donaldson, Currie, and Eliasziw (2004) found that specialized units for those with dementia demonstrated improved residents' activity and lessened their negative responses. Innovative research projects such as these have been found important to improving the quality of life for persons living with dementia. Such findings emphasize the need for researchers to continue to explore innovative ways to improve care, including how robotics might play a role.

Recreational activities, including music, art, exercise programs, and outings, are central to the quality of life for many older adults living in long-term care homes. The Canadian Therapeutic Recreation Association (2008) has defined therapeutic recreation as a profession that recognizes leisure, recreation, and play as components integral to quality of life. Therapeutic recreation is directed towards functional interventions, leisure education, and participation opportunities. These processes support the goal of assisting individuals to maximize their independence in leisure, and to achieve optimal health and the highest possible quality of life. These goals mirror the goals of a personhood approach as defined by Kitwood (1997) and others. The use of social commitment robots in long-term care fits directly within the realm of recreational therapies and exemplifies a personhood approach to care.

The benefits of therapeutic recreation have been shown through numerous studies that reference a vast array of improvements to persons living with dementia and their overall quality of life. Specifically, therapeutic recreation seeks to improve areas of total well-being including (a) cognition (Cheng, Chan, & Yu, 2006;

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Wise, 2002); (b) physical ability (Arkin, 1999); (c) social ability (Richeson & Neill, 2004); (d) emotional stability (Buettner & Fitzsimmons, 2004; Buetter, Fitzsimmons, & Atav, 2006); (e) sensory stimulation (Bittman et al., 2004); and (f) spiritual wellness (Trevitt & MacKinlay, 2006). Interventions to achieve improved quality of life are provided by professionally trained individuals who understand the importance of continual assessment, goal setting, interventions, and evaluation (Hare & Frisby, 1989). Rehabilitation through therapeutic recreation provides persons living with dementia an opportunity to attain their goals and improve their quality of life through individualized interventions of recreation and leisure (Wang, 2007). The integration of what has been learned from therapeutic recreation can significantly improve the successful application of social commitment robots.

Animal Assisted Therapy and the Social Commitment Robot

Animal-assisted therapy (AAT) is defined as the use of specific animals in treatment strategies in health and human service settings. As early as 1860, Florence Nightingale observed the connection between health and pets within chronically ill individuals and advocated the incorporation of animal care into convalescence settings (Fontaine, 2000). AAT provides persons living with dementia with important benefits such as feelings of happiness and companionship. Wada et al. (2005) agreed that interaction with animals has long been known to be emotionally beneficial. Filan and Llewellyn-Jones (2006), on the basis of their review of the AAT literature, proposed that AAT may ameliorate behavioural and psychological symptoms of dementia and that the use of robotic pets as an intervention deserves further investigation. Once viewed with skepticism, AAT is now increasingly used to provide people with therapeutic benefits in such diverse areas as pediatric, geriatric, and correctional settings.

Conversely, AAT may have a negative impact if persons living with dementia develop allergies or infections or suffer from bites and scratches. Gammonley and Yates (1991) addressed the importance of personal care homes choosing suitable animals specifically for the purposes of AAT. Animals must be disease-free and have temperaments that allow them to interact appropriately with all staff and persons living with dementia. For some persons living with dementia, negative memories of animals from previous life experiences may prevent them from participating in AAT.

Robotic animals are now emerging as a positive alternative and supplement to AAT in personal care homes. Robotic animals can provide some of the same benefits as live animals in AAT without the drawbacks. For example, Banks, Willoughby, and Banks (2008) conducted a study that measured loneliness in persons living with dementia in long-term care. They found that interactive robotic dogs were effective in decreasing loneliness in persons living with dementia in personal care homes and that persons living with dementia became attached to both robotic and live dogs.

On the other hand, in a study of 24 nursing home patients, Odetti et al. (2007) found that the ability of residents with moderate to severe dementia to accept and understand a robot "interacting" with them was inconsistent and limited. The researchers hypothesized that this may have occurred because the first model they used did not accurately resemble a live dog. Most of the subjects were unable to identify what the robot was designed to represent. Tamura et al. (2004) conducted a similar study that compared a toy dog and a robotic dog. They found that participants knew that the toy dog mimicked a puppy; they responded positively and cared for it. When the robotic dog was introduced, persons living with dementia could not identify with it, and an occupational therapist (OT) was needed for the intervention. They knew that it mimicked a real dog but only interacted with it when instructed by the OT. This result may be explained by the simplistic construction of that particular robot, and may not reflect the potential possibilities inherent in robotic animal use.

Deer Lodge Centre and the Interdisciplinary Summer Research Program

Deer Lodge Centre (DLC) is a 431-bed long-term care and rehabilitation facility located in Winnipeg, Manitoba. The Interdisciplinary Summer Research Program (ISRP) is a research and educational initiative supported by Deer Lodge Centre's Collaborative Research Unit and the University of Manitoba's Faculty of Nursing. The ISRP provides an opportunity for students from various disciplines to engage in research that pertains to aging, dementia, and long-term care.

DLC officials had made the decision to purchase two Paro robots after a visit to Japan to learn about Shibata and Wada's work with robotic animals in nursing homes. These two robotic seals were used in exploratory intervention studies conducted by the ISRP at Deer Lodge Centre from 2008 to 2010. To date, the ISRP has completed three Paro-related pilot studies. All received ethical approval from the Education Nursing Research Ethics Board at the University of Manitoba. Detailed analysis of these studies will be presented in future papers. Here, we introduce the background and context of this research in these studies and the meaning of the social commitment robot.

The first study (Murdoch, Roger, Guse, & Osterreicher, in preparation) was conducted in 2008. The purpose of this pilot study was twofold: (a) to examine resident interactions with Paro and consequent changes in mood and affect, and (b) to understand family members' perceptions of the interaction between Paro and residents. The sample consisted of three residents residing in a long-term care home and their adult children. All residents had cognitive limitations: specifically, moderate dementia with anxiety or agitation. Dual consent was obtained from the residents and their adult children.

The residents participated in two weeks of videotaped interactions with Paro, lasting approximately 30 minutes per day. To provide a baseline of cognitive limitations, the Mini-Mental State Examination (MMSE) was administered to each resident at the beginning of the study. A face scale depicting a range of emotions, developed by Wada (2003), was shown to residents pre- and post-intervention. Residents were also asked a series of simple questions to assess depression. The adult children participated in two interviews: (a) an oral pre-intervention interview, which collected health and social information on the residents, and (b) an audiotaped post-intervention interview, which concerned the adult children's perceptions of the interactions and changes in their parents' mood and affect. Videotapes of the resident-and-Paro interactions were analyzed with a tool adapted from concepts used to measure interaction and engagement (Cohen-Mansfield, Dakheel-Ali, & Marx, 2009).

Results of this pilot study were mixed in regards to the benefits of using a social commitment robot. For two of the residents, the majority of their interactions were positive with elements of play, conversation, and tactile engagement indicating that they enjoyed their time with Paro. The third resident was fearful of the robot and hesitant to engage with it. Various factors could explain this behaviour, including physical fatigue, discomfort, and poor scheduling of the intervention. These are considerations for future planning of interventions. The face scale did not prove an effective evaluation tool, as residents had difficulty distinguishing between the faces. All adult children who were participants reported positive changes in their parents, citing improved mood, enjoyment of the interaction, and appreciation of the tactile nature of the intervention, which served to combat loneliness in their parents. One family member noted that although the parent could not speak about the effects of the intervention, the parent did appear to receive benefit from the interactions.

The second study, "The Use of a Social Commitment Robot in a Long-Term Care Facility: Staff Perceptions of Benefits, Drawbacks and Concerns", examined how the staff perceived the use of a robotic seal such that the study researchers could identify potential barriers and facilitation methods for the use of robotics within the care setting. Staff perceptions of Paro were assessed by survey. Preliminary findings suggest a positive staff perspective on the use of social commitment robots with persons living with dementia. Although some concerns arose regarding the cleanliness of Paro in a hospital setting, and whether some residents would be afraid of Paro, overall the responses indicated that staff felt Paro could be a helpful intervention, in particular for residents with anxiety and pain.

During the winter of 2008–2009, Deer Lodge Centre clinicians began to use Paro as a therapeutic aid for selected persons living with dementia who exhibited feelings of depression, anxiety, and agitation. This ongoing practice has provided anecdotal evidence of success in soothing, calming, and providing stimulation to persons living with dementia. These clinicians are working with the ISRP team to advise them of which persons living with dementia might benefit from one-to-one contact with Paro for future studies, and are providing direction for future research questions.

The third study, "The Use of a Social Assistive Robot with Residents in a Long Term Care Facility: Family Perceptions of Benefits, Drawback and Concerns", was conducted in 2009. This exploratory pilot study attempted to determine how Paro could facilitate interactions between family members and residents of a long-term care home who were suffering with moderate cognitive impairment: specifically, dementia and agitation or anxiety. Previous research has suggested that communication difficulties associated with dementia can be a major burden and can affect health outcomes (Savundranayagam, Hummert, & Montgomery, 2005).

In the 2009 study, four residents and their adult children participated in three 30-minute videotaped interactions with Paro. Prior to each interaction, residents and their families were re-introduced to Paro and encouraged to interact with the robot. Videotapes were analysed by the research team using guidelines developed from previous guides and based on the concepts of engagement, withdrawal, sharing, expressed emotions, attitude to Paro, and effect on family members and residents during the interaction. Each team member analysed the video interaction individually, then discussed and compared observations to reach team consensus on observations and analysis.

Data analysis indicates that family members perceived the use of Paro in five meaningful ways: (a) helpful in their interactions with their parents with dementia, in that Paro provides a vehicle for communication, often in the form of reminiscence; (b) providing an opportunity for emotional release in that the resident and family

members are able to express positive emotion towards the seal and engage in humor and play; (c) prompting dialogue between family members and their parents and providing a diversion from the usual conversations; (d) providing residents with comfort and moments of joy; and (e) providing opportunities for tactile stimulation, which can potentially reduce feelings of loneliness and offer opportunities for connection with something outside of the self. Families also identified a need for more structure and ideas on how to use Paro to engage the resident, in order to gain optimum benefit from the interactions. These results indicate that there is a role for social commitment robots to enhance communication and that there is a continued need to develop protocols for enhanced use of such robots.

Summary

To date, little research has been conducted with social commitment robots in Canada in long-term care settings. The ISRP research team is committed to developing further protocols and disseminating research findings in a way that will benefit professional care providers and assist in training students who may become future practitioners in long-term care.

Recommendations

Although data analysis of the video interactions of these studies is ongoing, preliminary conclusions of these three studies suggest that the integration of social commitment robots may be clinically valuable for older, agitated persons living with dementia and, also, beneficial to family members and staff. So far, the researchers offer the following recommendations:

1. To conduct ongoing research examining the benefits and potential risks of using Paro (and similar robots), particularly for persons living with dementia who experience frequent distress and agitation. The goal is to increase these individuals' experience of personhood.
2. To provide training opportunities for long-term care staff so that they are better able to engage Paro (and similar robots) in clinical interventions and increase a sense of personhood for persons living with dementia.
3. To conduct research that adequately measures the social, psychological, and physical impact of Paro (and similar robots) on persons living with dementia in long-term care.
4. To include family perceptions and needs in the development of interventions using Paro, so that family involvement with persons living with dementia can be enhanced.

Interest in how robotics can enhance care in personal care homes is growing. Paro and similar robots may be changing the daily lived experiences of persons living with dementia. As of 2008, for example, Denmark had purchased 1,000 Paro robots for its nursing homes, and 20 American nursing homes and hospitals had purchased Paros and started testing how interaction with Paro affects persons living with dementia (Pink Tentacle, 2008). Currently, in Manitoba, the ISRP research team at Deer Lodge Centre, in work that is the first of its kind in Canada, is endeavouring to put these recommendations into practice through ongoing research, user-friendly education, and dissemination of knowledge to practitioners. Depending upon the results of this research, these robots may in the future become an integral part of therapeutic care and an improved quality of life for persons living with dementia.

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