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Service Innovation Using Social Robot to Reduce Social Vulnerability among Older People in Residential Care Facilities

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ABSTRACT

This paper aims to explore the main factors of social vulnerability among older people and the improvements in social life after engaging with social robots. This paper also examines the influence of these factors on each other. Study 1 helped develop a conceptual model and research hypotheses by interviewing 17 specialists in both aged care and social robotics, using grounded theory methodology (GTM). To validate the conceptual model in general and its constructs and hypotheses in particular, Study 2 employed a confirmatory factor analysis (CFA) based on the survey distributed among 335 aged care specialists in Australia. The results of study 2 support the indirect effects of social robot enablement and robot mediation on reduction of social vulnerability (socioeconomic accessibility and community ties) through aged care service innovation. It also supports direct impact of robot mediation on augmentation of community ties among older people. Both qualitative and quantitative results measuring the research constructs and hypotheses provide valuable information to managers of aged care facilities and social robotics scholars to improve the quality of life for older people. The implementation of meaningful advances in merging people oriented robotic technology and social vulnerability in older people has demonstrated effective initiatives, including bridging the gap by synthesizing multi-disciplinary interventions to ease social vulnerability.

1. Introduction

The increasing prevalence of social vulnerability in aging societies is incontrovertible. In the context of aging, social vulnerability results from the defenselessness of aging community to social and economic changes in older people' life styles. The impacts on individual's physical and mental capabilities such as mobility and daily decisions often require massive aged care (Andrew et al., 2008; Depietri et al., 2013; Gronlund et al., 2015; Kimhi et al., 2012). Compared to frailty which only describes physical incapability such as low physical movement (Fried et al., 2001; Romero-Ortuno and Kenny, 2012), social vulnerability limits daily life and decision-making in a wider group of older people who are likely to have a loss of mental and physical functions (Kimhi et al., 2012; Nelson et al., 2015). Social vulnerability may even lead to isolation with loss of social engagement for older people in social context (Golden et al., 2009; Prince et al., 1997; Wenger, 1997). Such conditions have been a burning issue in most developed countries (Lloyd-Sherlock, 2000). For instance, the Australian Bureau of Statistics (2014) has forecasted approximately twice and triple increase of vulnerable older people in 2031 and 2061 respectively.

While some research on improving quality of life has mentioned to reduce social vulnerability among older people (Berkman et al., 2000; de Leon et al., 2003; Zunzunegui et al., 2004), it's still under debate in relation to how to keep an aged person engaged and connected with others (Andrew et al., 2008; Martinson and Minkler, 2006; Zunzunegui et al., 2003). Furthermore, despite the development of various studies on assistive technologies addressed social vulnerability (Bemelmans et al., 2012; Frennert and Östlund, 2014; Hindriks et al., 2012; Libin and Cohen-Mansfield, 2004; Louie et al., 2014; Saldien et al., 2010; Shibata and Wada, 2011), very few studies were found very useful regarding how advanced technologies such as assistive technologies actively engage with older people to resolve social issues. There is a need to understand if social changes happen in aging population depends on the technological changes. For example, while the use of assistive technologies in aged care facilities has a long history (Bemelmans et al., 2012; Compagna and Kohlbacher, 2015; Saborowski and Kollak, 2015), studies do not seem to locate older people as ongoing members of a community that are interested to use these technologies. As a result, the need to design and operate a new generation of assistive

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technologies such as social robots that enable older people to be independent and augment their mental and physical activities is required.

With innovation in aged care service in mind, studies might examine how a social robot is designed and operated to assist older people to provide innovative social services such as accessibility, adaptability, rehabilitation and therapy (Mordoch et al., 2013; Moyle et al., 2013; Saborowski and Kollak, 2015). Assuming that social robots facilitate the service-providing to older people, several studies implicitly highlight the need that social robots might enable caregivers to respond better to a wider range of health issues (Huschilt and Clune, 2012; Mordoch et al., 2013; Scassellati, 2007; Vallor, 2011; Wada et al., 2008). Such issues may include holistic care, disease diagnosis, and prevention of isolation and depression. These health issues motivate social robots to provide entertainment, interactive activities, or engaging games and daily communications. In this context, several social robots which are human-or-pet-like robots such as NAO, Paro, KASPAR, PaPeRo, AIBO and iCat aim to provide social support, engagement and independence for people with especial needs (Kramer et al., 2009; Moyle et al., 2013; Peca et al., 2014; Šabanović et al., 2015; Wu et al., 2012). There is also a rising demand for human-like social robots which can really provide human partner interaction and communication compared to pet-like social robots. Most of these previous studies have investigated the implementation of social robots in aged care without paying attention to the social needs of older people. In other words, service innovation in aged care needs to be reviewed to facilitate the use of social robots in aged care facilities (Khaksar et al., 2016a). It requires more qualitative and quantitative studies on both theoretical and empirical aspects of social robots. A realistic goal of these studies should focus on how to reduce social vulnerability in older people.

The purpose of this paper is to explore the main factors leading to reduction of social vulnerability among older people and the socioeconomic benefits that social robots can affect in aged care services from the lens of caregivers and robot developers. This paper also examines the logical influence of some of these factors on each other from the lens of caregivers. This is important because social robots are new to aged care industry and this paper intends to highlight the socioeconomic changes that social robots can offer to reduce vulnerability among older people. Consequently, this paper examines the following two questions: (1) What factors enable a social robot to provide service innovation to vulnerable older people? (2) How does a social robot mediate between aged care services and socially vulnerable older people? And finally, how does a social robot help reduce social vulnerability among these people?

This paper is structured as follows: First, it reviews literature on social vulnerability issues around older people. The role of social robots, as service innovators, is then reviewed, especially in the context of providing social services to vulnerable older people living in aged care facilities. Second, from a methodological point of view, a sequential mixed methods research is presented. The research design combines a qualitative and quantitative approach, to explore and assess the factors that enable social robots for innovative service-providing and mediate between the robot services and service innovation to finally seek factors that can lead to reduction of vulnerability among older people. More specifically, GTM (Ground Theory Methodology) was used to analyse qualitative data from in-depth interviews with 17 specialists in social robotics and aged care. Five constructs have been established and examined, namely robot service enablement (aged care service reliability, costs and safety), robot mediation (personalised service delivery, entertainment, social connectivity), aged care service innovation (social interaction and self-care and social companionship), socioeconomic accessibility (personalised capacity awareness, affordability and decision power), and the strength of community ties among older people (sense of community, social support and sense of place and time), as the main factors that reduce social vulnerability. Following this section, the role of these constructs is theoretically reviewed to develop the possible hypotheses. The confirmatory factor analysis (CFA) is then used to examine the model developed and its hypotheses based on the survey distributed among 335 aged care practitioners in Australia. The paper then draws discussion and conclusions and provides recommendations and implications.

2. Literature Review

In light of emerging prevalence of assistive technologies and their novelty in the market, especially for people with especial needs such as older people, a social robot can significantly improve the quality of social services by assisting caregivers (Huschilt and Clune, 2012; Mordoch et al., 2013; Scassellati, 2007; Vallor, 2011; Wada et al., 2008). A social robot is an accumulating body of applications suited for social interaction and physical presence (Bemelmans et al., 2012; Louie et al., 2014; Wu et al., 2012). Social robots such as Paro, Hobbit and PaPeRo are used in aged care facilities to evaluate social effects among older people and improve their quality of lives in terms of loneliness, isolation and depression (Frennert and Östlund, 2014; Robinson et al., 2013; Šabanović et al., 2015; Wu et al., 2012; Yan et al., 2014). However, most of these robots are not specifically designed to boost the engagement in an aged care facility rather than a pet-like companion or machine-like advanced computer. Along with technology advancement, social robots in aged care are expected to play a facilitating role among older people to motivate them to communicate with others (Kim et al., 2013; Riether et al., 2012). Another demand from social robots is to improve the capacity of caregivers in doing daily activities (Arkin et al., 2014; Pfadenhauer and Dukat, 2015; Salichs et al., 2015). The innovative services to residents in aged care facilities are also preferred to support these routines and habits (Rabbitt et al., 2015). Therefore, the emergence of social robots in aged care raises questions as to whether or not the use of robots in daily activities will be accepted by residents in aged care facilities and whether or not they can promote the quality of life by providing innovative services, as older people include a large part of the socially vulnerable in developed countries such as Australia. In the next section, social vulnerability among older people is reviewed in regard to the role of social robots as assistive technologies in aged care.

2.1. Older People's Social Vulnerability

Since the 1980s, social vulnerability has become a common topic of interest among researchers in robotics. Social vulnerability derives from social circumstances of daily activities that negatively influence quality and security of social welfare. The social and economic circumstances that contribute to social vulnerability include a lack of social engagement, social companionship, social support and poor socioeconomic status (Andrew et al., 2012; Andrew and Rockwood, 2010; Bath and Deeg, 2005; Dupuis-Blanchard et al., 2009; Gleibs et al., 2011). Social vulnerability is also associated with uncertainty increased due to social changes (Eakin and Luers, 2006). These changes may result from technological developments and modernization in advanced societies and generate new risks for people that co-exist with existing risks (Cutler, 2006; Millar and Lockett, 2014).

In relation to an aging society, social vulnerability is related to older people's capacity to respond to hazards (Andrew, 2005; Cutter et al., 2003). It requires considering multidimensional sources such as social intimidations, social interactions, affordability and individual characteristics (Mendes et al., 2003; Schröder-Butterfill and Marianti, 2006). Hence, it has been difficult to provide a comprehensive definition for social factors that influence social vulnerability among older people (Cloutier-Fisher, 2005). However, some scholars in their definitions have tried to provide an understanding of causes and effects of social vulnerability. For instance, Grundy (2006) defined a vulnerable older person as a person whose accumulation social capabilities fall below the threshold required to manage actively their daily challenges.