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Emotional robots: principles and practice with PARO in Denmark, Germany and the UK

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Abstract:	As societies age there will be a significant increase of those over 80 and a predicted increase in people with dementia. We know that loneliness increases with old age, and those living with dementia are at risk of social isolation. Also opportunities for sensory stimulation and engagement in pleasurable activities are reduced in old age. The question is what technologies can be used to extend the range of available interventions that can enhance well-being. Emotional robots have been developed for activity and therapeutic purposes. This article explores experiences of the emotional robot PARO in Denmark, Germany and UK, and provides principles of this robot as an activity or activity with a therapeutic purpose.
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	3. Consideration of these aspects in Chapter 5, esp. 5.1 and 5.2 4. the methodological approaches differ very much / descriptions are in chapter 4 and table 1. 5. Final chapter is changed 6. see reviewer 1, point 4.

Emotional robots: principles and practice with PARO in Denmark, Germany and the UK

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ABSTRACT

As societies age there will be a significant increase of those over 80 and a predicted increase in people with dementia. We know that loneliness increases with old age, and those living with dementia are at risk of social isolation. Also opportunities for sensory stimulation and engagement in pleasurable activities are reduced in advanced old age. The question is what technologies can be used to extend the range of available interventions than can enhance well-being. Emotional robots have been developed for activity and therapeutic purposes. This article explores experiences of the emotional robot PARO in Denmark, Germany and UK, and provides principles of this robot as an activity or as an activity with a therapeutic purpose

KEYWORDS: Emotional robots; socio-pedagogical concept; robot-therapy; social activity; dementia care

Emotional Robots: Principles and practice with PARO in Denmark, Germany and the UK

1. Robots in Care?

Most Western societies are experiencing ageing of the population. The fastest increase is in the over eighty group. This human success story is often referred to as an ageing problem with the discourse focusing on the increased incidence of chronic disease, co-morbidity and frailty, and the associated need for care that these health problems bring. Dementia is a condition that is highlighted within this discourse as the prevalence of dementia increases with advancing age: in the 70-74 years-old age group the prevalence is 5.5%; 75-79: 7.4%; 80-84: 15.7%; 85-89: 26.3%; 90-94: 41.0% and 95 and over: 46.3% (EUROCODE, 2009). This condition sharpens attention to the social and emotional consequences of living with a chronic condition. People living with dementia can experience a poor quality of life as a consequence of reduced social engagement, inactivity and reduced stimulation.

One response to the challenges of ageing societies has been the development of robotic technologies. These developments can be classified according to their purposes: rehabilitation robotics enabling lower and upper limb training. Prominent for rehabilitation robots are developments such as HAL, a powered exoskeleton (Cyberdyne Inc., 2004-2013)

Service robots have the potential to provide care support, addressing problems that an individual faces in meeting their activities of daily living, for example Care-O-Bot. In a German nursing care home Care-O-Bot was tested with functionalities for handling drinks, documenting the intake in the care documentation, playing memory games and chanting with residents (Fraunhofer IPA, 2009). Other functionalities of service robots have been explored including their potential to support fetch and carry tasks. CASERO was tested in the same

nursing care home as Care-O-Bot, and was used for transporting heavy loads such as the clothes basket, and monitoring the hallways throughout the night. Telepresence robots such as GIRAFF of VGo can be utilized for monitoring purposes for nursing care or social work staff, but also for communicating with relatives and friends over distances (Giraff, 2012, Lewis D., 2012, VGo, undated). Whilst rehabilitation and service robots support residual capacity following illness or degeneration or address functional limitations in meeting the demands of independent living they do not optimize emotional and social well-being – important determinants of quality of life.

Since the nineties there has been the emergence of emotional robots also referred to as social robots or companion robots. These include AIBO, Yumel, PLEO, Huggable and PaPeRo (Broekens, Heering & Rosendahl, 2009; Heerink, 2010; Turkle, 2011; Klein, 2011; Meyer 2011). These robots interact with people and have been introduced to the health and care sectors internationally as activities or tools that might be used with (socio)pedagogic, social and therapeutic purposes, underpinned by the development of the concept of "robotherapy" by Libin & Libin in 2004. "Robotherapy . . . aimed at the reconstruction of a person´s negative experiences through the development of coping strategies, mediated by technological tools, in order to provide a platform for building new positive life skills".

This raises many questions including: What is the potential of robot-activity/ intervention? Has robot-therapy the potential of a new approach in social-pedagogy? Can robot activity/ intervention contribute to well-being of people with dementia? What are the ethical issues associated with the use of an emotional robot?

Robots used in a social and caregiving contexts is a new research area that focuses on understanding the potential of practice applications, and person – robot interaction and communication. The research is also concerned with the impact of this complex intervention, with the emphasis on understanding psychological effect (emotion and behavior), impact on

prognosis, and influence on social contexts (Libin & Libin, 2004). This paper focuses on use of the robot seal 'PARO' in the context of care homes (residential and nursing) for older people in Europe.

PARO is an emotional robot in form of a baby harp seal (Shibata & Tanie 1999). PARO has touch sensors over its body and in the whiskers, sensors to detect position and temperature, vision and hearing. Actuators include eyelids, upper body motors, front paw and hind limb motors as well as calling sounds. PARO has both pro-active and reactive programmed behaviors. These features enable PARO to interact with people in a baby-like animal manner.

The resemblance of PARO to an infant seal raises the issue whether the interaction with the seal is comparable to the form of interaction that occurs in animal assisted activities (AAA) or animal assisted therapy (AAT). In a socio-pedagogic framework the objective of AAA is to contribute to wellbeing, entertainment and fun: that is creating a situation for enjoyment. This can be realized with groups or individuals. In contrast to AAA, AAT specifies goals to be achieved and is realized mainly with individuals. These approaches are in line with many other concepts and approaches such as validation and ongoing further developments aimed at an affirmative communication, self-preservation-therapy (SET) geared at stabilizing the person´s own identity, reality orientation therapy (ROT) aimed at getting access to lost relations to reality, Snoezelen aims to improve perception through multi-sensory stimulation, similar is aromatherapy which pursues alleviation of anxiety and agitation, 10 minutes activation – a common approach in German care homes - aims to trigger key stimuli, music therapy and doll therapy aiming to promote interaction. Although with different purposes these concepts and approaches are used with people living with dementia to address the symptoms and problems arising from the condition.

This article provides an overview of experiences with the robotic seal, PARO, in three countries –Denmark, Germany and the UK. These three countries have different experiences and approaches in the utilization of the PARO. Through discussion the authors identified that they adopted similar, yet different approaches to the implementation of PARO activity.

This paper explores these approaches and presents principles for the use of PARO in the context of care homes in each country, and these form the foundation for recommendations for a standardized approach to support cross cultural comparisons of the outcomes derived from PARO activity. The paper considers methodological issues in order to appraise current understanding of ways to use PARO.

2. Background information on the three countries

The discussion in this paper is on the experience of PARO in care homes in Denmark, Germany and UK. These countries are amongst the early adopters of emotional robots, both within the international context as well as in Europe. The emerging literature largely reflects experiences arising from Asia (e.g. Heerink, 2010), hence this paper seeks to contribute a European perspective. To add context to this paper an overview of population trends and directions in policy related to service for people with dementia is presented.

European countries are ageing societies. Eurostats' latest set of population projections (EUROPOP, 2011: for the period 2011 to 2060) indicate that population ageing is likely to affect all EU Member States. There will be progressive ageing of the older population, as the proportion of those over eighty is growing at a faster pace than any other age segment of the EU's population. This is reflected in projections for Denmark that will witness an increase of approximately 200% of those 80+ during the period 2005-60, and proportionally less, though not less impressive increases in Germany (111.9%) and the UK (151.7%) (EUROPOP, 2011)

With the increase in the over eighty population, internationally, it is predicted that there will be an increase in the incidence of dementia. The 2010 report by Alzheimer´s Disease International estimates 35.6 million people worldwide in 2010 and forecasts to nearly double every 20 years. In Europe the estimated number of people suffering from dementia varies between 6.5 and 7.3 million (Alzheimer Europe, 2009). Within Demark 1.45 % of the population was reported in 2006 to experience dementia; Germany 1.66% and in the UK 1.54% (Alzheimer Europe, 2009). However, it is assumed that these numbers are underestimated because of lack of diagnosis in the early stages of dementia.

Changes in the structure of populations have focused attention on the need to develop innovative responses to the problems and challenges that accompany this ageing phenomenon namely chronic disease, disability and frailty. These include disease management programs (Weingarten et al, 2002; Rijken et al, 2012), such as national service frameworks for chronic conditions, including dementia in Denmark and the UK; and the widespread adoption of assistive technology (Cash, 2003). The majority of assistive technologies such as cognitive aids, environmental sensors, video and audio technologies were developed or tested with people with mild or moderate dementia suggesting that there is a need for development of understanding of what is appropriate and effective for people with advanced dementia (Cook, Bailey and Moyle, in review). Moreover much of the existing assistive technologies being explored in the European context seek to support the functional, safety and security aspects of independent living with aim of promoting quality of life for those with dementia. Less attention has been given to examining technologies that have the potential to stimulate and provide opportunities for enjoyment for those with advanced dementia. It is within this context that the emergence of emotional robots has occurred. There is recognition in policy and practice (in Denmark:Redegørelse fra Sundhedsstyrelsens arbejdsgruppe vedrørende demens, 2001; England: Living well with dementia, 2011; and Germany: Ministry of Health

2013 that people with dementia should be supported to engage in activities that are meaningful and promote their quality of life.

Adoption of PARO

Denmark started using PARO in 2004 and has now the highest penetration of the robot seal in the world: 210 PARO´s in December 2012, which means that PARO is present in 70 % of the 98 municipalities. The Danish Technological Institute (DTI) cooperates with local PARO-distributors in other European countries and collects the different national PARO-experiences. In England only two care homes have experience of PARO. This was in the context of a practice development initiative led by Northumbria University. More than 30 care homes have a PARO in Germany, and a further 9 care homes provide activities with PARO through a visiting service. There are a further 20 PAROs in use in research institutions and universities across Germany (Bachhausen, 2012). Since 2008 the University of Applied Sciences Frankfurt utilizes PARO in the bachelor social work course to promote competence to work with older residents in are services.

3. Why robot-therapy is being used as an intervention for people with dementia

Therapeutic (Merriam-Webster Online Dictionary, 2009) in everyday language, means to attend, treat, relating to the treatment of disease or disorder by remedial agents or methods. This is a prescriptive and narrow understanding of therapeutic. In the context of nursing, for example the use of the term therapeutic means a way through to an outcome, through restoring wellbeing, health or quality of life (Lima-Basto et al., 2010). Interpersonal therapeutic interventions are characterized by McMahon & Pearson (1998) as developing a partnership, intimacy, and reciprocity in the nurse-client relationship, caring and comforting, physical intervention, teaching, manipulation of the environment and alternative health

practices. With a focus on the psycho-social aspects of the interaction between a service user and professional there is a substantial move away from the narrow prescriptive definition of therapeutic. This points to the importance of considering the purpose and outcomes of a therapeutic encounter. When we refer to a ´therapeutic´ intervention in relation to PARO in this paper it is with the very broad conceptualization embracing the psycho-social and emotional elements of the encounter.

These ideas concerning activity that has therapeutic purpose are relevant when considering the characteristics, nature and purpose of human-robot interaction. Service robots have functions that perform tasks required by the operator. The purpose of emotional robots is less evident. These may include enjoyment, socio/psychological (e.g. mood improvement, social interaction, social connection: Cook, Clarke & Cowie, 2009) and physiological (e.g. stress reduction) purposes (Bemelmans et al, 2012).

Concerning stress reduction, Swedish Kerstin Uvnäs-Moberg from the Karolinska Institute in Stockholm has documented that the hormone oxytocin has a potential physiological anti stress effect by decreasing blood pressure and cortisol levels (see for example: Uvnäs-Moberg, 1998). The oxytocin hormone is released by somatosensory stimulation/ nonnoxious stimuli such as breastfeeding, touching, warm temperature, soft massage, petting, hugging, physical proximity etc., which may further lead to calm social behavior and positive social interaction in a more general context. The evidence concerning effect of oxytocin hormone in relation to stress, behavior and social interaction, may contribute to explain why PARO is powerful for some users, when placed on the lap/ next to the user, and he/ she thereby is able to pet, touch and hug PARO.

Oxytocin released in response to social stimuli may be part of a neuroendocrine substrate which underlies the benefits of positive social experiences, and such processes may in addition explain the health-promoting effects of certain alternative therapies, including

PARO. Urine tests taken from nine individuals showed improved values (Wada, Shibata, 2007b).

If the robot is to fulfill the purpose of social interaction, it beckons questions about interaction with what and with whom. At a minimal level interaction can be between the robot and the user, in social contexts the interaction may include other stakeholders thus interaction is between robot to human and human. The human to human interaction may focus on the robot and in this situation the robot becomes a stimulus for interaction. Developing activities that influence social stimulation is important in populations where these issues have a negative influence on the quality of an individual's life.

This is illustrated in the case of people with dementia. Living with dementia impacts on social interaction in two distinct ways: It leads to changes in the person diagnosed with dementia. These individuals can experience memory loss, communication difficulties such as word finding problems, use of words in inappropriate contexts, repetitive questioning and poor articulation, and inability to understand what is said to them (Cook, 2008). Charlotte Clarke (2009) points out that the person who has dementia can also experience changes in the way that other people approach them and the way in which they communicate with and involve the person (Cook, Clarke & Cowie, 2009). However, people will also learn to be passive – if people are treated as though they are incapable of social interaction then they will withdraw and cease trying to communicate (Whitworth, Perkins, Lesserl., 1999).

These points can be addressed in PARO activity. The intervention is constructed as a novel situation where all participants are perceived to be capable of interacting with PARO and have the opportunity to engage with the robot. Different methods have been adopted for the human-robot interaction. Heerink (2010) gives an overview of the utilization of companion robots. Most of the studies were case studies on AIBO and PARO, undertaken in Japan (see for example Wada and Shibata, 2007a). Positive outcomes were predominantly

reported "Elderly react positively with respect to mood, health status, memory function and social connections with others. … companion robots seem to alleviate stress (e.g. measured by stress hormones in urine) and increase social interaction (measured by frequency of contact between elderly)." (Heerink, 2010)

Studies (see Marti et al 2006; Wada and Shibata, 2007a, b; Heerink 2010; Broekens et al 2009, Moyle et al, in press) indicate that people, including those with advanced dementia, have skills to interact with the PARO. Interacting with a robot is a novel situation; therefore it is possible for preconceived ideas to be set aside. The activity is also familiar (stroking a pet/toy) therefore individuals have a point of reference and comparison. This enables them to bring pre-existing knowledge of how animals react to human contact that can be used to shape interaction during an encounter with the robot. The sensory feedback between the human and robot maintains the interaction and ensures that the encounter is dynamic and unique to the individual.

4. PARO-Approaches in Denmark, England and Germany

In the following section the approaches in the three countries are presented in order to analyze indicators and inherent principles on the use of PARO.

4.1 Danish Approach

Objective

The Danish Technological Institute (DTI) is a technology transfer organization and the key task is to ensure that new knowledge and technology can quickly be converted into value for customers in the form of new or improved products, materials, processes, methods and organizational structures.

DTI is the European distributor for PARO and has established a PARO project. The primary objective of this -project is to focus on documenting effects of using PARO for different target groups and gather knowledge about conditions for successful interaction between humans and robots. This knowledge is used to inform on development and use of robots in general. PARO is used in Denmark for older people with dementia, and for people with developmental disorders, autism, brain damage, neurological syndromes and mental illness.

The project also aims to contribute to the development of a generic methodology that may assess effects and use of welfare technologies. The PARO project adopts a systematic approach for the collection of quantitative and qualitative data in relation to the use of PARO in real life contexts. The following findings are derived from this data, in particular the results from a questionnaire that was completed by approximately 100 caregivers who participated in the one day certified qualification on the use of PARO. These individuals were using PARO for at least three months.

Requirements for the utilization of PARO

To ensure qualified, reflective and ethical implementation and use of PARO, DTI has stipulated that PARO can only be bought if the caregivers/ pedagogues participate in a one-day certified training. The content of this training addresses care-professional strategies and ethical aspects of working with PARO, principles for daily use, information to residents, relatives and colleagues, roles of caregivers and pedagogues, motivation or resistance in the organization/ nursing home, evidence based practice, different ways to evaluate and document the effect of PARO and maintenance of health and safety including processes for maintaining hygiene standards.

The certified training disseminates and suggests that PARO can be used in two different ways: as an activity in order to stimulate the user and for amusement as a pet and friend. Interaction with PARO can occur as a one-to-one individual activity or in a group in much the same way as Animal Assisted Activity. Much more specialized, PARO can be used on an individual basis and as socio-pedagogic (therapeutic) tool The purpose of this application is to calm the user, wake up memories, stimulate the person to remember and pronounce lost words/ language, revive the individuals identity as a caregiver. This is illustrated in the following case:

> "A man with advanced dementia had moved into a nursing home. At evening time he left the home in spite of bad and cold winter weather, which was most dangerous to him. The nurses became aware that he had always gone to bed with his dog, and they suggested that PARO should be placed in bed with him. The result was that he easily fell asleep and stayed in his bed all night long (which is AAT-use of PARO). After very few days, he felt at home at the nursing home, and he then only used PARO when it was time for PARO to go out and pee in a bush in the garden (which is AAA-use of PARO)".

The certified training emphasizes that the way PARO is used, depends on the interests, biography of the person with dementia, resources and disabilities of the individual(s), as well as the situation. Hence caregivers and pedagogues need to be creative, imaginative and observant when using PARO, to optimize positive outcomes.

The indication for using PARO typically precedes some or more of these symptoms: easily falling asleep; a little sad; difficult to motivate the individual to attend to their personal hygiene needs; difficulties in verbal communication, expressing humor and/or feelings

inappropriately; easily being confused; inner restless or worrying much; motoric restless/ shaking (arms, hands); leaving the nursing home at inappropriate times; aggressive communication and behavior.

Summary of experiences

Results from the above mentioned questionnaire showed that caregivers used PARO one to three hours on average a week, usually as an activity to stimulate or entertain residents and only sometimes as a socio-pedagogic tool. 75% of the respondents say that PARO is placed in the common room where residents can take PARO whenever they prefer.

End-user attitudes and reaction to PARO differ considerably. PARO can be viewed as an indifferent, useless thing, and it may stimulate provocation. Alternatively end-users can have an extremely positive response to PARO and it is treated as a companion.

People with dementia who do not like or reject PARO may react like this because PARO has no meaning for them or because they dissociate from a ´childish toy´ or because they are stimulated and reminded of a tough life at the countryside when they were responsible for the care of animals both day and night.

People with dementia who like and prefer PARO may react in this way because PARO is functioning as a confident companion, PARO facilitates the use of words and verbal communication, PARO stimulates memories, feelings and identity as a caregiver, stimulates petting behavior and calms down (or wakes up

PARO appears to have a range of effects when it is accepted positively, for example as a social mediator and a ´common third´ in communication. For individuals who cannot engage in complex interventions PARO can contributes to calmness and safety through reducing restlessness and wandering. PARO has reduced – though only in a 3-4 cases - anxiety and use

of medication. Observations made showed that PARO can reduce aggressive behavior when interacting with caregivers in the delivery of personal care.

4.2 German Approach:

Objective

Universities of Applied Sciences in Germany educate and undertake applied research. The Faculty of Social Work and Health at the University of Applied Sciences in Frankfurt am Main has the objective to qualify students on innovative technologies in the health care sector. To achieve this a permanent exhibition on independent living focusing on innovative new assistive technologies has been established with a corresponding cross media platform (Klein et al, 2012).

The robotic seal PARO was one of the first new technologies purchased in 2008. Since summer term 2009 PARO is used in student -teaching research projects. In the bachelor of social work course a module is offered on "user-orientation and well-being in service provision of elder care." The objective of the course is to give theory based insight to the work of social workers in nursing care homes. This knowledge is transferred in practice in the form of project work. Depending on the size of nursing care homes in Germany social workers can have their work focus on managerial and organizational tasks, but most times social workers are also responsible for organizing daily activities for residents.

Requirements for the utilization of PARO

Students have to complete a practice transfer project in teams of three to five students and must comply with the following guidelines: They have to find a nursing care home and obtain authorization to do the project by the management and obtain informed consent of residents or legal custodians. They develop a concept using the chosen technology for

activities with the residents e.g. PARO, PLEO and software programs and carry out at least three sessions with residents. Usually they record these sessions by video or observation protocols and write up a project report. Then they participate in a 3-days lasting workshop, where the experiences made are reflected and give a final presentation.

Summary of experiences

The following analysis is based on six project reports where PARO was utilized in nursing care homes during 2009-2011. In total 37 residents participated, 30 of them were female. There were 15 group and 32 individual interventions. The group interventions usually took 30 to 60 minutes, individual interventions between 10 to 30 minutes. Students usually distinguished three phases for their activities according to Kramer (2007):

Phase I: Preparation of the sessions

Here they develop a concept and agree on roles during the intervention (facilitator, participant observer, taking the videos) and agree if these will be individual or group interventions with PARO. They agree with social worker/nurse or care staff on the number of residents who will be invited to take part, and informed consent is obtained. Prior to the sessions the plan the environment and prepare the room; obtain background information on the residents such as age and gender.

Phase II: The intervention

The sessions are opened with a round of introductions. Students explain their approach for the activity/intervention. Usually, everybody who participates should be involved in social interaction. Often, PARO lies on the table and every resident gets the opportunity to touch/hold PARO. Students prepare a list of topics to talk about (e.g. how residents like PARO, pets, mourning, emotions, etc.). After the session they say their farewell.

Phase III: Follow-up of the session

A major role play the follow-up-reflections on what has happened and what can be changed resp. improved the next time. Students analyze communication structures and talk with staff in order to understand reactions.

The findings have been described in Klein 2011 and Klein, Cook 2012 and are summarized in the UK section.

4.3 English approach

Objective

Northumbria University is involved in a practice development network "My Home Life North East care homes". Here a framework INTERACT has been developed to enhance social interaction with residents suffering from dementia in nursing homes. Using this framework in an exploratory study PARO was introduced in groups with four to five residents (Cook, Clarke & Cowie, 2009). This study specifically sought to enhance social interaction between older residents with dementia through a novel intervention that involved facilitated group discussion with the emotional robot, PARO in 2009.

Requirements for the utilization of PARO

For research activities many care home organizations have their own research and development governance processes. Prior to implementing PARO intervention in care homes it has been necessary to secure these approvals from these regulatory bodies.

Methods to gather information on the use and effect of PARO

This was an ethnographic study of facilitated group discussions with PARO in a care home in North East England. PARO sessions were led by a facilitator who was supported by a care assistant who had known the participants for at least one year. The sessions were held for a period of five weeks:

Session 1: orientation:

The PARO is placed out of sight while participants enter or are assisted to the room and are seated around a table. At this point the facilitator explains that they have brought something about which she would like their opinion. After the introduction the PARO is brought out, placed on the table, and turned on. The residents are told 'I have brought something for you to see today. This is PARO. It was given to us by someone from Japan. I am curious about what you think of PARO.' After some introduction PARO is held by each member of the group. As each participant holds PARO the facilitator asks the participants: 'What do you think of PARO? What do you want to know about PARO? What do you like or dislike about PARO?' 'What can PARO sense?' 'What can PAO do?' The session ends when the discussion ceases and PARO is turned off. Participants are asked if they would like to take part in a discussion with PARO next week.

Session 2:

PARO is turned on when the participants are seated around the table. They are asked if they can recall the PARO discussions from the previous week. Then they are invited to interact with PARO in any way that they want. The facilitator leads discussions about what name should be given to PARO. They are also invited to discuss the same questions as the previous week: 'What do you think of PARO? What do you want to know about PARO? What do you like or dislike about PARO?' They are encouraged to hold PARO, stroke PARO and interact with PARO (for example by brushing PARO or cleaning PARO.

Sessions 3-5:

Following initial interaction with PARO and exploration of any issues that arose spontaneously the facilitator can introduce the following topics – 'Have you had a pet in the past? What type of pet? How long did you have the pet and what did you do with it? What memories do you have of the pet? What were the most memorable moments with your pet?' At the end of the fifth discussion the participants were asked about their views of participating in the group discussions.

Summary of experiences

The analysis of the project reports show a range of reported, mainly positive, effects (cf. also Klein 2011; 2012; Klein & Cook 2012). These comprise behavior such as: (Tenderly) touching the robot; (positive) mimic expressions and gestures; verbalization and talking with the robot, often similar to the way adults talk with pets; stimulation of interaction with other residents; caring behavior such as feeding, covering PARO with a blanket; twofold consciousness of PARO as a subject and animal and also as an object and machine; but also rejection, upset and dislike of PARO in rare circumstances

Looking at these findings the questions arises whether they have relevance beyond casuistic descriptions and case studies. The following discussion appraises the current understanding derived from the above forms of PARO-therapy.

5. Discussion

Following issues will be discussed: some reflections on the reasons for the differing distribution of PARO and reflections on (ethical) concerns of the usage of PARO that has

been experienced by the authors. The approaches in Denmark, Germany and England are compared with a focus on study design and the necessities for research designs of a higher order are proposed. However, based on the authors positive experiences principles for using PARO are suggested which could provide a basis for the development of research designs.

5.1 Causes for the different distribution of PARO

Although, principles for the utilization of PARO can be derived through the work in the three different countries, it still does not answer issues such as why the distribution differs so enormously. These countries have policies to support well-being of people with dementia in nursing care homes. The costs for PARO are similar throughout Europe (ca. 5,000 Euro). The differences could be attributed to different funding systems – municipalities as main decision-makers in Denmark might have more financial possibilities and a political interest. E.g. the region of Odense where DTI is located has a robot-cluster with subsequent promotion of robotics including the healthcare sector. In Germany, nursing care home managers or the management of the superior (welfare) organization they belong to decide on these investments. There are cases where PARO has been bought as a consequence of sponsorship, fundraising and other special programs. In the UK, funding structures may not prioritize the purchase of PARO, particularly with the limited evidence base to determine its effectiveness.

Other factors which might contribute to the differences are attitudes towards new technologies, but also media coverage.

5.2 Ethical concerns

The field of robot activities for therapeutic purposes is developing. With the experiences of using PARO for therapeutic purposes there are many ethical issues, some that

have been discussed in the wider literature (e.g. Scholtz, 2008; Turkle, 2011). The authors were often confronted with questions such as: Does the utilization of PARO contribute to infantilisation of people suffering from dementia? Are there false pretenses when using a robot which resembles a living animal? Will robots replace the original humanness through the emotional approach?

Future cross-national research should explore different notions of age and images of old age. The terms "social robot", “emotional robot” or “companion robot” feed an illusion that can reinforce the idea of a social practice, according to which artificial agents are perceived as equal interaction partners – how ethical is this when using PARO with people with dementia? Christopher Scholtz demands that the person should still be capable of distinguishing two mind sets which he describes as “twofold consciousness” (Scholtz, 2008) switching between the knowledge that PARO is a robot and to behaving as if PARO is alive. The German students did observe this capacity to ‘switch’ in their work; we do not know whether this is still the case in more advanced dementia. These considerations raise ethical debate about the effect of PARO when there is little understanding of the impact of ’switching’ on the individual particularly if the requirement to do no harm is be maintained. The experiences discussed in this paper indicate that PARO can be an intervention to trigger positive emotion and to stimulate social interaction, thus enabling the person with dementia to experience pleasure and engagement with other people. However, whether this has a higher priority than ethical concerns has to be discussed on a broader level.

5.3 Comparison of the study designs

In the following table 1 the experiences with PARO in the three countries are classified according to their scientific impact.

Table 1: Characteristics of the experiences with PARO in the 3 countries

Characteristics	Danish Data	German Data	English Data
Characteristica of the "research" use of PARO	Use of technology to gather experience and evaluations in order to develop technology	Teaching research projects in order to qualify students in observational skills and issues of social work	Ethnographic study of facilitated group discussion
Information collection / Research Methods	Questionnaire filled in by caregivers	Observing interactions, usually supported by videographing	Observing interaction
	Case reports, caregivers description, annual meeetings with PARO-users	Additional: sociogramm of the interventions, Smiley-scale for residents: How did you like . . .?	Notes after each session, which were validated by the supporting carer
	Analysis of nursing records	Questionaire or interviews with (nursing)care staf or social worker	Interviews with the carer who supported the facilitator and other staff who observed the sessions
		Write up in project reports	Verbatim transcription
			Thematic analysis across observation and interview data set
Requirements for using PARO	Purchase of PARO	Qualification of students in a range of topics in elder care	Obtaining informed consent
	One day qualification of staff of the nursing care homes	Obtaining informed consent	
Hierarchy of the research design	Ideas, opinions	Ideas, opinions	
	Single case reports	Single case reports	Single case report
		Case Series?	

The evidence generated from experiences in the three countries indicates that care-/pedagogic-professional interaction with PARO gives a variety of reactions and effects. There is still hardly any evidence for whom, when, where, in what situations and relations, for how long/ how many times PARO has a positive effect on people suffering from dementia. Though there are many positive PARO-experiences, there are still many open questions and therefore clearly a need to develop a higher order of evidence concerning PARO.

5.4 Principles for practice with PARO

As the first known pilot randomized controlled study on PARO, Moyle et al (in press) report positive outcomes of intervention with PARO with people with dementia, following principles in table 2 can be suggested for the use of PARO as an activity.

Table 2: Suggested principles for utilizing PARO

Principles to be considered	Group facilitation	Individual facilitation
Characteristics of the facilitator	Skilled communicator	dito
	Ability to lead group discussions	
	In-depth understanding of dementia and how the condition impacts on individuals	dito
	In-depth understanding of PARO technology, functions and pedagogic and ethical aspects of using PARO	dito
	Sensitive to the needs of individuals	dito
	Positive attitude towards PARO	dito
Co-facilitator	Ensure that the co-facilitator knows each participant and has in-depth understanding oft verbal and non-verbal communication to interpret positive and negative interactions with PARO and can respond appropriately	Probably no co-facilitator. Facilitator knows the resident and his/her biography and is able to interpret reactions and can respond appropriately
Organisational aspects	Managers and collegues should have basic knowledge on PARO´s technology, ethical and pedagogic aspects as well as be motivated for the use of PARO	dito
Developing the group	Small group interaction is most effective	
	Groups of up to 5 participants of mixed cognitive and communication abilities	
Planning the environment	Quiet delimited location. Notice: some people do not like to interact with PARO when others are around or looking	dito, the private room where the resident feels secure and private may be better
	Comfortable seating	Comfortable seating or lying if resident is bed-ridden
	Moderate lighting to enhance ambience	dito
	Ensure all participants can see, reach and touch PARO	
	(Wheel)chairs located around a table that PARO can lie on and that is not too big, so that everybody can reach, touch and pet PARO	PARO can be located on the lap or in the arms of the resident. If the person is bed-ridden PARO can be put onto the bed - depending on the wishes and reactions of the resident
Introducing PARO	Provide information about the nature and functions of PARO	dito
	Observe initial reactions	dito
	If an individual appears to become anxious/agitated/disturbed/angry/ provoked or other negative reactions when introduced to PARO, the co-facilitator will offer to withdraw PARO from the group	If the person appears to become anxious/agitated/disturbed/angry/ provoked or other negative reactions when introduced to PARO, the facilitator will offer to withdraw PARO
	Withdrawal will be followed by on-going support by someone who knows the individual to explore the reason for their distress and reassure them that they do not have to take part in future PARO sessions	Withdrawal will be followed by on-going support to explore the reason for distress and reassure the resident that he or she do not have to take part in future PARO sessions. Notice that some residents reject PARO in some situations or relations, but may be positive in other contexts
Promoting interaction with PARO	Opportunity for all participants to touch, hold, stroke and interact with PARO in different ways, for more or less time	dito
	Talk with the residents about their views, thoughts, reflections on technology, their past or what else comes up or is thought about. Facilitate dialogue,speaking, expressions, contact, arousal/ calmness, answer questions etc	dito
Supporting interaction between group members	Encourage sharing of PARO within the group	
	Introduce topics related to PARO to facilitate discussion	
	Introduce topics related to previous experience with pets/animals to facilitate discussion	
Involving non-group members in the PARO-activity	Often those who observe PARO attempt to join the group discussion	
Closing the session	Summarize the discussion/ reactions and attitudes of the residents	dito
	Indicate what is happening to PARO and where PARO is stored	dito
	Exploring if the participants want to take part in future PARO (group/ individual) activities	dito
	Explore what the participants want to do with PARO in the following session	dito
After the session	Updating the care documentation	dito

These principles underpin the work in Denmark, Germany and the UK. Although casuistic in origin they provide a comprehensible way to work with PARO in practice and

research. This would also enable studies with other forms of non-pharmacological interventions for people with dementia.

Analyzing literature of socio-pedagogic or socio-therapeutic approaches for people with dementia it becomes obvious that there are many approaches that have developed to contribute to wellbeing

A meta-analysis of Halek & Bartholomeyczik (2006) looked on the effects of different approaches such as validation, reminiscence therapy, the multisensory stimulation Snoezelen, massages and therapeutic effects of touch on people with dementia and having behavioral symptoms. Summarizing the results these authors conclude that any interactive activity is better than nothing. Those analyzed approaches have in common an appreciative attitude which impacts positive on emotions, contentment, wellbeing and behavioral aspects. The important factor seems to be a constructive relationship between caregiver and resident. However, no statements can be deduced on issues such as which form of intervention, how long and how often, what intensity can contribute to alleviation. What is paramount is the response to individual needs.

The PARO-observations undertaken in the three countries are qualitative approaches. As no instruments e.g. such as Mini-Mental Status-Test or others were implemented, PARO users cannot be compared and measurement of the progress or changes with respect to cognitive and motor skills is not possible. The observed reactions on PARO can be classified as emotional reactions and are assumed to contribute to wellbeing. Further research on that should consider the application of suitable methods for measurement.

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