Playful persuasion to support older adults’ social and physical activities

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ABSTRACT

In this paper we describe a case study in which we examine how to develop playful persuasive solutions to motivate older adults to maintain or increase their social and physical activities. By including various stakeholders (older adults, family, and care givers) and by designing for transitions in life we intend to create solutions that can be used by many different user groups. Based on a playful interaction framework and user studies we are designing playful persuasive solutions that incorporate social and physical activities as mutual motivators. Furthermore, the persuasive solutions should be relevant for the life transitions of losing partners or friends, of having to move to a care facility and of declining physical and cognitive capabilities. We describe our experiences with involving older adults in a design process. Finally, we present our initial concept the ‘Activator’, that provides awareness about upcoming activities and own performances and goals, and provides opportunities for older adults based on physical or social motivators to keep and extend their social circle, and to perform activities of lower and higher physical demand.

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1. Introduction

Research in independent living aims at maintaining old adults’ quality of life as they face functional, physical and social challenges of ageing. The area that covers designing technology and environments for independent living and social participation of older persons in good health, comfort and safety is called gerontechnology. One class of technologies within gerontechnology is called persuasive technologies. These technologies support users in changing attitudes or behaviours with the purpose to increase their well-being (Kort et al., 2005). The project described in this paper covers the design of persuasive solutions, which fall within the goals of prevention and engagement and the life domains of health and self-esteem and work/leisure in the area of gerontechnology (Bouma et al., 2009). In addition we are interested in creating technological solutions that follow a user centred design approach as they contribute to successful aging (Charness and Schaie, 2003).

Because of declining abilities older adults become less physically and socially active (CBS, 2009). Persuasive technologies that stimulate physical and social activities can contribute to older adults’ sense of well-being, based on the definition of quality of life as proposed by Hirsch et al. (2000). Creating solutions that support social communication and good health for frail seniors is very important (Bronswijk et al., 2009). So, far limited work has examined persuasive technologies for older adults (Albaina et al., 2009), and even less has focussed on more frail older adults that live in care homes.

Designs exist to either persuade people towards social interaction (e.g. digital family portrait by Rowan and Mynatt (2005)) or to physical activity (e.g. virtual fitness coaches by Westerink et al. (2004)). We will examine a novel direction where we create a combined solution.

Finally, we follow a novel approach in which we examine how we can create playful persuasion by combining subtle persuasive mechanisms with playful components to existing daily practices. We will not create completely new activities, such as the Dance-Along solution (Keyani et al., 2005), or games such as the Age Invaders (Khoo et al., 2008). Instead we will examine opportunities to combine persuasive solutions for existing practices, an approach that has been found to contribute to technology acceptance (Vastenburg et al., 2008). We are interested in creating playful persuasive solutions that will create opportunities for older adults to engage in social and physical activities. The assumption is that by using playful mechanisms, such as curiosity, exploration and nurturing (Korhonen et al., 2009) people will be motivated to certain behaviour by appealing to intrinsically motivating strategies.

In summary, we will describe a case study conducted as part of the Independent Living project that examines how to create playful persuasive solutions for frail seniors and persuade them to...
participate in social and physical activities. We follow a user centred and a research through design process that aims to understand the role of social and physical activities in older people’s life and identify the challenges they face in maintaining a desired level of social and physical interaction when life-changing events occur. We will examine the following research questions:

- What are the challenges of creating persuasive solutions for older adults in a care home?
- To what extent might playful persuasion work?
- How to design such a solution so that it relates to existing living patterns (Vastenburg et al., 2008), how to do this in a care home?

The outline of the paper is the following. We first ground our work in relation to studies on social and physical activities of older adults and persuasive technologies. Then we present our user centred-design process. As outcome of our user requirement study we present a set of scenarios and personas that describe the domains where physical and social activities play an important role in the life of an older adult and the ageing transitions. We then discuss the importance of design solutions that facilitate social and physical interaction as mutual motivators. Finally we identify requirements for the design of playful persuasive solutions that motivate older adults to social and physical activities.

2. Background: quality of life and social and physical activity

In the field of independent and assisted living and gerontology much research effort has been devoted to identify the factors that influence the quality of life for seniors. One challenge to do this is the highly individualized and dynamic nature of quality of life that changes from day to day as persons’ capabilities change and people are continuously balancing their perception about independence and engagement (Hirsch et al., 2000). Therefore we need to understand the different categories of social and physical activities that are relevant in the context of older adults.

Based on the concept of quality of life (QOL) we explain how designing for social and physical activities, will contribute to independent living. Quality of life (QOL) is a multidimensional concept that touches all aspects of human life: from supporting basic/functional needs such as physical and cognitive aids, activities of daily living (ADL) and instrumental ADL (iADL) to maintaining a rich set of social relationships, and providing control of autonomy, self-esteem and self-actualization. In the context of residents of care living homes, the need to support both functional as well as social needs is crucial to increase life satisfaction. On the one hand functional help provides harmony and good health; on the other hand a cohesive social environment encourages social participation and family involvement which contributes to a positive impact on the quality of life of the residents of senior housing (Mitchell and Kemp, 2000). Social activity is a predictor of enjoyment in life, which contributes to the quality of life of a person (Dobbs et al., 2005; Gregg, 2001; Kho et al., 2008). The experience of meaningful social relations also leads to psychological and physical well-being (Morris et al., 2004), bringing benefits on a daily life basis such as feelings of trust, intimacy, emotional closeness, companionship, learning and help with housekeeping (Lang, 2000). Physical activity relates directly to health, slows disease progression and prolongs functional independence (Philips et al., 2004).

There are a number of challenges that a senior faces to initiate physical or social interaction. Philips et al. (2004) has identified a set of intrinsic and extrinsic motivational barriers that affect the willingness of an older adult to initiate social and physically activity, like lack of pleasure or missing a partner to do an activity. The motivation to do something depends on how people perceive their chances of success (e.g. how confident does a person feel regarding an activity), the importance of the activity goal, the cost of the exercise (e.g. the cost of joining a gym, or the risk of losing time and energy) and the inclination to remain sedentary. As a consequence it is common that old people start avoiding physical and social activities not only because of functional limitations but because of misperception of their own abilities, overestimating time or effort needed for an activity, and therefore becoming unmotivated to interact with the unpredictability of the world (Hirsch et al., 2000; Philips et al., 2004).

From a social perspective, literature describes how ageing makes people invest more on emotionally close and on short-distance relationships (Melenhorst, 2002); older adults focus their energy only in the activities they perceive are most essential and valuable in their lives, which may imply that they voluntarily restrict their social contacts as they grow older. Old people need to regulate their emotions avoiding negative emotions and experiencing positive ones, finding meaning in life, gain emotional intimacy and establish feelings of social embeddedness (Carstensen, 1993).

On the other hand, physical activity can involve either heavy exercise or light movements. Everard et al. (2000) classify activities into four types: instrumental activities (e.g., shopping, cooking, paying bills, and doing housework); social activities (e.g., traveling, entertaining, attending parties, and attending church); and high (e.g., swimming, woodworking, walking, gardening) and low-demand leisure activities (e.g., sewing, reading, watching television, listening to music). When investigating what are the motivational mechanisms that could trigger these factors we can identify a joint relation between social and physical activities. Social interaction does not only increase social activity but contributes to physical activity, facilitates recreation and mobility for older people (Spiriduso et al., 2005) and promotes functional abilities (Kho et al., 2008; Unger et al., 1997). When observing the relations between social and physical activity, Unger and Johnson (1995) identify a social push, where exercise may be motivated by friendships that involve exercising together and the social contacts that result from exercising in public places such as health clubs and open parks. Similarly, Mollenkopf et al. (1997) found that people’s social situation may influence the amount of physical activity that they engage in due to a clear connection between the social situation of an older adult and their specific mobility patterns; if people have a very close network of family or friends, then they are away from home more frequently than when this is not the case. From a physical push, people derive not only physical, but also social benefits from exercise, which may encourage them to adhere to their exercise programs.

In summary, we recognize the importance of designing a cohesive social environment in the care home, and the opportunities of using intrinsic social and physical motivations as persuasive mechanisms that could facilitate social and physical triggers. We will further explore how this can be supported in a playful manner.

3. Related work: playful interaction and persuasive technologies

Research in persuasiveness explores the role of technology to change users’ attitudes and behaviours through persuasion and social influence (Fogg, 2002). As technology develops and becomes more accessible, an increasing effort has been dedicated to the design of technical solutions that motivate people to change their behaviours on their daily practices. For example, the use of Internet and sensor technology to develop e-health services that provide remote and immediate assistance to motivate users increase their physical activities, like the virtual fitness coaches by IJsselsteijn et al. (2006). Another example is the use of digital pictures in the
form of storytelling to stimulate old people to have conversations about their past (Morris, 2005). Brunette et al. (2005) suggest that technology in the context of older adults and senior housing should explore devices that build a sense of place, exposure (e.g. sharing photos of previous events in the community), identity creation, constancy and a perceived valuable function.

A large part of the existing research into the design of persuasive mechanisms to increase the quality of life of an older adult has focused on more traditional persuasive mechanisms, such as monitoring, and preventing (Oinas-Kukkonen and Harjumaa, 2008; Fogg, 2002). Chattejjee and Price (2009) provide a framework that describes the relationship between technologies, persuasive mechanisms and challenges in various domains. Another approach is to apply more playful persuasive mechanisms, such as curiosity, challenge and nurturing inspired by game design guidelines (e.g. Korhonen et al., 2009). Examples of solutions that explore the benefits of gaming in motivating groups of old people to be more socially and physically active, are the Walk2Win (Mubin et al., 2008) and DanceAlong (Keyani et al., 2005) games. A similar example that addresses the interaction between the older adult and their family is the Age Invaders concept (Khoo et al., 2008) where co-located and online players interact synchronously. All these projects provide insights on what aspect of gaming should be considered when designing for older people, but they assume that there always will always be a motivation to play. However, initiating an activity is one of older adults’ major challenges, as they feel uncomfortable to interrupt others and they prefer to avoid possible rejections (Hurks, 2008). Therefore, we are interested in exploring more subtle playful mechanisms that not only bring a fun experience but also serve as triggers to motivate older adults to engage in more physical and social interaction.

The following are some examples of student projects in our faculty, which are trying to explore playful mechanisms to motivate people to engage in activities. The LED Light Guide (Opt Hof, 2008) provides ‘dynamic lightning walking routes’ where lamp-posts invite walkers to explore random routes, which are guided by dynamic light patterns. The concept uses a surprise effect to motivate people to walk, however it does not explicitly include social elements. The Let’s Walk Together (Hurks, 2008) is a prototype that combines tangible interaction and non-digital visualization to facilitate social and physical contact. By placing a pair of porcelain clogs in a specific spot in her house an old lady indicates that she wants to go for a walk, which is visualized at her friend’s home with a picture that appears (and later disappears) in a delft blue tile. This concept aims at diminishing the threat of being rejected when initiating a contact, however is limited to one-to-one connection and to a particular activity: walking.

Our main contribution to the existing efforts is two folded. First, we want to support social and physical interaction by incorporating subtle playful mechanisms that link social and physical activities as mutual motivators. We think that a solution like this needs to explore adaptive motivational strategies and information management techniques that can respond to the needs for subtle cues, lightweight mechanisms to share information, and non-disruptive information displays. Second, we want to support existing daily activities rather than engage old adults in completely new activities. For that we investigate the use of technology in the context of playful interaction and persuasiveness to explore alternative designs to motivate social and physical interaction as part of old adults’ daily activities.

4. Approach: research through design methodology

In this project we follow a research through design approach (Zimmerman et al., 2007), in which we involve various stakeholders in an iterative user-centred design process (Sharp et al., 2006). We foresee a number of design opportunities. First, understanding old adults’ daily practices and preferences, we expect to implement different and dynamic motivational strategies depending on how social and physical people are and how that evolves over time. For the more socially active people, social motivators could work to engage them in more physical activities, while for others engaging in physical activities could work as a motivator to spend more time with others. Second, by focusing on the design for cohesive social environments we expect to address the issues related to the introduction of technology to persuade and support playful interaction, which could raise concerns regarding the acceptance of technology by the older adult (Leonardi et al., 2009) and the fear of being stigmatized for using a product (Davis et al., 2005; Chen et al., 2005).

Third, we combine the views and requirements of the various stakeholders to further facilitate inclusive design, exploring how design solutions can be usable and beneficial for as many people as possible (Newell and Gregor, 2000; Keates and Clarkson, 2003).

Our user-centred design process consisted of four design phases (research, design requirements, design concepts, and outcomes), which are supported by a number of methods (literature review, user studies, design sessions, prototyping, evaluations) and techniques (diaries, interviews, focus groups, prototypes, usability and field studies) executed in several iterations. First, we uncovered a global description of contexts and users based on literature and we developed our theoretical framework including concepts of persuasiveness, awareness information and playful interaction. In the next step we iteratively defined design requirements through a sequence of user inputs in the form of diaries and interviews, which were followed by design sessions and focus groups. The design sessions gathered the partners of the project bringing together expertise in design, sensor technology and elderly care professionals, to translate the results of the user studies into personas and scenarios identifying (1) older adults’ likes and dislikes related to their daily routines, (2) the life changes experiences that could threaten their quality of life and (3) opportunities for persuasive strategies in supporting seniors’ life changes. Two focus groups sessions were conducted to validate the findings represented by the personas and scenarios. The design sessions and focus groups outcomes were then translated into design concepts, which were iteratively developed and validated using low and high technology prototypes. In this paper we describe the design process we followed and our preliminary design concept as outcome of the design sessions. A usability and long-term field study are being conducted at the moment of finishing this publication and will be reported later on.

5. User studies

5.1. Participants

Our project goal is to design a technology solution to older adults residents of a care home. Nevertheless, we are also interested to involve in our requirement studies independent older adults. First of all, to identify the life changes an older adult experiences, we need to understand what they gradually start missing and what are their fears in the transition of losing their independence. Secondly, to conduct an in-depth exploratory study of the daily practices in the life of a senior we want to investigate the use of diaries as a means to capture self-reports of the likes and dislikes of the older adults’ daily activities. Being aware of the high demand that a diary can be for seniors with more disabilities, we conducted a 1-week diary study with independent older adults while we used a day-reconstruction technique with seniors in a care home, both based on a similar structure to collect the information.
For our observations we recruited 12 participants: eight older adults (+65 and retired), two family members and two care givers. Of the eight seniors five of them were living independent in their own homes and three were residents of a care facility. The group that lived independently (two females; age range 67–82) included two participants living with their spouses and three living alone. Also as part of this group we interviewed two adult children of our participants. The resident group included two females with specific care needs (age range 65–80) and one male (80) living fully independent inside the care facility. Also as part of this group we interviewed two staff members of the care facility: a caregiver and an activity organizer.

5.2. Methods

To gather design requirements we combined the following methods for user observations: interviews, diaries and focus groups.

5.2.1. Diaries

The diary study aimed to explain what old people enjoy doing in their daily routines, as input for the design of playful motivators to support quality of life. Each diary was an A4-booklet containing a number of pages per day, which were divided in two parts: one to be filled in the morning and the other at the end of each day. In the morning participants were asked to describe and reflect on the physical and social activities that they have planned for the day; in the evening they were asked to reflect on the activities that they actually did that day. In both instances participants had to fill one A4 format paper per activity, first providing a brief description of the activity regarding its location, duration, companion, type of activity, and who organized it; and second to self-report on their feelings about the activity such as expectations, effort regarding preparations, fears, and satisfaction of the outcomes. Overall, the diary aimed to provide information on the following questions:

- What are their daily routines?
- What do they like most to do?
- What do they like least to do?
- What do they find difficult to do?
- What do they desire to do but it is not always possible?

During the diary study participants also received a disposable camera to encourage them to take creative pictures related to positive feelings over their activities during the day.

5.2.2. Interviews and focus groups

Interviews were conducted before and after the week they filled in the diary in the residence of each participant, lasting in between 40 and 60 min. The pre-interviews aimed to collect context information of participants’ activities and daily routines, and to instruct them on how to fill in the questionnaires and how to use the photo cameras to highlight positive moments during the day. Once the diaries were collected for analysis, we used them to identify positive and negative reports to further discuss them with the participants during the post-interviews. During the post-interviews, we also interviewed the adult child of two of our senior participants, to complement insights of our findings in the diaries and post-interviews.

As we mentioned earlier, we used a different data gathering technique than diaries with the resident group to minimize the burden that diary studies could put on participants. We conducted individual interviews to three residents and two staff members. In the interviews with the residents we used a day-reconstruction technique to help the participant recalling as much information as possible about the social and physical activities they did the day before the interview. We ask them to describe their day from the moment they woke up till they went to bed. We ask them to explain whether it was a ‘normal’ or a ‘special’ day, and we pinpoint to specific activities and ask them to reflect on how did they prepare for that activity, what did they expect from it, and what did they like or did not like about it. We finally ask them to describe and reflect on a typical week and weekend day to get an overview of how an average day looks like. The individual interviews with two staff members aimed to collect information about their role in motivating residents to be more physical and social active, and the difficulties they face in doing so.

Finally, focus group sessions were organized to present our participants the initial results and concepts from the requirement study and obtain their feedback to validate our design rationale. We conducted two sessions: one with the independent living participants and one with the residents of the care home. During the sessions we presented them our initial results from the design sessions in the form of personas and scenarios to discuss whether they recognized the description of the persona as an older adult with ageing problems and how they would see the scenarios supporting the issues presented in the persona.

5.3. Data analysis

From diaries, interviews and focus groups we collected a variety of data including notes, pictures and audio recordings. We based our analysis on Case Study methodology (Yin, 1994), which is appropriate to answer ‘how’ and ‘why’ questions covering the contextual conditions of a phenomenon. We selected a single case design represented by a community of older adults who are retired and experiencing life changes due to ageing. We collected the data from the independent living participants (diaries) and the residents of the care home (interviews) and coded based on the five questions we defined in the diary study to identify playful aspects in the daily activities of an older adult. We contextualized the analyzed data with information captured from the other interviews and the focus groups. Our outcomes are by nature subjective and should not be considered either exhaustive or conclusive. However by applying data triangulation (Mackay and Fayard, 1997) to the variety of data collections used and the several stakeholders involved in our studies, our results can serve as foundations for informing our design implications for playful persuasive solutions.

6. Results

The diaries were filled completely by the five participants during seven days. Their descriptions and reflections were more extensive in the first part of the week compared to the last days. They enjoyed doing the activity and reported to consciously fill the two parts of the diary in the morning and evening respectively. They did find it somehow tiring having to report same routines everyday, and it was sometimes difficult to remember at the end of day what have they done. The interviews with the participants in the care facility lasted in average 45 min, which were taped and notes were made. The participants provided information of their activities of the day before as well as giving an example of a normal week and weekend day. They were very enthusiastic to show objects in their rooms that help us to understand more about their activities and hobbies.

The use of the camera turned out to be more difficult than expected. Only two of the participants made more than 20 pictures, while the others did not take more than 10. The collected pictures represented the variety of social and physical activities of older adults, showing gatherings with friends and family, during walks, bike trips, and family celebrations, to individual activities to the grocery store or the dentist. Most pictures were taken by the participants themselves, while in few others they asked someone else
to take it so they could be in it (e.g. dentist taking a picture of the participant with his mouth open).

The pre- and post-interviews lasted in average 45 min, which were taped and notes were made and used in the analysis of the diaries to add context information. Participants provided information about the activities they like to do and the activity they used to do but they cannot do as often as they wish anymore. They also discussed their preferences to do more social or physical activities and the problem they faced now to keep the rhythm they wish to keep.

We organized our analysis into three primary categories: social and physical motivators, which describes how older adults are intrinsically motivated to be active during the day; persuasive strategies, that describe the ways older adults react to intrinsic and extrinsic motivators; and transitions that explores the role that older adults want to maintain in their family and how do they keep interaction with the younger generations.

6.1. Social and physical motivators

Participants showed clear individual differences regarding their own abilities and preferences to keep themselves socially and physically active, which we also confirmed from literature (Lorenz et al., 2007; Fuchsberger, 2008). Social encounters could take shape as rituals on a weekly, monthly or yearly basis (e.g. the yearly bowling game to celebrate grandma’s birthday, or the weekly painting workshop with the best friends). Alternatively, social encounters could also be sporadic reunions requested by someone from their close social network (e.g. taking care of the grandchildren for a day). Reasons to meet with a group of friends or family could be just for socializing or to engage in a particular activity. In the later case meeting with others was sometimes seen as a means to do something (e.g. playing tennis, chorus rehearsals, book discussions, etc.) rather than socializing, although the activity was reported more satisfactory if there were enough people engaged in the activity. In summary, it was observed that some older adults could be driven by their social network to keep themselves physically active, while others could be better driven by physical activities and as consequence expanding their interaction with others.

6.2. Persuasive strategies

Most physical activities reported were part of the older adult’s daily tasks like groceries, biking to visit someone, working in the garden, cooking, laundry and ironing. Some reported to dedicate special time and effort to realize some exercise (e.g. morning yoga, tennis three times a week, long walks, etc.). In the first case, people were often unaware of the amount of exercise they do: one day they could do too many household tasks and therefore feeling extremely tired at the end of the day; while another day they could spend most of the day sitting at home and therefore experiencing a monotonous and boring day. In the second case, older adults reported the need of (social) motivation to keep an exercise routine. For sportive older adults the motivation was mostly intrinsic, as well as for people who were in need to do exercise for health reasons. But for others the motivation mostly came from external sources, like for example a medical prescription from their physiotherapist, or an outdoor activity organized by a club, friends or family members. We relate these insights to the playful mechanism of nurturing and curiosity as people could be easily reminded to take a rest if they have completed their goal for the day or to offer a challenge to reach their goal.

They reported that they also liked to be flexible regarding the time of their activities. Although they like their routines, they could become a second priority if a family member suddenly visits or a friend asks for. Additionally, when a day is free of programmed activities, they like to keep it free and open to do whatever the day brings and whatever they feel like to do. But they also reported a couple of difficulties when only relying on spontaneous encounters, like when they want to do something with others, they often feel insecure as whether others would like to do something as well and therefore the avoid initiating an activity with others; or when no planning they can easily miss important events that they would have otherwise like to attend. Anyway, they reported that it is very important for them to feel in control of when and what to do at any moment. We relate these insights to the playful mechanism of exploration and curiosity as old adults could be aware of what activities are available in their social and of the availability of others to make an informed decision of what to do and with whom.

Overall, the participants reported to feel positive about their social and physical activities. Even if they missed an important event but they had a nice talk with a friend they feel satisfied about it. If something goes wrong they feel like it was supposed to happen and they easily move on.

Formal caregivers recognized the importance of providing residents the space to find their own ways to live in the facility, so they can develop their own identity and roles in their new environment. However they also reported the need to help the older adult that requires stimuli to participate in the activities organized by the facility. Finding the balance between giving residents the freedom to do as they wish (which could be sitting in their rooms all day) and pushing them to join an activity is a constant challenge. In addition, caregivers also emphasized the need for an appropriate infrastructure to facilitate old people getting involved in organizing activities, so they can match their preferences with others with similar interests.

6.3. Transitions

Regarding the quality of their relations with others, older adults reported to obtain more satisfaction when they feel they can help others in their social network than when they perceive that they only receive help from others. Within their family network, this observation is in line with what Lindley et al. (2008) have reported regarding reciprocity and autonomy: old parents need to feel that they can contribute in their children’s life, for example by cooking for them, helping with the housework or taking care of the grandchildren, so they can preserve their autonomy regardless the fact that they gradually start depending on their children. Similarly, we observed that older adults who are residents in a care facility even though they are there to obtain care support, they also feel the need to help others, for example by sharing with others their knowledge or expertise about their hobbies.

Informal caregivers reported that there is little support that allows them to gradually get more involved in facilitating the older adults’ daily activities, progressively while protecting their independency and autonomy. They reported their worries of the moment their parents could not live any longer independent, as they can not imagine their parents not being able to do what they like to by themselves, and how that would affect also their own lives as they would have to help them to keep certain activities.

These findings highlight the importance to address issues related to less participation and more dependency of old adults in their social networks.

7. Design sessions

7.1. Personas

From iterative design sessions and focus groups we developed four personas. The first version provided initial descriptors of the life of an older adult regarding their social and physical preferences and identified potential breakdowns in their life style that could affect
their social and physical daily practices. From our research and from literature we distilled three main life changes in the ageing process of an adult that directly affect their social and physical life style (Bekker et al., 2010): losing a partner or a close friend, physical or cognitive deterioration and moving to a care facility (see Fig. 1).

The second version of the personas further developed the ‘life changes in the ageing process’ describing the weaknesses and threats of an older adult towards a life change and what are the opportunities and strength to tackle the related risks. The final version of the personas contains a general description of the persona, a timeline illustrates the activities of a typical day in the persona’s life, detailed information of activities, social life and ageing transitions, an illustration of the strengths, weaknesses, opportunities and threats of that persona and a box highlighting the persona’s needs in relation to maintaining a healthy life style. Fig. 2 shows a summary of all four personas (in English).

The four personas represent the nuances that we observed in our participants with regards to their capabilities and preferences on their physical and social daily activities. For example, Els and Hilda are both inherently socially motivated but Els prefers more open networks than Hilda, which brings slightly different consequences to their daily physical activities. The type of concerns Hilda and Els have on their daily life are as they quoted: “staying inside the house for a whole day feels like a plain and boring day” (Els), “feeling tired after an intense day” (Hilde).

Arnout and Frank are inherently motivated by cognitive and physical activities respectively, which could motivate them to be more socially active, but not always seems an easy transition to do. Things that Frank and Arnout dislike are usually about circumstances that interfere with their plans: “if the weather is too bad for outdoor activities” (Frank) “when technology doesn’t work” (Arnout).

The strengths–weaknesses–opportunities–threats descriptions of each persona illustrate how life changes could affect the life of seniors. For example, Frank had to move to a care facility because his wife needs special health care. Moving to a care facility gave him peace of mind about his wife’s health condition, but it brought drastic changes in the life of Frank and his relations with friends. As an active member of the tennis club, the singing group, and the reading club now is hard for him to keep connected with his circle as he cannot attend all the meetings due to being so far away.

The personas were used as instruments to support the iterative sessions between users and designers, helping to define the context of the problem of ageing and its relation to particular problems of social and physical interaction, while characterizing relevant nuances of the ageing population.

7.2. Scenarios

With the use of scenarios we represented directions for technology solutions to address the user needs and context described in the personas.

The scenarios illustrate three situations that describe how technology could support social and physical motivators to encourage changes in behaviour and increase social and physical activities. The situations relate to peer-to-peer interaction, interaction between older adults and caregivers, and intergenerational interaction. Each scenario presents a brief description of the context of a situation and illustrates in four stages how the situation is supported by technology (see Fig. 3).

Scenario 1 covers how residents of a care facility can benefit from a technology based communication platform that informs them about upcoming events, and allows them to share with others their preferences to participate. It could also support self-exposure to increase the sense of place and identity. The scenario shows possibilities for creating social motivators by allowing caregivers to inform about organized activities and by allowing the residents themselves to communicate about their preferences for activities. By means of exploration, the scenario aims to provide playful ways for people to exchange information, learn from others and eventually participate in new activities.

Scenario 2 describes how an older adult could benefit from a system that provides information about their own activities, creating self-awareness of their current needs and capabilities. The scenario shows possibilities for creating physical motivators by having easy/meaningful access to personal activity indicators, which can be displayed together with personal goals. The scenario aims to use nurturing as a playful technique to create self-awareness, and personal challenges to keep one-self active.

Scenario 3 presents opportunities to maintain remote communication between older adults and their grand children, creating instances where they can engage in playful interaction to maintain their connection to desire levels and explore areas to motivate each other to be more physically active. By means of curiosity the scenario aims to provide playful ways for grandparents and grandchildren to stay in touch, keeping each other updated of their daily achievements, which might indirectly motivate them to be more active.

Interactions within the scenarios can illustrate how the different playful persuasive techniques could support social and physical motivational strategies. For example, if our persona Frank is motivated to keep himself fit he can benefit from the system information about how he is doing compared to his own goals. Combining nurturing with exploration, the system could, at opportune times, inform him (physical motivator) that a group walk is scheduled for that afternoon; Frank could create a link between his motivation and goals and the available activities communicated by the system. Even more, adding the element of curiosity, the system could let Frank known whether the group joining this activity matches or not his preferences and walking skills. Alternatively, for Els who is constantly updating with others about their activities and often checks for social events in the system (social motivator), the system can combine exploration techniques with nurturing by informing her that she has had a very active day so far. In this way, Els could match her current state with her preferences and decides to have a relaxing social evening joining going to a movie.

The scenarios also illustrate opportunities to change the nature of existing interactions between the older adult and his/her family and caregivers. For example, if Frank and his grandson could share their personal goals about their daily physical activities they could nurture them to reach their goals. In the case of Hilda and her son, an awareness platform that could combine curiosity and exploration, by providing opportunities for both to help and care about each other could balance the perception of Hilda of becoming too dependent on her son, as she can see that she is also helping his son.
7.3. Combining the insights into the first design concept

As a result of our iterative design sessions, using the personas and the scenarios, three important values emerged that should be reflected in our designs. We design for the transitions in life that seniors encounter, translating social and physical preferences into mutual motivators through playful interactions that can create opportunities for persuading healthy behaviours in the seniors' daily routines. Fig. 4 summarizes the three design values that we intend to incorporate in our concepts.

7.3.1. The Activator

After several iterations of idea generation we arrived at our first real concept representing our three design values and incorporating some elements of our three scenarios. The main aim of the concept – the Activator – is to motivate the residents of a care facility...
to engage and be more active in the planning and participation of the activities that are organized in the care home (see Fig. 5). The concept enhances the traditional activity leaflet used in the care home with a digital display that provides interactivity and additional relevant information. From the scenarios previously described, the Activator implemented two main functionalities: activity notification and self-awareness (de Valk et al., 2010). The activity notification gives the older adults information about activities that are about to start, as it was clear in the focus group that such reminders are needed as well as an overview of the upcoming activities organized by the facility. A light starts to shine on the activity leaflet when an activity is going to start within a short period of time. This light works as a curiosity technique to persuade older adults to take a look at the activity leaflet for more information (e.g. what activity is about to start). The self-awareness functionality uses sensor technology to support self-monitoring as a motivator based on information of an older adult’s behaviour, both physical and social. The display can also be used to communicate spontaneously planned activities by the activity organizers that are not yet on the activity leaflet.

We know from literature that although high-demand leisure and social activities are associated with greater physical health than low-demand leisure activities, older adults benefit greatly from low-demand activities because of their effect on mental health in successful ageing (Lawlor et al., 2002). Also, Matsuo et al. (2003) have demonstrated that participation in an activity that people engage in over a long period of time significantly increases the quality of life of older people in relation to health consciousness, life satisfaction, and happy feelings. Similarly, Philips et al. (2004) suggest that challenging but achievable short-term goals that progress gradually over time ensure sustainable exercise improving the perceived efficacy of an activity. For these reasons, our aim is not to provide a new physical or social activity but to enhance the existing low-demand opportunities that are offered in the care home to engage in a healthy lifestyle. The Activator concept applies sensor networks and information management to bring awareness to the residents of a care facility about their daily performances and opportunities for physical and social interaction.

The Activator concept supports *playfulness* by applying elements of nurturing, curiosity and exploration in the design of interactions. First of all, the concept provides a subtle and playful goal-setting feature allowing the user to set and visualize performance goals, which allows us to study the effects of nurturing on encouraging physical and social activity. Secondly, curiosity and exploration are implemented by linking this personal information with information that is displayed in public areas such as the corridor and the coffee room. On these public displays residents can get more information about the upcoming activities, such as who is planning to attend, and see how their performance is in relation to other resident.

By combining feedback on performance on both social and physical activities with awareness of the activities that are organized and by stimulating community-building, we allow physical and social factors to be *mutual motivators*.

Finally, we designed for *ageing transitions* by addressing issues regarding loss of participation and independency observed in our user studies. Seniors’ fear of becoming more dependent and less participative in their social network makes them reluctant to accept technology that would make more visible their need for help. On the other hand, technology is seen by older adults as alienating...
their current customs and daily practices. We tried to minimize any stigmatizing effects of the concept by offering a platform that does not only support seniors to receive help but also to provide help to others thus avoiding the negative tag of an ‘elderly system’. In addition, to address concerns of technology acceptance, we combine familiar objects (in this case the weekly paper residents receive with the program for that week) with dynamic visualizations (in a digital display) that enhance the information on the activity sheet with relevant up to date information.

The following scenario describes a possible use-case of the Activator (see Fig. 5) describing elements of awareness (always-on, periphery display), playful persuasiveness (playful visualization, link between upcoming activities and current performance) and mutual motivator (social and physical descriptions of activity and performance):

“Emma has been sitting in her living room big part of the day. Mid-afternoon the Activator uses a light effect to notify Emma that a walking activity is taking place in half an hour. Emma notices in the periphery the light signal, and checks the details of the activity in the Activator. She can see the time and location, and how many other people are planning to participate. The Activator uses a star-scheme to describe how physical and/or social is the activity (e.g. a group walk has two social stars and one physical star). The Activator also invites her to check her daily performance, which is represented using the same star-scheme. Her performance tells Emma that she has not been as socially and physically active as she thought today (fewer stars than usual). This stimulates her decide to join the walk and uses the Activator to sign in. Five minutes before the activity takes place the Activator reminds her that the activity is about to start. When Emma is back from the walk the Activator updates her performance displaying the new stars of her walk, which reinforces her that she took a good decision and that she has done sufficient physical activity for the day”.

8. Discussion and reflection

We present a novel research through design work, which provides a combined solution to support social and physical activity in the life of senior residents of a care home. We address the challenge of designing for frail older adults, particularly related to issues of acceptance and stigmatization, by characterizing the need to balance seniors’ feelings of losing participation and increasing dependency in their social networks. We emphasize the need to provide solutions closely related to existing activities and with playful components.

Two elements of our design concept provide a unique solution in the area of persuasive design for seniors. One major challenge for our persuasive mechanisms was to let the old adults perceive a degree of control by being able to decide for themselves about their activities, while still persuade them to stay active. The first element uses the principle of curiosity and exploration to design dynamic interaction styles. Personal and public information will be displayed at different locations in the care home triggering old adults to link own personal information with related information at a group level (e.g. floor, facility, neighbourhood, etc.).

The second element uses the principle of nurturing by providing a subtle reward mechanism that links the personal information about one’s performance with public information of available activities. Using the same visual description to quantify the performed level of activity and the available activities, our solution might influence the old adults’ decision whether to join or not an activity.

Involving older adults throughout the design process was valuable and important lessons were learned over the techniques we selected for this purpose. The decision to involve older adults that live independent in the requirement study, provided with valuable information regarding aspects in the transitions of the ageing process that relate to their like and dislikes of their daily activities. We could reaffirm from our independent living participants that one of the main goals they have is to keep themselves participating in their social network, something we could as well identify in the more active seniors in the care home. The use of diaries allowed us to extensively capture the nuances regarding the likes and dislikes of a senior in their daily activities. The simple structure designed in the diaries helped participants to focus on reporting reflections rather than detailed descriptions of their activities. However, the morning part (plans of the day) was not an easy task for some of them as they rarely plan their days ahead. But for the majority, it helped them to recall at the end of the day what they actually did and focus on their reflections rather than describing them again.

The pre-interviews were also a valuable source to contextualize participants’ activities when analysing the diaries. All participants were very proud to show us pictures, sculptures, paintings and other objects in their home to explain more about their activities and hobbies. Interestingly, during the post-interviews most participants manifested their concern as they thought they did not have
enough interesting things to write down during the week of the study. However when we would examined the diaries in preparation for the interviews we were thrilled by the amount of information given and how active in general they were, which they also became aware of after the interview.

The use of personas and scenarios were used in several iterations to map the needs collected from our participants with the design and technology challenges we have in our project. During the focus group sessions we asked participants to get familiar with the personas and the scenarios, discussing how a particular scenario could help a persona. Participants would only use the positive aspects of the personas (as they needed to feel identified with them) as well as the familiar elements of a scenario, to start imagine how a scenario could help a hypothetical persona. For example we presented a scenario where a smart display could inform them about how active they had been during the day; only after one lady related that scenario to her pedometer they could all start imagine how that display could be useful in their lives. In our design sessions we redefined our personas and scenarios to address the need to enhance the positive aspects of a persona with technology that will have familiar components for the senior community.

9. Conclusion

The results of our process are illustrated in Fig. 4, where we identify three components for the design for persuasive mechanisms to help older adults to be aware and proactive in maintaining a proper level of social and physical activity in their daily life: design for transitions, using mutual motivators and playful persuasive mechanisms. In addition we also identify three contexts of use to support the interaction between older adults and their peers, their family (in particular grandchildren) and their caregivers (family as well as professional).

Our work shows that when developing persuasive solutions for (frail) older adults it is important to design for transitions: design solutions that include the nuances and dynamics of the life of the seniors and of their social networks. On the one hand, we have observed that there is little social support to the transitions of becoming less active and therefore more dependent on others. For example, technology solutions that emphasize seniors’ need for help often raise issues of stigmatization. On the other hand, technical solutions that try to introduce new ways of interaction often raise issues of acceptance. Therefore, we focus on the design for cohesive social environments supporting familiarity and promoting participation, thus addressing issues related to acceptance of the technology and stigmatization.

Our focus on playful persuasion and mutual motivators aim to address the dynamic nature of social and physical patterns and the subjectivity of social and physical preferences. Our findings have shown that the motivation for an older adult to engage in certain activity would vary depending on contextual factors (weather, location, quorum, etc.) and their intrinsic motivations, which evolve over time. Therefore our second conclusion highlights the importance to explore designs that integrate social and physical motivators to address difference preferences and context by providing flexible and dynamic triggers.

We identify two areas where technology could support our combined approach of designing for transitions using social and physical triggers as mutual motivators. These areas represent aspects in the life of an older adult that relate to self-awareness (personal activity monitoring) and social/group awareness (programmed and spontaneous events/activities). We think that facilitating the monitoring of own activities (self-awareness) could work as a physical motivator, making people more sentient of their own capabilities and goals and helping them to make more informed decisions whether they should do more activities or whether they have done enough for the day. The latter decision is particularly important, as many existing solutions only focus on encouraging people to be more active, but our observations show that is equally important to guide old people to learn when to take breaks and not overdo. Similarly, sharing programmed and spontaneous activities is considered a social motivator, as it can create more opportunities for social encounters that are more in line with the moment-to-moment people’s needs and desires. We conclude that combining these two areas with playful interaction mechanisms, our design solutions could support curiosity, exploration, fellowship and nurturing by the display of meaningful and relevant awareness information.

From our process so far we also draw a first set of requirements for the design of persuasive mechanisms to motivate older adults to keep a healthy level of social and physical interactions. First, our design for transitions approach requires for modular and flexible solutions allowing people to develop different uses over time. Secondly, to design for mutual motivators we identify a playful persuasive component to offer motivating mechanisms while evoking a fun experience. Finally, designing for older adults requires familiar and tangible designs with simple and straightforward interfaces to interact with.

10. Future work

We plan to evaluate the Activator concept on different levels. First of all, we will evaluate the design of the system, including its physical appearance and the visualization of the performance data and the upcoming activities, answering questions such as: is the information clear (visible, legible)? Does it communicate what it should communicate? Do users prefer abstract or more concrete visualizations? Different variations of the visualizations will be evaluated in this way. In addition, we will evaluate the usability of the device, answering questions like: Is the navigational structure clear? Are the notifications clear? Is the information displayed relevant? We will also be looking at privacy concerns regarding sharing the performance information to others. In the next iteration, a redefined concept is implemented, and will be evaluated the whole system in a longitudinal field test, uncovering if and how the system is used by the participants, measuring the attitudes of users towards the system, and assessing whether the concept is able to lead to behavioural change among the participants.

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References


