Cooperative Intergenerational Location-based Game with Mobile Technology for the Elderly and the Assistance of the Younger Participants

Katarzyna Abramczuk\(^1\), Bartłomiej Balcerzak\(^2\), Katarzyna Gniadzik\(^2\), Marta Juźwin\(^2\), Wiesław Kopeć\(^2\), and Grzegorz Kowalik\(^2\)

\(^1\) Institute of Sociology, University of Warsaw, Karowa 18, 00-927 Warsaw, Poland
\(^2\) Polish-Japanese Academy of Information Technology, Koszykowa 86, 02-008 Warsaw, Poland

\{bartlomiej.balcerzak,katarzyna.gniadzik, marta.juzwin, wieslaw.kopec, grzegorz.kowalik\}@pja.edu.pl

Abstract. This paper presents a cooperative location-based game for the elderly with the use of tablets equipped with mobile application. The game was designed to tackle at once several crucial topics related to the aging problem, namely the social inclusion, education in the field of modern technology, motivation for learning as well as physical activity. The game was played by mixed-aged teams consisting of two players: a junior and a senior. The preliminary results suggest that the game can successfully address a number of issues including increasing the elderly technical skills, increasing the elderly physical activity, and positive intergenerational interaction. The paper describes the game setup in details and presents some initial data gathered during the gameplay.

Keywords: location-based games, elderly, intergenerational cooperation, mobile games and applications.

1 Introduction

The process of aging accelerates in European societies and becomes one of the greatest social and economic challenges. Specialists in the field of demographics predict that by 2050 over a quarter of EU population will be composed of people that are 65+. Therefore, it is of highest importance for us to learn how to include this demographic in various activities, facilitate their participation in modern technology-based world, and ultimately apply their strength for the benefit of society at large. This objective cannot be achieved without solid knowledge about the psychological and sociological processes associated with aging. The modern ways of dealing with the problem are inevitably related to the Information and Communication Technologies (ICT).
The location-based-game research case described in this paper is a part of the project called Living Laboratory (LivingLab) initialized, developed and implemented at Polish-Japanese Academy of Information Technology (PJAIT) located in Warsaw, Poland. It is run in cooperation with the Municipality of Warsaw. Its goals are related to vital problems of social informatics and are connected with a broad range of GOWELL topics including research and development of solutions for active aging and healthy living, game application for better lifestyle and well-being, positive gaming, stress management and technologies enhancing social well-being. Currently it is in testing stage, with over 200 hundred of the elderly participants, most of whom are seniors who completed the basic computer course provided by the City of Warsaw.

In this paper we describe one of our recent endeavors. We decided to tackle several problems at once. We explored the problem of social inclusion of the elderly, the problem of education of the elderly in the field of mobile technologies and their motivation to learn. At the same time we organized a physical activity for the elders. The tool that allowed for combining all those issues was a location-based game “Stroll Around Yesterday” which joined historical knowledge with the use of tablets and interaction in mixed-age teams of two players (a senior and a PJAIT student of the computer science track). We chose this form of activity to help the IT student understand the requirements that should be taken into account in the process of creating software applications for senior citizens.

2 Related work

The multidisciplinary research approach mentioned above implies the necessity of considering various perspectives related to broad range of topics including social inclusion of elders, intergenerational interaction and stereotypes, ICT skills and barriers as well as well-being of the elderly. The problem analysis leads from the motivation and social activities of older adults to the use of location-based games and modern ICT technology.

A general model for changes in social activities at different stages of life was proposed by Carstensen [1], who suggested that limited activity among older adults may be an adaptive mechanism for coping with a changing environment. Previously models of motivation of the elderly were also studied by Vallerand [2], where motivation was separated into 4 measurable mechanisms. Similar measures for apathy among older adults were proposed by Resnick [3]. Motivation has ramifications in many fields of social activity. Hence researchers conducted studies about the interaction between the elderly motivation and their purchase decisions [4], physical and sport activity [5][6], psychological adjustment in nursing homes [7], family interactions [8] and workplace performance [9], [10], volunteering for social activities and leisure participation [11],[12], and, what is particularly important for the scope of our paper, use of internet-based communication and use of computing technologies [13], [14], [15], [16], [17], [18]. A separate aspect of this research is also connected to investigation into the use of ICT resources in medical treatment of older adults [19].
All of these studies made the observation that older adults suffer from a decrease in motivation, and suggested an active role of the elderly in restoring lost motivation and activity. This makes reaching out and providing support for the elderly crucial.

Many methods for achieving this objective have been suggested and tested. Casati et al. [20], [21] have built an on-line platform which encompasses various application designed to motivate older adults to participate in various physical activities. They emphasize the importance of social cues, such as communication with other users, and a coherent narrative for improving the overall performance of the older adults.

Combining location-based games and mobile technologies has also been studied. Avouris [22] reviewed 15 location-based games where mobile technologies were applied and described the impact of the technology on the general performance. Kiefer [23] proposed a classification of different designs of location-based games. Intergenerational aspects of location-based games were considered for example by Charness [9], who studied how participation in such activities differs among younger and older adults. The findings suggested that older adults, while more cooperative, were equally motivated as their younger counterparts.

Another important field of scientific research is related to intergroup relations and intergenerational interactions. In connection with outdoor activities and location-based games they are sometimes referred to as hybrid reality games [24]. There are some studies on the impact of negative stereotypes on the attitudes and performance of the elders. They reveal interference with intergenerational communication [25], show that stereotypes can both impair and enhance older adults’ memory [26], and indicate that the direct, personal contact with members of a different age group can be more effective in improving intergroup relations than indirect contact [27], [28].

3 Gameplay

The game setup was inspired by the study of related work and literature supported by set of best practices conveyed by external consultants experienced in location-based game design and elderly outdoor activities (e.g. city tour guides). Since every successful location-based game needs a good storyline with an alluring plot, we developed a story about a mad scientist, dr von Gestern, who has constructed a machine disturbing the space-time continuum and bringing back buildings from the past, namely from the communist era. The task for each team was to find and close all the wormholes and restore the contemporary buildings. The corresponding promotional materials were created (movie trailer, website, press release, facebook profile etc.) in order to support the recruitment process of game participants.

The teams consisted of two people: a senior and a junior. They were all equipped with space-time fixing modules i.e. tablets provided by the LivingLab team with preloaded software including special game application. The tablets could only be operated by the older team member. The gameplay consisted of a series of consecutive locations (game station). Directions to the next location were provided by our mobile application. Having reached the location players were obliged to close a wormhole by completing certain task which always included using the tablet. The application
displayed current GPS position alongside with additional destination hints: textual (based on literature and cultural context) and visual (old B&W depiction gradually transforming into contemporary colorful location photograph). The tasks were connected with the storyline and related to various activities usually performed on mobile devices e.g. connecting to Wi-Fi hotspot, scanning QR code, taking panoramic picture, searching information on the internet and playing puzzle games.

The study concept was to stimulate interaction and cooperation between the team partners: on one hand, the elderly participants were using the device and mobile apps with an indirect assistance of the younger tech-savvy team member, on the other hand the elderly should be more familiar with the historical and cultural context of the game (location descriptions and hints based on the literature and photos from the past).

The preliminary expert consultation along with field tests provided valuable insight and led us to refining the scenario before conducting the first research gameplay. The route was simplified and tailored to the capabilities of the elderly. Finally the game consisted of four stages, with total route about 2 km length and duration of about 1.5 h including mid-time coffee break. The gameplay was accompanied by the pre- and post-game evaluation as well as in-game observation.

The initial gameplay “Stroll Around Yesterday” was held in Warsaw in the area of the Constitution Square (Southern part of the city center) on October 4th 2015. It was during Warsaw Senior Week, as a part of the local International Day of Older Persons celebration (UN established, observed on October 1st). The follow-up game (shortened demonstration version) was held on October 9th as a subject of a field visit of the “AFE-INNOVNET: Towards an Age-Friendly Europe” international workshop.

4 Results

Initial game was played by 30 participants divided into 15 two-person teams. The general impression was very positive. Both groups of participants (younger and older ones) enjoyed it and we received many requests for the continuation. In particular older persons were satisfied with their performance and pleased with cooperation with the junior counterparts. The most important outcome is that both groups claimed that during the game there was a true cooperation were both sides had an opportunity for an initiative and contributed nearly equally to the success of the team (all the teams completed the game).

Before an in-depth insight into the research results, we present the profile of our elderly participant. An average senior player was almost seventy-year-old retired woman from the large city (73% female participants, average age 69, youngest 60, oldest 86) rather well educated (60% of higher education) with basic computer skills and motivation to learn how to use tablets. She uses smartphones rather regularly (60%) and considers mobile devices very useful (75% before the game, 87% after the game), but has a limited knowledge about using it (40% of younger participants evaluated their older counterpart as having little knowledge about how to use tablet; some participants claimed that it was the first time they used the tablet, nevertheless they managed to complete the game). From additional surveys performed on the
LivingLab platform we also know, that our senior is rather independent: 50% lives on their own, without family members, 75% have a PC, and 63% use it without any assistance. They have a broad variety of interests from cooking and crosswords to chemometrics and fitness.

To evaluate the performance, we asked both groups (seniors and juniors) to choose the most accurate description of what happened on each stage of the game on a 5-point scale from “junior completed the task” to “senior completed the task without any assistance”. The results were rather consistent and very encouraging. In very few cases the evaluations by two parties differed by more than one category. In most cases the senior completed the tasks instructed by her/his partner. The most problematic task appeared the connection to the Wi-Fi and verifying the connection – many seniors asked their partners for direct assistance. As a comment we should add that general opinion from the above-mentioned demonstrative game edition proved that tasks were not so easy to perform.

In terms of learning and self-awareness an interesting conclusion is that seniors generally underestimate their performance. This refers particularly to taking the panoramic photo, scanning the QR code and playing a mobile game. On the other hand, seniors overestimate their capabilities in searching and in establishing the Wi-Fi connection.

As for the cooperative intergenerational activity, we were successful not only in lowering the technical barriers but also in encouraging intergroup relations. We explored this issue relying on contact theory [29], [30] which essentially claims that if certain conditions are met the contact between different groups can improve their attitudes and opinions of each other. Our game fulfilled most of the criteria for a successful contact. Therefore we decided to check whether the attitudes of the elders towards the young and vice versa changed after the game was played. To verify this hypothesis we asked both seniors and juniors to evaluate members of the other age group with the use of a set of antonyms grouped into 12 dimensions (Table 1).

<table>
<thead>
<tr>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>productive</td>
<td>unproductive</td>
</tr>
<tr>
<td>active</td>
<td>passive</td>
</tr>
<tr>
<td>aggressive</td>
<td>defensive</td>
</tr>
<tr>
<td>independent</td>
<td>dependent</td>
</tr>
<tr>
<td>organized</td>
<td>disorganized</td>
</tr>
<tr>
<td>decisive</td>
<td>indecisive</td>
</tr>
<tr>
<td>cooperative</td>
<td>uncooperative</td>
</tr>
<tr>
<td>flexible</td>
<td>inflexible</td>
</tr>
<tr>
<td>hopeful</td>
<td>dejected</td>
</tr>
<tr>
<td>trustful</td>
<td>suspicious</td>
</tr>
<tr>
<td>pleasant</td>
<td>unpleasant</td>
</tr>
<tr>
<td>exciting</td>
<td>dull</td>
</tr>
</tbody>
</table>

Before the game the participants were asked to evaluate a general other (some unspecified member of the other age group) and some specific, familiar member of the other age group they were asked to think about. The chart below shows median
evaluations of the general other and a familiar other from the other age group for junior and senior evaluators. The larger values indicate less favorable opinions. The size of the circles matches to the number of dimensions (from the list in Table 1) with the corresponding coordinates. For example the largest circle on the left hand side shows that for most dimensions the median evaluations of the general older other was 3 while the median evaluation of the familiar older other was 2. The red lines indicate equal median. As most of the circles in Figure 1 are below that line, we can safely state that before the game the familiar others from the other age group were perceived more favorably than the general others.

Fig. 1. Median evaluations of general other and familiar other before the game.

After the game we asked participants to evaluate a general other from the other age group once again. The next chart plots the median evaluations of the outgroup among young (the left hand side) and older (the right hand side) evaluators before and after the game. The results are striking. Virtually all the circles are below the red lines which indicated that for almost all the dimensions the perception of the outgroup improved for both juniors and seniors.

Fig. 2. Median evaluations of general other before and after the game.

Summing up, we have reasons to believe that this kind of activity is a very promising tool for improving intergroup relations, and diminishing age-based stereotypes. We plan to conduct additional gameplays to verify this result.
5 Summary and future work

The game described in this paper proved promising in several ways. It can increase the technical skills of the elderly, improve their physical activity and enhance positive intergenerational interaction.

Apart from the scientific results the outcome from the initial gameplay was lots of hands-on experience. Unfortunately the initial game setup was very demanding and turned out to be resource intensive and time consuming. On the whole there were dozens of people engaged from actors and movie crew to software developers, testers and gameplay staff.

In the nearest future we plan to retake the original game to verify the outcome, as well as to continue the struggle in order to prepare more concise and robust setup of the game which could be replayed automatically by a larger group of participants without the need of relying on the human staff, since reusability and scalability are crucial for various research approaches, i.e. crowdsourcing. We also plan to develop a setup that could be used indoors with the use of QR codes and BT beacons.

Acknowledgments. This project has received funding from the European Union’s Horizon 2020 Research and Innovation Programme under the Marie Skłodowska-Curie grant agreement No 690962.

References