Experiences from Long-Term Exergaming with Elderly

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ABSTRACT
Physical activity is important at all ages, and for the oldest it is also essential to stay fit to manage daily life. Exergames can make physical activity fun and motivational, and we see that senior centres and retirement homes start offering exergames to seniors. We wanted to find out whether seniors will keep on playing over time and what motivates them to play on. In a five month study we found that seniors still enjoy playing given that they have games that they enjoy, and that they ask for new challenges and new games when they master the basic gameplay.

Categories and Subject Descriptors
J.3 [Computer Application]: Health

General Terms
Documentation, Human Factors, Verification

Keywords
Exergames, aging, Nintendo Wii, physical activity.

1. INTRODUCTION
Serious games are widely being used in health care [1] and for elderly exergames are used for physical activity and rehabilitation [2]. Particularly Nintedo Wii is often found in senior centres due to its early entrance on the market with exergames targeting a larger audience. However, the games are not specifically designed for elderly and some studies indicate shortcomings with the commercial Wii games [3,4,6,7]. Scores and progress measurements are too generic for rehabilitation use [5]. Many of the games are difficult to play [5] or too fast. [3,7] However, studies show that elderly seem to enjoy playing commercial Wii games [6,8] and studies also show that the gameplay can be good for balance and rehabilitation. [3,4,6,7,8,9,10].

Most studies with exergames are short term, for instance ranging from six to twelve weeks. [3,4,6,8] We wanted to find out whether the users still enjoy the exergaming after playing for a longer period and what the motivational factors were.

Seniors from a senior centre were invited to try out different commercial Nintendo Wii games as a part of a lab test in a research project and they enjoyed it so much that they started to have a one hour weekly training session organised through the senior centre.

The project research team has been there regularly, helping, observing and talking to the elderly gamers. The study has followed a group of seven players who have been playing for five months. This paper describes some of the lessons we have learned, both by observations and through interviews.

2. METHODS
2.1 Recruitment and data collection method
The participants were recruited by an activator at the senior centre. Seven persons have been playing Wii regularly for the last five months, five women and two men. Their average age is 80 ranging from 76 to 83. They are all relatively fit, being able to go for walks and climb stairs and they come to the senior centre by their own means.

Members of the project team have observed the senior players in several gaming sessions. The seven players were also interviewed in semi-structured interviews following an interview guide with questions regarding the games and gameplay, and the interviewers also filled out questionnaires about the gameplay. This was done after 5 months of playing. The activator was also interviewed about the games and gaming sessions in general.

All participants have also completed questionnaires about their background regarding age, technology, and exercise habits as well as one about the Wii play. All participants have signed an informed consent.
2.2 Method for Game-Play

The project team, with the help of a nurse and a physiotherapist, did an initial selection of Wii games that could be suitable for the target group, following criteria for elderly persons both regarding movements and gaming. The initially chosen games were Table Tilt, Yoga half-moon, Hula hoop, walking (actually a jogging game), tennis and bowling. Two players can walk together in the walking game. In Table Tilt the players stand on a Wii balance board, while in the jogging/walking game they use a Wii remote that preferably is placed in a pocket. In Table Tilt the players are supposed to get balls into holes on a tilting board, and the game gets increasingly more difficult with new boards and more balls as the players advance.

Figure 1 Wii remote, nunchuck and balance board

An activator at the senior centre was trained by the project team on how to arrange the exercise sessions and how to handle the Wii components and games. The activator organised the gaming sessions with a regular exergame program starting with yoga warm-up followed by balance exercises (Table Tilt) and endurance (walking / jogging).

In the beginning they followed the program with the chosen games, but the activator wanted to try some other games, and the seniors also requested new games and more yoga exercise when they felt they mastered the initial selection. They have tried a wide variety of games from Wii Sports (using the remote) and Wii Fit plus (mainly using the balance board, but also the walking/jogging game). All players have not tried all the games, since some games only have been tried in one or a few sessions. After the initial weeks the seniors have also been asked which games they wanted to play.

Games played using the balance board (all from Wii Fit):
- Slalom
- Table tilt
- Hula-hoop
- Yoga – simple exercises for warm-up: deep breathing, half-moon, palm tree and warrior.
- Ski jump
- Penguin slide

Games played with the Wii remote:
- Basic run (can be walked) from Wii fit
- Bowling
- Cycling
- Sword fight

3. RESULTS

All participated in the exergame sessions when they did not have other appointments or occasional illness. In the beginning the participants wanted to play the same games over again. As the weeks went by, and they had a gaming and exercise program that they perceived and mastered well, the participants became more eager to try out other games. The program with yoga warm-up and balance training was followed, but the last part varied between the sessions, making room for other games. All games have been played standing, partly with great vigour and engagement.

They started mainly using the balance board (table tilt, slalom, yoga, ski jump), but later also the Wii remote. Since most of the games are single player, it takes time to wait for turn when there are so many players. The activator has been changing program to try to find a way to activate all the players and reduce the total waiting time. For a long period they have started the warm-up with the activator standing on the balance board performing yoga exercises (deep breathing, half moon, palm tree, warrior) while the participants were standing on the floor, all doing the same exercises. After that they would take turn playing the other games but they always played at least one balance / flexibility game (table tilt / slalom) and one endurance game (jogging).

Figure 2 Four persons in the walking game – two without remotes

Our main findings from the observations and interviews are that on the balance board they preferred “fantasy” games (table tilt, penguin slide) over sports games. When it came to sports games they preferred slalom. We also noticed that they preferred sports games where they could continue playing even if they failed (for instance missing a gate in slalom). One of the players disliked ski jump and one sword play, which was the only negative feedbacks on the games, although one was indifferent towards yoga.

Figure 3 Yoga warm-up

See table 1 for how they like the games they played the most. Only five have tried ski jump and yoga by themselves, as
indicated in the table. Table 2 sums up how the users perceive the usefulness of the balance board games as physical exercise.

### Table 1. The most played games and how the seniors liked them after 5 months of playing

<table>
<thead>
<tr>
<th>I like…</th>
<th>Very well</th>
<th>Well</th>
<th>Neither nor</th>
<th>Bad</th>
<th>Very bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slalom</td>
<td>2</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Table tilt</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ski jump</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Yoga</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bowling</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Jogging</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Table 2. The perceived usefulness after playing balance board games for 5 months. 1 – Agree strongly, 2 – Agree, 3 – Neither agree nor disagree, 4 – Disagree, 5 – Disagree strongly

| I think balance board is fun | 1 | 2 | 3 | 4 | 5 |
| I feel it helps my balance  | 2 | 4 | 1 | 0 | 0 |
| I feel it is good for the flexibility | 2 | 4 | 1 | 0 | 0 |
| I am afraid to fall off      | 0 | 1 | 0 | 1 | 5 |

All of the seven participants liked the balance board, and six out of the seven felt it improved both their balance and flexibility. One says that he/she is too old to get better. Only one was afraid of falling off the board while playing. All of the respondents enjoyed the Table Tilt game, even though one finds it difficult.

Table Tilt was the most popular game. The jogging game was also popular, even after five months of playing. Four think that it can improve their endurance while three do not. They have been playing jogging two and two, competing, and sometimes almost running into the TV screen. Bowling became popular after they had tried bowling for real, before that they did not like it. They have also tried some other games briefly. Penguin slide was fun, but sword fighting was not so well received.

When asked to tell about likes and/or dislikes about particular games, two preferred bowling, one liked ski jump because they had to use the knees. Another preferred yoga, but says that most games are good, it depends on the movements. One preferred bowling because he/she gets to use the head since you both have to push two buttons on the remote and you are able to adjust the direction of the ball. One said that all the games are fun. One preferred bowling and balance (table tilt and slalom).

When it comes to perceived total usefulness of playing Wii, six out of the seven find that it helps the balance, only three think it helps their endurance, five think it increases their strength and six think the flexibility. The one respondent who says it does not help the endurance, is a person who already go for long walks every day.

Six liked very much (3) or much (3) the cheering audience in the games, they get stimulated and encouraged. Six would also observe how many points they get.

We also asked how they liked the feedback on calories burnt. One had not even noticed, four found it good and one was neutral.

Only three said that they could understand the English, the rest could not. The activator had to translate and explain. Some also thinks the time it takes to navigate and change games can be too long, but they do not agree that the time spent in games is too long (three think the time is good, one finds it too short and three are indifferent).

When asked about the remote control, particularly in bowling, only one says it is difficult, the rest are either neutral (neither easy nor difficult) or say it is easy, but some of those still comment on the difficulty of coordinating two buttons. They also say that they have learnt to master the remote, but they found it quite hard in the beginning.

When asked how they perceived the weekly exergaming, some comments were: “would like some new games”, “children and grandchildren are impressed”, “the best is the arrangement itself”, “glad that I started”, “should also have something where the arms must be lifted” and “I have become more social”.

### 4. DISCUSSION

We wanted to find whether and what kind of exergaming could be motivational to play over time for seniors. Most seniors asked were reluctant to participate, but we recruited some who were not afraid to try new things. One of them could be considered a driving force for involvement at the senior center. The other participants were more reserved but open-minded and positive. All but one of the participants in the study were considered quite fit.

Playing together with peers proved to be both rewarding and motivational. Also those who are not playing are eager and cheering audience. The group has become a well-knit group who socialise and enjoy each other’s company, even though they did not know each other from the beginning.

Being physically active is perceived as motivational for them, just as they like that they have to use their cognitive skills in some of the games. However, so far we only have results for the participants’ perceived usefulness of exergaming and no physical measurements of the effects. Since we know that physical activity is good for people, maybe exergaming can motivate some to exercise more than they otherwise would have done.

The participants are getting involved and excited while playing, to the extent that some walks off the balance board or almost runs into the screen. They all need to drink water during exergaming, and they all dress up in loose clothing when arriving at the sessions.

We think that the intensity of the gaming is important for the health benefits. Also, the physical fitness and activity level in daily life of the respondents is important when comparing answers from the questionnaires. The respondent who regularly walks several kilometres did not find the endurance exergames useful for her fitness, compared to the respondent who is less active and dependent on a walking-frame for outdoor walks.

At first the players wanted to play the initial games over and over again. However, when they mastered both games and gameplay they were ready for new challenges, so they were happy to try additional games proposed by the activator, and later they asked for new games. We found that for the senior gamers it takes time to get familiar with the technology and feeling comfortable while playing. Thus, the introduction and training period should not be too short. However, after having played for several weeks, they
were less afraid to try new things and not so embarrassed if they failed, and they found it boring to do the same things every time. The activator took care of the technology in all of the sessions. She started the Wii and changed between the games. The users were never asked to try since the game console and other game equipment is kept in a different room between sessions, and it takes some time to get ready. Still, a very visible annoyance for the players is the time it takes to switch between games, and also the time calibration takes. They feel that this steals time that they could have spent exergaming. To restart a game is easy, so having many participants take turn playing the same game is not so time consuming. However, then we could not use personalised and weight calibrated avatars for the individual players. When all use the same avatar, the difficulty for the different persons is biased.

Also we wanted to avoid difficulties with handling the Wii remote buttons. Some games are played with two hands, using a Wii remote in one hand and a Wii “nunchuck” in the other hand. These two are of different shape, and we think this could be confusing. They did however manage bowling where two buttons on a Wii remote had to be handled, but still some had to be given an instruction in every session about how this was done.

Previous experience and cultural aspects seem to be important when choosing games. When they play sports games, they seem to prefer games where they know the sport (for instance all in the group have been skiing) – except when they have a strong dislike for it (boxing). They particularly find the balance board game Table Tilt a good exercise and fun to play, and this is a game that is not mimicking a sport. They can twist the hips in their own manner and after their own abilities. Some are barely moving while others really are twisting and rolling their hips. Table Tilt is easy to understand and it automatically gets more challenging as the players master a level, but still it is possible to play on even when the player fails. We think these are the main reasons why it kept being the most popular game throughout the study period. Also walking was popular. This is also a game that is easy to understand, and since they play it two-and-two, a bit of competition is added. The group we had is however small, and it would be interesting to try with a bigger group.

5. CONCLUSIONS

Even after five months of play the players seem to be enthusiastic, so we think that exergaming can motivate seniors to exercise for a long period, particularly if they get new games and challenges. We also think that exergaming can be useful, since the players are on their feet and also get exhausted. The usefulness will however both depend on the intensity and duration of the exergaming, and according to the perceived usefulness by our test groups, on the fitness of the players.

We have also seen that it takes time to get acquainted with new technology and to understand the gaming concepts, so good supervision and easy gameplay is required in the beginning. Our study also indicates that exergaming can be motivational over time, but then it is important that it is possible to advance to new challenges when a game is mastered. We see that particularly table titt, that gets increasingly more difficult, continues to be very popular even after several months of playing. Bowling only became fun when they played for real and then also mastered its game rules. The other games they tried do not have the same fine-grained balance between game difficulty and player skill.

The fun and social factor for our senior participants seems more important than mastering particular rules of sports. In exergames players should be able to continue the play even when small mistakes are made, and thus avoid the repeated restarts and frustrations of not understanding what went wrong.

We have seen that some of the Nintendo Wii games are suitable for the elderly, but many more are not. Several games are unsuited for people with disabilities, although some can be played sitting down or with a walking frame. There is thus a need for more exergames targeting the old.

6. ACKNOWLEDGMENTS

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7. REFERENCES


