Creating an Healthcare-application to socialize elderly people: Final Report

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ABSTRACT

Due to the demographic change in the world, especially in the western part of the hemisphere the overall population gets older and older and we have to face new problems resulting from this change. One of these problems is the increasing factor of loneliness and isolation among the elderly. The consequences are psychological as well as physiological diseases causes by loneliness. To improve the quality of life among the elderly we want to reduce these diseases by decrease the level of loneliness in first place. As a tool to reach this goal we used a prototype of an application for a Tablet, more precisely the game called Bingo to help elderly socialize with others even when they cant leave their home or even worse their bed. In this application they can use pre-made chat massages to communicate with each other while they waiting for a game to start as well as during the game itself. On the first level they play a enjoyable game and on the way they connect to other people and we were able to create bonds between test participants which reduces the level of isolation and will therefor also reduce the related diseases. An improvement of in this project generated prototype should generate a valid tool to help facing the isolation among the elderly and improve therefor the quality of life.

Author Keywords

Gaming for Elderly;Gaming vs. Isolation of Elderly; Digital Communication for Elderly

INTRODUCTION

To cerate a common ground: Bingo is a game of chance and searching. Every player gets a different 5×5 grid of numbers and needs to find specific numbers in the given grid and mark them. For each number there is only a certain time available. To win a match the marked numbers needs to fulfill characteristic patterns, in this case create a marked row or column. Whoever gets this pattern first and are also able to press the Bingo-button first win the game.

This project combine special factors of creating applications or

rather games for elderly. Especially the communication is focused in this project and elderly should find new people or stay in contact with known ones highly requires communication. There are further crucial points when designing games for elderly. The primary function of bingo for the development-team was the socialization, but the users main interest is probably the application and in this case the game itself. With that premise the user starts the game because he wants to play and maybe find people while playing which dramatically reduce the pressure of such people, but keeps the possibilities open [18]. This on the other hand lower the abortion when something went wrong. To prevent that something went wrong the application tries to find the perfect compromise between functionality and simplicity. That means exclude everything that is not needed or can distract. Bingo was chosen to get closer to the common interest of those people as with something like Counter Strike¹ as well as because its visual simplicity and the scalable difficulties. Intuitively is an important point which should considered in every digital program, but there are different levels of intuitively between the daily consumer of the digital world and most elderly with limited experience in terms of using more then Skype or Whatsapp or even more. Therefore things need to be explained or rethought which would normally considered as common use-case[10][18]. An additional factor is the high contrasts and the low diversity in colors and animations to distinguish this Bingo application from those for children. To achieve the crucial point of social connectivity every player need a name and and avatar(profile picture). Of course is it optional to publish the real name or image but its not important what they choose, rather then with name and image it is far easier to craft social bonds and recognize who wrote or said which message.

In the following parts of this report we address further justification about the need of this project in "Related Work"; how the study for the evaluation was designed and executed in chapter "Study"; an overview about the outcome of the study in chapter "Results"; an discourse in how to interpret

¹Highly action and reaction based competitive first person shooter. http://blog.counter-strike.net/



Figure 1. In a gamelobby, for up to five people, they can chat with each other and see there names and images and they will see this also while playing.

these results in "Discussion"; afterwards an advice what can be done in the next projects in "Future work" and finally the "conclusion".

RELATED WORK

Designing software for elderly is an growing field and need some special attention according to the special needs of those people. The danger of loneliness and isolation is there, independent from the age, but nevertheless elderly takes a higher risk [1] and negative blood pressure [15] is one of the less dangerous results. Games can influence these people in an entertaining and therapeutic way, as well as helps building social bonds with others [7][5]. Additionally they can train cognitive and physical abilities[16] or help regaining lost skills[4][20]. Good luck that the elderly in general were interested to engage in playing digital games [19][6]. Gerling et al. presents the game "Silver Promenade" and evaluates it to improve physical skills[6]. There are many games to create physical activity [11][9] but also some with cognitive interests like a Pokergame especially for seniors [14]. One problem is that those who wants to learn software on their own often do not understand it fully [3], therefore we need special design for elderly people [6][2] and also have to think about meaningful play for older adults [13]. If we can realize a suitable game for seniors we can increase the quality of life and may also increase the emotional well-being[8]. Some of the prior works gives valuable suggestion regarding design considerations for game development for elderly people[10][18] and some literature shows that 60% of elderly people are not necessarily interested in games, just for the sake of games they want something more out of it, i.e. social component[18]. This project tries to combine most of these points to create a pleasuring and healthy experience for elderly. The next chapter addresses the Study which evaluated this application.

STUDY

For this Study participates 30 (25 male, 5 female) people between the age of 18 and 30. Even though that technically elderly people are needed for this investigation, mostly students where chosen because of a lack of funds and time.

The study itself begun with a short introduction and the Data agreement. After that there was a short personal questionnaire

(e.g. age, gender, tablet experience). The main task for the participants was to play two rounds of Bingo against the investigator followed by parts of the gaming-questionnaire by Ijsselsteijn[17] whereat every question is designed as a five point MOS-scale. Every game was completely random and the first round was just the basic game and the second one with the whole chat included. The chat adds two new features: *First*, every User get notifications from the System about the progress of the other players which look like:"PlayerXY only needs X more numbers to win"; *Second*, every User have four text messages to choose from hided under four different smilies (1. You have no chance winning. 2. Thats only your opinion. 3. Well played and 4. I will loose). The whole study took mostly between 20 and 25 minutes inside the same room and was rewarded with two pieces of candy.



Figure 2. The game itself without chat. Here the Players with the names are displayed similar as in the game-lobby on the left hand side. On the opposite side is the grid with the number which can be marked by simply tapping on them. Between those the pool-ball with the number which have to be searched and a little time-bar that shows how much time is left to find this number.



Figure 3. The game itself with the new chat window and the for smilies with the hidden messages below the chat-window.

According to Ijsselsteijn[17][12]there are several dimensions of player experience that can be excerpt by the questionnaire. These are: Competence, Sensory and Imagitive Immersion, Flow, Tension/Annoyance, Challange, Negative affect, Positive affect, Empathy, Negative Feelings and Behavioural Involvement. The first seven are related to gaming experience based on the game itself and the last three to the social bonds. Both parts are highly interesting because a pleasuring game is needed in the first place to get the elderly playing and in the second place the social bonds reduces the loneliness and is therefor a direct goal of this project.

These dimensions are computed as the average value of the means of specific questions and are evaluated by ANOVA to ensure the evidence.

RESULTS

Before the final results are shown comes a prof of statistically significant effect of the chat for the 10 dimensions done by repeated measure ANOVA, which presented in short form in the following table:

The chat changes the	Values (df1,df2,F,p)
competence	F(1,29) = 0,655; p = ,425
Sensory/imaginative im-	F(1,29) = 3,625; p = ,067
mersion	
flow	F(1,29) = 0,360; p = ,553
tension/annoyance	F(1,29) = 1,335; p = ,257
challenge	F(1,29) = 2,894; p = ,100
negative affect	F(1,29) = 31,75; p = 0,00
positive affect	F(1,29) = 4,444; p = ,044
empathy	F(1,29) = 11,30; p = 0.002
negative feelings	F(1,29) = 6,883; p = .014
behavioral involvement	F(1,29) = 24,98; p = 0.00

Highlighted in red are the non-significant factors and in green the not significant ones separated by the p-value-boarder of 0,05. The two charts (Figure4 and Figure5) shows the resulting values of the 10 dimensions. The first one contains all non-valuable and the second one all the valuable dimensions.



Figure 4. In this chart are all non-significant dimensions. The numbers below are the averages of the mean values of the for this dimension needed questions.

The differences in the Figure4 are very small according to the results of the ANOVA but in Figure5 there are quite big changes as visible in the next chart. The last diagram (Figure6 addresses the relative change of the five significant dimensions in percent compared with the fix changes which can be found in Figure4-5.



Figure 5. In this chart are all significant dimensions. The numbers below are the averages of the mean values of the for this dimension needed questions.



Figure 6. In this chart are the relative improvement in percentage of the significant dimensions. Negative values are a decrease and positive values a increase compared to the first round.

Unfortunately only two participants are left-handed, therefor this study delivered no information about the usability for those people or rather if this arrangement of object while playing is usable or not. This is also true for the five female participants which are not enough to get significant result and find any differences. The general discussion about the data and the results will be done in the next chapter.

DISCUSSION

Before the dive into the details it has do be clarified what the meanings of these 10 dimensions are. Therefore is in the next table a short summarization of the short meaning of every dimension. The first seven are related to the gaming experience directly whereas the last three consider the social aspect of gaming. Because the changes are limited in communication it is not surprising that most of the gaming related dimensions are not significant and all the social ones are.

dimension	short meaning
competence	pride, euphoria, accomplish-
	ment accomplishment
sensory/imaginative immer-	absorbed in the story, identi-
sion	fication, presence
flow	concentration, absorption,
	detachment
tension/annoyance	irritability, frustration
challenge	basically how challenging
	the experience was
negative affect	frustration, disappointment,
	irritation, anger
positive affect	fun, happiness, enjoyment
empathy	mutual happiness influence,
	connection, sympathize
negative feelings	mutual ignorance, revenge-
	fulness, malicious delight,
	jealousness
behavioral involvement	mutual influence with action,
	attention and intentions

The first five dimensions are the non-significant and the rest the significant ones and now the more specific meaning of these are known it can be discussed why these results appear. To answer this question remind, that the change between the two played rounds is the added possibility to communicate with each other threw these notifications or rather the pre-made chat messages.

To win the game the same amount of accomplishments are required and this basic level of communication is simply not enough to make any differences in *competence*. Furthermore the *immersion*, *flow* and *challenge*, do not change because of an increase level of communication. The player will not be dragged into the game more or are more absorbed by the gameworld because the pre-made chat do not aim those targets. The range of the chat is also not enough to taunt players to make a significant change in *tension/annoyance*. With other words the added tool does not bother the players. With an increased stage of communication it might be possible to reach a significant change in these 5 dimensions but for now this result is not much surprising.

The study shows that even this basic amount of communication reduces the anger and frustration (*negative affect* of the player by round about 22% (2,14 \rightarrow 1,68). That means that the possibility to communicate alone can negate these *negative affects* which is a most welcome point because it is hardly needed to keep those points low to create an enjoyable game, especially for elderly people. Interestingly, considering the previously dimension the added tool increases the *positive affect* (6,9%; 3,30 \rightarrow 3,53) less than it decrease the *negative affect* (-21,8%).

The key dimensions in this project are the social ones and there is an high increase in *empathy* (21,2%; 2,25 \rightarrow 2,73) and also in *behavioral involvement* (33,2%; 1,56 \rightarrow 2,07). The pre-made messages improve the overall mutual characteristics and therefor is a valuable help to create social connectivity among the players (elderly). Somehow the *negative feelings* (24,1%; 1,71 \rightarrow 2,13) also increased. This might not always be a bad thing, but in further development there should keep an eye on this dimension and also investigate how big the impact of *negative feelings* is related to the overall project (effect). The focus of the analysation of the dimensions was more related to the difference and the relative percentage rather then the absolute values. Only two dimensions are on the MOSscale higher scored as three and none can pass the four. Would the quality of the game be defined as the mean value of each of the dimensions, the application would get 2,43 with all dimensions as well as only with the significant ones. This value can not even pass the middle of the MOS-scale. Is the conclusion that the game is a failure? We would disagree, because it is a prototype comparable to an alpha-version and in the next chapter is a list of suggestions for next projects to improve this Bingogame.

FUTURE WORK

As in this project there is a prototype created there is a lot room for improvements. The most important point is to expand the ability to communicate. This can be split into three sub-points. First: Change the Chat in Lobby; Currently this chat is also realized with pre-made chat messages. This should be changed to real chat to eliminate the limitation in communication.Second: Add audio chat to the game. While playing text-chatting is simply not possible, but audio-chat allows the user to have a real conversation while playing. Third: Considering the cognitive loads the elderly people might have while playing the game with text messaging, we think premade text messaging can help to reduce the cognitive load. But some additional research to pre-made text messages is needed and need to improve them according to the need of elderly in case someone do not want to use audio chat or is not able to do so but still wants to communicate. In this way not using audio chat still give the possibility to react to someone who do so or start acting.

Another point is to redo the Study again with elderly people to get more valid results and find more weak points in design and usability. Additionally apply a more realistic environment by separating the participant and the investigator and put them into single rooms isolated. Further play scripted games, where the winner and looser is fixed in every game, of course without the knowledge of the participants to get more stable results and eliminate the factor of luck with its influence on the participants answers.

The last factor which can be improved is the gaming experience in two points. *First:* Improving the overall usability by add more multi-model output. Especially the synergy or counterproductiveness of audio chat and sound outputs. *Second:* Add scalability by the rules to address more different players with different abilities: changeability of winning pattern; distribute the numbers more random in grid; remove the color hint with ball and column; display instead number little math assignments (e.g. not search 32: search 4×8).

CONCLUSION

The goal was to reduce the isolation and loneliness of elderly people and here is an prototype that should helping to address this problem. Even in this early state of development the study shows an improvement in social bounding which will probably increase when future work is realized. It is shown how effective notifications about the progress compared with a limited number of chat massages can be to enhance social bonds. The Bingo prototype is on a good way to be an effective tool fighting against isolation among the elderly and probably be able to have a big impact on those people.

REFERENCES

- "SCIE: At a glance 60: Preventing loneliness and social isolation among older people". 2012. [online] Available: http://www.scie.org.uklpublications/ataglance/ataglance60.asp. (2012).
- 2. Abdullah Al Mahmud, Omar Mubin, Suleman Shahid, and Jean-Bernard Martens. 2008. Designing and Evaluating the Tabletop Game Experience for Senior Citizens. *Proceedings of the 5th Nordic Conference on Human-computer Interaction: Building Bridges* (2008), 403–406. DOI:

http://dx.doi.org/10.1145/1463160.1463205

- S. Borsch. 2011. Elderly Need Super-Simple, Phone-like Skype. Connect Dots [Online] Available: http://iconnectdots.com/2011/10/elderly-and-skype.html [Accessed: 07-Feb-2014] (2011).
- 4. J. W. Burke, M. D. J. McNeill, D. K. Charles, P. J. Morrow, J. H. Crosbie, and S. M. McDonough. 2009. Optimising Engagement for Stroke Rehabilitation Using Serious Games. *Vis. Comput.* 25, 12 (Oct. 2009), 1085–1099. DOI:

http://dx.doi.org/10.1007/s00371-009-0387-4

- L. Gamberini, M. Alcaniz, G. Barresi, M. Fabregat, L. Prontu, and B. Seraglia. 2008. Playing for a Real Bonus: Videogames to Empower Elderly People. *Journal of CyberTherapy & Rehabilitation* (2008), 37–38.
- 6. Kathrin M. Gerling, Frank P. Schulte, and Maic Masuch. 2011. Designing and Evaluating Digital Games for Frail Elderly Persons. *Proceedings of the 8th International Conference on Advances in Computer Entertainment Technology*, Article 62 (2011), 8 pages. DOI: http://dx.doi.org/10.1145/2071423.2071501
- 7. Wijnand Ijsselsteijn, Henk Herman Nap, Yvonne de Kort, and Karolien Poels. 2007. Digital Game Design for Elderly Users. *Proceedings of the 2007 Conference on Future Play* (2007), 17–22.
- 8. Younbo Jung, Koay Jing Li, Ng Sihui Janissa, Wong Li Chieh Gladys, and Kwan Min Lee. 2009. Games for a Better Life: Effects of Playing Wii Games on the Well-being of Seniors in a Long-term Care Facility. *Proceedings of the Sixth Australasian Conference on Interactive Entertainment*, Article 5 (2009), 6 pages. DOI: http://dx.doi.org/10.1145/1746050.1746055
- 9. D.A. Kenny. 1987. Statistics for the social and behavioral sciences. *Bosten: Little, Brown* (1987).
- T. Miura C. Asakawa M. Hirose T. Ifukube M. Kobayashi, A. Hiyama. 2011. Elderly User Evaluation of Mobile Touchscreen Interactions. *Proceeding*

INTERACT'11 Proceedings of the 13th IFIP TC 13 international conference on Human-computer interaction - Volume Part I Pages 83-99, ACM (2011).

- 11. Omar Mubin, Suleman Shahid, and Abdullah Al Mahmud. 2008. Walk 2 Win: Towards Designing a Mobile Game for Elderly's Social Engagement. Proceedings of the 22Nd British HCI Group Annual Conference on People and Computers: Culture, Creativity, Interaction - Volume 2 (2008), 11–14. http://dl.acm.org/citation.cfm?id=1531826.1531830
- 12. K. Poels, Y.A.W. de Kort, and W.A. Ijsselsteijn. "It is always a lot of fun!" : exploring dimensions of digital game experience using focus group methodology. *Proceedings of the International Academic Conference* on the Future of Game Design and Technology : FuturePlay 2007, November 15-17, 2007, Toronto, Canada. - New York : ACM, 2007. (????), 83–89.
- 13. B. De Schutter and V. Vanden Abeele. 2008. Meaningful Play in Elderly Life. *Proceedings of the 58th Annual Conference of the International Communication Association, Montreal, Canada* (2008).
- 14. Nicholas Shim, Ronald Baecker, Jeremy Birnholtz, and Karyn Moffatt. 2010. TableTalk Poker: An Online Social Gaming Environment for Seniors. *Proceedings of the International Academic Conference on the Future of Game Design and Technology* (2010), 98–104. DOI: http://dx.doi.org/10.1145/1920778.1920792
- A. Singh and N. Misra. 2009. Loneliness, depression and sociability in old age. *Ind. Psychiary J. vol. 18, no. 1* (2009).
- 16. Yin-Leng Theng, Amirrudin Bin Dahlan, Meutia Latifah Akmal, and Thant Zin Myint. 2009. An Exploratory Study on Senior Citizens' Perceptions of the Nintendo Wii: The Case of Singapore. Proceedings of the 3rd International Convention on Rehabilitation Engineering & Assistive Technology, Article 10 (2009), 5 pages. DOI: http://dx.doi.org/10.1145/1592700.1592712
- 17. Ijsselsteijn W, A, Y. A. W. de Kort, and K. Poels. 2013. The Game Experience Questionnaire. (2013).
- Y. de Kort W. IJsselsteijn, H. Herman Nap. 2007. Digital Game Design for Elderly Users. *Proceeding Future Play* '07 Proceedings of the 2007 conference on Future Play Pages 17-22, ACM (2007).
- 19. G.R. Whitcomb. 1990. Computer games for elderly. *Proceedings of the conference on Computers and the quality of life* (1990), 112–115.
- W. Young, S. Ferguson, S. Brault, and C. Craig. 2010. Assessing and training standing balance in older adults: A novel approach using the "Nintendo Wii" Balance Board. *Gait & Posture* (2010).