Motivational Factors for Mobile Serious Games for Elderly Users

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Abstract

Due to the increasing life expectancy in the world, the number of elderly people is also augmenting. Thus, society will have to offer more and more products and services that meet the specific needs and desires of these people, who seek alternatives for entertainment, social interaction and learning. Serious games are an option to provide them learning combined with entertainment. In Brazil, it is known that a small part of the elderly has access to computers, and that a larger part already uses mobile phones. Therefore, we carried out a survey to identify the features that serious mobile games should have, so that older people could feel pleasure and desire to use them. This survey was based on a literature review and also on a case study with a group of seniors who evaluated five serious games for smart phones. From the data collected we compiled a list of guidelines for developing mobile serious games that meet the needs, interests and motivations of older players.

Keywords: elderly, mobile serious games, motivation

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1. Introduction

The World Health Organization considers that, in developing countries, the old age is made up of people aged over 60 years. According to the Brazilian Institute of Geography and Statistics [IBGE 2010], the elderly population in Brazil is growing rapidly. It is estimated that in 2050 the number of seniors over 60 years old will represent 60 million Brazilians.

In this context, it is necessary to develop products and services to keep these people updated, to provide them learning, entertainment and means of communicating with other people. One proposal that can fulfill these needs is the digital serious games [Mol 2011].

Serious games refer to games that do not have the sole purpose of entertainment. So, all games that also have the purpose of education, training and physical or mental exercise can be characterized as serious games. These games can also enable social interaction, besides being a hobby to prevent the feeling of loneliness.

However, technology can embarrass the use of these games. The fear, lack of access or lack of experience with computers may hinder the use of digital games. According to the Internet Steering Committee in Brazil [Comitê Gestor da Internet no Brasil 2011] only 6% of seniors have access to computers. But the same survey shows that, in contrast, 34% of the seniors have access to mobile phones, which motivates the research on serious games for smart phones.

There are few researches about digital games for seniors and most of them are focused on computer games usability. Studies aiming to understand the elderly motivation for the use of digital games on mobile devices are rare [Flores et al. 2008; Gerling et al. 2010; Ijsselsteijn et al. 2007].

Game usability is a very important topic to study, because usability is one of the reasons that make the gamers feel pleasure in playing, but it is not sufficient to satisfy the needs and desires of the elderly people. According to Kim [2008], cited by Vieira and Santarosa [2009], the lack of motivation for the use of digital games by the elderly can be justified by the fact that the current elderly have lived most of their lives without access to these technologies. Selwin et al. [2003], cited by Vieira and Santarosa [2009] showed that the major cause for the elderly not using the computer is that they do not identify a need (motivation) for doing it. Thus, it is important to study the preferences of the elderly in order to raise their motivation to the use of digital games.

So, this paper aims to propose guidelines for the development of mobile serious games for seniors considering the preferences, needs and interests that motivate the use of games by older users.

This paper is structured as follows. Section 2 presents related work. Section 3 presents the methodology of the research. Section 4 presents the results and Section 5, our conclusions.

2. Related work

This section presents some related work about digital games for seniors, mobile serious games, and how motivation interferes with the use of games.

2.1 Digital games for seniors

During the last decades, digital games have been a popular leisure activity. Ijsselsteijn et al. [2007] claim that digital games can be considered a promise to improve the lives of seniors, but for that, it is important to develop interesting and accessible games for them,

which could provide them fun and an option to spend time with clear benefits.

However, most of the released games are targeted to children, youth and young adults. As the number of elderly people is increasing every day, Ijsselsteijn et al. [2007] emphasize the growing need to provide alternative entertainment and learning for them. Pearce [2008] reports that the studies of digital games with an emphasis on older people are still rare, because this need is relatively new. This perception may be justified by the fact that the current elderly people did not have much access to technology in their earlier age.

According to Melo and Baranauskas [2006], it is not necessary for the developer to worry about specifics restrictions or disabilities of the users, such as seniors who have limitations due to their age. The developer must provide a structure that meets the diversity. Different point of view has Mol [2011], who states that it should be given a specific treatment to the interface of software which targets the seniors. Issues such as font size, scroll bar, size and placement of lists of options for selection, size of buttons, among others, should be treated differently in order to meet the needs of users with restrictions due to their age.

Tambascia et al. [2008] also state that it is important to develop technological solutions aiming at better usability and accessibility to reduce barriers against the use of information and communication technologies, making the use of the computer accessible to all people, including the elderly.

Ijsselsteijn et al. [2007] reported some restrictions due to age that should be taken into account when developing software for the elderly, such as reduction in the range of visual accommodation, a loss of contrast sensitivity and hearing problems. Therefore, the authors recommend offering the options of zooming, high definition color contrast and the resizing of windows; avoiding small elements (images) or instructions and legends in small font text size; using sounds with tones of lower frequency, which according to the authors are easier to be heard than higher sounds; providing information through some mechanism that causes more effect, such as vibration; allowing the use of headphones; avoiding situations where it is required a higher level of attention, for example, situations that the user needs to remember something that was shown in a previous screen. Despite all these restrictions perceived in most of the elderly, the authors point out that the fact that most of these people are retired offers a differential which is the time they can devote to activities that interest them.

Ijsselsteijn et al. [2007] state that usability is essential in games, but “usability in itself is not a sufficient motivation to use software”. Thus, the lack of awareness of the benefits can be detrimental to the use of a software. This is discussed in Section 2.3.

2.2 Mobile serious games

Pandeliev and Baecker [2010] reported that, each day, serious games reach more diverse audiences, including seniors. According to the Top Highlights from the State of the Brain Fitness [2009], the sector of the serious games industry was valued at 265 million dollars in 2008 and will grow to 1.5 billion dollars in 2015. The authors also highlight that what makes the audience choose between one or other software is the ability to prove that certain software really brings benefits to users, both in mental fitness as in satisfaction with the entertainment. Nap et al. [2009a] share this same point of view.

Mobile games is the term used for games available on mobile devices, which cover mobile phones, smart phones, PDAs and notebooks. According to Yee et al. [2010], games on mobile devices are still little studied, but the research done by these authors show that the use of mobile devices by people in general, including the elderly, is a promising challenge. As design and usability methodologies consider the user the principal involved in the development process [Melo and Baranauskas 2006], there is the need to include the user in new researches.

Yee et al. [2010] also state that the elderly users can use mobile phones to play games provided that the games are interesting to the user and have good usability. Two factors are essential in order to make a software, such as a mobile game, meet user expectations: having good usability and increasing the users motivation to use the software through resources that meet their interests, needs and desires. In this paper, good usability heuristics are considered essential to assess the motivational factors because restrictions on the usability could interfere in the process of motivation evaluation.

2.3 Motivation and digital games

According to Weinberg and Gould [2001], the motivation is the most important factor in a learning process and also in an entertainment process. The intensity or the duration of stay of an individual in a particular activity is influenced by his/her motivation. Of course, other factors such as health, level of anxiety, physical constraints may influence this behavior, but the motivation is one of the most important factors for people's involvement in certain activities.

According to Mendonça and Mustaro [2011], a story of a serious game can make the game much more exciting, and thus offering a motivational condition for its use. The authors proposed some strategies in the development of serious games aimed for students to achieve motivation: (1) to provide in the game the sensation of reality in order to attract the player; (2) to choose a way to tell the story in order to involve the student; (3) to offer elements of challenge, conflict,

surprise, curiosity, increasing levels of difficulty, the emergence of expectations, informational and motivational feedbacks.

Pandeliev and Baecker [2010] proposed an evaluation method of serious games by proving the benefits that games claim to offer. One of the authors' conclusions is that a crucial component of mental fitness games and other serious games is entertainment. If the game is fun, it will be used for longer, allowing the user to achieve more benefits from the game, thus bringing them greater motivation. Massarella and Winterstein [2009] argue that people start some activity externally motivated but the permanence of motivation is something that depends on several factors. According to the authors, the elements that characterize this permanent state of motivation are related to a mental state identified as flow.

2.3.1 Theory of Flow

The theory of intrinsic motivation explains the reasons that lead people to do certain activities without a specific goal. The Theory of Flow was proposed en 1970 by the American psychologist Mihaly Csikszentmihalyi, based on a research which aimed to analyze the feelings of people in performing certain activities. He found that the cognitive and emotional state is related to the degrees of skill and difficulty in performing a particular activity. If the ability is low due to the difficulty of the activity, it causes anxiety in the person. If the ability is high, it will cause boredom. If the ability and level of challenge are balanced, the flow state is achieved. For Csikszentmihalyi [1999], the motivation influence the concentration of people in doing a task and staying focused on it. And when that motivation is intrinsic, there is a tendency to be more satisfactory for the individual. Figure 1 depicts the process to achieve the flow state.

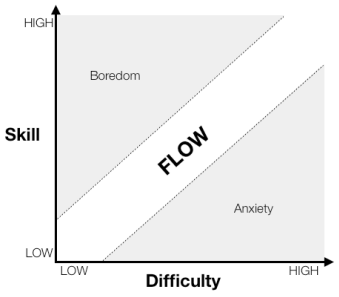


Figure 1- Model of the flow state [Csikszentmihalyi 1999]

Based on the Theory of Flow, Sweetser and Wyeth [2005] proposed a heuristic for evaluating fun in games, which they named GameFlow model. GameFlow consists of eight elements: concentration, challenge, skills, control, clear goals, feedback, immersion and social interaction. Each of these elements is associated with a set of criteria to make the game fun. In the survey, it was realized that the proposed model is more suitable for some genres of games and does not apply to games of strategy. Moreover, it is important to use the method in conjunction with the observation of players in action to define and evaluate their immersion and also if the game has a good level pacing. The authors also suggested that the GameFlow could be used as a set of guidelines for evaluation by a specialist or as a basis for building other types of assessments. Despite its flaws, the proposal contributed to a better understanding of fun in games.

2.3.2 Motivational factors for the use of digital games by the elderly

Dantas et al. [2011] claim that the success of any system is its acceptance by its users. The authors emphasize the importance of knowing the profile of its users and present a methodology for user-centered development in order to understand the real needs, interests and desires of the target audience. Thus, it is important to knowing more about the elderly in order to develop serious games that really interest them.

Fox [2001] and Gatto and Tak [2008] showed that the key motivation of the elderly in using information and communication technologies is related to the possibility of communication and interaction, especially with family and friends. Melenhorst [2002], cited by Ijsselsteijn et al. [2007], believe that the elderly are encouraged to use the technology, only when they realize the benefits it offers them. The lack of this perception is enough to reduce motivation. Schutter [2010] presents the following items that depict the main reasons that stimulate older people to play digital games: challenge, excitement, fun, fantasy, competition and social interaction. According to the author, the technology is considered, by the older, as a form of social interaction. Digital games can be an alternative for the elderly to relate among themselves and with their family.

Schutter and Abeele [2010] show that another important motivational factor is the meaning of the games for the players. A list of meanings was constructed as part of their research results, including: (1) “Digital games are a fun way to compete with my partner and my children”, (2) “Digital games are something that I do alone” and (3) “Digital games are a way to meet new people”.

Santarosa and Vieira [2009] did a similar study, in order to answer the question “Why would I want to attend a course on Digital Inclusion and learn to use technologies such as computer and Internet?” They reached the following results from the responses of elderly users interviewed: (1) update staff; (2) communication; (3) source of information and knowledge; (4) to consolidate previous knowledge in computer science; (5) to be happier; (6) hobby, leisure; (7) professional development; (8) relationship with others; (9) to keep the brain active; and (10) to decrease the feeling of loneliness. These results show

that there is a need to offer continuous learning to the elderly.

Nap et al. [2009a] showed that the players have a preference for casual games (fun and relaxation) or escapism (escape from the sadness, from the reality, from home). They also mention that the elderly prefer solitary games by fear of failure and unwillingness to be bound to specific times. In another study done by the same authors in 2008, it was realized that the elderly seek three goals: (1) to connect with other players, (2) to learn through play and (3) to contribute to the society.

Therefore, it is clear that there are controversies regarding these preferences: some studies have indicated interest in the interaction with other players and other studies show the interest of players in lonely games without the need for interaction with other players.

Gerling and Masuch [2010] also conducted a research focused on the elderly in order to raise motivational issues for the use of games. As a result of the research, the authors found that older people suffer from a reduced attention when working on complex activities. So this is a factor that should be considered in the development of games for the elderly. Other interesting issues raised by their study were: (1) to consider the decline of motor activity, (2) to consider that there are several chronic diseases that impact on the physical abilities of the elderly, (3) extreme or sudden movements must be avoided and (4) to provide the possibility of adjusting level pacing of the game in accordance with the development of the player. The authors also identified that among the preferences of older people the following deserve our attention: (1) the idea of competition as a positive factor, (2) design issues should be related to motivation and (3) restrictions due to age should be considered in the development of serious games. It is noteworthy that with respect to the first question (the idea of competition as a positive factor), other studies show that older people do not like competition, and are more focused on cooperation [Gajadhar 2010].

Flores et al. [2008] enumerate six criteria to assess the motivation for playing games: (1) adequate cognitive challenge, (2) objective and simple interface, (3) motivational comments, (4) elements of social activity and (5) adequacy of the genre. According to the authors, most of the serious games do not meet fun, which is necessary to increase interest in their use.

In order to gather knowledge about the perceptions and motivations of older players, Nap et al. [2009b] used the method of free association originated by Sigmund Freud. After analyzing the responses, the authors state that most of the older people are concerned about the possible negative influences of digital games to players. For example, if games that depict violence can negatively influence the players because of the naturalness as violence is treated. These factors may create a barrier for older people to get involved with digital games.

Ijsselsteijn et al. [2007] reported an important alternative that could help to encourage the use of games by the elderly. In their studies, they realized that the lack of confidence in playing can inhibit this activity. So the game should provide mechanisms that make older people feel confident in their ability to play. Therefore, it is important that games provide encouraging feedback showing levels of success that the player is reaching, even when the phase is very simple. And if the phase is more extensive, intermediate feedbacks may be interesting to stimulate development. Nap et al. [2009a] reaffirm this theory from the interview with several elderly where they showed the importance of feedback as a stimulating factor for progress.

3. Methodology

This section aims to describe how we performed the case study and collected data that will be presented in Section 4 of this paper. The study included the analysis of the profile of the selected group of elderly and the observation of the tests with five serious games running on a smart phone. The following sections present the detailed steps of this study.

3.1 Participants selection and space of the tests

The case study was done with a group of seniors who attended the Project “Digital Inclusion for Adults and the Elderly” and with a group that was participating in the Project “Digital Games for Adults and Elderly”. Both projects take place in Pontifícia Universidade Católica de Minas Gerais (PUC Minas), in the campus situated in the city of Arcos.

Participants were selected after filling an initial questionnaire. This initial questionnaire contained ten questions, and aimed to gather demographic information and information related to user involvement with computers and digital games.

The seniors were also asked to sign a consent form.

To be selected, the senior should meet the following criteria: basic experience in the use of computer and of mobile phones; he/she did not have vision problems that could not be corrected by corrective lenses; and he/she was older than 59 years.

The study was conducted in a computer lab in PUC Minas, in Arcos, which hosts the activities of the mentioned projects. This place was selected because the participants were there twice a week developing the activities of the project, therefore, this place would bring greater convenience with respect to displacement

and the participants could develop other activities while they were not participating in the tests.

The tests were performed on a smart phone, Motorola Razr model, Android version 2.3.5. The tests were recorded for posterior analysis.

3.2 Identification of mental associations and expectations of participants in relation to digital games

This activity aimed to identify what the selected group of elderly think about digital games, serious games and smart phones, using the method known as free association technique, already mentioned in Section 2.3.2.

Initially, participants were randomly invited to write on paper, words related to each of the following words or expressions: digital games, serious games and smart phones. Each participant chose a different place to stay in a room, so that one could not observe what the others were writing. It was informed one word at a time. When all the participants ended to write associations about a word, the sheets of paper were collected and blank ones were distributed. This method is considered the most appropriate so that there is no interference between the responses related to each word and a participant could not influence the response of the other.

Secondly, it was made the following question: "*what would motivate you to play a game in the traditional manner, using a computer or using a mobile phone*?". The answers to this question were given orally. The method was changed because it was important that each one hear the answers of the others in order to motivate them to agree or disagree with the points of view previously submitted.

3.3 Game selection

For our tests, we chose five digital serious games for smart phones. Based on the statement of Nap et al. [2009a] that the elderly prefer casual games and also on the definition of serious games which includes mental exercises, it was chosen casual serious games that exercise reasoning, perception, memory and concentration. Another important aspects of the chosen games were their usability (an essential factor to prevent that usability problems interfere in the evaluation of the motivational factors of the games, which is the focus of this work) and motivational items. These characteristics were identified from the literature research, data collected in the initial questionnaire and in the use of the free association technique.

3.4 Games evaluation

The games selected in the previous step were installed on the smart phone so that older people could test them. After exposing the initial procedures with respect to the games, such as their objectives, some general guidelines for using the game and the basic functions for the use of the smart phone, the testing process was initiated. Data were collected in two ways:

- Observation process: observations were made in order to record the experiences of the elderly with the game on the smart phone, by means of written notes and films. The objective was to register facial and body expressions, questions, comments, difficulties, interest shown, among other manifestations.

- Questionnaires and interviews with participants: after testing all games, each participant received a questionnaire, in order to evaluate the experience with the games, such as satisfaction, aspects considered positive or negative, suggestions for new games items, their opinions. The interviews took place after the questionnaires, with the same questions of the questionnaire. The use of questionnaires and interviews is due to the fact that many users are better in writing and others express better their thoughts orally.

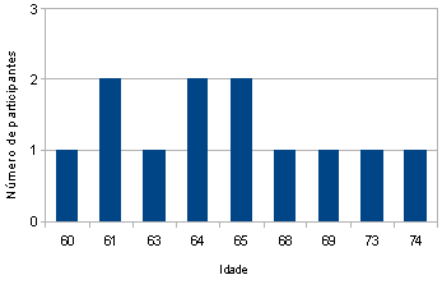
4. Results

All data collected were analyzed in order to identify items that serious mobile games should have to ensure the elderly satisfaction, to motivate them to play. This section presents the results already achieved.

4.1 Characteristics of the Participants

From the fifty-two initial questionnaires applied, twelve participants met the minimum factors required to participate in the test (Section 3.1). The selected group consisted of eight women and four men.

The average age group was 65.6 years. Among the selected group, the youngest participant was 60 year-old and the oldest, 74 year-old. Graphic 1 shows the exact number of participants in each age.



Graphic 1 – Age of the participants

Only one participant was graduated. Three participants finished high school and the eight

remaining participants finished only the primary level of education.

All participants were retired and did not perform any paid work at the time of the survey.

With regard to marital status, six participants were married, two were single and four were widowers.

All participants had basic informatics knowledge. All of them also had mobile phones, but none had a smart phone. All used mobile phones only to make or receive calls and messaging.

Four participants said they have already played games on computers. They cited only the card games. But none of them had the habit of playing digital games, nor on computers and neither on mobile phones, but they liked traditional games. Although it was mentioned that some participants were part of the Project "Digital Games for Adults and Elderly", none of them had started the activities with games yet.

4.2 Mental associations and expectations of participants in relation to digital games

As described in Section 3.2, after the selection of participants, they were invited to participate in an activity identified as free association technique related to three subjects: (1) Digital Games, (2) Serious Games and (3) Smart phones.

For the subject "Digital Games", the main words presented were: fun, therapy, hobby, competition, cards, crosswords, communication, integration, dominoes, memory (meaning memory game or the improvement of memory through games) and computing.

For the subject "Serious Games", the main associations presented were: planned games, championship, competition, world cup, fun, truth, therapy, intelligence, creativity, puzzle, memory, development, mental development, education and learning.

Finally, the activity was carried out with the subject "Smart phone". It was necessary to explain what is a smart phone, because the participants did not know what this term meant. The explanation was restricted to the information that it was kind of a mobile phone with several additional features. After the explanation, we collected the following results: mobile phone, chat, message, sounds, technology, load, battery, touch and photograph.

After finishing the written phase, we began the oral phase. The question to answer was "*what would motivate you to play a game in the traditional manner, using a computer and using a mobile phone*". The main responses to traditional games were fun, competition, exercise, physical education, championship. For computer games: fun, learn computer technology, headset, competition, mind exercise. For games on mobile phones: never played, difficult, shot.

After data collection, there was an analysis and classification of the collected words. Some words were considered equivalent and were gathered in a single classification. For example, fun and funny were classified in the same category "fun". Some responses were discarded because they were not related to games, for example, truth, sounds and battery. The classification results can be seen in Table 1.

Important items	Genres of games	Possibilities
• Fun • Therapy • Entertainment • Competition • Memory development • Intelligence and creativity development • Brain development • Education • Learning	• Cards • Crosswords • Dominoes • Memory game • Puzzle • Shot	• Communication • Integration • Computer Science • Chat • Informatics • Technology

Table 1 – Collected associations

4.2.1 Identification of motivational factors for Games

It was noticed that the motivation factor is changeable and individual. Several internal and external factors can influence the motivation of the user to perform an activity. Sometimes, activities considered identical with different implementation procedures are sufficient to show differences in users' behavior with respect to the motivation to develop this activity.

The motivation of playing on computers is very different from traditional games – the mere fact of having contact with the computer brings different motivations which should be the interest in the new technology in learning.

It was observed that the feeling of fun and competition is common for traditional games and computer games. Funny games that evoke the feeling of competition motivate older gamers. Another factor that stimulates them to play games is that they found a way to learn computer technology and exercise their brain.

For mobile games, there were not significant factors. Only one participant cited the shooting game as a known gender. All others have expressed they have never played games on mobile phones because they found it difficult or because they never had the opportunity. Nevertheless, they expressed that they would be interested in this experience, since it would

be more practical due to their easier access to mobile phones.

4.3 Selected games

According to the criteria presented in Section 3.2, the selected games were:

• Mobile Sudoku: a puzzle style game. The selected game is simple, it has bright colors that facilitates the visual perception of the elderly, as shown in Figure 2. Because of its simplicity and also for being fun, it was hoped to interest older player. As it is a game of reasoning and logic, it is important for mental exercises that develop reasoning and exercise the brain.

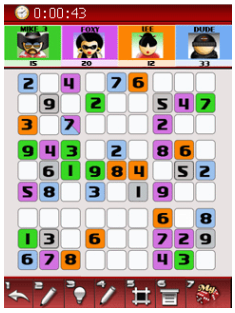


Figure 2: Mobile Sudoku
Available at: http://www.jogosparacelularjava. com/java/ sudoku-facil-puzzle-java

- Mahjong: it is a game of perception and attention to join identical pairs in order to empty the board. It is also considered a simple and fun game. Its purpose is to increase the attention and concentration of the player. The selected game Mahjong is not the traditional one, with Japanese drawings, because it would be difficult to the elderly, due to their vision impairments. The selected game has large drawings with well-defined colors, as shown in Figure 3.

Figure 3: Fairy Mahjong
Available at: http://www.baixaki.com.br/android /download/fairy-mahjong-3d.htm

- Puzzles: these games are meant to improve thought and attention. The Bejeweled Twist is a game of matching three tiles on the board to score points. The selected puzzle game has a storyline that stimulates the curiosity of the player. This game also has several warnings that motivate the player to continue playing. The image of the selected game can be seen in Figure 4.

Figure 4: Bejeweled Twist
Available at: http://jogostouchscreen.com /bejeweled-twist-java-touch-screen-gratis/

- Tetris: this game stimulates quick thinking. It consists of stacking blocks to fill all spaces to complete horizontal lines (Figure 5). As lines are completed, without containing unfilled spaces, the gamer gains points. As it is a game without too many details, it was considered well suited to the elderly. The only difficulty, which can also be a stimulus, is the quick thinking that it requires.

Figure 5: Classic Tetris
Available at: http://www.appbrain.com/app/classic-tetris/antris.gameblasters.classic

- Maze game: despite having a cartoon style (Figure 6), the game still has the serious purpose of improving the reasoning: it requires the development of strategies to exit the maze as quickly as possible, raising also the feeling of speed and competition, considered by many as motivational factors.

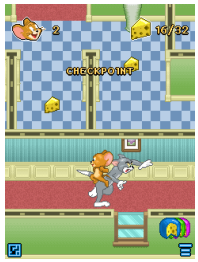


Figure 6: Tom & Jerry game: the maze of the rat
Available at: http://jogosgratisdecelular. com/jogo-para-celular-tom-jerry-o-labirinto-do-rato/

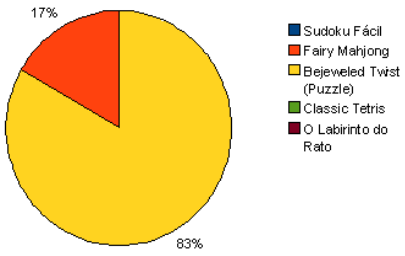
All selected games are free and are available for download on the web.

4.3.1 Behavior analysis and identification of motivational factors in the games tested

In this section we will present some observations and conclusions of the tests already carried out. It is noteworthy that the tests have not yet finalized.

During the tests it was observed that, at the beginning, most of the elderly had great difficulty and reluctance to handle the smart phone, but soon after, they managed to focus attention on the game itself, despite the remaining of the difficulty in handling the smart phone. None of the elderly had the ability to use touch screen. Because of that, the touches in the screen did not always resulted in the intended action. Some of them showed up impatience with the device, almost giving up the tests. But then, gradually, they succeeded in using the smart phone. The curiosity was a motivation to play the games offered. They did not want to "die", or, in other words, they wanted to move to the next phases. They were desperate when time was running out and they could not finish the activities. When the time ended and they returned to the start of the game, they got very unmotivated. The time was considered "short for them" and that negatively impacted a lot in their motivation.

The preferred game was the puzzle Bejeweled Twist, as shown in Graphic 2. It was considered the most interesting because it had a story and was considered easy to play. The most criticized was the game Tetris. It was considered difficult: many of them did not have enough skill to change the positions of the blocks in order to appropriately fill the gaps, even at the lowest level, with more time available. Regarding Majhong, many had difficulty seeing the differences in the designs, but two of them praised the game. They considered it funny and interesting.



Graphic 2 – Preferred games

The main strengths of the games were: (1) Sudoku: no outstanding strength; (2) Mahjong: "easy to play", "interesting", "it exercises memory and attention"; (3) Puzzle: "easy to play", "it motivates to reach the end", "I wanted to earn points for having bonus", "motivational messages"; (4) Tetris: no outstanding strength; and (5) Maze game: "fun"

The main drawbacks of the games were: (1) Sudoku: "boring"; (2) Mahjong: "I did not really understand how it worked", "I could not see the differences in the design"; (3) Puzzle: "I should have more time to end each phase"; (4) Tetris: "difficult", "I do not really understand how it worked", "plain" and (5) Maze game: no outstanding drawback.

Among the items suggested by the elderly for a game, we can outstand the following: be interesting, have great designs, have a story, have sound, be easy to play, be fun, to stimulate memory/brain. The limitation of the time was the item that was treated by all as negative.

Besides these technical considerations, it was found that after the experience with serious mobile games, all the seniors considered them a good option to spend time. It was quoted by one of them that after starting this experience, he began playing with his grandson and having a great time of fun. Another interesting account was from a lady who takes care of her mother in bed: before, the nights were very sad, but now she plays games at home, which is an option for distraction and fun.

4.3.2 Guidelines related to motivational factors for developing mobile serious games for seniors

With the data collected in the related work and in the case study conducted up to date, it was possible to propose some guidelines related to motivational factors for the successful development of mobile serious games for the elderly. They are:

- Follow usability heuristics for mobile devices and consider the impairments of the elderly, such as: the possibility of resizing the screen and font size, avoiding large texts with small font and small and low resolution images, using color high definition, using sounds and vibration as a way to call attention.
- Clarify the benefits that the game will provide for the seniors.
- Avoid the need for high levels of attention.
- Provide entertainment: the game should be fun.
- The game should have a story that motivates the advancement of the phases, not just a matter of increasing the level of difficulty from one phase to another.
- Offer the option of disabling the feature of timing: users who prefer not to have time limits can go through all the stages only by overcoming the obstacles of the activities of each phase, without worrying about the time.
- Offer motivational feedback at the time of advancing phases and making errors.
- Offer the option of setting the difficulty level of the game.
- Offer appropriate cognitive challenge: the game should be neither too simple nor too complex; the senior players should feel confident to

play and be proud of their ability. Therefore, the importance of the encouraging feedback, even in the most simple stages.
- Avoid monotonous and repetitive tasks that discourage users to play the game for long: if the player does not play, he does not achieve the benefits that the game can provide.

It is noteworthy that many of the presented guidelines did not aim solely the elderly, but all audiences. However, when developing games for the elderly, there must be a greater compromise in respecting these guidelines, given the restrictions due to age that older people suffer.

5. Conclusions

This paper aimed to present motivational factors that influence the elderly to play serious games on smart phones. For this it was done a literature review in the area and a case study with a group of elderly in the city of Arcos, situated in Minas Gerais, Brazil, in order to verify if the results reported by related work are confirmed by the selected group of elderly for the case study in question. It has been possible to confirm several of these results.

According to most studies, it was realized that usability is the primary factor that causes a game to be accepted by the user. So, elderly users, because of the restrictions due to their age, need software with some adjustments so that they can better meet their needs. It was perceived that there is the need of specific usability heuristics for the development of application for smart phones.

From the studies it was revealed that digital games can be very useful for the elderly in various aspects such as entertainment, an option to pass the time, an option to be connected with technology and as a mechanism for continuous learning. By playing games, the elderly can become more integrated into society, reducing the digital exclusion. It was also realized that while there is a fear of handling a smart phone, because of the difficulty, there is a motivation to use it since it is more affordable compared to a computer or notebook, and it can be used anywhere due to the easiness in transporting it, which brings convenience.

But it was noticed that most games does not meet necessary features required by elderly users. First of all, because most of the games was developed for children, youth and young adults. And the few games developed for older people do not follow the guidelines of usability and motivational factors that the public requires. It is necessary for game developers focused on the elderly to improve some aspects of usability for this specific audience, especially when considering mobile games and users who have age restrictions, such as shorter attention, vision, hearing, motor skills and practice with technology. And not only that, another essential factor for the game to be accepted by the elderly is their ability to motivate this group.

A good game should motivate users for its use. To achieve this objective, it is necessary that the same fulfill some requisites such as to be fun, to allow social interaction, to be significant, to present motivational messages, to balance ability and difficulty, to enable the personalization of levels and time, and finally, it was concluded that in addition to ensure the usability of games for seniors, the game developer must make sure that the benefits are perceived by users. This requires more researches to understand the needs and motivations of older players. The more investigations and studies of these users, the more chance of defining the criteria needed for the game to meet the needs, interests and preferences of the elderly.

From the study so far, some conclusions have already been defined. What is already known is that the main reason why older users like games is the possibility of escape from reality, or a means of fun and relaxation. The games give them direction for the day to day.

After the tests, we found that most of the previous results found in the literature review was confirmed by the case study done so far with the elderly group selected. Some difficulties presented by the participants, such as the difficulty in dealing with the smart phone and the misunderstanding of the operation of some games may be related to the number of tests and time that users have dedicated themselves to the games. It should be studied if the longer the older play, the more able he/she will be to identify strengths and weaknesses of the games, and to perceive the benefits that the games provided them. The results presented in this paper are still preliminary.

Therefore, we intend to continue the tests with the selected group of elderly. We propose as future work the application of the same tests with other seniors to confirm the results. From this it would be interesting to develop a prototype that meets the proposed guidelines and make further tests with elderly users in order to verify that the prototype meets the needs, interests and preferences of the elderly.

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