ERGONOMIC REQUIREMENTS FOR CREATING ONLINE EDUCATIONAL GAMES APAPTED FOR SENIORS

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Abstract: Online games aimed at seniors need to address the particular needs and physical limitations of this target group. Several researchers have attempted to use commercial digital games in their investigations with seniors, while others have adapted the games or have done research to establish the requirements of digital games aimed at seniors. However, research is still lacking about the evaluation of the ergonomic requirements of online games created for seniors. The goal of our research and development is to examine through online games conceived for seniors, the optimal requirements for the interface: design, readability, and user-friendliness. In this study, several games will be created for seniors (http://cvje2.savie.ca). During their creation, the authors will take into account the ergonomic requirements described in the literature and the needs assessment conducted with seniors in three Canadian provinces to identify the types of games seniors play and the content of what they wish to learn with the help of online games. This presentation will discuss the factors that creators of online games for seniors need to take into account and presents the results of the analysis of the needs and features of online games for seniors.

INTRODUCTION

The American ESA (2012) reported that 29% of individual aged 50+ are digital game users. A further split in the ages by Pew survey found that 23% of individuals 65+ played digital games; while 40% of adults between the age of 50-64 played digital games (Lenhart, Jones, & Rankin, 2008). Considering that the percentage reported by the ESA in 1999 was only 9%, this is a large increase over the past 10 years. Can digital games help seniors to age more effectively?

An increasing number of studies have demonstrated that video games can have a positive impact on seniors: digital games can provide physical training for seniors and can overcome their isolation. These studies show as well that the effect of these games depends on the needs and individual characteristics of seniors and that systems need to be developed that are capable of adapting to the demands of this population. An inappropriate design can act as a barrier to the use of games by seniors, reducing their cognitive and social benefits and consequently the health and quality of life of seniors (Whitlock, McLaughlin et Allaire, 2011). It is therefore important to ensure the ergonomics[1] of games offered to seniors.

In the case of computer interfaces, such as for serious online games, the ergonomist must develop solutions that inform and guide the user while minimizing cognitive load as much as possible (Millerand & Martial, 2001). Given the importance of a well-built interface, it is surprising that the literature, whether in information technology, communication sciences, cognitive sciences or educational sciences, is not very prolific on this subject for digital games (Kellner, 2008). In order to establish ergonomic indicators for online games, we relied on studies of the ergonomics of web environments and on studies of games for seniors. For online gaming to be effective, it must satisfy two quality criteria: it must be useful, that is to say, adapted to the needs and expectations of the users, and it must also be user-friendly, easy to learn and to use.

In the context of our research financed by the SSHRC Insight program, our objective is to create and experiment with retired seniors (55+ years) with games that take into account the ergonomic conditions described in the literature and the preferences of Canadian seniors. These types of social games (Tic Tac Toe, Bingo, Treasure Hunt), are favorites of senior occasional game players and will be created with the help of generic game shells for educational games (http://cvje2concepteur.savie.ca). Three aspects will be evaluated in this ergonomic research: game design, user-friendliness and readability. This presentation will outline the ergonomic conditions which will be integrated into the digital games developed for seniors.

DESIGN OF THE GAME

An increasing number of studies advocate that it is necessary to create a design specifically tailored to players from the 'baby boomer' generation (Hwang, Hong, Hao et Jong, 2011; Marin, Lawrence, Navarro & Sax, 2011; Rice, Wan, Foo, Ng, Wai, Kwok, Lee et Teo, 2011). Different components of digital games must be adapted to respond to the needs and characteristics of seniors[1].

Competition. The serious game must create competition between players to maintain their interest. However, games must be fairly short in duration (between 5 and 15 minutes). The game should provide: (1) mechanisms that allow players to adapt the game based on their capabilities (reaction time, degree of difficulty, etc.); (2) rules that determine the winner or winners and the loser or losers; (3) points; and (4) gains for a player which constitute a loss for the others.

Challenge. The serious game must maintain a constant challenge for the players. It must introduce components that maintain a sense of uncertainty about the outcome of the game. Thus, the learning content of the serious game must take into account the prior knowledge of the learners for whom it is intended, and the questions must offer varying degrees of difficulty in order to promote the participation of all players, even those with little knowledge on the subject matter at hand. Mechanisms must also be provided to ensure that the outcome of a game remains uncertain, including: (1) the controlled addition of random events, for example, bonus cards distributed by the computer system to reduce the gap between opponents who are sometimes too strong or too weak; and (2) the degree of difficulty of the questions from one game to another.

Feedback. The serious game must provide feedback to support the learning of the defined content. Immediate feedback, related to each learning task, allows the player to identify successful activities and those they have failed. The game must incorporate mechanisms that: (1) highlight the results of each learning activity through visual or audible feedback (success or failure), for example, a smiley face or sad face, positive or negative sounds, points earned that add up the score; (2) correct incorrect answers through textual, visual or audible feedback on the content of the learning activity or provide additional information to sustain interest in the case of positive responses; and (3) allow players to see what they learned by providing an overview of the results of the game's learning activities, together with teaching materials to review subject matter that has not been learned. The game should

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[1] Voir entre autres Sauvé, 2010a; De Schutter, 2011; Rice, Wan, Foo, Ng, Wai, Kwok, Lee et Teo, 2011; Ogomori, Nagamachi, Ishihara, Ishihara, et Kohchi, 2011; Callari, Ciairano et Re, 2012; Lopez-Martinez, Santiago-Ramajo, Caracuel, Valls-Serrano, Hornos, & Rodriguez-Fortiz, 2011; Diaz-Orueta, Facal, Herman Nap et Ranga, 2012; Pham et Theng, 2012; Shang-Ti, Huang, & Chiang, 2012; Theng, Chua, & Pham, 2012; Whitlock, McLaughlin et Allaire, 2011; Wu, Miao, Tao, et Helander, 2012.

also provide feedback linked to players' actions throughout the game in order for players to see the results of their actions during the game. It is rare that a game is completely intuitive. The game needs to include hints or a tutorial that guides the player throughout the game. This tutorial should be available as needed by the players. For seniors, guidance about the actions that need to be taken must be available to reassure them and reduce their cognitive load. Bringing up a tutorial or a digital assistant that guides the players about what to do should be available at all times by a single click. This simplifies the use of the game by eliminating the need to quickly learn the rules of the game, thereby reducing the cognitive load. Hints, examples and demonstrations are necessary to avoid the types of errors that reduce seniors' motivation. These should be explicit and use the imperative verb form. Finally, the error messages must be clear and always appear at the same place on the screen.

The controller used to play the game. Three types of controllers are currently used in digital games: manual control using a keyboard or joystick, physical control through motion capture, and a mixture of both. The game console (machine) should be adjustable to the physical limitations of players. The keyboard or joystick have been the primary controllers that have been investigated in research studies. These studies have found that small keys or buttons that require significant manual dexterity should be avoided, as well as joysticks that require much manipulation as these are difficult for seniors to use. Other guidelines include the following : (1) avoid double actions that require the player to control precisely a pointer on the screen while needing to correctly press a button at the same time to obtain the desired result; (2) use bottoms that are sensitive to a light touch yet solid enough to support a strong hit, and large enough to be easily seen and pressed by seniors; (3) use game controllers that use one hand, such as a computer mouse or Wii controller, as this represents one option more accessible to seniors than those designed to be used by two hands.

THE GAME'S USER-FRIENDLINESS

Referring to the characteristics of user-friendliness conceived by Hwang, Hong, Hao et Jong (2011) - learnability efficacy, memorability, errors, satisfaction – the game should take into account the necessary conditions of screen design and navigation in the game[2].

The display screen of the game and the learning activities. First, the games must contain a mechanism that defines the display area through a predetermined framework that will maintain a standard for displaying on screen. It is important that the game appears in the same way from one computer to another. Moreover, avoid scroll bars on the web page that contains the game. The game display must maximize the visibility of the content and minimize the download time. The game and the learning activities should also be seen in their entirety on the width of the screen without the need to use a horizontal scroll bar. The rules, the tutorial or the instructions as well as the players' scores must be in the field of vision of the players and visible with different types of computer screens. The movement of people or tokens in an environment or on a game board must be taken into account in order to avoid an obstruction to accessing important learning information. In addition, the size of the players' tokens must be in proportion to the size of the squares.

Navigation in the game. The game should provide easy navigation and must meet certain conditions. At all times, the board, the pieces, the navigation buttons, instructions, scoring and the rules must be posted and accessible to ensure the smooth running of the game. It is

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[2] Voir entre autres Pearrow, 2007; Sauvé, 2010b ; Hwang, Hong, Hao et Jong, 2011; Marin, Lawrence, Navarro, et Sax, 2011; Whitlock, McLaughlin et Allaire, 2011.

also important to consider that the repeated use of the mouse to access a game component slows the pace of the game and hinders the motivation of players. It is preferable that the player access all the elements with a simple click to get points or to progress in the game. The game must use known symbols or icons to facilitate player actions and to avoid errors due to a misunderstanding. Symbols and icons must be the same on all pages of the game and located close to the required action. Finally, avoid designing games with more than three overlapping windows, which affects the intuitiveness of the game.

READABILITY OF THE GAME WITH REGARD TO MULTIMEDIA

The game should observe certain minimal conditions with regard to text, video, and illustrations[3]. Use of a large screen improves the readability of the game for seniors particularly if the screens are clear and simple. The layout of the text on the screen must facilitate reading and viewing. The text should be arranged in paragraphs, or information units, well separated for cohesion. In general, the Web page must be organized and airy and a separation between the title of the text and the paragraphs should be inserted. It is preferable that the words are seamless and the text is justified to the left to increase the speed of reading, particularly for readers with learning disabilities. It is very important that the chosen font and size promote onscreen reading. Finally, we must ensure that the game reserves underlining only for hyperlinks. It is recommended that the text utilises a large font (12pt. or more) that is easy to read. Avoid using too many different font styles in the game. The game should also provide a way for a player to increase the font size if they wish. For ease of reading by seniors, use short text sequences, limit the amount of information on each page, and simplify the structure of the text. Remember to provide good contrast between the text and background or between the levels of the game.

The use of illustrations and videos must be relevant to the content of the game. Too often some games use a profusion of illustrations and videos to make their game more attractive but these additions often cause cognitive overload and the display time is too long thus reducing the medium-term motivation of the players. The illustrations should not include too many details, as this would prevent players from perceiving the main idea. The positioning of the video viewer on the screen should allow for good viewing and allow access at all times to the control buttons (stop / play video, adjust volume, etc.). The displaying of an illustration or a video should not require a waiting time on the computer of more than two seconds for its appearance on screen. If this is the case and the content is relevant, it is necessary for the game to display a meter or bar that indicates the download time otherwise the players will think it is equipment failure. Illustrations and videos must be displayed within a window screen. If the images have too much detail or if they are large, the game should provide the option to view them in a new window.

Use of audio content or spoken text can motivate students and increase their interest in the subject matter studied in the game, however, the sound samples should be used with caution. In general, it is necessary that the game offer the option to present the content in text, in addition to the audio aspect. It is important to remember that the difficulty of auditory information is that it fits into the flow of time while the fixed image may remain displayed and accessible at all times. The game requires that the sound be audible and that the instructions to activate the speaker or sound controls of the computer (replay audio,

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[3] Voir entre autres Millerand et Martial, 2001; Ergolab, 2003; Nogier, 2005; Sauvé, 2010b; Kellner, 2008; Whitlock, McLaughlin et Allaire, 2011.

adjust volume, etc.) be integrated into the game and accessible during listening. It should also allow for a silent mode of play that can be selected by players who do not want others to know that they have committed an error.

CONCLUSION

At least three games will be created and evaluated with seniors (n=150) based on the ergonomic principles found in the literature between now and May, 2013. Interviews and short questionnaires (q) will be administered in summer, 2013 to determine the degree of seniors approval regarding the design (2 q X 12 criteria), user-friendliness (2 q X 9 criteria), and readability (1 q X 13 criteria). A descriptive analysis will allow us to create a picture of the important considerations for the use of digital games as a learning medium for seniors. The preliminary results will be discussed during the presentation in August, 2013.

KEYWORDS INDEX

Educational games, serious games, seniors, ergonomics, user-friendliness, design, readability

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