Serious Games for Secondary School Students: Ergonomics and Motivational Support Mechanisms

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Abstract: Millions of students are investing significant time in playing online games. Why not use these games to promote responsible behaviours among young people? In this study, we tested the hypothesis that the introduction into a serious game of appropriate mechanisms to support motivation, together with effective ergonomic design, can enhance young people's learning through gameplay. We developed a serious game, *Water Game*, using a generic shell for serious games (GSSG), and tested it with 156 secondary school students. The results show a high degree of student appreciation for the motivational support mechanisms and ergonomic conditions that were implemented in the game to support attitude change. Recommendations are offered to developers of serious online games for learning purposes.

Introduction

We are increasingly aware of the fragility of worldwide resources, with water certainly one of the most important. Stakeholder participation is important in increasing awareness of the importance of this resource to encourage its preservation. Today's teenagers, who have an immediate impact on their environment through family and friends, will eventually bear responsibility for the development of our social norms. Many initiatives involve young people in water conservation campaigns, promoting the idea that water conservation is everyone's responsibility. It is therefore legitimate to ask how we can effectively educate and encourage young people to adopt everyday behaviours that contribute to preserving water for future generations. How can we raise awareness among digital-generation students of the reality that affects our planet?

Knowing that the Internet and online games have become very popular with young people (CEFRIO 2009), this study focused on factors making a serious game an effective tool for societal change. We worked to identify the ergonomic conditions and motivational support mechanisms needed for a serious game designed to educate young secondary school students about how to behave responsibly in regards to the consumption of water. We experimented with the *Water Game* with 156 secondary school students in order to answer the following questions: (1) Do the ergonomic conditions implemented in the serious online game *Water Game* facilitate its use by grade 10 and 11 students? (2) Do the support mechanisms for motivation integrated into game facilitate the motivation of these students to learn through the use of the game? and (3) How does the game support a change in attitudes towards the consumption of water? This paper presents and discusses the results of the first two questions: the ergonomic conditions and motivational support mechanisms for learning that were integrated in the serious online game *Water Game*.

The Ergonomics of Serious Games

Ergonomics is the body of scientific knowledge related to how humans design tools, machines and devices to be used with maximum comfort, safety and efficacy (Wisner 1972). In the case of computer interfaces, such as for serious online games, the ergonomist develops solutions that inform and guide the user while minimizing cognitive information load as much as possible (Millerand & Martial 2001). Given the importance of a well-built interface, it is surprising that the literature, whether it is information and communication sciences, cognitive sciences or educational sciences, is not very prolific on the subject for digital games (Kellner 2008). In order to establish ergonomic indicators for serious online games, we relied on studies of the ergonomics of Web environments (e.g., Adams &

Rollings 2003; Livet 2007; Millerand & Martial 2001; Sauvé 2010b). For serious 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.

Three ergonomic aspects were evaluated in this study: the design of the serious game, its readability and its usability. Screen design assists the user and invites the user to look at what is important. For Kellner (2008), a visual interface is problematic if it does not make essential elements stand out. To avoid overload and emphasize the point, general design rules should be followed for a serious online learning game; these affect the game display (e.g., format, positioning in the page download time, standard display); the game board; the learning activities; scoring and rules; images and videos; pawns; and the number of windows that are accessible at the same time in the game (Millerand & Martial 2001, Nogier 2005; Sauvé 2010b; Shneiderman & Plaisant 2004).

The serious game user interface must offer easy navigation (usability) at any time by readily providing all elements needed to run the game smoothly. These elements include the board, pawns, navigation buttons, instructions, scoring and rules. The interface should take into account the "three clicks rule," under which a player should not have to click more than three times to get to desired game information. The interface should ensure that important information is highlighted by graphical and textual means and should use known symbols to show actions or obvious functions. Interface elements must be the same on all pages of the game and be located close to the required action (Livet 2007; Pearrow 2007; Rollings & Morris 2005; Sauvé 2010b).

A legible interface, including text, videos, illustrations, and sound, is essential for any digital product (Ergolab 2003), especially one used by a young learner (Kellner, 2008). In this study, we maximized editorial and typographic legibility of the text by paying attention to the layout on the web page, justification, fonts and font sizes, content highlighting (underlined, bold, italic), and text length. The display and content of videos and illustrations, incorporated recommendations from Lebrun & Berthelot (1996), Millerand & Martial (2001), Nogier (2005), and Sauvé & Chamberland (2006). We followed recommendations in Sauvé (1995, p. 293-295; 2010a; 2010b) on digital games covering the use, quantity, length, and frequency of sound.

Mechanisms to Support Motivation in Serious Games

A game is intrinsically motivating in that the player finds pleasure in the activity itself, regardless of any benefit that may be derived in terms of learning (Sauvé & Chamberland 2006). This distinguishes games from other educational forms, which are often seen by the learner as monotonous, even tiring, and which must compensate for the learner's lack of motivation towards the learning objectives. We often observe that a learner who is interested in a certain subject is annoyed by the way teachers approach it (e.g., through a lecture). A game can sometimes do the reverse, i.e., draw in a learner who is initially resistant to a given topic. Play in itself is an activity that provides satisfaction. But what are the specific educational game mechanisms that support players' motivation?

A number of authors (e.g. Asakawa & Gilbert 2003; De Schutter 2010; Diaz-Orueta, Facal, Herman Nap, & Ranga 2012; Hingston, Combes & Masek 2006) hold that a game's challenge and its competitive and interactive aspects are elements that can motivate the learner. This motivation is enhanced by some game mechanics. Lieberman (1998) found that earning points promotes self-esteem and self-confidence among players, which allows them to remain interested in playing. Rapeepisarn, Wong, Fung & Khine (2008) and Virvou, Katsionis & Manos (2005) identify feedback as an important motivational condition for learning in digital games. Gee (2003) also considers that the fact that players can consume and produce information is an important motivational element. Active participation by the learner in the game promotes learning and maintains motivation (Lennon & Coombs 2006; Markey, Power & Booker 2003). Meel (2000), Moyer & Bolyard (2003), and Winograd (2001) stress the sense of commitment that participation brings about: learners must feel called on and actively involved during the course of the game, which awakens their desire to persevere, to accomplish the task, and thereby motivates them to learn.

Games usually have many types of player reinforcement, such as the accumulation of points, bonuses, and resources, which have the effect of encouraging the learner. The reverse is also true, meaning that mistakes made during a game often lead to negative reinforcement (loss of points or other resources). Negative reinforcement is acknowledged as being less effective than positive reinforcement, because it causes an unpleasant feeling vis-à-vis the self-esteem of the learner. However, in the context of a game, the situation is artificial; therefore, negative reinforcement does not affect the learner's self-esteem much as it is perceived with a certain detachment (Sauvé & Chamberland 2006).

Research has clearly demonstrated that games positively support self-esteem and self-confidence, the pleasure of playing, and a sense of commitment as well as the desire to persevere and to carry out a task (Sauvé 2010a). Various game mechanisms eliciting this motivation were evaluated in our study, including challenge and competition, feedback, and active participation in the game.

Methodology

Sample

We tested the serious game using the case study method, which allows us to document and evaluate the implementation of a serious game with a convenience sample (Gauthier 2009). This method provides data collection in the natural learning environment of the respondents. For the collection of mixed data (quantitative and qualitative), it can make stronger inferences and based on a greater diversity of views. The compilation and classification of qualitative and quantitative data allows us to identify the characteristics of our sample, to establish statistical and functional links between the components studied, and to emphasizing the value of significant variables. Because we wished to establish a broader understanding of serious games as a medium for learning, we also used a descriptive analysis of the results to evaluate the game's ergonomics (usability, readability and design) and the effectiveness of its learning support mechanisms (challenge, competition, active participation and feedback).

For evaluation of the game's ergonomics and support mechanisms, we chose a sample of 156 grade 10 and 11 students (secondary levels 4 and 5 in Québec). The selection of respondents was done by cluster due to the difficulty of experimenting in schools. Thus, the sample was drawn from class groups from two Québec schools. All students from each class group were invited to participate in the experiment.

The Serious Game

The *Water Game,* used during the experimentation in schools, was developed using a generic shell for serious games (GSSG) (http://cvje2concepteur.savie.ca). Four themes are presented in the game: Water, biology and science; water and land management; consumption and water conservation; and water in the world. Appendix A describes the hardware and the rules of the game. To access the game, a web environment has been posted so that players can participate in a team tournament (http://cvje2.savie.ca). This serious game was tested with a sample of 19 students in order to correct any technical problems prior to the experiment.

Data Collection Methods

The ergonomics of the serious game were evaluated using short online Likert scale questionnaires on (1) usability (17 statements), (2) efficiency of design (13 statements), and (3) educational readability (11 statements); each also included one open-ended question. Usability covers guidelines and rules related to the navigation in the communication tools and the ease of execution of this process. Design efficiency covers the display format and the layout of the web game. Educational readability focuses on the vocabulary used and the visual treatment of text, photos and videos. User-friendliness covers the instructions and rules linked to the navigation with the communication tools and ease of carrying out the actions.

Motivational support was also evaluated with short Likert scale questionnaires, each including one open question. These specifically covered quick feedback related to navigation and learning tasks and navigation (5 statements), active student participation in terms of commitment and game manipulations (6 statements), a sense of challenge as evidenced by a feeling of uncertainty about the game outcome as well as integration of goals associated with achieving the tournament objectives (6 statements), and a sense of competition, linked with the score and the winner/loser (6 statements).

The questionnaires were pilot tested with grade 10 and 11 students in order to check their understanding of the statements. Participants in the experiment were informed of the research and signed a consent form. All questionnaires are available online in the Questionnaires menu of the Publications tab of *Knowing all about the research* at the following address: http://eau.savie.ca.

Analytical Strategies and Techniques

Our study is based on both quantitative and qualitative data collection methods, using analysis techniques suitable for each method. The questionnaires were first verified in terms of the validity and reliability of the measurement scales before proceeding to any other analysis. Various types of analysis were used to establish the psychometric properties of the measurement scales. First, a factor analysis by the principal components method with a varimax rotation was used to check the validity of the additive scales, in order to know if the statements that compose them represent one or several concepts as desired. The Kaiser-Meyer-Olkin test in the SPSS software (KMO) was used to assess the adequacy of the sample for a factor analysis. The more the measure of the adequacy of the overall sampling approaches 1, the more the sample is considered adequate. In practice, the minimum threshold of the overall measure should be at least 0.6. To determine the number of factors to retain, three methods were used simultaneously to ensure rigor: the eigenvalue method, eigenvalue graphs , and parallel analysis. The graph of the

eigenvalues is useful to visually locate the value right before the fall of the explained generalized variance of the remaining components. Parallel analysis, in turn, establishes the cumulative proportion of the variance explained, the maximum should be up to 60%. This practice allows for the visualizing of the dimensionality and factorial structure of the chosen scales. Finally, the Cronbach coefficient α was also examined to determine the homogeneity of the statements of the additive scales, an accuracy index. The values of this coefficient vary between 0 and 1: the more the value of α is close to 1, the more the scale is accurate.

Quantitative data were processed using descriptive analysis techniques (frequency, averages, percentages, etc.). Socio-demographic variables related to age, educational level and the gender of the participants were analyzed. Always in an exploratory context, an analysis of variance (ANOVA) was conducted in order to see whether these variables play a special role, to know if they can be explained by certain independent variables. Qualitative data were provided by the open questions in the questionnaires.

Main Results

There were 156 students who participated in the experiment, half in Grade 10 (Secondary 4) and the other half in Grade 11 (Secondary 5). 44% were girls and 52% were boys; 4% were missing this data). A little over 80% of respondents were between 15 and 17 years of age, and 90% were Francophone.

All measurement scales were found to possess satisfactory psychometric characteristics. Overall, the analysis shows that the scales used are adequate because for the vast majority they explain beyond 50% of the variance of the measured variables and their accurateness indices are beyond 0.60, which is sufficient for an exploratory study.

Participants' evaluation of the ergonomics of the game was positive; scores for the usability, design and readability of the game varied between 3.74 and 4.12 out of a possible 5. **User-friendliness.** The results indicate that the tutorial and the rules helped the students to understand the game's operation. With regard to the navigation on the game board (moving the pawns on the tracks, responding to questions, modifications for improving the environment, signage and rules), students' satisfaction scores were very high. As well, use of symbols known by the players, such as a simple click to access all elements of the game (moving a pawn, responding to questions for points and improvements) are elements that were evaluated positively by the students.

Design. The results show that the grouping of strategic information on the lteral panel of the game board (points, number of positive and negative resources acquired, pawns in the bank, environment to improve, levels of improvement, the name of the player's avatar and control of one's computer) facilitates the understanding of the game and makes it more intuitive. Also, the format of the signage and the position of the questions, videos and illustrations as well as the restriction to two windows on the game board are elements that were evaluated very positively by the students.

Readability. The results indicate that the presentation of the question text, and the size of photos, videos were particularly appreciated. Students made very few comments on the readability other than some feedback judged to be too lengthy to read.

Participants' assessment of the support mechanisms for learning was positive, especially concerning feedback given for incorrect answers. The evaluations concerning the aspects of challenge, competition, feedback, and active participation varied between 3.26 and 4.17 out of a possible 5. **Challenge and competition.** Respondents indicated that the questions for winning resources and their level of difficulty as well as obtaining positive and negative resources represented an important challenge. Regarding questions of fairness, the respondents considered that these added competition in the game. **Feedback.** Respondents felt that the feedback given for questions answered incorrectly allowed them to move forward in the game. **Active participation**. Respondents had the sense of controlling the game through their responses and their choice of plans. They liked being able to construct an environment et the animations in the environment. The chat and sound in real time were strongly appreciated.

In terms of **socio-demographic variables**, there were no differences between the two groups with respect to the score obtained in the game, either individually or in teams. However, some differences were found. The average of two variables differed significantly between boys and girls: boys appreciated more the display format of the game and the readability of the vocabulary of the game. As for age, only one significant difference was found concerning the perceived challenge related to the game: older participants perceived a slightly greater challenge than younger ones. Finally, Secondary 5 students perceived more competition in the game.

Recommendations

Various recommendations were drawn from the analysis of the ergonomics and motivational support mechanisms.

Ergonomic Design Aspects of Serious Games
Design - 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 in 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 pawns in an environment or on a game board must be taken into account in order to avoid an obstruction in regards to accessing important information as it pertains to learning. In addition, the size of the pawns must be in proportion to the size of the squares.
User-friendliness - Navigation in the game. The game should provide easy navigation and must meet certain conditions. At all times, the board, the pawns, the navigation buttons, instructions, scoring and the rules must be posted and accessible to ensure the smooth running of the game. It is 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 can access all the elements with a simple click to which he will have to answer 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 games with more than three overlapping windows, which affect the intuitiveness of the game. Here are some comments from students: *« It's cool to bring up the rules and the tutorial when we want. I found this tiring at the begnning and turned it off. Then I opened it when I failed to improve with the bins, as I didn't want to lose any points. » « Several rules are easy to understand, but other times less so, it's lucky that the game guides us. » « It's easy to play. I play often online with this type of game.»* [translated from French].
Readability of the game as it pertains to the multimedia aspects. The game must meet certain minimum requirements in relation to text, video and illustrations.

- 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.
- 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 are often 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, which 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 2 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 texts 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 a text, in addition to the sound 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, adjust volume, etc...) be integrated into the game and accessible during listening.

Motivational Support Mechanisms for Learning

Competition. The serious game must create competition between players to maintain their interest. It should provide (1) rules that determine the winner or winners and the loser or losers; (2) points (positive or negative) obtained every time an action is executed whether it is correct or not; (3) gains for a player which constitute a loss for the others; (4) reaction speed to an answer or to an action before the others in order to obtain a gain, etc. Here are

some comments from students: "*If you're fast, you risk winning a lot but you also have to answer correctly, otherwise the other wins.*"; "*It's funny when you win trash! It's less funny when I lose an improvement and the game.*"

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. Here are some comments from students: "*I really enjoyed the experience. It is also a strategy game.*"; "*Bonus questions are fun! I was always the first to respond.*"; "*When I got pawns with the cards, I won the game because the pawns gave me more points.*"

Feedback. The serious game must provide feedback to support the learning of the defined content. On the spot feedback, related to each learning task, allows the player to identify successful activities and those they have failed. The game must incorporate mechanisms (1) that 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, etc.; (2) that 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) that 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. Here are some comments from students: "*I really liked knowing why I answered incorrectly.*"; *When I saw the moon smiling, I knew that I had answered correctly.*"

The serious game must also provide feedback related to players' actions throughout the game to enable them to visualize the results of their actions in the game. It's rare that a game is totally intuitive. The game should include instructions or a tutorial that guides each player throughout the game. This tutorial should be available whenever players need it. Here are some comments from students: "*Many rules are easy to understand, but sometimes less so. We were lucky that the game was guiding us.*"; "*I found that the text being displayed in front of the game kept me from playing quickly so I closed it. I reopened it a few times to understand how the game works.*"

Active participation. The serious game must provide mechanisms for activate participation. The integration of chat and audio in real time promote exchanges between players. Here are some comments from students: "*THIS CHAT IS SICK*"; "*Very cool to talk to each other!*"; "*Wow! Cool sound!*"

Conclusions

In 2002, Quebec adopted a water policy to ensure the protection of this unique resource which is highly sought after in emerging countries. Building on the premise that young people today have an immediate impact on their environment (through family and friends) and that tomorrow they will have the responsibility for the development of our society, we asked ourselves how to educate youth to adopt daily behaviours that will make all the difference for water conservation for the future generations. Serious games can help young people understand cause and effect relationships, and thus the effect of actions and decisions they make in relation to water conservation. The goal of this study was to create and test a serious game to educate young people in grades 10 and 11 in adopting responsible behaviours with regard to water consumption. Specifically, we wanted to examine the influence of the ergonomic conditions of serious games and the motivational support mechanisms that encourage perseverance in players who are learning by playing the game.

Relying on an iterative process of creation, we developed a generic shell for serious games (GSSG) that empowers teachers so that they can easily create serious games without advanced computer knowledge and which are adapted to the content of their curriculum. Subsequently, we used the GSSG to produce *Water Game,* a serious game about water conservation. This game, in French and English, was tested with 19 students in regards to functionality. After revisions were made, it was tested with 156 students in single and multi-player mode. The students enjoyed the motivational support mechanisms that are offered in the game, as well as the quality of design, usability and the pedagogical readability of the game. The results were discussed in the form of recommendations for designers of serious games for educational purposes.

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Appendix A - The *Water Game*

Player instructions
Goal of the game: The goal of the game is to improve your environment by collecting the necessary resources for its construction. These improvements will allow you to accumulate points. The first player to complete the improvements in their environment while having the highest score wins the game.
**Maximum number of players:** 2 players
Number of Turns: A game has 12 turns. If the environment is not completed after the first 12 turns, players play an additional eight turns or until one player has completed their environment. If no player has completed their environment after 20 turns, the game is declared a tie.

Game Materials

- The **game board** includes a predetermined path (7 squares) located in the center of the game board. Each square allows the players to acquire resources (e.g. water or flowers) or to lose resources (e.g. garbage bags). On each side of the game board is a lateral panel with information (one for each player). For the single player version (Figure 1A), each panel displays the following information: points earned, positive resources acquired (e.g. a drop of water, a flower), negative resources (e.g. garbage bags), pawns, an image of the evolution of the player's environment, the three levels of improvements, the player's name and avatar, etc. For the multiplayer version, two additions are made to the game board: control of the voice audio level around the avatar and chat (Figure 1B).

Figure 1. A- Game board and information panels (single player version)	Figure 1.B- Game board in multiplayer mode
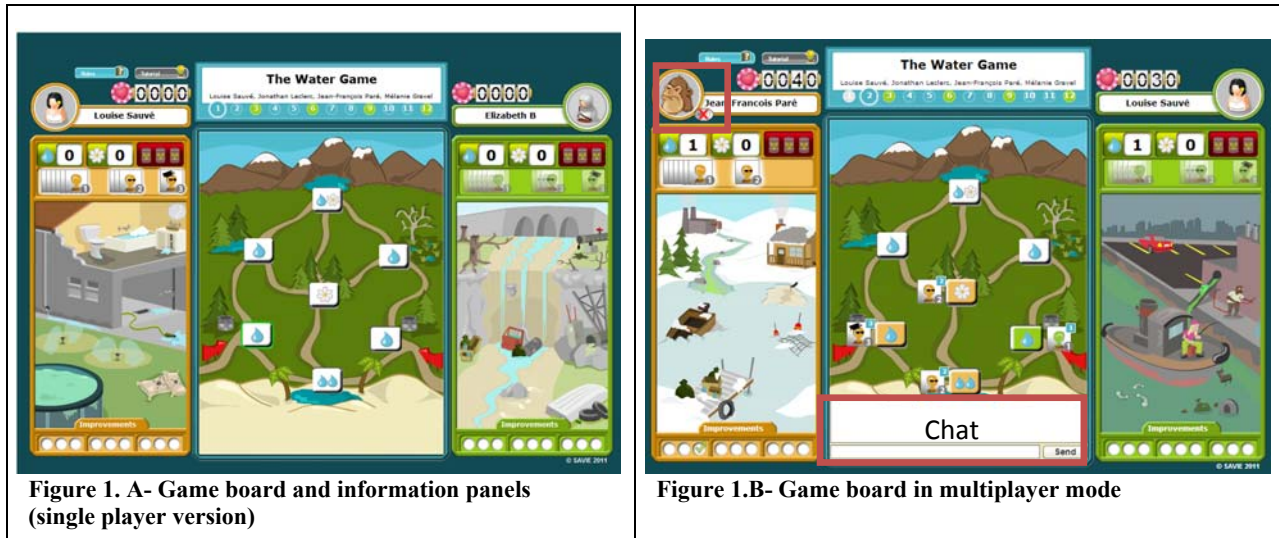
- Two series of 10 **pawns**: six Level 1 pawns, three Level 2 pawns, and one Level 3 pawn.
- Three series of r**esources**:
    1) Resource 1: drop of water (4 squares provide 1 drop of water, 1 square provides 2 drops of water)
    2) Resource 2: flower, more scarce (1 square provides 1 flower and 1 square provides 1 flower and 1 drop of water)
    3) Resource 3: garbage bags (acquired when a wrong answer is provided).
- Three **levels of improvement**: Level 1 has a value of 2 positive resources (2 drops of water); Level 2 has a value of 4 positive resources (4 drops of water); Level 3 has a value of 7 resources (5 drops of water plus a flower).
- A series of **questions**: 81 questions were created to ensure that the questions differ from one game to another. These questions are chosen randomly. There are three levels of questions (easy, medium and hard). There is a minimum of 16 questions per game that can be generated, or one question per turn; there are 12 turns and four special questions for the acquisition of Bonus Cards. This number increases when there are ties between players. Ties can arise as soon as the second turn and continue until the end of the regulation turns; there is a maximum of 11 questions for ties. In this sense, the maximum number of questions during the 12 regulation turns is 25. To this must be added the questions asked during the additional turns. There are a limited number of additional turns (8), which means that there can be a single additional turn or 8 additional turns thus increasing the number of questions required for the game by 16.
- A series of **Bonus Cards**. These cards are randomly chosen at 4 times during the game, during turns 3, 6, 9 and 12. These are obtained by giving a correct answer to the bonus questions the players are asked. Here are a few examples of Bonus Cards: (1) Win a Level 2 pawn. This pawn cannot be placed immediately, it must be kept in the bank and placed during the following turns; (2) Win a scarce resource (flower); (3) Win 4 drops of water.

The Rules of the Game

The rules take into account the operating mode of the game: single or multi-player. In this paper we present only the rules of the single player mode. There are ten rules, and they govern all player movements:

1. The game is played with two players. Before starting the game, the players must first choose an opponent. Two options are available to them. The player has the option to play against another player who is already registered for the tournament by selecting their name from the dropdown list. They can also choose to play with a guest (a player who has no password). In a tournament, each player can have a teammate. The teammates must register with the game at the same time as the players register. Throughout the game, players can ask their teammates for help in answering the questions. Please note, only the points earned by the players are calculated for the tournament.
2. The computer randomly selects the player who will start the game.
3. On the first turn, each player places one of his pawns on the starting square. Each pawn can only be played once. Each player can only play one pawn in each turn.
4. As soon as the players start playing, game turns happen in the following manner:
    1. For every game turn, a player places a pawn on an accessible square along the path. To be accessible, a square must be connected by the path to a square already owned by the player.
    2. A pawn cannot jump over an empty square or around a square owned by an opponent. A player can have several pawns on a square they own or on a square owned by an opponent by simply placing a pawn on it at the rate of one per turn.

9

3. Once the pawn is placed, the player must answer a question. A good answer is worth 30 points and for a wrong answer you get a negative resource (garbage bag). These negative resources accumulate over time; when a player has three of these, the player loses the highest level of improvement that was placed on their environment.
4. With a right or wrong answer, the player still owns the square and the resource when the player is the only one on the square or when he has the highest number of pawns on the square.
5. When a player has placed his pawn and has answered the question, it is then the opponent's turn to place their pawn on a square and then answer a question.
6. When both players have placed their pawns and have responded to a question, the computer counts up the resources the players obtain depending on the squares they occupy. Two windows appear in the center of their screen, one for each player and labeled with their name. This tells the players the total amount of points they have accumulated for that turn.
7. Depending on the total resources obtained, players can build their environment by acquiring an improvement. The improvement is also worth points which are added to the total. Players can gain one improvement per turn.
8. Once these steps are completed, the game switches to the next turn and the players repeat steps 4.1 to 4.8.

5. Players have 12 turns to complete their environment by acquiring improvements. To do this, they must acquire nine improvements, or if you will they must obtain: three Level 1 improvements, three Level 2 improvements and three Level 3 improvements. To gain an improvement, a player must have a certain number of resources. The value of a Level 1 improvement is 2 resources. A Level 2 improvement has a value of 4 resources, while a Level 3 improvement is worth 5 resources and 1 resource of another nature. These improvements are gained by players at the end of each turn. Players can acquire only a single level of improvement per turn.
6. At the start of rounds 3, 6, 9 and 12, the computer randomly displays a Bonus question to one of the 2 players.
    a) If the player answers the question correctly, the player wins a Bonus Card. The player must follow the instructions on the Bonus Card. Some cards require immediate action and some imply that the action be deferred to the next turn.
    b) If the player does not answer correctly, the opponent wins the Bonus Card.
7. When players earn three negative resources (garbage bags) as a result of answering incorrectly, they lose the highest level of improvement in their environment. During a game, a player can earn three negative resources several times and lose more than one level of improvement.
8. A player may place his pawn on an opponent's square. When both players have played and there is a tie on a square, a question is displayed randomly to one of the players. If the player does not answer correctly, the resource is given to the opponent. This process is repeated as long as there is a tie.
9. After 12 turns, if no player has completed the development of their environment, an additional turn will appear. After 20 turns, if players have not completed their environments, the game is tied and no additional points will be earned.
10. The game ends when one player has completed their environment within 20 turns. The first player to complete their environment gets an extra 150 points. If both players complete their environment at the same time at the end of a turn, they each get an extra 150 points. The player with the highest score wins the game. The result is displayed on the screen along with an animation to highlight the winner and player results.