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A serious game-based solution to prevent bullying

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Abstract

Purpose – The purpose of this paper is to present a Serious Game with the main purpose of inducing attitude changes as a way to prevent bullying, in a target audience of young people between 10 and 12 years old.

Design/methodology/approach – The rationale for prevention is: first, to help victims of these aggressive episodes to acquire or improve competencies in avoiding or dealing with future real bullying situations; and second, to promote empathy toward the victims in bystanders. A back office application complements the game, providing substantial assistance to psychologists while using the game with patients in therapy or in research work.

Findings – Both components, the game and the back office, were evaluated with volunteers. The user study leads the authors to the conclusion that the current version of the game holds good potential in bullying prevention: the young people that played the game in a continuous time span, at the end of this testing process, have expressed improvements in their bullying prevention strategies. The back office application, a distinctive feature of the solution when compared to other similar bullying prevention solutions, was positively assessed by the psychologists who tested it.

Originality/value – The game deals with strong social features, such as number of friends and invitations to social events (e.g. a birthday party), to which young people give much importance. Additionally, it offers a variability of scenarios and consequences of actions, taking into account the user's performance in the game. The main factors that makes the presented solution stand out in comparison with other similar bullying prevention solutions are mainly the following: It includes a back office application to assist therapists with data management features; the role of the player in the game

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can be chosen according to his own profile; it is possible to play even outside a therapy session (e.g. at home); and it is a portable solution.

Keywords Prevention, Bullying, Bystander, Platform game, Serious game, Victim

Paper type Research paper

1. Introduction

Bullying is a type of aggressive behavior that involves intentionality from the aggressor, repetition over time and abuse of power (Olweus, 1993). It has severe short-term consequences for the victims (in the worst scenario the suicide), long-term effects in health and also in financial and social outcomes (Carvalhosa, 2009). Therefore, it is a phenomenon that increasingly concerns civil society, families and school communities, thus being a frequent topic in the media.

All over the world, and despite the differences between countries, the prevalence of bullying is high and shows a tendency to grow, especially among girls and boys aged from 10 to 12 years (Carvalhosa, 2008; Nansel *et al.*, 2001; Wang *et al.*, 2009). Victims (the targets of bullying) and bullies (the agents of bullying) are the minority, while bystanders (the witnesses of these situations) are the majority but, in most cases, a non-intervening audience.

The existing interventions have not proved to be effective (Cook *et al.*, 2010), and traditional psychologic therapy usually adopts clinical models that are not adapted to the specificities of bullying participants with a potentially critical time gap between sessions.

All these factors highlight the need to find appropriate solutions to prevent bullying. To effectively minimize bullying episodes, specific skills should be taught to victims, while bystanders should be encouraged to intervene toward helping the victims (Carvalhosa, 2009; Gini *et al.*, 2008; Nickerson *et al.*, 2008).

The use of interactive technologies (ITs) has produced fruitful results in cognitive and self-efficiency development and in the promotion of specific behaviors (Cláudio *et al.*, 2013; Gold *et al.*, 1997), with promising results in the training of problem-solving skills (Cook *et al.*, 2010). In particular, persuasive technologies (PTs) that are focused on behavior changes, when used properly and ethically, allow the user to reach more rapidly the desired type of behavior (Fogg, 2003).

More specifically, Serious Games (SGs), which are interactive applications that use videogames' technology with purposes beyond mere entertainment (Susi, 2007), have several advantages that make them an exceptional tool for teaching and influence people's behavior (McQuiggan *et al.*, 2008; Pereira *et al.*, 2012). In fact, the popularity of videogames among the youngsters may influence positively their receptivity to therapeutic approaches that are less traditional.

This paper describes a tool whose main component is a SG, called "StopBully", conceived to help preventing bullying and promoting empathy. The game uses PTs and the goal is to encourage young players (from 10 to 12 years) to change their behavior when they have to deal with this type of situations. The tool also includes a back office application (BOA) which assists the work of the psychologists that are applying the game to assess and/or to treat young people with different levels of involvement in bullying.

The team designing this solution is multidisciplinary and includes psychologists with knowledge and experience in the topics of bullying and empathy and specialists in computer graphics.

The characters of the game, designed by two Art students following the psychologists' guidelines, went through a validation process to confirm their adequacy to the game. A preliminary evaluation of the game was also performed, and it produced several ideas to refine and improve the first prototype. After the necessary adjustments, a second user study was conducted to evaluate usability, playability and the effectiveness of the game in changing bullying-related attitudes. The functionalities of the BOA were also evaluated by therapists.

This paper has the following structure: Section 2 describes the most relevant work on SGs applied to bullying and some considerations about PTs; Section 3 presents the StopBully solution; Section 4 presents the user studies and the discussion of their results; and Section 5 draws conclusions and lines for future work.

2. Related work

Bullying episodes take place in a social context, so it is necessary to consider individual and contextual characteristics (Cook *et al.*, 2010; Olweus, 1993). Within the school, the social, political and economic conditions should also be analyzed (Carvalhosa, 2009). Table I summarizes the individual and contextual characteristics of victims, bullies and bully-victim (someone that is bullied and also a bully) (Cook *et al.*, 2010). These characteristics were considered in the conception of the characters of StopBully and the episodes it recreates.

The testimonies of what is happening between the bully and the victim are called bystanders, and they may have a passive or an active defending behavior in bullying situations (Gini *et al.*, 2008). Most of the time, they are passive witnesses (Gini *et al.*, 2008; Nickerson *et al.*, 2008), because they do not know what to do to help the victim; they are afraid of becoming bully's next victim or to do the wrong thing. However, comparing with the victims, they are more self-confident, possess social skills and resist to group pressure.

When a bullying episode happens, bystanders are usually in majority, so they should be encouraged to intervene, to denounce the bully, using a group strategy to avoid being the next victims. Inducing higher empathy levels toward the victim and assertiveness training to improve their perceived social self-efficacy may have an important role in their attitude changing (Gini *et al.*, 2008).

Considering the level of popularity that videogames have among the youngsters, a serious game has potential to play an important role in promoting the empathy and appropriate behaviors in bullying situations. There are currently some SG solutions targeting bullying: "School Bullying" (www.schoolbullying.eu/en/home) provides a limited set of situations and stories, runs only on PCs (not tablets) and has a weak performance, possibly due to the three-dimensional (3D) graphics with too much detail. In another SG (Rodrigues *et al.*, 2013), developed at the University of Trás-os-Montes and Alto Douro (UTAD), the player cannot explicitly choose the victim or bystander role, a discouraging motivation for players. "FearNot!" (Hall *et al.*, 2009), a widely tested European project, has too a profile restriction, forcing the player to always be a bystander.

Intervenients	Individual characteristics	Contextual characteristics	
		Outside the school	Inside the school
Victim	Insecure Difficulty making friends Great vulnerability Low levels of health and wellness Internalizing behavior (introvert) difficulty with social problem-solving	Overprotective parents Little support from friends	Negative environment Noticeable peer rejection and isolation
Bully	Externalizing behavior Negative cognitions related to others Problems with academic challenges Problems with attitudes and beliefs about the others Difficulty with social problem-solving	Poor family environment (e.g. parental conflict, lack of cohesiveness) Poor parental monitoring Supportive friendships	Little support from teachers Good support from colleagues
Bully victim (they both bully and are bullied by others)	Co-morbid externalizing and internalizing problems Significant negative attitudes and beliefs about the others and about himself/herself Low social competence skills Negative self-related cognitions Difficulty with social problem-solving Weak academic performance	Little to medium family support Little support from friends	Rejected and isolated Negatively influenced by peers Little support from colleagues and teachers

Table I.
Characteristics of victim, bully and bully-victim

Another approach, "KiVa" (www.kivaprogram.net), is an anti-bullying program for schools that was created in Finland. It has two components: universal actions, for all students, and indicated actions, used when a bullying case has emerged. The universal component includes online games, not open to the general public. One of them was developed in cartoon stylish two dimension (2D), with different situations, where the player has to make the right decision. The data generated by these videogames are not saved. Still, the data collection is achieved through questionnaires administered at the end of each school year. The program has already been implemented in countries such as Finland, New Zealand, Estonia and the UK, with positive results, such as a reduction in bullying events.

To change the victims' and bystanders' behavior, it is necessary to look for the best PT design approaches. King *et al.* (1999) advise the use of portable or environment-integrated solutions with simulated experiences or surveillance-based solutions. Fogg (2003) also suggests the following design principles:

- reinforcement (reinforce positively when the desired behavior occurs and negatively when it does not occur);
- reduction (simplify more complicated tasks, removing unnecessary steps);
- self-monitoring (allow the user to monitor his/her behavior);
- suggestion (intervene at the right time, when there is motivation and ease in acting);
- surveillance (user behavior is monitored and observed by others);
- tailoring (use relevant personal information as part of the intervention); and
- tunneling (sequence tasks to achieve, more easily, the great ultimate goal, reducing cognitive load).

Previous studies reveal that SG players, in general, prefer single player mode, 2D environments and cartoon stylish characters (Zamboni *et al.*, 2011). Children prefer to play on laptops, videogames consoles and tablets (Carvalho and Araújo, 2014). Platform games are among the most popular; these are 2D games, allowing players to move left or right to overcome obstacles and collect items, tasks that make them earn points and higher game levels.

To address the problem of bullying and the lack of effectiveness of the existing solutions, this paper presents a solution that comprises:

- a game, StopBully, which is a SG with cartoon stylish characters and scenarios, based on platform games; and
- a BOA to support the psychologist in the management and monitoring of the players that he/she follows in therapy (Raminhos *et al.*, 2015).

The purpose of the game is to help bystanders and victims to change their behavior toward this type of violence, usually at school, by simulating their environments and stories.

The solution presented in this paper adopts the best approaches found in previous works and had in consideration the characteristics of victims and bullies described in Table I and also the bystander profile. For the moment, the bully-victim role was not considered in our game, because it would increase significantly the complexity of the

scenes in the game and probably would endanger the comprehension of the potential of the tool to induce empathy toward the victim.

The characters of the SG were drawn and painted by Arts students, based on requirements outlined by the psychologists of the team considering the roles that they required for the first prototype of the game: victim, bully and bystander.

3. StopBully

The target audience of StopBully are children from 10 to 12 years old, specifically victims and bystanders, roles that have been mapped in user profiles. For ethical reasons, a bully profile was not created because there would be a risk that victims and bystanders could play the game as bullies with unknown consequences for the players, and it would also require, in the opinion of the whole team of this project, different strategies from those used for the other roles.

The SG was conceived for tablets and PCs, using the Unity 3D (http://unity3d.com/) and some free sounds libraries. Although mobile devices are the preferred platforms of our target audience, not all children have them at their disposal; for this reason, the computer remains an option and even adds the advantage of a larger screen.

The game can be used in therapy sessions, that is, in the presence of the therapist but also autonomously, outside this environment. Each game session generates an information record that offers to the therapist the possibility of following the progress of the patient up close and timely. Thus, her/his progress can be effectively monitored, even outside the in-person therapy sessions. This information is provided through the BOA (Figure 1). Additionally, researchers may use this solution in studies in the area of bullying, exploiting the BOA to assist in data analysis of a particular sample. Some mechanisms were implemented in the BOA and in the SG to ensure data security.

3.1 The Serious Game

After logging in with credentials, previously provided by the psychologist who accompanies the young player, he/she can see his/her score and the level he/she is in each profile or can start the game.

At the beginning of the game, the player chooses one of two profiles, victim or bystander, and one of the characters available for that profile. After the character choice, he/she indicates the level he/she wants to start (Figure 2). A level comprises a chapter (accommodates a recreated situation or narrative) and an area (a place inside the school).

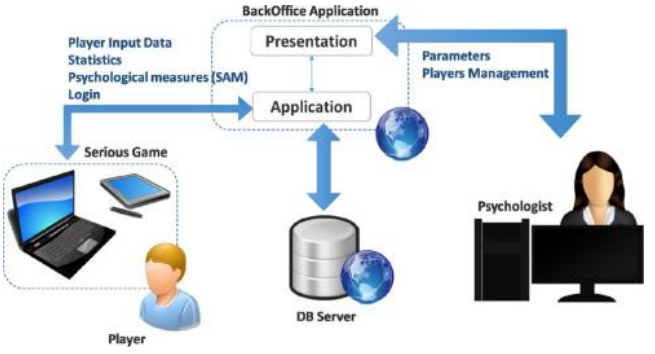

Figure 1.
The proposed solution: the Serious Game and the backoffice application

Figure 2.
Map of the school, where the player can choose the level

Note: The circles in grey represent three different locations: the school entrance, a hallway and the football field

If the player successfully finishes all areas in a chapter, then he/she can freely choose one of the other areas where the other levels are held.

Before and after the level execution, the player must assess his/her emotional state, indicating the values of each dimension of the Self-Assessment Manikin (SAM), an instrument comprising pictorial scales for assessing emotional responses perceived by the individual (Bradley and Lang, 1994). One dimension of this instrument, Pleasure, ranging from "Displeased" to "Pleased", can be observed in Figure 3. This instrument was integrated in the SG, because it is straightforward to use, easy to understand and is commonly used to measure affective responses.

In the course of a level, the player is faced with challenges and bullying situations, as a bystander or a victim, depending on the chosen profile at the beginning of the game. Those situations are integrated in familiar stories and scenarios and accompanied by environment sounds, thus altogether attempting to create an experience as closer to the reality as possible. When faced with a challenge, the player must make a decision, which will have consequences on the score that is built up by number of friends, amount of courage and count of invitations and will affect the course of the story. The player only passes the level, if he/she gets at least the minimum score required.

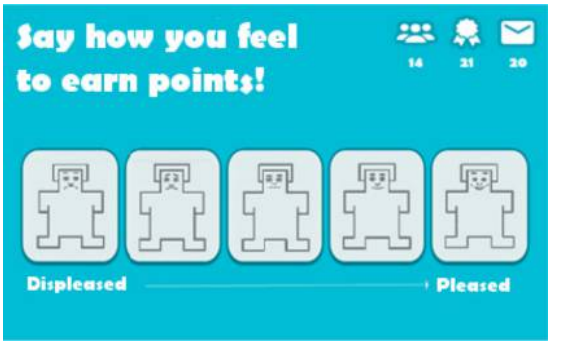

Figure 3.
Interface of the self-assessment of the pleasure component of SAM

Currently, the SG has three levels in the bystander profile and three in the victim profile. The levels take place in different locations, the school entrance, the football field and the school hallway (Figure 2), according to the storyboards provided by the Psychology team, based on the qualitative study conducted with some youth from the target audience of the game (Candeias and Carvalhosa, 2014). Some levels may also have different degrees of difficulty, depending on the score obtained previously by the player: easy, medium and hard. These levels of difficulty can be mapped in more intimidating scenarios or in the degree of difficulty of winning points, ensuring variability and a more challenging game.

The design principles of PT (Fogg, 2003) in our SG are ensured as follows:

- *Reinforcement*: It is ensured by assigning the score depending on the chosen option in every interaction and by authorizing the access to the next level when the performed choices were the most appropriate.
- *Reduction*: More complicated tasks were simplified, removing unnecessary steps in the simulation of bullying situations.
- *Self-monitoring*: Monitoring of the performance of the player through the summary of the scores and the wins/losses notifications in the end of the level, indicating a good behavior/misbehavior.
- *Suggestion*: The intervention is performed during the game through the options available in each interaction and the return of those choices, with the attribution of the score, and after the game, when the player is faced with its performance relative to the number of friends achieved, how brave he/she is and his/her popularity, symbolized by the number of invitations.
- *Surveillance*: The choices made by the player and his/her emotional evolution are monitored by the player's psychologist.
- *Tailoring*: After having chosen the profile, the player chooses her/his character in the game. In addition to the gender, there was a concern to provide characters with the most prevalent ethnic groups in Portugal: Caucasian and African.
- *Tunneling*: To achieve the goals of the game, the player has to pass each level. To pass each level, the player must successfully complete small tasks (making a decision in a given interaction).

The values of the SAM and the choices made by the player are sent to the BOA and can be queried by the psychologist who accompanies the player.

Next section describes a level of the SG, to make easier the understanding of the game dynamics.

3.2 Playing a level of the Serious Game

The level taking place in the school hallway, with a bystander profile, starts with a group of bystanders and bullies talking; the player joins the group, while an isolated victim, slightly away from the group, reads the messages in the mobile phone. One of the bullies suggests that they could steal the mobile phone and the whole group agrees, laughing (Figure 4). The character of the player (with a grey circle beneath), although thoughtful, follows the group.

Figure 4.
Level in the school hallway, where the bully proposes to steal the victim's mobile phone

Note: The character of the player has a grey circle beneath it. The victim is slightly away from the group, not yet visible in this screen of the game

When approaching the victim, the bully that made the suggestion, asks her the mobile phone and everyone laughs (except the character's player). The victim refuses to give him the phone, saying that she needs it. Another bully threatens her and the group keeps laughing. At this point, the player has to make a decision (Figure 5): joins them (loosing points), moves away and says nothing (loosing points) or bids the group to stop (winning points).

If he/she choose the last option, then the player is faced by the bully and by the mockery of the remaining individuals of the group. To escape from this situation, he/she will have to choose one of three paths: laughs (loosing points), moves away and reports the situation to a janitor or faces the group (winning points), making it clear that their attitudes are wrong (Figure 6). If the player chooses the last one, then the whole group is thoughtful and looks to the player with admiration, and the victim is relieved.

The player can only pass this level if he/she chooses to tell what happened to a janitor or to face the group. When this happens, a screen like the one in Figure 7 appears showing the points obtained in the three categories: friends, courage and invitations.

Figure 5.
Level in the school hallway, where the player must make a decision, while witnessing a bullying episode

Note: The victim is the character on the right

3.3 The architecture of the Serious Game

To assure that the game can have its interface easily altered (for instance, to change the language), the adopted software design pattern was the "Model, View and Controller". Moreover, as the game is implemented in Unity 3D, a suitable architecture by components was adopted. The components are as follows (Figure 8):

- The UI (user interface) layer handles all user interactions and generates the graphical representations of the levels and menus.
- The Managers layer includes the GameManager component, responsible for managing the current session of the game; the LevelManager, responsible for managing the current level of the player; the SoundManager that manages all sounds and activates them in the correct moments; and finally, the DataManager that stores data such as statistics and login information.
- The Catalog layer groups static data regarding sounds, chapters and levels.
- The Model layer keeps the information of the structure of a level and a chapter.
- The Data layer knows how to access the remote and local data.

The architecture is designed to support future extensions that include new scenarios, characters and levels.

Figure 6.
Level in the school hallway, where the player must make a decision after facing the group and the intimidation of the bully

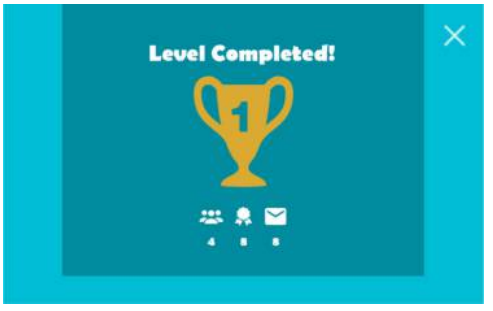

Figure 7.
Serious Game's interface of the level end, stating that the player passes it, with four friends, level of eight in courage and eight invitations

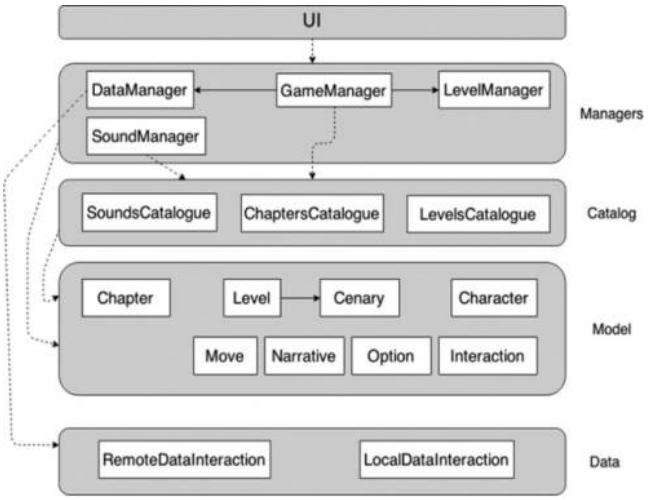

Figure 8.
The architecture of the serious game

The structure of a Unity application is based on scenes. Figure 9 illustrates a simplified version of the structure that was defined using this approach, and the respective communications with the BOA, taking into account the storyboards and drawn architecture for SG, with the following scenes:

- *Login*: It is where the user inserts his/her system credentials. The system subsequently receives the game statistics in XML format. Being the first scene of the system, the GameManager, the SoundManager and the scripts that perform the interaction with the BOA are all loaded to provide the sounds, the game session data and the communication between the BOA and the other scenes.
- *Initial Menu*: It is where the user can choose between the options of playing, consulting his/her score or exiting from the game.

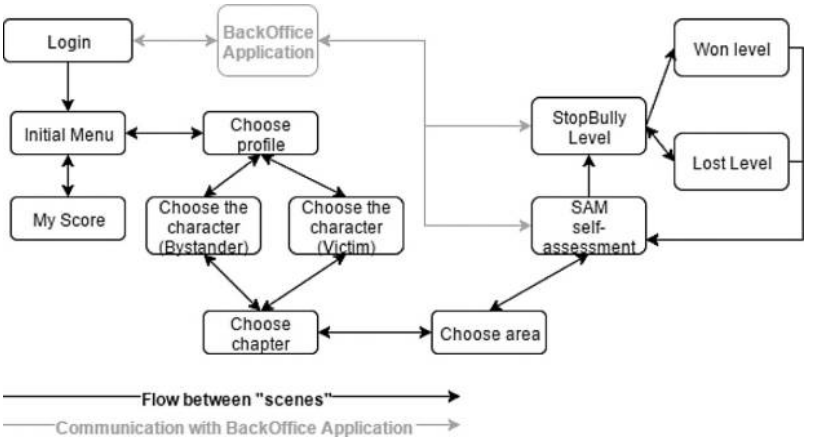

Figure 9.
The flow between game scenes

- *My score*: This is selected if the player wants to know his/her own score. It uses the game session data provided by the game manager.
- *Choose Profile*: It is where the player chooses his/her role, bystander or victim, when starting the game. This choice is recorded in the game session data (GameManager).
- *Choose the Character (bystander)*: It is selected if the player has previously chosen this role. This profile information is stored in the game session data.
- *Choose the Character (victim)*: It is selected if the player has previously chosen this role. This profile information is stored in the game session data.
- *Choose Chapter*: It is where the player chooses one of the chapters available (this information is in the ChapterCatalog). This choice is stored in the game session data.
- *Choose Area*: It is where the player chooses a location in the map of the school that corresponds to the chosen chapter. After this decision, it is possible to identify: i) the level of difficulty based on the player's score in the current profile and the minimum scores for each difficulty level, which are defined in each area; and ii) if the player has chosen the bystander role, if the minimum score for a victim in that level was attained, to allow or not the execution of the level.
- *SAM Self-assessment*: If the player is authorized to play the level, here is where he/she evaluates his/her own emotional state. This information is sent to the BOA or stored locally.
- *StopBully Level*: It is where the level is executed after the instantiation of the scenario prefabs, of the player's character and the remaining characters and their respective interactions. The Level Manager component loads this information which is stored in a .xml file that contains the definition of the current level.
- *Won Level*: This happens whenever the player reaches the minimum score set defined in the .xml file of the level. The score of the player is displayed, and the player can return to the "Choose area" scene. Game statistics are updated and sent to the BOA or the local storage.
- *Lost Level*: This happens if the player has not attained the minimum score. The score turns 0 and the player has two options: to play again or go to the "Choose Area" scene. Game statistics are updated and sent to the BOA or the local storage.

The XML format was chosen for the game statistics and the levels because it is easily processed. Besides, all the data are not kept in RAM, not compromising the performance of the game. Figures 9 and 10 explain the flow between the game scenes; the second also shows the interfaces that are displayed.

3.4 Building the scenarios and animating the characters

To simulate depth in the scenes of the game, the successive background layers are parallel and have different depths (Figure 11). When the perspective camera makes a move parallel to them, to the left or the right, the layers seem to move at different speeds,

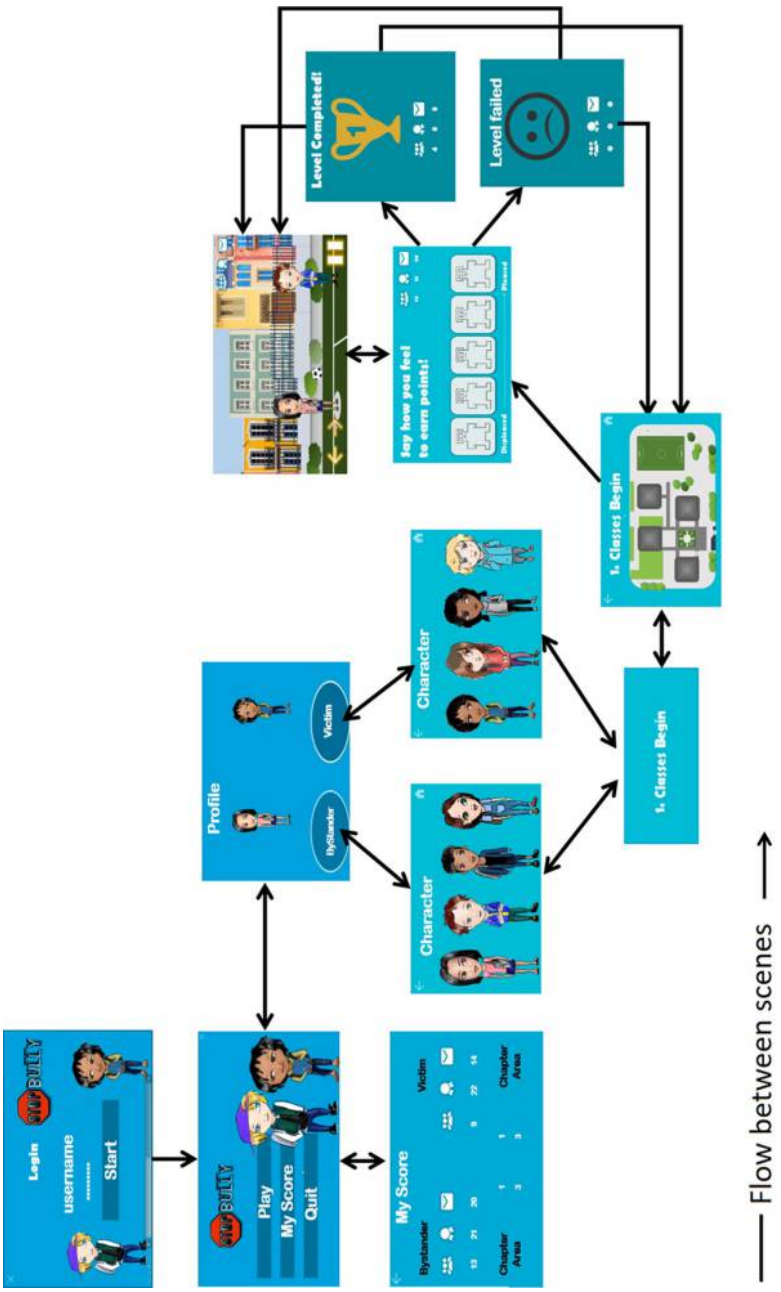

Figure 10.
The flow between game scenes (interfaces)

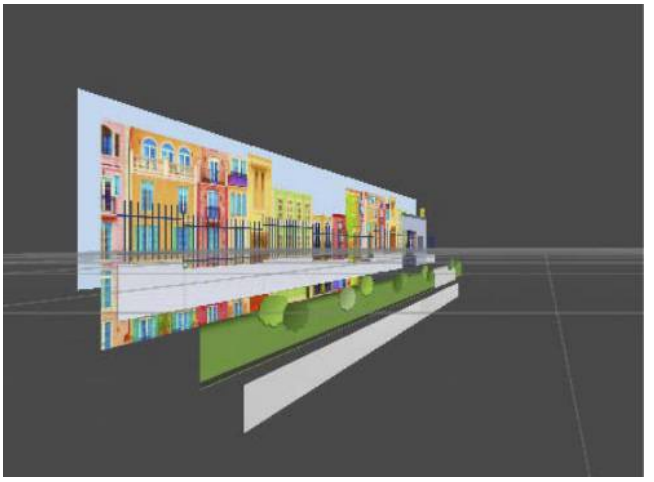

Figure 11.
The background layers with different depth values

simulating the desired depth effect. This process is described in (http://crushysblog.titanforgedgames.com/2013/10/easy-paralax-scrolling-on-25d-game.html). There is an alternative method that consists of defining different speeds for each layer (http://pixelnest.io/tutorials/2d-game-unity/parallax-scrolling/), but it is more complex to use and to adapt for different scenarios.

To produce the animation of the digital characters, 2D and 3D tools were used: Gimp (www.gimp.org) and Blender (www.blender.org). Gimp was used to separate the parts of the body relevant for the desired animation, that is, the legs and the head of the characters using the functionality "Intelligent Scissors"; subsequently, all parts were imported to Blender with the option "Import Image as Plan". Then, each character was animated using keyframing and rigging methods. Appropriate weights had to be assigned to the polygonal mesh of each plan ("Weight Paint" mode) to avoid imitating the stretching of the skin, which would bring strange results during animations, having in consideration that the characters are cartoonish. The smoothness of the animation was also adjusted with Blender's Graph Editor.

This overall animation process in Blender, whose result in one of the digital characters is illustrated in Figure 12, allowed us to recycle the animation of the first character to the remaining characters, accelerating the animating stage.

4. StopBully evaluation

Several evaluation stages took place during the development of the proposed solution:

- a validation of the characters, before their inclusion in the game;
- a preliminary evaluation of the prototype, with the target audience to ensure that every eventual problem would be solved in the prototype to be assessed in schools;
- an evaluation of the SG prototype, with the target audience at a school; and
- an evaluation of the BOA with psychologists.

Figure 12.
Three frames in the animation of one of the characters

4.1 Characters validation and preliminary evaluation

A study conducted with focus groups allowed the identification of the physical and visual characteristics that the target public associates with the characters that are represented in the game: victims, bullies, bystanders and adults.

It was concluded that the ethnic identification is very important for the connection between the young player and the SG. So it was decided to introduce four characters for each one of the roles victim, bully and bystander: male and female with Caucasian appearance, male and female with African appearance. These choices are because they are the most common phenotypes in Portuguese primary schools.

Considering that teachers are woman in the majority, it was decided that a female character impersonating a teacher should be present. Finally, a character to represent a school vigilant was also included; it is a male character because it was considered more adequate as an authority figure for this age group.

To confirm the roles that had been assigned to each character designed by the Arts students, a role validation study was conducted with a large audience involving persons inside and outside the target audience. The group of participants was composed of 82 individuals:

- 13 (16 per cent) of them in the age group, medium age 10.46, minimum 8 and maximum 12; and
- 69 (84 per cent) older individuals, medium age 22.72, minimum 13 and maximum 51. Volunteers were recruited in schools and universities in the Lisbon area and invited to fill an online questionnaire about the game characters.

The characters were presented randomly in one of the three different sequences. One of the three sequences is presented in Figure 13; the legend of the figure lists the roles conceived for each one of them.

There were no identifiable critical problems; most characters received highly convergent role attributions (i.e. matching our expectation). There were no significant differences in role attribution between the two considered age groups: less than 12 years old, inclusive and more than 12 years old (df = 1; $p > 0.05$; Character z, $\chi^2 = 0.059$; Character y, $\chi^2 = 0.364$; Character v, $\chi^2 = 1.11$; Character m, $\chi^2 = 2.78$; Character i, $\chi^2 = 5.76$; Character o, $\chi^2 = 0.0004$; Character t, $\chi^2 = 1.61$; Character p, $\chi^2 = 0.531$;

Note: bystanders (y, o, x and s), victims (v, t, u and k), bullies (z, m, p and w) and adults (i and j)

Figure 13.
Set of characters

Character x, $\chi^2 = 0.061$; Character j, $\chi^2 = 0.0882$; Character s, $\chi^2 = 0.0079$; Character u, $\chi^2 = 5.75$; Character w, $\chi^2 = 0.001$; Character k, $\chi^2 = 0.631$). Although respondents reported the lack of a social context, as the characters were displayed individually, this is of course a problem that is overcome when they are integrated into the SG.

After the validation of the characters, a preliminary evaluation of the prototype was made considering only two levels. The usability and playability were evaluated with seven individuals of the target audience, who used an online version of the prototype and answered to an online questionnaire. The obtained feedback was very positive. Some minor detected problems were rapidly corrected.

4.2 Serious game evaluation

To validate the levels and the impact of the first prototype of the game on the prevention of bullying, the SG was evaluated with the target audience.

4.2.1 Methods

4.2.1.1 Participants. In all, 27 students (9-14 years old; M = 11.37; SD = 1.11) from fourth to sixth grades, participated in the SG assessment [Girls = 10 (37 per cent); Boys = 17 (63 per cent)]. Most participants were from the same school and were monitored for 4.5 weeks.

4.2.1.2 Instruments. An online questionnaire was made available to validate the integrated levels and the respective stories, the decisions taken and the changes on the preliminary prototype. The questionnaire link was given to the school participants and 60 questions were answered (e.g. perception of scenarios at each level of the SG), 45 with a Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree). To determine the participants' type of bullying involvement and to measure empathy, a questionnaire in paper was provided, comprising the following instruments: Olweus Bully/Victim Questionnaire (Solberg and Olweus, 2003); Davis Interpersonal Reactivity Index Perspective Taking and Empathic Concern scales (Davis, 1983); Reading the Mind in the Eyes Test (RMIEt) (Baron-Cohen *et al.*, 2001); and the Portuguese version of the Animal Empathy Scale (AES) (Emauz *et al.*, 2016).

4.2.1.3 Procedures. For a month, two weekly sessions (eight sessions in total) of 45 min each took place in the school facilities, monitored by a member of the psychology

team. All the participants in these sessions had an informed consent signed by their respective guardians. Among the 25 individuals monitored in this school, 22 were enrolled in these sessions and 4 only played the SG.

In the first session, a questionnaire was given out to participants, to determine their type of involvement in bullying episodes and to measure empathy. In the second session, participants began to play the desktop version of the SG, which communicated with our server, and 15 min before finishing the session, they filled an online questionnaire about the game. In the remaining sessions, they continued to play the SG. In the last three sessions, and after 15 min of playing the SG, the psychologist discussed with the students the bullying situations, favorite profiles and levels in the SG, and the anti-bullying strategies that could be adopted by bystanders and by the school, as a community. In the last session, empathy was measured again, to determine if and how much it might have changed as a result of playing the SG; the results of these empathy measurements are still in preparation. The results of the SG questionnaire is reported and discussed here.

The individuals who did not participate in these sessions (four of the total number of participants), played all SG levels and subsequently completed the online questionnaire.

4.2.2 Results and discussion. Almost all participants in the user study played videogames (93 per cent); the most popular were Grand Theft Auto, friv, transformice, imvu, videogames for girls, cars videogames and football videogames.

Based on a previous questionnaire instrument (Wang *et al.*, 2009), team psychologists were able to identify the role of 22 of the 25 participants in real bullying situations in school context: one was a bully (4 per cent), five were victims (23 per cent) and the remaining were bystanders (73 per cent).

For most of the menus of the game, with improvements from the previous version of the prototype, there were no doubts. The screens with the three pictorial subscales of SAM raised more doubts. Some of the individuals were careful when choosing the values of SAM, but others indicated them randomly.

To assess each level of the SG, questions were posed about the perception of the scenario, the perception of sound and immersion, the perception of the story and the grade to give to the level.

In the perception of the scenarios (Figure 14), all levels had positive and similar results, with the backdrop of the football field getting the best result (by having the grass and the ball and, therefore, being a more obvious scenario than the others).

With regard to perception of sound and immersion, there were some differences between the levels, more significant in the levels at school entry (Figure 15). This significant difference may be related to the fact that the school entrance is not usually a playful place (perhaps more convivial, before entering in the classrooms). The levels in the football field were the ones with better results because there are usually children playing on the spot. Furthermore, the levels that take place in the school hallway have results below the levels that occur on the football field, perhaps due to the nature and volume of the sound recreated in this location: low volume and sounds of steps and distant voices.

As for the perception of the story, in all levels, positive and similar results were obtained (Figure 16). The simplest levels were those that performed better (school entrance in both profiles and school hallway in the victim profile). In the grade given to each level, the results, concerning the perception of the story, are reversed (Figure 17), with the simplest levels being the least favorite and the most complex and challenging the favorites.

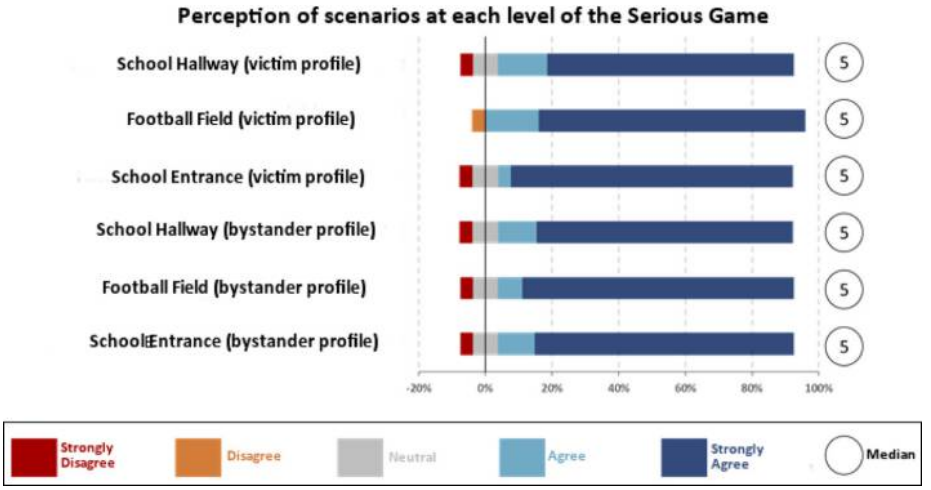

Figure 14.
Level of agreement of participants with the perception of scenarios at each level of the Serious Game

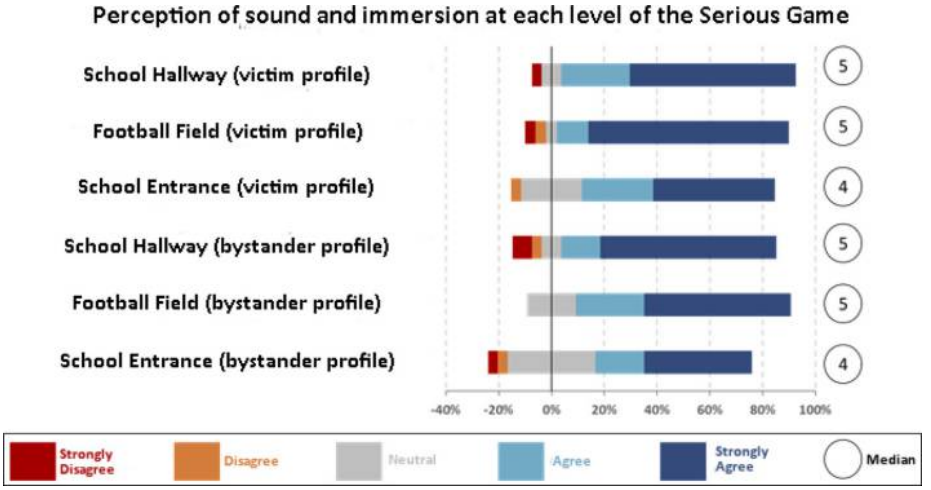

Figure 15.
Level of agreement of participants with the perception of sound and immersion at each level of the Serious Game

Regarding the preferences of the victim's profile levels, there were no differences attributable to the distinct roles in bullying, as shown by a Kruskal–Wallis test ($\chi^2 = 0{,}375$; N = 21; $p = 0.829$).

Concerning the characters of the game, and in a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), there was a general satisfaction with the diversity, regarding player's character and the other characters in the levels (*Median* = 5), a general approval of speech bubbles (*Median* = 5) and of the interaction with other characters (*Median* = 5). However, the participants commented that there were few characters to choose from and in the course of the level. For the narration, some judges did not like the associated sound. In general, participants succeeded in identifying the three types of score, but it was not clear to everyone that courage was included. A large number of participants

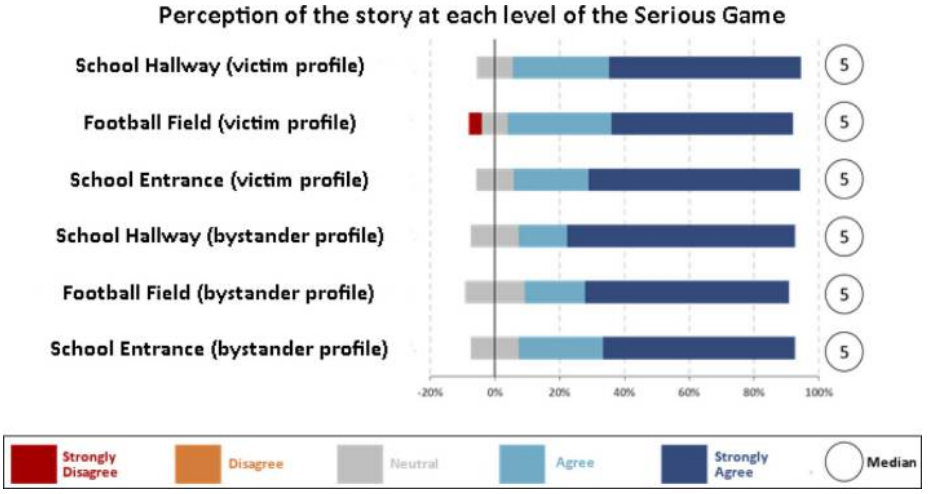

Figure 16.
Level of agreement of participants with the perception of the story at each level of the Serious Game

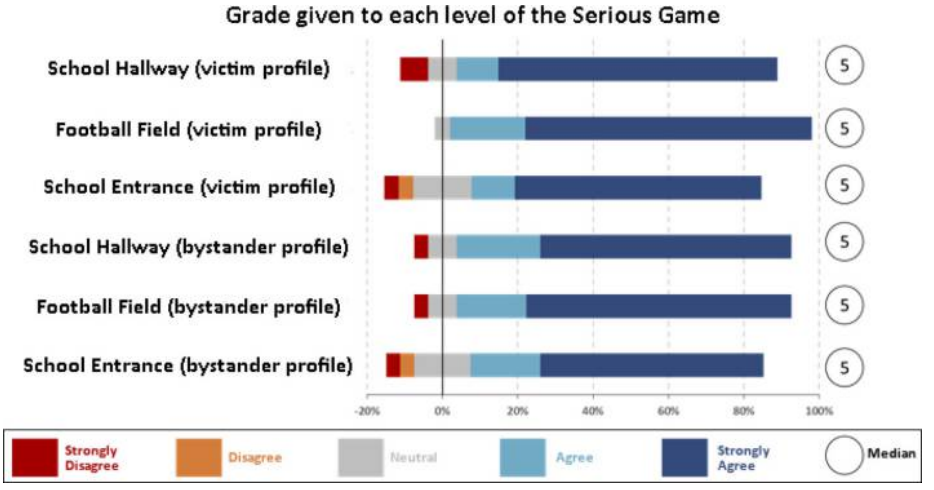

Figure 17.
Grade given to each level of the Serious Game by the participants

enjoyed the game (*Median* = 5) and provided suggestions for its instructions (e.g. with an animation) and more difficult levels.

Regarding the grade given to the game, a Wilcoxon–Mann Witney test revealed differences neither between boys and girls (U = 62.5; N = 22; p = 0.129 two tailed) nor between participants who usually play violent and complex games and those who not play this kind of games (U = 76; N = 22; p = 0.247 two tailed). A Kruskal–Wallis test showed that there was not an effect of roles in bullying over this grade (χ^2 = 0,228; N = 21; p = 0.892). Throughout the discussion sessions, an assimilation of the strategies learned while playing the game was also noted. In addition, most individuals involved in these discussions said that they preferred the bystander profile because it was the most useful for them (most of them were bystanders).

4.3 Assessment of the BackOffice application

BOA interfaces and features were evaluated by clinical psychologists and psychology researchers, providing an online questionnaire. Despite the small sample (five subjects), several suggestions were obtained. Some of the suggestions are: to include more explicit error messages; to improve the aesthetics of some interfaces and tables; to provide fields for the school status of the player; to use stronger and different colors in the SAM evolution chart and manual setting of the sessions plan; to insert more editable fields on the psychologist and player accounts; to integrate a password recovery mechanism; to enable a preview of the excel file with the data of the players.

All individuals were unanimous saying that they are interested in the solution that combines the BOA with the SG and they would use it as an auxiliary tool in their real work contexts.

5. Conclusions and future work

This paper describes a serious game to prevent episodes of school bullying. This phenomenon, highly prevalent in several countries, leaves indelible marks on its victims and bystanders and has an impact on their future lives.

The presented solution stands out because: it includes a BOA to assist therapists with data management features, including the choice of profiles adjusted to the individuals; it generates a targeted intervention, by allowing the player to play the SG whenever she/he wants, even outside a therapy session (e.g. at home); it is portable; it deals with strong social features, such as friends and invitations, to which young people give much importance; and it offers a variability of scenarios and consequences of actions, taking into account the user's performance in the game. Table II, presents a summarized comparison of StopBully with other approaches.

By and large, the roles attributed to the characters to be included in the SG were matched by participants' role attributions, even when participants were from outside the target audience. This suggests that there is a consistent representation of roles between young people and professionals in this area. However, a possible shortcoming is the dissemination of stereotypes. The SG was appreciated by young people and it allowed, according to discussion sessions, the "intake" of bullying prevention strategies. In addition, the BOA was widely accepted and appreciated by psychologists who participated in the assessment. The problems encountered and a set of suggestions provided should be used to improve both tools in the future.

Characteristics	"FearNot!"	"School Bullying"	Project UTAD	KiVa	StopBully
BackOffice	No	No	No	No	Yes
Graphics	2D	3D	3D	2D	2D
Good performance	Yes	No	Yes	Yes	Yes
Several player roles	No	Yes	No	No	Yes
Suitable characters	Yes	Yes	No	Yes	Yes
Suitable scenarios	Yes	Yes	Yes	Yes	Yes
Several histories and scenarios	Yes	No	Yes	Yes	Yes
Version for mobile devices	No	No	No	No	Yes
Adjustable to player's performance	Yes	No	Yes	No	Yes

Table II. Comparing StopBully with other approaches

The results of empathy questionnaires are currently being examined to understand the impact of the SG on it. The appearance of the characters should also be further explored, enabling identification whilst avoiding stereotypy (e.g. a girl with a friendly look, who is in fact a bully). Future developments are: to include more storyboards and adjust current ones, to develop a fluid story and more challenging levels. As collaboration/competition increases players' motivation to engage in the game, it is planned to address whether it is appropriate and feasible to include some mechanisms of collaboration/competition.

This tool holds potential as a bullying preventive intervention in schools, and thus, studying ways to improve it is a current priority. Another promising step in this research will be to explore the impact of 3D on motivation, immersion and effectiveness of the SG and to study the best approach to deal with cyberbullying.

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