Poster Abstracts

Using the Educational Potential Mapper to Design an Adaptive Serious Game: The "uManager" Case Study

Manuel Gentile(✉), Salvatore Perna, Giuseppe Città, Simona Ottaviano, Valentina Dal Grande, Dario La Guardia, and Mario Allegra

ITD - National Research Council of Italy, Via Ugo La Malfa 153, 90146 Palermo, Italy
{manuel.gentile, salvatore.perna, giuseppe.citta, simona.ottaviano, valentina.dalgrande, dario.laguardia, mario.allegra}@itd.cnr.it

Abstract. The frame pedagogy is a methodological framework that gives a key role to the concept of game mechanic in identifying the educational domain of a game. In this view, the activation of a subset of the game mechanics highlights a portion of the domain. Consequently, the game mechanics become a fundamental element in defining personalized and adaptive learning paths. As a case study, we discuss the implementation of a serious game called "uManager", aimed at stimulating and supporting entrepreneurial skills in young people. In the paper, we provide a brief description of the process and the conceptual model behind the design and implementation of the game.

1 Introduction

In serious game design, the dynamic activation of Game Mechanics (GMs) is one of the main strategies to ensure the adaptability and personalized learning, since it allows the designer to modulate the game to adapt its complexity to the student's knowledge.

A meaningful interpretation of the GMs dynamic activation strategy can be achieved applying the concept of the game mechanic presented in Gentile et al. [1]. According to the frame pedagogy approach [2], a GM is a verb in a context of use; consequently, it is possible to link each GM to a frame to obtain a network of connected frames that represent the domain knowledge of the game.

In this view, a partial activation of the GMs reduces the complexity of the game not only from a mere quantitative point of view but principally from a cognitive point of view. In fact, reducing the number of actions (GMs) on which the student has to reflect and decide allows students to focus on a portion of the domain knowledge elicited by the game. Therefore, a path of gradual activation of the game mechanics generates a sequence of activation maps which progressively tends to cover the entire game knowledge domain. Following this approach, we present the implementation of the uManager serious game, a management/construction game aimed at promoting entrepreneurial skills in young students (Fig. 1). The aim of the paper is to show how the

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Fig. 1. A screenshot of the uManager game.

proposed methodology was used by the designer to create a game model that gives flexibility to the teacher in the process of learning design (personalization), setting the foundation for creating a fully adaptive game.

2 The Design Elements Behind uManager

uManager is a typical management/construction game aimed to foster entrepreneurial skills in young students in which the user has to construct and manage a holiday resort.

According to the framework presented in Gentile et al. [1], the adaptivity features of the uManager game was based on the *Game Mechanic* concept.

The game model connects the GMs with the *Levels* and *Tasks* to give to the game designer the maximum flexibility in the definition of a learning path. The *Level* concept is used to identify the set of enabled GMs. Each of activated GM is used to evaluate user activity according to a specific degree of difficulty. These evaluations are the base of the assessment of the resort quality. The *Task* concept is used to structure user activities; a task usually involves the use of one or more GMs and as such can be used to introduce new GMs to the player or consolidate the understanding of already known ones defining a quest. Finally, the *Game Model* defines the sequences of the levels and the progression mechanism, which can either be automatic or manually controlled by the teacher. In the first case, there are two main strategies to regulate the level progression; the former is to use rules linked to the evaluation of the user's performances, while the latter is achieved connecting the level progression to the virtual time progression.

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Serious Games for Participatory Design, Crowdsourcing and Remote Usability Testing

Edward Oates(✉)

Cranfield University, Cranfield, UK
e.oates@cranfield.ac.uk

1 Introduction

Designers rely on direct access to 'users' to assist in their design process. Within defence Human Factors Integration, the engineering process of Human-Computer Interface (HCI) design sometimes has difficulty accessing users. This study investigates the extent to which Serious Games may offer an asynchronous remote alternative to 'face-to-face' design through Crowdsourced Participatory Design.

Usability testing of the HCI may also lack access to users. This is a serious limitation which may be offset by remote unmoderated usability testing. The extent to which Serious Games may support remote usability testing is also explored in this research.

This is a mid-study report on UK Ministry of Defence sponsored research under the Royal Navy 'DARE Innovation' initiative.

2 Aims

Assess the viability of a Serious Game to support a Crowdsourced Participatory Design process.

Assess the method of remote unmoderated testing with a Serious Game for selecting human-computer interface components based on Game-play scores.

3 Method

An Electronic Warfare interface was built within a maritime-air synthetic environment. The first-person web browser game emulated an existing naval helicopter HCI. The game task was to detect and identify ships using electronic support, radar and electro-optic controls and displays.

The game was hosted on the MOD intranet and made available for all 120,000 users to play. The security restrictions on write-back to the server prevented automatic data from being logged. There was no way of knowing how many played the game. Log Files were sent in attached to emails.

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The Crowdsourcing task was to play the game, identify functions and displays that would assist game-play and recommend how these should be designed. All available methods of communication were used: phone, email, blog. It didn't matter what was requested as testing would later identify the useful and the not-so-useful. All ideas were built into the game no matter what the motivation; intrinsic or extrinsic.

Remote unmoderated testing was implemented through competitions with Amazon tokens as prizes. For the Level 3 Game, seven experienced operators competed using the Original Game and Crowdsourced Game interfaces. The data log files recorded were then analysed for correlations between player selections and game results.

An on-line questionnaire was used for System Usability Scale (SUS) assessment, Flow (Csikszentmihalyi) assessment and subjective assessment of how realistic the game was. The questionnaire results have yet to be analysed.

4 Results

The Crowdsourcing activity with the Serious Game engaged with a geographically dispersed population. Design ideas were freely offered to develop the functions and displays. Twenty-two developments were specified and added over 28 months.

Remote unmoderated testing took all function 'click' (selection) data, and display duration data and looked for correlation with Game-play results. Game-play results were scored on time, (shorter duration being better than longer duration) and points (a negative scoring system rewarded correct and penalised incorrect identification of shipping). Use of Inverse Synthetic Aperture Radar correlated with high-score/short-duration games. Some Crowdsourced functions may have assisted reduce durations.

5 Conclusions

Results show that Serious Games provide a credible tool for Crowdsourced Participatory Design with a geographically dispersed crowd of volunteers. Even with a minimally advertised game, the game generated actionable new design ideas.

Remote unmoderated testing using a Serious Game has provided some indication of which functions and displays underpin effective and efficient Game-play. Crowdsourced functions may have helped some lower score players to reduce their game-play times. Further data is required to provide greater certainty of this method.

Using Choreographies to Support the Gamification Process on the Development of an Application to Reduce Electricity Costs

Fernando Cassola[1,2(✉)], José Iria[1,3], Hugo Paredes[1,2], Leonel Morgado[1,4], António Coelho[1,3], and Filipe Soares[1]

[1] INESC TEC - INESC Technology and Science, Porto, Portugal
{fernando.c.marques, jpiria, antonio.n.coelho, filipe.j.soares}@inesctec.pt
[2] UTAD – Universidade de Trás-os-Montes e Alto Douro, Vila Real, Portugal
hparedes@utad.pt
[3] FEUP – Faculdade de Engenharia da Universidade do Porto, Porto, Portugal
[4] Universidade Aberta, Lisbon, Portugal
leonel.morgado@uab.pt

1 Extended Abstract

Building automation systems contribute to reduce electricity costs by managing distributed energy resources in an efficient way. However, a large share of consumption cannot be optimized through automation alone, since it mainly depends on human interactions. Gamification can be used as one form of changing users' behaviours [1], but its implementation does require assumptions on the behaviour patterns that need to be identified, encouraged, or discouraged. To tackle this problem, we propose a framework that joins building automation solutions with gamification techniques to enable behavioural demand response.

Ultimately various authors converge to define gamification as "the use of game design elements in non-game contexts" [2]. So we use game elements and mechanics to engage and motivate end-users on an interactive platform [3]. To persuade this approach we will follow the Six Steps Gamification framework [4]. Additionally employ another gamification design framework, which places more emphasis on human motivation: Octalysis [5], proposed by Yu-kay Chou.

Several authors [6] tell us that the "knowledge acquired in an action-based and meaningful context promotes behavioural change" [7]. So we propose identifying users' behaviours that can be potentially relevant in a three phase process. In the first phase we will be using the building automation systems to monitor electric consumption of all actions produced by the building equipment (elevators, air conditioning, etc.) and inhabitants. Next we intend to extract users' behavioural patterns as choreographies related with energy consumption. After that, analysing the energy consumption of choreographies, we will promote the most effective ones employing gamification techniques (or even promote novel choreographies), with the goal of achieving electricity savings.

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Employing platform-independent choreographies is a way to guarantee the interoperability and integration with other systems and approaches. First of all, because we have multiple input datasets from which to create the choreographies of the building devices and their occupants. Namely we are going to use the data given by the building automation electricity meters and also use smartphone and desktop applications to collect indoor users' locations and behaviours. Platform independence will enable the future association/adaptation of choreographies to different inputs. The other reason is because we must be able to render them in various output systems. We need to employ a graphical interface, showing the collected behaviours associated energy consumption data, so human users can identify choreographies on that historical data registry. Choreographies will also be used on the gamified application in order to encourage users to adopt specific behaviours. So the platform independence enables choreographies to be treated as core data for this software solution, rather than a mere visual gimmick. For this purpose, we will follow the Ontology-based transformation approach for choreographies proposed by Silva et al. [8].

Concluding, this is an approach of using choreographies to support the gamification design process on the development of an application to reduce electricity costs. The primary obstacle to this field is to identify main behaviours and join them with the electricity meters. Another technical challenge is to draw alternative behaviours to reduce electricity costs. Rather the technical barriers we need to obtain a large spectrum of related behaviours and engage the building occupants to participate on this project. Using the gamification techniques presented merged with the independent choreographies method we can expect to present a new way to engage people to reduce energy costs.

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Gaming Against Violence: An Exploratory Evaluation Through Mechanical Turk of the Efficacy of Persuasive Digital Games in Improving Unhealthy Relationship Attitudes

Drew Crecente[1(✉)] and Ruud S. Jacobs[1,2]

[1] Jennifer Ann's Group, Atlanta, GA, USA
[2] Erasmus Research Centre for Media, Communication, and Culture, Erasmus University Rotterdam, Rotterdam, The Netherlands

1 Introduction

Teen dating violence (TDV) is a pervasive and complex public health problem. Despite its ubiquity – an estimated 40% of graduating college students in the US have been in an abusive relationship at least once [1] – and adverse effects on, among others, academic achievement and substance abuse, 16 million (of about 21 million) US students are educated in states lacking teen dating violence (TDV) education legislation [2]. This causes institutions that lack in-house expertise on this matter to acquire TDV prevention programs that do not adequately prevent violence perpetration or address bystander intervention [3]. It is therefore necessary to approach this issue in a way that does not rely on institutional education practices. Digital games are a novel method to confront the problem of TDV and since 2008 Jennifer Ann's Group (JAG) has produced videogames for this purpose through its "Gaming Against Violence" program [4]. This technology solution allows school systems to affordably and reliably meet student needs without specialized training, knowledge, or additional resources. It also allows adolescents seeking to assist themselves or their peers to utilize a medium that promotes private exploration of sensitive topics at the player's pace. The current study explores the influences teen dating violence games have on players and their effectiveness at overcoming those challenges which limit traditional interventions.

Approaching dating violence prevention through a game allows creators to present their message in a wholly unique way. Although video games are still often seen as mere entertainment, their ability to effect both generally positive changes in players [5] as well as more specific changes in attitudes towards social issues [6] is increasingly recognized. By offering simulated environments, TDV games promotes experiential learning in players [7, 8] allowing them to reach their own conclusions about the critical aspects of TDV [9]. They also learn about this topic in the context of biographical or fictional stories, rather than in an abstract way [10]. Teens prefer games over other media, [8, 11] and see the use of computers in instruction as a more positive experience than other methods [12]. Though the games affect knowledge and skills, they also aim to change players' attitudes, to convince players certain behaviors constitute abuse and should not be condoned. This makes TDV games *persuasive games*.

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While persuasive games have been shown to positively affect player-held beliefs on several topics, [6, 13, 14] evidence is still needed to support attitude-changing effects of TDV games [15]. Our study was therefore guided by the following research question: Do teen dating violence games change the attitudes of unguided players towards this topic when compared to games unrelated to the topic?

2 Methods and Results

A 2 (TDV and entertainment control games) by 2 (pre- and post-test) mixed experimental design was applied to 86 US-based participants (all adults, 76% over 25 years, 68% male) gathered through the Amazon M-Turk service [16]. To get an overview of the generalized efficacy of the TDV games, 5 different JAG games were included with each game taking 30–60 min to complete. Two browser-based games formed the control condition: Samorost, [17] and Today I Die [18]. This 'no-treatment' control served to eliminate re-testing and experimenter effects to show if the TDV games changed attitudes. The Attitudes Towards Dating Violence Scales [19] were used as the indicator of the games' effects.

In a repeated measures ANOVA, significant main effects were found for the pre- and post-test difference ($F(1,84) = 7.1$, $p = .009$, $\eta_p^2 = 0.8$), as well as for the condition ($F(1,84) = 6.7$, $p = .012$, $\eta_p^2 = 0.7$). An interaction effect was also found, indicating that TDV game players changed their attitudes towards the topic more than people who played the control game. The two conditions did not significantly differ at pre-test ($t(84) = 1.8$), though they were different at post-test ($t(84) = 3.3$, two-tailed-$p = 0.002$, Hedges' $g_s = .83$), with means indicating that the TDV players ($M = 4.6$, $SD = 0.5$) had greater scores than the control players ($M = 4.2$, $SD = 0.6$). When looking at the difference scores between the two observations, the increase was largest for players of the TDV games (Control $M = .2$, $SD = 0.3$, TDV $M = .0$, $SD = 0.2$, $t(84) = 2.5$, $p = 0.013$, Hedges' $g_s = .64$). The TDV games incited significantly greater attitude change in their players than the control games did. No significant differences were found among the 5 TDV games tested ($F(4,61) = .5$). Lastly, gender differences were found in the pre-test scores of players of the TDV games ($t(64) = 2.629$, $p = .011$, Hedges' $g_s = .67$), indicating women ($M = 4.7$, $SD = .4$) had higher scores than men ($M = 4.3$, $SD = .6$). The difference in effect between genders ($t(64) = 1.947$, two-tailed-$p = .056$, Hedges' $g_s = .50$) indicated that men's attitudes ($M = .2$, $SD = .3$) underwent greater changes than women's ($M = .1$, $SD = .3$), though this was not significant at .05 level.

3 Discussion

Summarizing, the interaction effect found indicates the change in attitudes for TDV game players was greater than for control game players. TDV game players changed their attitude positively, whereas the control group showed no increase. This means it is

highly likely the TDV games had an effect on the attitudes of its players and games intended to have an effect on TDV attitudes affect these attitudes more than games not designed for this purpose.

To conclude, despite the fact that the TDV games used in this study were not developed with the current study's sample in mind, the games clearly affected their players. This result supports the viability of persuasive games in combating the all-too-common phenomenon of teen dating violence.

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A VR Cardiac Auscultation Examination Game

Mario Vargas-Orjuela[1], Alvaro Uribe-Quevedo[3(✉)], David Rojas[2], Bill Kapralos[3], and Byron Perez-Gutierrez[1]

[1] Universidad Militar Nueva Granada, Bogota, Colombia
marvaror@gmail.com, byron.perez@unimilitar.edu.co
[2] The Wilson Centre, Toronto, ON, Canada
david.rojasgualdron@gmail.com
[3] University of Ontario Institute of Technology, Oshawa, ON, Canada
alvaro.j.uribe@ieee.org, bill.kapralos@uoit.ca

Abstract. Virtual simulation and serious games are becoming more prevalent in training by providing simulated, monitored and controlled scenarios. They provide medical trainees with the opportunity to acquire both cognitive and technical skills outside of the medical environment in an engaging, and cost-effective manner. Here we present the design and implementation of a mobile game for cardiac auscultation training Preliminary results indicate the mobile game is engaging and enjoyable.

Keywords: Cardiac auscultation · Serious games · Simulator

1 Introduction

Cardiac auscultation is a routine medical examination procedure whereby a stethoscope hear and interpret heart murmurs [1]. Simulation, virtual simulation and serious games (that is, games developed specifically for education and training), and gaming technologies in particular, are capable of providing highly immersive, and engaging training experiences, not possible with traditional media. For example, Katz et al. (2017) developed a serious game to teach best practices for the anesthetic management of a standard orthotopic liver transplantation (OLT) procedure which itself is very complex [2].

In this paper we present a mobile-based serious game for cardiac auscultation examination, where a user diagnoses a virtual patient, and obtains scores for proper diagnoses, without penalties if mistaken. We compared the examination diagnosis between audio-only, a SAM 3G simulation manikin, and our game. We presented four random scenarios with different heart murmurs (i.e., normal, mitral stenosis, mitral regurgitation, and aortic stenosis), and virtual patients requiring a diagnosis from the user, by listening to the aortic, pulmonic, mitral and tricuspid chest areas. We chose the Unity3D engine to develop the serious game and integrate the game assets. We additionally incorporated learning and game mechanics including exploration, assessment, feedback, and repetition into the game [3]. We qualitatively measured engagement of our serious game using the verified Game Engagement Questionnaire [4].

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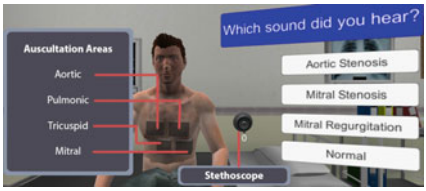
2 Results and Discussion

Seven fourth-year medical students with prior cardiac auscultation knowledge and experience and who considered themselves proficient with cardiac auscultation, volunteered to participate in the experiment. Participants completed a pre-test where none were able to identify the murmurs. During the testing, only two diagnosed the normal murmur with the simulation manikin, while with the game six students identified the normal murmur, four the mitral stenosis and the mitral regurgitation, and one the aortic stenosis (See Fig. 1). Based on the GEQ results, the serious game requires refinement to improve absorption and flow, while presence and immersion were perceived as engaging.



GEQ Element	Average Score
Presence	0.42
Absorption	-0.77
Flow	-0.04
Immersion	0.71

Fig. 1. In-game screen captures and GEQ results.

Future work will focus on additional game elements to increase flow and absorption. We will examine immersion and presence through the use of a virtual reality head-mounted display, and increase the number of participants to obtain statistically significant results.

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