

Usability Assessment Heuristics in New Genre Videogames

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Abstract— In this paper, we introduce a new set of heuristics that can be used to carry out usability studies on new genre video games. The definition new genre games refers to videogames that use specific and unique equipment or are part of a general software category such as platforms of social networking. Based on videogame usability problems stated in game reviews on relevant websites and in earlier scientific researches, heuristics were developed to help resolve usability problems in gameplay and game interface level. In addition usability problems concerning new genre videogames were identified through an integrated experimental procedure that took place in HOU's quality assessment laboratory or in players' own place by using suitable software developed by the Software Quality Research Group (SQRG) to simulate laboratory functions. Once the heuristics had been developed, they were applied on the observation procedure during the players' encounters with the games Wii Sports and Pet Society (used inside the famous networking platform Facebook). The validity of heuristics is tested through two different usability evaluating methods; users logging and heuristic evaluation.

Keywords- combined usability assessment methods; heuristics; heuristic evaluation; new genre videogames.

I. INTRODUCTION

The goal of the present research is the assessment of games' usability, with the aid of adapted heuristics. According to the literature review there is no method or methodology on how to evaluate a game's usability in an accurate and adequate way. Heuristics are design guidelines which serve as a useful evaluation tool for both product designers and usability professionals. Thirty (30) participants were selected and took part as players in the usability evaluation of the games, which took place both in the software quality assessment laboratory of Hellenic Open University (5 participants) and at the players' own space (25 participants). In order to achieve this task specialised software (UXM Observer), which has been developed by SQRG [19], was used. This software records the activity on the computer screen or on the screen of the device with which the player interacts, facial expressions and player's verbal reactions when thinking aloud protocol is used while interacting with other players or expressed out during game

play (i.e. expressing anger or enthusiasm) by the use of a camera. When a completed assessment usability experiment is used, the players' actions are recorded so as to verify the validity of heuristics, also tested by usability experts through heuristics evaluation.

II. LITERATURE REVIEW

There are plenty of literature references on videogames and are usually studies that combine more than one scientific field. There is not a specific model that has been "adopted" by the scientific community for the measurement of games' usability [5] and undoubtedly there is no model considering usability characteristics that a new genre game like Wii Sports or Pet Society in the popular social networking Facebook must cover.

In this paper, we explore game usability as the degree to which a player is able to learn, control, understand, be intrigued and enjoy a game. This definition is partly accepted on playability heuristics described by Federoff [5], Pinelle et al. [16], Desurvire et al. [3] and on evaluation experiments, which measure game's usability and other usability elements like socializing, education or fun [14], [15], [20]. Some usability issues found in games are similar to those seen in other application areas, such as the need to design visual consistency and readability. Game's usability is highly related to how easily the player is able to start playing the game and to discover –and eventually use– all the features and functions available in the game. Studies on games have numerous extensions not all of which are relevant to the present research that focuses on measuring the usability of videogames. In an effort to define usability in relation to a game we refer to ISO 9241 standard of usability [10] in which the three basic usability metrics are described: *effectiveness*, *efficiency* and *satisfaction*.

Federoff [5] based on the literature of game heuristics identified that ten of them concern the user interface, two the game mechanics, and nineteen involve game play. Papaloukas and Xenos [15] have used combined experimental methods for the measurement of usability in the game Civilization as well as in the game Second Life [14] in usability experiments conducted in the HOU's

quality laboratory. The results have shown that the combination of methods amplifies the progress of the experimental procedure, providing that the conducting conditions simulate reality adequately.

In order to measure the game's usability we use adapted heuristics and observational evaluation methods in the Software Quality Assessment Laboratory of Hellenic Open University. This laboratory is suitably equipped for the performance of usability experiments of various systems. The methodology used in the development of heuristics and validity testing is described in the following section.

III. RESEARCH METHODS

Our method is based on the idea that heuristics can be developed for specific videogame categories by evaluating existing titles of videogames, and by developing principles that describe the usability problems that might occur. The practice that we used to develop the heuristics had the following five main stages:

- 1) Analysis of existing scientific researches, identification and classification of usability problems or fun problems as found in game reviews.
- 2) Observing players interact and at the same time the evaluation expert records the usability problems that they may encounter, whilst most of these problems already exist on a list produced on stage 1. For that reason the user logging method is used in aid of the specialized software in the player's own place or in HOU's laboratory.
- 3) Similar usability problems which occurred in previous stages are being categorized.
- 4) Description of how usability problems can be resolved through the creation of heuristics; the rules that a game must comply to. Although rules derived from previous researches, they are suitably adapted for new genre games. It is worth mentioning that the developed heuristics concern usability game play or game interface and only one includes fun, curiosity and challenge, all three being crucial usability factors but not relevant to interface.
- 5) Testing our heuristics by an integrated experimental procedure using two different methods, heuristic evaluation and users logging combined with thinking aloud protocol.

A. Researches on videogames heuristics

Malone [11] has performed the first approach to develop heuristics in order to guide the design and evaluation of videogames. He developed heuristics for the designing of instructional video games, and then other researchers have attempted to capture the nature of successful games in heuristic form. Many of these attempts, however, lack the rigour of Malone, who developed specific game prototypes using different elements of his theory and testing them with

children [12]. Instead, recent heuristics tend to be based on designer experience [17], interviews with members of the game industry [5], or simply drawn from existing literature [3], [16]. In most cases, heuristics are not actually applied or tested in any way, but are offered as a kind of instinctual knowledge ultimately derived from the game industry [1].

In terms of research in game usability, Federoff [5] attempted to generate heuristics and usability guidelines for the creation and evaluation of fun in video games by working closely with game developers. Following this, Desurvire et al. [3] developed a method, known as Heuristic Evaluation for Playability (HEP) as a comprehensive set of heuristics for playability specifically for evaluating games. Another project, known as the 400 Project [4] is also an attempt to gather computer game heuristics compiled by game designer and producers from the game industry. Heuristics for the factor of fun in videogames consists of three main elements that draw largely from Csikszentmihaly's [2] flow theory: challenge, fantasy and curiosity. There have also been researches on the evaluation of the usability of games [9], studies focused on the human behaviour and physiological responses like frustration [18] in order to understand better the interface design toward building affective computer.

B. The Games of the experiment – New genre of games

The games that we have selected in this research are Wii Sports and Pet Society, as mentioned before. The videogame Wii Sports was introduced by Nintendo (www.nintendo.com) in 2006. It runs Wii and GameCube software and features a wireless motion sensing controller that looks like a TV remote rather than a game controller. Then a sensor bar is placed in front of the screen to orient the Bluetooth-based remote via infrared signals, the unit is strapped to the wrist and swung like a tennis racket, golf club or other sports equipment. Dubbed the "Wiimote," its internal accelerometers sense the motion on three axes and up to four players can have their own controller. For example for the game Tennis the players hold the controller like a racket and swing – the game will register forehands, backhands, volleys, lobs, slices, spin and power depending on how fast the user swings and at what angle.

It is worth mentioning that thousands of consoles sold immediately, but players found their wrist straps breaking and controllers flying across the room. Nintendo instantly improved the strap and offered everyone a replacement. The unpleasant experience that both the players and for the company had, illustrates the necessity of developing adapted heuristics for games of new genre.

In Pet Society (<http://www.playfish.com>) you can customize the pet in any way you want by choosing different colors, clothes and fun items like watches and jewellery. You can also extend your pet's house and decorate it with furniture and even show off the various awards you have won in the mini-games.

What led us in selecting the games Wii Sports and Pet

Society is associated to the fact that both games have unique features and, therefore, can be classified as new genre games. More specifically Wi Sports has a Wii Remote controller which gives the player the feeling of participation in a real life sport, since physical movement and actions similar to those actually required in the chosen sport must be performed by the player. Pet Society has the peculiarity of being embedded in the famous social networking platform Facebook.

C. Usability problems on games

Our previous researches on usability problems focused on earlier scientific studies and on game reviews from valid websites [6], [7], [8]. The usability problems on videogames concern game interface, game mechanic and game play as much as fun, which is a basic element of usability according to the definition of the term that we have accepted. It is obvious that in a videogame usability and fun are concepts that cannot be measured separately, provided that fun is prerequisite of usability.

Of course the basic goal was to identify usability problems that are relevant to popular and recent videogames, and that reflect current tensions in game play, game interface and game mechanic. After all reviews were examined, some problem categories were discarded because they were overlapped and described similar problems or focused on technical issues such as bugs, aesthetics or sound.

As far as fun problems are concerned, we do not investigate them in depth, but we classify them in a summarized category, which includes fun, pleasure, challenge and satisfaction problems. We define the most important usability problems, while we introduce the problems' solutions as heuristics in next section. Our methodology then includes observation of the players while they are interacting with a game of new genre. Their actions, face expressions and verbal communication are being recorded at the same time as the players are using the thinking aloud protocol. The recording data has been used in three different ways, to identify possible usability problems, to develop heuristics and to validate them.

There are usability problems which affect characteristics specifically adapted in new genre videogames, whilst all the usability problems we have already identified concern contemporary and popular videogames. These characteristics are unique because of their specialized equipment or specific use, i.e. in a social networking platform like Facebook.

D. Heuristics for game's usability

The heuristics we developed derived from the problem categories we had identified and their descriptions. The heuristics describe principles with the intention of creating usable to create usable videogames in order to prevent players from facing common usability problems when using videogames. One of our main objectives was to create

heuristics that could assess new genre games like Wii Sports, which uses a remote control or like Pet Society, which is used in the social networking platform Facebook. A short description of how problems associated with each heuristic can be avoided is presented:

1. **Customize game, network and environment settings**

The videogame should allow players to customize the settings so that the game accommodates their individual needs.

2. **Information about game, players and online friends status**

Users should be provided with enough information about game (status character, level, health, etc) but also about other players and online friends in order to play in a cooperative manner as in real life.

3. **Training, help and suggestions**

The videogame should provide interactive training and recommended choices, i.e. regarding new genre videogames should advice players the most appropriate clothing or the most suitable space arrangement for a more efficient or enjoyable game.

4. **Control of actions**

The game should respond to input devices in a way that mirrors the real world. Computer controlled units should respond in an ordinary manner.

5. **Challenge, fun, pleasure, fantasy**

The game should provide fun and challenge. The players should be able to live their desired "reality" in the fantasy world of a videogame. Pleasure should be one of the most important elements of game.

6. **Minimize memory requirements**

Abbreviations should not be used. The players should not be asked to count resources like bullets and life and they should not have to memorize the level's design. Area maps should be easy to learn and should be intuitive to use.

7. **Clear goal, conditions**

New genre games need special equipment and in some cases suggestions are required on how to use it more efficiently. The goal of the game must be clear, so the player do not feel confused.

8. **Visual representations**

Visual representations, such as maps, icons, and avatars, are frequently used to convey information about the status of the game. Visual representations should be designed in an easy to interpret way, and so that users can differentiate important elements from irrelevant elements [16].

9. **Social networking, socializing and gaming**

A game in a social network should support all the tasks, which facilitate the communication and socializing of players. The game should have "shared" versions or "shared" applications in order to direct "social networking friends" to tasks that enhance socializing.

10. **Health, day-to-day life and gaming**

New genre games should help on player's mental and physical health, using specific equipment and applications.

IV. TESTING HEURISTICS

The heuristics that have been created are validated through an integrated experiment by the use of evaluation method, as by the combination of user logging and thinking aloud protocol.

A. Heuristic evaluation

A heuristic evaluation is a usability inspection method for computer software that helps to identify usability problems especially in the user interface design. It specifically involves evaluators examining the interface and judging its compliance with recognized usability principles ("heuristics"). Malone [12] was the first who developed specific game prototypes based on heuristics, using different elements of his theory and tested them with children. In the present research we used 3 evaluators (usability experts), who had experience in playing and evaluating videogames. The evaluators based on the developed heuristics, and by individual work they assessed the usability of the games Wii Sports and Pet Society. All the evaluators had already been familiar with the Wii console and had also been users of Facebook. They had to inspect the game for one week, to identify usability problems, and to write down the heuristic that they used to find the problem.

Our method is basically based on Nielsen's heuristics [13] but it is adapted for videogames' usability. Nielsen uses the severity of a usability problem, which is a combination of three factors:

- The frequency with which the problem occurs.
- The impact of the problem when it occurs.
- The persistence of the problem.

These three factors refer basically to software interfaces, so we have decided not to give each problem a severity rating using Nielsen's severity scale [13]. The problems each evaluator has identified and the total number of unique problems are listed in Table I.

B. Users Logging – Thinking Aloud Protocol

Actions Logging (or User Logging) is a usability inspection method that includes recording of all user's activities by the use of special equipment like cameras, microphones and specialized logging software. Thinking Aloud Protocol is a method in which the users express verbally their thoughts, feelings and opinions while interacting with the system. Papaloukas & Xenos [15] have already used a combination of these methods and the results were of great interest, as the experimental procedure has shown that the players could interact and simultaneously express their thoughts in an easier and more spontaneous manner. These methods were used initially so as to categorise usability problems, through the observation of the players and then to validate them by the use of an integrate experiment. The combined methods were used both in

HOU's laboratory under the discrete attendance of the usability experts but also in the players' own places.

V. RESULTS

The total number of unique problems that were found during the heuristic evaluation is twenty five (25). This number increased to thirty six (36), when evaluators examined the data from players' observation, while interacting with the videogame using thinking aloud protocol in HOU's Laboratory or using specific software (UXM Observer) and thinking aloud protocol in their own place. It is worth mentioning that the specific evaluators examined the recording data of only five (5) players in order to discover more usability problems. The reason is that the observation and examination procedure requires a lot of resources (specific evaluators, special equipment) and it is time-consuming, while the heuristic evaluation has already revealed an important number of problems. Table I shows the number of problems found with each heuristic and by each evaluator. The problems were found with all heuristics and the most frequently found were 1, and 3. Heuristics 1, 2, 9, and 10 are particular interesting as they mainly refer to new genre videogames and identify almost 39% of all identified problems.

TABLE I
NUMBER OF PROBLEMS FOUND WITH EACH HEURISTIC

Heuristics	Usability Experts			Total Number of Unique Usability Problems
	A Expert	B Expert	C Expert	
1	3	4	4	6
2	3	2	2	3
3	5	4	5	6
4	2	1	1	3
5	3	4	4	4
6	4	3	2	4
7	2	3	2	3
8	1	2	2	2
9	2	2	1	3
10	2	1	1	2
Total	27	26	24	36

The usability experts noticed crucial points that they encountered when using heuristics.

- Heuristics were not specified for a particular level of video game i.e. game interface or game play so it was difficult to focus and identify all the problems.
- Heuristics enabled the evaluators to identify problems that they would have otherwise failed to notice.
- Heuristics 5, 9 and 10 should be more accurate or should be divided in more categories.
- Heuristic 10 refers to new game's characteristic and most videogames do not support it yet.

- The investigation of recording data from observation, after heuristic evaluation had as a result to increase the identified usability problems.
- There is a small amount of overlapping between different heuristics.
- It is easier to use heuristics in order to identify usability problems in game interface rather in game play.

VI. CONCLUSION – FUTURE WORK

The constant developments and improvements in technology result in numerous daily changes in software, therefore, in videogames too. Consequently it is imperative to study games' new features that involve equally both game play and game interface in order to assess games' usability accurately and develop new heuristics that cover the players' new needs. The results of the present research revealed the developed heuristics' validity as well as the fact that they can be used for the usability evaluation of new genre videogames. Usability experts identified usability problems using these heuristics and applying the heuristic evaluation method. The final results were enriched with data that arose during player's observation. The players were interacting with new genre games using the thinking aloud protocol. The examination of the recording data by usability experts, and according to the developed heuristics, it is obvious that there were usability problems which the experts had not initially identified during the heuristic evaluation.

Undoubtedly, our methodology is a new approach that can be used by researchers to identify usability problems in several types of videogames. It can also be used in further studies of videogames in order to correlate fun, acquisition of knowledge and socializing with videogame's usability. The fact that videogame's usability has an impact on the above elements has already been the object of various scientific researches [14], [15], [21]. This and the fact that new heuristics can be developed is a challenge of great scientific interest.

In the future, we will carry out an extended evaluation of heuristics. We will include more evaluators and games from several different genres. Based on usability expert notes, we will divide heuristics into separate categories, which will refer to game interface, game play and specific characteristics of new genre games.

Future work will address firstly the creation of more reliable heuristics which will accurately detect issues that can be characterized as usability problems. This will be feasible if a similar methodology as in the presented research is used and if reviews of new videogame titles are studied. The application of our methodology on games developed especially for disabled people would be particularly interesting and the application of this methodology in measuring usability of social's networks

like Facebook or MySpace would be a very optimistic task.

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