FunTain:

Design Implications for Edutainment Games

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Abstract: This paper is a report on the initial findings of a study conducted in the project FunTain with the main purpose to find general guidelines for edutainment games. This to guide designers of such games, as they often lack in design guidelines. Usability evaluations were conducted on the edutainment game in order to find usability problems. These findings were then analyzed and used as input in focus group meetings, held with joint teams with game designers and HCI experts. The result was a proposal of a list of ten general design guidelines. Findings indicate that users had problems in understanding the underlying model for the game as well as finding the knowledge related content. Experts, further, gave comments about feedback problems and different types of consistencies. Some of the implications from the findings, as discussed in focus group, are guidelines for earning and loosing points, scoring and performance feedback and game object characteristics.

Introduction

Entertainment is a factor that recently has become important for a number of different areas. Entertaining experiences today become in focus not only in traditional areas of entertainment, but are currently used in previously non-entertaining contexts as a mean to improve products and experiences (Pine II & Gilmore, 1999; Wolf, 1999). Examples of this could be found both in the physical world (i.e. restaurants and theme parks) but also in computer One of the areas where entertainment is applied with purposes beyond just creating an amusing experience is the area of edutainment, where entertainment is used in combination with education in order to create a motivating and successful environment for learning. Edutainment could be described as: *"...the marriage of education and entertainment in a work or presentation such as a television program or a Web site."* (Adams et al.,1996) provide a very similar description when they define edutainment to be a blend of education and entertainment, pursued in multimedia software. The definitions or descriptions indicate that the two major dimensions of importance in edutainment is some kind of pedagogy (education) and some kind of "fun" or entertaining experience (entertainment). Edutainment is therefore one example where research on new appliances of entertainment in previously no-entertainment contexts may be conducted.

Considering the definition of the edutainment concept (as a blend of entertainment and education), we might conclude that design of edutainment includes the design of both entertainment and educational aspects in a design artifact. This may cause some difficulties. The pedagogical aspects that are of importance for the educational part of the artifact may in some cases be in opposition to the aspects of importance for the entertainment part of the artifact. There seem to be a need for some kind of trade offs to be made, in order to achieve a good result in the design of both the entertainment and the education in the artifact. A parallel could be made to Nielsen's (1999) discussion about content and package of the content in a web page design context. According to Nielsen (1999) the users of a web page are focused on the content of the page and consider the user interface, or package, as a barrier through which they reach for the content they want. Despite a cool, sizzling or "killer" interface or environment, the usability of a web page would be negatively affected if the content of the web page fails to deliver something to the user (Nielsen, 1999). Therefore, Nielsen (1999) concludes

that content is king. There is a need for design guidelines and implications, when designing under these circumstances. This paper reports from an initial study conducted in purpose of providing implications for design of edutainment games (an instance of edutainment), The purpose of this paper is to report on initial usability evaluations on an edutainment game in order to provide design implications for design of edutainment games.

Qualities of an edutainment artifact

In related work, suggestions of aspects that are of major importance for educational software and multimedia could be found. These suggestions should be of importance also in design of edutainment artifacts such as edutainment games. Adams et al. (1996) suggest that multimedia products for educational purposes should be designed with the following aspects in mind: effective learning, effective teaching effective communication of the content and effective use of technology to achieve the previous aspects..Lin et al. (2001) highlight the possibility to pass control of learning sequences from the program designer to the learner in web-based teaching. Good education software should be active, not passive, in that the learner should be doing something actively and not watching something passively. Adams et al. (1996) seem to agree with this recommendation and they conclude by suggesting that active engagement by interaction with multimedia can increase the attention span for learners, with positive effects such as customization of pace and learning style to suit the individual learner's specific needs. The suggested aspects and factors above all tend to focus on the education dimension of edutainment. When designing edutainment games this is of great importance, however, if the game itself is not considered entertaining, it is likely that users will end playing with no education as a result. Further, the above suggestions further give high level implications with no specific guiding for designing edutainment games in specific

Evaluation Method

The objects of study – a game called "Laser Challenge" –was designed in order to educate the player/user about appliances of laser technique.

When evaluating educational software, learning and usability need to be considered as interacting in order to avoid superficial evaluation (Jones et al., 1999). Given the interaction between learning and usability, usability evaluation methods should be well suited for evaluation of edutainment artifacts, since the methods would capture both design implications (Karat, 1997) and potentially also the interaction between usability and learning. Therefore, an approach based on evaluation methods from the usability discipline will here be used for the purposes of identifying empirical design implications for edutainment games. This approach would then potentially address the learning aspects and most importantly for the focus of this paper, obtain implications for design. Previous findings in the related area of interactive entertainment evaluation (Wiberg, 2001a) reveals that evaluation of entertainment web sites based on methods from the usability discipline, and user testing in particular, tend to provide findings that are focused on basic usability problems concerning navigation, design of menu buttons, etc. This implies that more subtle factors such as immersion, absorption and engagement, all potentially important to both entertainment and education, are difficult to grasp with the user testing method (Wiberg, 2001b). Several studies reveal that usability inspection methods, such as Design Walkthrough (c.f Karat, 1997), Cognitive Walkthrough (c.f. Lewis et al, 1994) and Heuristic evaluation (c.f Nielsen, 1993;1994) in many cases identifies problems overlooked by user testing, but also that user testing may identify problems overlook in an inspection (Nielsen, 1994). In this study, we therefore use a combination of evaluation methods including both user testing and inspection methods.

Participants

Subject	Age	Gender	Computer literacy (1=Novice, 5=Expert)	Computer gaming literacy (1=Novice, 5=Expert)	Comment
1	25-30	Female	3	1	Researcher HCI
2	25-30	Female	5	5	Researcher HCI
3	50-60	Male	3	1	Engineer
4	20-25	Male	4	4	HCI analyst and lecturer

A total number of five (5) subjects were invited to participate in the user testing, of which four (4) actually participated.

The subjects performed the test one at a time, and each test took about 30 minutes in all. The user tests consisted of three

parts (1) 10 minutes of free surf with Think Aloud, (2)10 minutes of Walkthrough, performed by the test subject in collaboration with the test leader (collaborative evaluation), and (3) 10 minutes of post-interaction interview. In the first part of the session, the subjects played the game without any specific task to solve or instructions to be carried out. The post-interaction interview gave the subjects an opportunity to give comments and thoughts on general aspects of the game, the interaction and the performed test procedure.

Expert walkthrough

In the design walkthrough, or here called expert walkthrough, the experts investigated and collaborated with the game prototype and made comments on possible problems or design improvements. The comments were written down and discussed in the last part of the evaluation, the focus group. The instructions were very brief, and the experts had a large degree of freedom in the evaluation procedure. In a large extent they relied on their personal experience and opinions in their evaluations.

Focus group

When the User tests and Expert Walkthrough parts were finished, the HCI researchers, and also test leaders from the empirical evaluations and the game designers performed a focus group meeting. In the focus group, the results from the previous parts of the study were discussed and reported. From the results, a more general picture of the reported issues in the prototype was constructed.

Usability problems found

In order to highlight the research process, some of the usability problems found are stated below. These are kept short, with the only purpose to pinpoint the overall picture of what occurred. Most of the usability problems in the examples occurred both in the expert walkthroughs as well as in the empirical usability evaluations, however not in all the empirical sessions. The most obvious usability problems found in the empirical usability evaluations (1-4) and in the expert walkthroughs (5-11) are listed below:

1. It was unclear how to gain scores. Strange question marks and other moving objects confused and search of hidden, score giving objects was fruitless.
2. Not obvious what to look out for. What is really dangerous in the game?
3. The skateboard kid somewhat seemed dangerous, however not clear at all how he could harm you.
4. Overall, feedback problems occured in the game. When feedback was expected it did not occure.
5. Lack of interest in reading initial instructions results in frustration later in game.
6. Loss of only some points was confused with a total loss of points
7. The music is not connected to the actions in the game which confuses player and do not highlight level of danger.
8. The level of the game is experienced to be to low.
9. Frustration over lack of consistency with other arcade games, like for instance the possibility to jump on 'bad guys' in order to gain points.
10. Lack possibility to move information pop-up windows, in order to see information in hidden windows.
11. Frustration over the fact that some objects, in this case a plastic road cone, does not work as in real life, i.e that they could be pushed over. In the game, player has to move around the cone.

Design implications

The above stated usability problems are examples of some of the occurred issues from expert walkthroughs and empirical evaluations of the game. In the focus group session, a thorough discussion of all sessions was conducted and the general guideline list below was created. The general list of guidelines is listed below.

1. *Earning and loosing points* – The overall scoring system should be clear, unambiguous and provide distinct feedback to the user concerning changes in the points scored or lost.
2. *Scoring and performance feedback* - The points should be summarized in a visible and easily interpreted counter, placed at a location in the environment according to conventions in the game genre.
3. *Differences in valuable objects* – There should be intuitive, easily understood representations of objects and actions that results in scoring points when performed.
4. *Task performance and feedback* – In order to achieve good gameplay and competition, a failure to achieve a certain task that successfully performed will result in a large amount of points scored, should lead to the disappearance of the opportunity to score that particular set of points.

5. ***Promoting exploration*** – There should be "hidden points" in the game environment, to reward the user when exploration of the environment is performed and to provide variation and discrimination in the overall performance of users considering points scored.
6. ***Game objects characteristics*** – The difference between objects that affects the gaming procedure and objects that constitutes the background surroundings of the environment should be clear and unambiguous.
7. ***Real world inheritance*** – When designing objects in the game environment, it is important to be aware of the conventions considering the specific object generated by other similar types of games, but also conventions and affordances provided by real world connections.
8. ***Understandable menus*** – Menu buttons and choices should be clear, descriptive and context sensitive
9. ***Supporting tools and their layout*** – Pop up menus and additional tools for problem solving (i.e. information databases or dictionaries) should never occur on top of the main element (i.e. a particular question) which they are supposed to support, but should occur beside that particular element.
10. ***Game instructions*** – Instructions dealing with basic movements and actions in the game environment should be visually presented and explained in a short and compact fashion.

Conclusions

In this paper we have presented an initial study with the main purpose to find design guidelines for edutainment games. After the evaluation process, where expert walkthroughs as well as empirical usability evaluations were conducted, focus group sessions with HCI experts and game designers. This resulted in a list of guidelines. These guidelines included:(1) Earning and loosing points, (2) Scoring and performance feedback (3) Differences in valuable objects (4)Task performance and feedback (5) Promoting exploration (6) Game objects characteristics (7) Real world inheritance(8)Understandable menus (9) Supporting tools and their layout and finally (10) Game instructions.Issues for future research includes further testing of other types of edutainment games in order to further verify the generality of the above developed design guidelines for edutainment games.

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