

Satisfaction and Learnability in Edutainment: A usability study of the knowledge game 'Laser Challenge' at the Nobel e-museum

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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, in order to guide designers of such games. Usability evaluations, with users and experts, 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 consisting of game designers and HCI experts. The result was a proposal of a list of design guidelines. In this paper they are grouped in three general categories; (1) game experience, (2) balance between entertainment and education, and (3) general understanding. 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 inconsistencies. Some of the implications from the findings, as discussed in the focus group, were guidelines for earning and losing points, scoring and performance feedback and game object characteristics.

1 Introduction

Entertainment is a factor that recently has become important for a number of different areas. 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. An example of how edutainment could be defined is:

"...the marriage of education and entertainment in a work or presentation such as a television program or a Web site."(Jones et. al., 1999)

Considering the definition of the edutainment concept 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. Furthermore, existing guidelines are developed to cover more general usability aspects or with the intention to regard only entertainment aspects. The purpose of this paper is to report on initial usability evaluations on an edutainment game performed in order to provide design implications for design of edutainment games, for future research to refine and revise.

2 Usability and entertainment

Previous findings in the related area of interactive entertainment evaluation 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, 2001). Other related work include, for instance, Malone (1982) where the researcher spot four (4) characteristics of games. However, these characteristics do not consider any educational aspects.

3 The edutainment game

The game evaluated in the study is called “Laser Challenge” and was designed in order to educate the player/user about appliances of the laser technique. No specific knowledge about the laser technique was required for playing the game, but the user was supposed to be inspired by the game to learn more about laser. The game followed a linear, platform metaphor, and consisted of four episodes with increasing difficulty in the interactive parts. The main theme was supposed to be non-violent and the basis was that the user should collect CD’s to give a party. Further, the user got points when answering questions.

4 Evaluation method

Methodologically, several studies reveal that usability inspection methods, such as Design Walkthrough (Karat, 1997) and Heuristic evaluation [c.f Nielsen, 1993) in many cases identifies problems overlooked by user testing, but also that user testing may identify problems overlooked in an inspection (Nielsen, 1993). In this study, we therefore use a combination of evaluation methods including both user testing and inspection methods; (1) An empirical usability evaluation, (2) Evaluations using inspection methods, in this case *Design Walkthrough* (DW) and (3) *Focus Groups* (FG).

4.1 User testing

The subjects performed the test individually, and each test took about 30 minutes in all. The user tests consisted of three parts;(1) 10 minutes of free surf (Wiberg, 2001) with Think Aloud, (2) 10 minutes of Walkthrough, performed by the test subject in collaboration with the test leader (collaborate evaluation), and finally (3) 10 minutes of post-interaction interview. Below, the subjects are described:

Sub ject	Age	Sex	Computer literacy (1=Novice,5=Expert)	Computer gaming literacy (1=Novice, 5=Expert)	Comment
1	25-30	Female	3	1	IS researcher
2	25-30	Female	5	5	IS researcher
3	50-60	Male	3	1	Engineer
4	20-25	Male	4	4	IS lecturer
5	20-25	Male	3	3	IS lecturer

In the first part of the session, the subjects played the game without any specific task to solve or instructions to be carried out. They were asked to verbalise their thoughts throughout the interaction, and they finished the session when they wished to do so. In the second part, the subjects performed a Walkthrough of the whole game prototype in collaboration with the test leader. Different aspects of the game were discussed, and the subjects were asked to give their opinions about specific features and parts of the design. They were also able to express any thoughts and comments they wanted to share. 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. Here, the subjects could develop or refine their opinions and ideas from the previous parts of the test, and the test leader could follow up on issues that needed to be clarified.

4.2 Design Walkthrough

Exp ert	Age	Sex	Computer literacy (1=Novice, 5=Expert)	Computer gaming literacy (1=Novice, 5=Expert)	Comment
1	20-25	Male	5	4	HCI expert
2	30-35	Female	5	3	HCI expert
3	25-30	Female	5	3	HCI expert
4	30-35	Female	5	3	Interaction designer

The evaluators investigated 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.

4.3 Focus group

When the User tests and Design Walkthrough parts were finished, the test leaders and the expert evaluators (which in some cases were the same persons) performed a focus group meeting. In the focus group, the results from the previous parts of the study were discussed and reported. This was done in order to conduct design implications or guidelines based on found problems. From the results, a more general picture of the reported problems in the prototype was constructed. This picture was then used to generate a number of implications for the next step in the overall design process; design implications. Since the study was performed as a collaborative part of the process of designing the edutainment game, implications were kept at a level that was considered to be meaningful for the overall design process in terms of redesign of this specific game. From a research point of view, these findings could be considered as input for further revisions and refinement in future studies of other types of edutainment games.

5 Usability problems found

In order to highlight the research process, examples of the usability problems found are stated below. These are kept short, with the only purpose to pinpoint the overall picture of what occurred. In the expert walkthroughs, three main findings were found. (1) It was unclear how to gain points. Strange question marks and other moving objects confused and search of “hidden”, point 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. Further, in the empirical usability evaluations, the above usability problems were also found, and also three more. (1) A lack of interest in reading initial instructions results in frustration later in game was noted. (2) A loss of only some points was confused with a total loss of points. (3) The music is not connected to the actions in the game which confuses player and do not highlight level of danger

6 Design implications

The above stated usability problems are examples of some of the occurred issues from evaluation 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 initial list of guidelines includes ten (10) guidelines. Below, these guidelines are divided into three general groups; (1) Game experience, (2) balance between entertainment and education, and finally (3) general understanding.

6.1 Game experience

(1) *Task performance and feedback*: In order to achieve good game experience 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. (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.

6.2 Balance between entertainment and education

(1) *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. (2) *Earning and losing points*: The overall scoring system should be clear, unambiguous and provide distinct feedback to the user. Here the balance between entertainment and education seems critical. The points system seems to be one of the most important triggers for the user to enter the parts of the game connected to learning, i.e. if the scoring for the knowledge parts is too low, the users hesitate to enter these parts or objects.

6.3 General understanding

(1) *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. (2) *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. (3) *Understandable menus*: Menu buttons and choices should be clear, descriptive and context sensitive. (4) *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. (5) *Differences in valuable objects*: There should be intuitive, easily understood representations of objects and actions that result in scoring points when performed. (6) 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.

7 Conclusions

In this paper we have presented an initial study with the main purpose to find design guidelines for edutainment games, as it seems to exist a lack of guidelines both in research as well as practice. After the evaluation process, where expert walkthroughs as well as empirical usability evaluations were conducted, focus group sessions with HCI experts and game designers were performed. This resulted in the above-described guidelines. Briefly described, the guidelines could be grouped into (1) game experience, (2) balance between entertainment and education, and (3) general understanding. These findings could work as input in future research with purpose of further revision and refinement of the guidelines, in order to strengthen the generalizability of the guidelines.

References

- Jones, A., Scanlon, E., Tosunoglu, C., Morris, E., Ross, S., Butcher, P., Greensberg, J. (1999) Contexts for evaluating educational software. In *Interacting with Computers 11* (1999) 499-516, Elsevier.
- Karat, J. (1997) User-Centered Software Evaluation Methodologies. In *Handbook of Human-Computer Interaction*, 2nd edition, Helander, M., Landauer, T. K., Prabhu, P. (eds), Elsevier.
- Malone, T. W. (1982). Heuristics for Designing Enjoyable User Interfaces: Lessons from Computer Games. *Eight Short Papers in User Psychology*. T. P. Moran. Palo Alto, Palo Alto Research Centers: 37-42.
- Nielsen, J. (1993) *Usability Engineering*. Academic Press, San Diego
- Wiberg, C. (2001). From ease of use to fun of use : Usability evaluation guidelines for testing entertainment web sites. In *Proceedings of Conference on Affective Human Factors Design, CAHD*, Singapore