Usability Evaluation applied to a children's website

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Abstract: When designing an interactive application where the main users are children, a set of special needs must be taken into account. Usability and Accessibility are two important issues to consider with especial care in this sector of the population. This paper explains the adaptations that must be introduced in the evaluation methods applied to children and what type of evaluation methods are the most recommended for this kind of user. In conclusion, this paper is a compendium of HCI evaluation techniques, based on a real project which must be considered when developing a website focused on children.

Keywords: Usability, evaluation methods, process model

1. Introduction.

After three years of life of a children focused website our HCI research team were asked to redesign it giving new functionalities and improving its usability mostly that concerned with youngest audience. The related web is part of the global website of the council government of Lleida (Spain). One of the most important aspects of interactive systems resides in the user dialogue. The user interface is the part of the systems (hard and soft) that enables to the users to accede to the computer resources. Therefore, this interface will determine the perception and the impression that the user has about the application (Thimbleby et. al., 1990). When children are the final users of this interface a mental barrier can be found if their particular aspects are not conveniently considered. Great divergences can arise because the gap between developer's and the end user's mental models is too huge; making it essential to supply the development process with evaluation methods that bring together the interface design with the cognitive model of the children. Most users desire learning software by exploration (Wharton et. al., 1994) and in addition it should be mentioned that in childhood the active multimedia environments favour exploration and make learning more stimulating, attractive and amusing. Considering the usability of a Web site as Brinck introduces (Brinck et. al., 2001), a new intuitive, transparent Web has to be designed that helps the

users to obtain their objectives in a fast, efficient and easy way. All in all, the main objectives were marked as being the following: to create a bond of communication with the children, to develop a process of education in human values, respect for others, children's rights, health education, etc. outside of the normal educational channels, to get to know the most emblematic places of Lleida, its customs, culture and sites, and in addition it would also have to be an element of interaction between children and the communication and information technologies, maximizing its 'easy-of-use' level for all of them. Children as young as only 3 years old would have to be able to accede to this new Web site; therefore in the design it is essential to bear in mind the characteristics, aptitudes and mental models of the children of this age as one more requirement of the system. Once at this point, on the verge of initiating the development process of the Site, we studied the HCI evaluation methods, to take into account all the human and interaction aspects relative to the project.

2. UEPM applied to the related Website

Hereby, in a brief summary way we present the steps followed when applying the Usability Engineering Process Model (UEPM) (Lorés, 2002, Granollers et al., 2003) to this project were: we started the requirements analysis phase defining three different user profiles: infant education

(between 3 and 6 years old), the initial cycle of primary education (between 7 and 10 years old) and the superior cycle of primary education (more than 10 years old), as 'input' to the other the user-centred model phases (Mayhew, 1999). This process of requirements analysis had to be repeated several times, since the users don't know their real necessities until they can see and interact with the options and functions available in the successive prototypes (Rosson et. al., 2002). During this phase some paper prototypes were developed and evaluated with some final users. In the design phase we defined the general style of the web based on some standards, all of which were directed to create functional and attractive environments, that is, at the same time easy to navigate and pleasant. This phase also included a complete Hierarchical Task Analysis (Annet et.al., 1967) that allowed to optimise the user actions. Prototyping phase, in order to get to know the user's mental model, and to adapt the design model to the conceptual model, several prototyping techniques were used, such as or software prototypes. Once each prototype was developed the evaluations of the Web site were carried out based on the methods introduced by Nielsen (Nielsen, 1993) of contextual enquiry, thinking aloud, surveys and focus groups. Each evaluation of a new prototype implies a new iteration of the UEPM. The enormous effort made in the prototyping and evaluation phases already indicates the pursuit of a repetitive process of the different stages of the UEPM, counting on the support of the user whenever necessary, guaranteeing therefore the pursuit of the user-centred design philosophy.

3. Evaluation Process

This paper is oriented to explain how this evaluation process has been affected by the fact of dealing with children from 3 years upwards and what conclusions can be obtained from having applied certain methods of evaluation on this group. For each prototype developed the user profiles were differentiated and the evaluation was adapted according to these profiles. The evaluations were carried out in three local primary schools, with which we tried to work with all defined user profiles and different environments (Mayhew, 1999), with children of middle-high social class, but with a considerable number of mentally diminished children. For the children of between 3 and 6 years of age the methods of contextual enquiry and thinking aloud were applied, while for the children of between 7 and 10 years of age, and also those of

more than 10, the methods of contextual enquiry, thinking aloud, surveys and focus groups were developed.

3.1 Analysing the Evaluation Results

As we have mentioned, the project was profile was divided into three natural levels, so this section is also explained separating the study following these grouping.

3.1.1 Infant Education (3 to 6 years)

This first population sector is very special, so the children belonging to this group had big innate age-difficulties such as their ignorance of the Internet, the little dominion of the handling of the mouse or clicking upon an object or link. This meant that the child didn't move with ease and moved the mouse without being able to position it correctly on the objects in screen. Children in Spanish schools start working with computers until the age of four. It must also be mentioned that children of this age can't read or are just beginning to do so. Those that have begun to read read the capital letters and the largest words; therefore, it's impossible for them to work on the page alone. With the help of the evaluator or the voice that explained the functioning, the child progressed with not a lot of problems. It was observed that it was difficult for the children to maintain attention for long enough to listen to the instructions, and it was more practical to explain the game while it was being played. The functioning of the game was quickly learnt. This reading difficulty is an important problem, and in this sense it was also observed that the vocabulary used was too complex for the children of this age. The children had difficulty in explaining what they had observed, which would have been an aid to glimpse at their mental model. Despite this reading difficulty, they observed that there was movement on the page, describing what each animation did. Some children that had begun to read found the text too long and they didn't understand the content.

3.1.2 Primary Education - Initial Cycle (7 to 10 years)

In this case, children were observed individually, so as not to lose any details of how each one of them carried out a task. Because the children had little dominion of the interface it was difficult for them at first. Once we had explained the functioning, most of them worked without any problem. They didn't have a defined mental model. It was also observed that the children didn't read anything; they were going directly to play, even though the children of 9 and 10 years of age didn't have any reading or

vocabulary problems. We observed that the children had an incomplete mental model of what appeared in some of the menu options, not clearly understanding their meaning and therefore not forming a real idea of what they were really going to find. The surveys were completed by 14 children with a lower middle level of computer science knowledge. Of these, five had never been connected to the Internet, and 11 had never used a chat. The children were able to complete all the tasks with few problems, in some cases they couldn't find or do the task and needed help. They very much liked the game-related tasks, although in some game which was difficult to understand, they had to go back to help or have the game explained by voice, since the help was not clear. They found the page easy to use in general.

3.1.3 Primary Education - Superior Cycle (more than 10 years)

The children observed were familiar with the Internet and have an average knowledge of computer science at user level and they had no problem in navigating the Internet. Observations of their approach revealed that they don't read the text and they don't pay attention to what they can do but rather locate the most attractive aspects to them, like the games or the chat. It was observed that these children had an oriented mental model. They identified most of the objects on each page and understood their significance. Working with all the pages they explained what they saw and understood, but they didn't find any usefulness for some of them, and in other cases they were disoriented with respect to their function. Once all the tasks had been done, it should be emphasized that the children were unaware of the game level adapted to their age. They found that it was an easy-to-use page and that the instructions that appeared were clear. They answered that there is too much text on the pages.

4. Discussion

We have reflected that there are some problems with each method and for each range of age, because of the differences in applying the same method to different age groups. After applying different methods, from the evaluation we can see that for children from 3 to 6 years of age the contextual enquiry evaluation method is valid. In general terms, with children from 7 years upwards, any one of the presented methods of evaluation is applicable. Thinking Aloud and Contextual Enquiry are very good methods in these environments, from which excellent conclusions can be obtained. The Focus

Groups method as well as the use of Surveys, while being good evaluation methods, are as yet poorly adapted to children, because they are lengthy procedures which makes children tired, which in turn translate into a loss of quality in the evaluation. After making all these evaluations, we come to the conclusion that it's practically impossible to design interactive applications for children in general. The fundamental characteristics of the age groups that should be considered when interfaces for children are designed are the following:

4.1 Infant Education (3 to 6 years)

Children between 3 and 6 years old, who have not yet begun to read or are just beginning to do so, need a visual content interface, based on images and even including auditory content. The text has to be brief and always goes with representative non-text elements (images, animations, programmatic objects, sounds, etc.). The graphical equivalent must serve the same purpose as the verbal content. At this age, attention capacity is very limited Consequently, activities provided must be short, quick and dynamic, to avoid tiredness and boredom. In this age group, the child is quite egocentric: children see the world only from their own perspective, focusing on themselves and having difficulties to understand others points of view (Moraleda, 1995). Because of self-centred thinking, personalized activities are important because the child can feel that he/she is the main character of what is happening on the screen. Due to the psychomotor level, the use of the mouse could be complicated. For this reason, is important to provide straightforward movement directions (up-down / right-left) and keyboard shortcuts to them. These directions must always go with arrows, graphical representations to support the concept (specially the right and left concepts) (Moraleda, 1995). Regarding the web structure, it must be unidirectional: links must go directly from one task to another. The menu options must be clear in each Web page, not only in the Principal page. Children at these ages are able to think out mental operations though in one direction. Because they can't reverse events, it's very difficult them to go back to the previous page. They don't have a mental model, so it is advisable to show a very simple Web structure. The Web content must be games. Through play children can master many skills. Play helps them to make adjustments, questions, and curiously explore what they don't understand. This moves children to a higher level of thinking. To sum up, play is how children learn (DeBord, 1996).

4.2 Primary Education- Initial Cycle (7 to 10 years)

Between 7 and 10 years old (concrete operations stage), children don't have any defined web mental model. They merely observed that there were multimedia environments. However, their cognitive development allows them to draw up a plan for this observation. It is not a passive observation, it is more systematic. They are able to perform logical operations between the different elements, to synthesize and reconstruct them to make up the whole. Therefore, the Web page structure could be contents units, with clear and simple connections between them. This kind of structure will help the children to acquire a mental model: to understand the Website as a group of linked pages, not a collection of isolated elements. The units structure allows the children to move inside small spaces, with a very simple logic, that the children in this age group are able to understand. During this period, there is an increase in the attention span: the child can do the same task for a long time, so it's possible to execute longer-lasting activities. In addition, there is a gradual increase in immediate memory (Moraleda, 1995). As a result, the activities structure and content could be more complicated. Despite the increase in language skills and logical thinking, the visual and concrete experiences support is still necessary, so it is important not to forget the graphical representation in the interface design.

4.3 Primary Education-Superior Cycle (more than 10 years)

From around 11 or 12 on, the children enter the formal operations stage. Here they become increasingly competent at adult thinking. This involves using logical operations, and using them in the abstract, rather than the concrete. Due to the development of hypothetical thinking, the visual content in the interface is not as important as the verbal aspect. It is the formal operations stage that allows the children to understand complex connections, so he/she shows a clearly defined mental model, being able to find those connections or contents that were the most attractive. During this period, the children know exactly what a Web page is, so they know what to expect in each of the menu options, being familiar with the Internet and navigating the Website in a natural way.

5. Conclusion

We can conclude that one of the best ways of designing interfaces for children is through collaborative design, without it's almost impossible be able to understand their special skills and needs, and in this sense this is where the proposed methods of evaluation take on a greater relevance. On the other hand, we are using real developments such as this to validate and improve our so mentioned Usability Engineering Process Model. So, the resulting interface has demonstrated that following this UEPM, centring the process on the user, is very beneficial and contributes the necessary degree of integration of the user in the design process of child-oriented interactive applications, thereby approaching the mental model of the children.

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