Interactive Cross-platform Environments for Young Children

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Abstract
The aim of this project is to produce design guidelines that provide pre-literate children with a personalised cross-platform experience in which they have control over a stimulating environment that leads to entertainment and cognitive development while interacting with a computer or digital television application.

2. Introduction

The amount of content available for young children on both Internet and digital television increases daily and almost every TV programme for children now has a website that allows them to interact with the show and send content of their own, such as drawings, pictures, videos and messages. As a result, the media scenario is now based on on-demand, cross-platform and user-generated content. "New media are adding to the media mix, but appear to be displacing non-media activities, more than other media. The more time children spend with one medium, the more they tend to spend with others." (Livingstone & Bovill, 2000, p.6) So, media becomes a central focus of young children's lives and consequently has significant impact on children's development.

Many parents are grateful that their children are learning from TV but it appears that the primary reason they choose to bring media into their children's life is not because of the educational factor, but because of the practical benefits it offers: uninterrupted time for chores, some quiet time, or even just an opportunity to watch their own favourite programmes. (Kaiser Family Foundation, 2006, p.5) While parents enjoy some time off children may develop independence and autonomy interacting without any adult help.

However, most interactive applications for young children available on the Internet or on digital TV today have textual interfaces that are not so intuitive to navigate, so children do need some adult help in order to interact. As a result, young children may not move from passive viewers to a more active role and full benefit from the potentials of the digital world unless they have some assistance.

3. Aims and Objectives

In this context, the aim of my research project is to examine how interactive applications for Internet and digital TV may be designed to meet the needs, capabilities and interests of pre-literate children for entertainment and cognitive development, providing a consistent experience across the two different platforms allowing the child to easily switch back and forth. The interfaces should enable children to explore and choose experiences that match their interest and needs, also providing ways for child-initiated activities and child-generated content by creating conditions which inspire children and foster creative and imaginative development.

Piaget stated that learning is an interactive process between children and their environment. (Duffy, 1998; Schaffer, 2004) He characterized children as active scientists, and their progression from one stage to the next was the result of children's efforts to 'accommodate' any new knowledge with that which they already know, and 'assimilate' it into a fuller understanding. This results in an 'equilibrium' where knowledge is embedded and part of the child. So development, in Piaget's view, was largely unaffected by interventions of adults in the process. He asserted that the learner has an active and independent role, often selecting activities, while the adult's role is supervisory rather then interactive: "In the public debate about children and media, people on all sides of the issue often end up pointing to the role of parents in monitoring their children's media use."(Kaiser Family Foundation, 2006, p.32).

The design guidelines resulting from this project will take into account the adult's responsibilities and provide ways in which parents can play the supervisory role shaping children's media habits and limiting screen time in today's realistic scenario in which most of the children are using media on their own. "In Vygotsky view, Piaget's work has led to a tendency to focus on what children can do unaided, what they already know or can do." (Duffy, 1998, p.92) Vygotsky identified a period that fell between two levels of development

in which children need assistance to complete a task, he defined it as 'zone of proximal development' "the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). His theory states that "cognitive development is essentially a social process" (Schaffer, 2004, p. 195) And "there seems to be an advantage in making technology play a more social role in supporting children's learning." (Ryokai, 2003, p.198) As a result, if "people's responses to media are fundamentally social and natural" resulting in media experiences being similar to human experiences (Reeves & Nass, 1996, p.251), different media can play the role of a more experienced that through instruction and modelling provides aid in intellectual growth to a less experienced.

To provide such a stimulating environment, enable children to interact without any help and enter their 'zone of proximal development' the guidelines will include ways in which interface designs can be finely tuned to each child's ability, providing a flexible framework and identifying the stage of development individual children have reached so that appropriate materials can be presented, supporting and extending children's learning and development by adding the information they need at the point they need it.

"The 'spiral curriculum': If one respects the ways of thought of the growing child, if one is courteous enough to translate material into his logical forms and challenging enough to tempt him in advance then it is possible to introduce him at an early age to the ideas and styles that in later life make an educated man." (Bruner, 1960, p. 52) To create respectful interactive applications for young children requires, as Bruner stated, an examination of what is worth teaching, so children's learning and development should be impacted by their capabilities, intentions and needs. According with Unesco, the ultimate purpose of early childhood services is to promote the holistic development of the child's emotions, personality and cognitive skills. However, the "preparation for primary school is easier to demonstrate than more nebulous concepts, such as 'cognitive development', that may be hard to measure." (Unesco, 2005, pp. 6)

The outcome guidelines to cross-platform interactive applications will respond to current understandings of pre-school child development, by providing a stimulating environment, which according to Piaget is vital to learning; adding instruction and modelling, important features of teaching that will facilitate media to play a social role and enable children achieve the 'zone of proximal development', defined in Vygotsky's work, together with Bruner's notion of the spiral curriculum in which the applications may address appropriate concepts to children at different levels. The tool will act as scaffolding to assist children in interacting independently, overcoming challenges and gaining control thus achieving the 'zone of actual development' that will also result in fun.

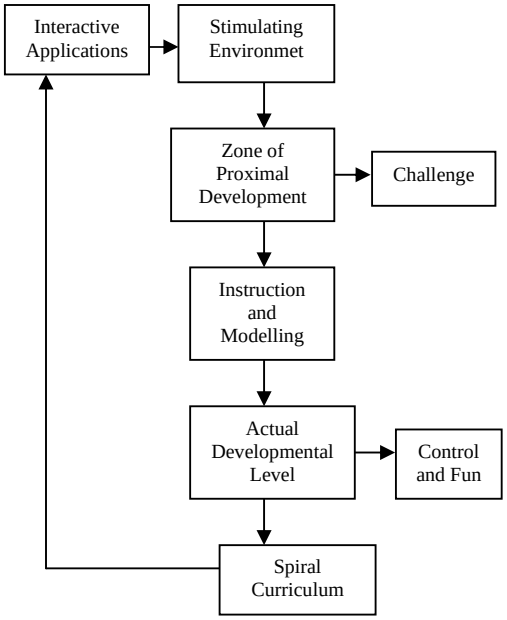

Figure 1.

Figure 1 represents the processes on which the cross-media prototypes developed will be focused to result in guidelines that may assist in the development of interface designs that enrich children's experiences while interacting with media and help their cognitive development.

4. Methodology

In order to produce the design guidelines a collaborative participatory environment will be developed with things children like to do, with different levels and types of facilitation that motivate them to view, rate, create and modify the content. This way, young children will be able to search and navigate though large volumes of archived content and also produce and distribute their own content.

To accomplish this, two interactive applications will be developed to a working prototype stage, one for the web and another for digital TV, incorporating requirements elicitation, participatory design and evaluation techniques. The web tool will be created based on the "desktop" model used in current operating systems, providing built-in applications such as drawing tools, games, RSS reader and easy content navigator whilst having a familiar operational environment. This tool will be an easy way for children to find, create, modify and rate anything they want.

The iTV application should follow the same concept with changes that will allow the use of the remote control instead of the computer mouse keyboard interface generating a consistent experience across different platforms allowing the child to easily switch from one media to the other.
Both environments will be developed using audio and iconic interfaces and may be entirely customised by the users with their favourite activities, programmes and self- generated content. The design oriented to pre-literate children will consider screen objects and metaphors that the child would find familiar and would be capable of interacting with without any adult help. To develop this interface metaphor of children's conceptual model, users will be involved in the research from the very beginning of the design process. They will be asked for input when direction and support is needed and will have an impact on how the prototypes will be shaped. Once the prototypes are developed they will test them and the results will be fed back to the prototypes that will then be retested to produce the guidelines.

The research is still in its initial stages, consisting of a literature review and a study of child development and psychology to situate the work and gain a better understanding of the users and technology. After that requirements will be identified, design and navigation defined to produce sketches and low tech prototypes. The subsequent stage will be the production of high tech prototypes that will be tested and evaluated. The design guidelines will be generated subsequent to the data analysis.

To test the prototypes the case study method will be used. This is a small-scale research method that aims to illuminate the general by looking at the particular, to delve into things in more detail and discover things that would not be apparent through more superficial research, focusing on relationships and processes. According to Descombe (2003) the real value of a case study is that it offers the opportunity to explain why certain outcomes might happen, more than just find out what those outcomes are. Another characteristic of the case study also present in the research is the multiple sources and multiple methods; the investigation is composed of a variety of sources, a variety of types of data and a variety of research methods: this facilitates the validation of data through triangulation. "The point at which the case study approach is most vulnerable to criticism is in relation to the credibility of generalization made from its findings." (Descombe, 2003, p. 39) To generalize from the case study, the data obtained will have significant features to demonstrate where the case study example fits in relation to the overall picture. The sample of children involved in the usability testing will be carefully designed so that the research may be generalized.

The project will rely on qualitative data and interpretive methods, like the majority of investigations in the social research field. This research will be made to be equally open-minded and self-reflective, recognizing the rights and interests of participants and cautious about claims based on the findings.

To make a user centred design, the system should be developed to support users' behaviour and context of use. According to [Preece et al, 2002] users should be consulted throughout development from earliest phases to the latest and their input should be seriously taken into account. It is complex and difficult to consult users, and even more complex to consult children. "Often, children are not consulted until the end of the design process, if at all. While there are many roles that children may play in the design of new technology." (Guha & Druin, 2004, p.1) Guha and Druin believe that children should be an integral part of the design process. Druin (2002) defines four main roles that children can play in the technology design process: user, tester, informant and design partner.

In this project, it was decided to have children as informants, playing a part in the design process at various stages. They will impact the prototype development from the very beginning of the design process; the findings from observational evaluations made previously (Joly, 2006) will give direction and support, and have an impact on how the prototypes will be shaped. Children will also be asked for input if needed at any stage during the design process. Once the prototypes are developed children will test them and will give their feedback. To evaluate the prototypes users will be observed, during usability testing sessions and then asked for

opinions using three different techniques as recommended by Pemberton and Fallahkhair.
"Although the application of several techniques in a single session was quite demanding of participants' time and concentration, the sessions succeeded in gathering a rich range of data, evaluating the usability, the perceived efficacy and the desirability." (Pemberton & Fallahkair, 2006, p.457).

The methods chosen to be used during the observational evaluation will be the Wizard of Oz combined with active intervention. Springett and Griffiths (2006) affirmed that the Wizard of Oz simulation during their usability testing was surprisingly effective, subjects reported that they believed that were directly controlling the TV. In their research, this was achieved because the secret operator knew the tasks the subjects were carrying out, and the subjects' comments as they attempted them. However, in the present project children will be involved in the usability testing sessions, so the simulation may not be as effective, because most of the time the remote control key they press will not be the one the controller is expecting them to press. However, in previous research with young children (Joly, 2006) it was noted that the fact that the Wizard of Oz method was used instead of the application running in real time had no effect on the results.

The lab equipment used will be as effectively yet as unobtrusively as possible. The sessions will be recorded via two CCTV cameras, a small microphone and the TV and computer screens will be directly recorded. The observation will be recorded to evaluate the engagement and behaviour signs such as smiles, laughs, frowns and sighs. "These behavioural signs are much more reliable than children's responses to questions about whether or not they like something". (Hanna, Risden & Alexander, 1997, pp.13) As a result, the video will be used to score engagement and in order to ask children their opinions the survey method chosen will be the Fun Toolkit. In its original form, the Fun Toolkit developed by Janet Read (2006) included four special tools, a Smileyometer, a Funometer, an Again – Again Table, and a Fun Sorter and also supported the idea of measuring remembrance.

In this project, to evaluate the prototypes, three of these methods were selected, the ones that could be better adjusted to be used by young children: The Smilyeometer, in which children choose a face (from awful to brilliant) to represent their opinion; the Again and Again table, in which children are asked which application they would like to use again; and finally the Remembrance Metrics to check what children liked the most and what they remembered from the experience it will be asked them to make a drawing.
Both Smileyometer and Again and Again Table were modified in previous research (Joly, 2006) and will be used in this research with the adaptations made earlier. Children will be able to choose a sticker for each activity, represented by the interface picture, reflecting their opinion. They will also be asked which activity they would like to play again or have at home, and the words under each interface picture will be yes, maybe and no, big and thick enough for them to colour. Following this first stage of usability testing and evaluation the results gathered from the data collected analysis will be used to improve the prototypes and refine the methods to test and evaluate interface designs for and in partnership with young children. After that, with improved prototypes and techniques, there will be another round of usability testing sessions.

The two interactive prototypes, one for web and the other for digital TV will be designed to create a cross-platform environment that allows young children to interact and enjoy the potential of both media on their own. The usability testing sessions in both stages of the research will then confirm if children interacted easily, had control over the applications but also found some challenge that would result in cognitive development and fun. The video and survey results will subsequently be analysed to produce the design guidelines for interactive applications for young children that could be useful to broadcasters, manufactures and designers in general.

5. Contributions to iTV

This project will result in design guidelines for interfaces that allow pre-literate children to interact, without any adult help, with computer and digital TV applications, considering children's needs, capabilities, interests and extending children's knowledge and skills. As a result they will develop independence and autonomy and will have fun.
It is intended to generate guidelines that if applied in interfaces will allow the parent to have control on what will be in their children screen and for how long and, at the same time, will enable children to interact without any help and choose the experience that matches their interest and needs, emphasizing exploration and active participation.

According to Plowman and Stephen, new technologies may lead to new concepts of play and learning, promoting discovery, delight, curiosity, creativity and self-expression. They emphasise that

"research in this area has an important role to play in investigating with greater rigour the complexities of arguments for and against young children's uses of ICT and, if appropriate, using that information to develop technologies specifically for pre-school children. Instead of the current situation in which very young children have to adapt to inappropriate technologies in pre-school settings, what could be referred to as 'malign addition', it is possible that adults too can benefit from these developments in unexpected ways."(Plowman & Stephen, 2003, p. 12) This work will contribute to the field of user centred design, and may influence the way interfaces for young children are produced. Following the outcome guidelines, may be created flexible interactive environments specifically designed to meet the needs, capabilities and interests of pre-literate children, which result in cognitive development and entertainment.

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