In Search for Evaluation Methods for Children’s Tangible Technology

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ABSTRACT
We selected some user-based evaluation methods for use with school children to evaluate our Tangible User Interface (TUI) prototype. We aimed to evaluate mainly the usability of the prototype, and also fun and educational design. The evaluations were carried out in different environments. We found location of the study and disposition of the space play important roles; selection of the participants is also important.

Keywords
Tangible, children, design, evaluation, usability

INTRODUCTION
In recent years, research in the area of alternative computer environments (especially tangible interfaces) for children has been increasingly popular. But so far work on the evaluation of tangible technologies has been rather scarce [5]. In our research we aim to apply a range of evaluation methods to the tangible interface prototype we have developed.

Introduction to the Project and the First Prototype
Nowadays in the UK, Information and Communication Technology (ICT) is already integrated into teaching across the curriculum [5]. Technology is becoming more pervasive in children’s environments.

Originally this project was inspired by the use of physical items in ‘museum loan boxes’. These boxes are supplied by museums on request to schools, and contain replica objects which can be explored in the classroom. To investigate how the artefacts in the loan boxes could be made more interactive, we aim to design and evaluate tangible technology based on the loan box items by using RFID technology.

Tangible technology has great educational potential [6]: unlike traditional GUI interfaces that rely on a limited variety of physical objects and a limited range of our abilities, TUIs offer direct manipulation of physical objects and provide more means of interaction. They are more explorative, collaborative and expressive.

The first prototype is a puzzle game on the life of the Romans. Children are given a number of different Roman replicas to investigate. Some of the items may have been used by the Romans in their dining room. When children select an item and place it into the miniature Roman Room, information on the item will be given in the form of visual and audio feedback.

Evaluation Methods for Children’s Interactive Products
Many methods have been used for evaluating products for children [2, 4]. In this study the evaluation was conducted using Think-Aloud (TA), Peer Tutoring (PT), Drawing Intervention (DI) and Questionnaires. In this paper we focus mainly on observational methods, rather than on the questionnaires.

Think-Aloud (TA) provides the evaluator with information about the cognition and emotion of a user while (s)he performs a task or solves a problem. There can be difficulties in applying this method to children, due to their more limited ability to verbalise their thoughts. Studies [1] have demonstrated that children aged 9 to 12 are able to speak about the problems they encounter while performing the tasks, but they often need to be prompted with hints or questions by the evaluators.

In the Peer Tutoring (PT) method, children teach their friends how to use the technology, after they have interacted with the product [3]. This technique is useful to see how children have understood the functioning of the product and how they are both able and willing to communicate it to their peers.

Drawing Intervention (DI) is new, and a more informal evaluation method inspired by school classroom settings. The name comes from active intervention. After the
children completed the tasks, we let them draw anything related to what they have done, and also write a sentence about their drawings, while the observer asked questions relevant to the drawings.

THE EVALUATION STUDIES
A total of 22 local school children (9 boys and 13 girls, aged 8-9, from the same school class) took part in the evaluation. We started testing the evaluation methods with a small number of children as pilot (4 children for the first study), then increase to 7 and then 11 in the other studies. The locations of the studies were in both University labs and the School ICT room.

The evaluation was not concerned with performance measures such as time of completion, error rates and other quantitative aspects of performance. The tasks were used as a means to get the participants to express themselves.

In Drawing Intervention (DI) we put children into a large group (4 to 11children) and allowed them to do an activity they are familiar with, so they were a lot more relaxed and felt free to talk with each other.

For the Think Aloud (TA) method, we tried to select the talkative children in the class, for the less talkative ones we attempted to encourage them to talk by putting them with a talkative friend. Also to let the activities flow more fluently, we re-used the children from the TA to the PT activity, by asking the 2 children from TA to pick one friend each to peer-tutor. By this means, we also reduced the time needed for the whole set of activities.

To avoid the children who had done the evaluation giving hints to the other children, we suggested that they were involved in a ‘secret mission’ and that they shouldn’t reveal anything when they went back; all the children seem to be excited about this idea and happily accepted the ‘mission’.

RESULTS
Each evaluation session gave some useful results about usability issues, mainly regarding some minor flaws in the programming of the interface, and the amount of information delivered to the children, in what form and in what pace.

DISCUSSIONS
More interesting for this paper were findings about the evaluation methods we used:

- For Think-Aloud method, the selection of children is important; not all the children were naturally talkative when they used the product.
- For Peer Tutoring, shy children who didn’t talk a lot during the Thinking Aloud showed enthusiasm and engagement in teaching their friends how to use the product and helping them to carry out the same tasks again.
- For Drawing Intervention, a number of children placed a chosen artifact in front of them to do the drawing. In terms of letting participant express themselves, DI was the most successful method used.

FUTURE WORK
We are still in search of the best evaluation methods for children’s tangible technology, the optimal environment setting for the evaluations, and best way of conducting the evaluations.

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