Designing Cultural Probes for Children

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ABSTRACT
This paper reports on the challenges faced during the design and deployment of educationally-focused cultural probes with children. The aim of the project was to use cultural probes to discover insights into children's interests and ideas within an educational context. The deployment of a cultural probe pack with children aged between 11 and 13 has demonstrated the method's effectiveness as a tool for design inspiration. Children's responses to the cultural probe have provided a valuable insight into the attributes of successful probe activities, the nature of contextual information which may be gathered and the limitations of the method.

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Children, cultural probes, educational technology

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

This paper describes a case study exploration of the use of cultural probes to provide design inspiration for innovative educational software for children. Cultural probes (Gaver et al., 2004; Gaver et al., 1999) are collections of evocative tasks meant to elicit inspirational responses from people. We describe the adaptation, utilization and subsequent evaluation of cultural probes with children as a means by which we can create personal connections with participants and leverage children's natural interests. The goal is to understand the role of cultural probes in educational settings and their potential contribution to the design of educational technologies. The aim is to use these contributions as part of a larger research project aspiring to design appropriate, usable and, most importantly, inspirational educational technology for cooperative scientific enquiry. The project applies a social constructivist philosophy, acknowledging the fundamentally social nature of learning activities (Vygotsky, 1978), to the development of collaborative technology for science education.

One of the challenges of designing for children is the potentially sensitive nature of the setting, with the need for extra levels of ethical and police clearance for research methods involving close contact. Cultural probes offer the potential for a "light touch" approach to engaging with participants in sensitive contexts, as has already been found in other sensitive settings (Crabtree et al., 2003). The adaptation of the cultural probe concept for use with children is explored here as an alternative approach to more time-consuming and intrusive methods for gathering contextually sensitive information. We outline the initial considerations when creating the cultural probe and the lessons learned through the deployment of our probe pack. We show an example of the type of design ideas that can be generated from the probe returns.

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DESIGNING WITH CHILDREN

Over the past decade a number of methods have been employed by researchers and practitioners to guide the design of suitable technology for children. While the use of participatory design and cooperative inquiry methods have proved useful (Druin, 2002), there are limitations when including children in the design process. The choice of participants is important. Participatory design processes work best with children who are good listeners, have the confidence to be actively involved and have some background knowledge of computers and technology (Jones et al., 2003; Knudtzon et al., 2003). Participatory design in school environments needs to be carefully considered. While it is necessary to include adults in the design team (Kafai, 1999), difficulties related to power structures and children's perceptions of appropriate behaviour need to be acknowledged (Knudtzon et al., 2003). A further issue is that participatory design sessions are time and resource intensive (Knudtzon et al., 2003).

CULTURAL PROBES

Probes are a new approach to gaining contextually-sensitive information in order to inform and inspire the design of new technology (Gaver & Dunne, 1999). Cultural probes are an appealing first step in a technology design process. Used as an instrument to "discover the unknown" (Gaver et al., 2004), it is envisaged that probes may be used to discover new ways to leverage children's natural interests.

Cultural probes have been adapted for children in various projects (Davis et al., 2006; Horst et al., 2004; Iversen & Nielsen, 2003). Horst et al. (2004) have used cultural probes to examine interactions within family groups while Davis et al. (2006) designed an intergenerational cultural probe to explore and capture communication between children and their grandparents. Cultural probes have been translated into a purely digital medium with the

use of mobile phones with cameras and Dictaphone functionality to allow submissions of pictures and audio clips in an attempt to move education outside the confines of the classroom (Iversen & Nielsen, 2003). These examples demonstrate that probes may be used to gain contextual and cultural insight in some aspect of children's lives.

CULTURAL PROBE DESIGN

Our cultural probes were designed to allow insight into children's interests and passions while at the same time keeping the wider educational context in sight. Probe activities were conceptualized through a series of brainstorming sessions. Many of the activities were designed to embrace ambiguity, absurdity and opacity (Gaver & Dunne, 1999). They were also designed to be open-ended and provocative. The activities were created based on exercises which have worked well in previous studies, exercises that were thought to be interesting for children, and ideas for areas that each exercise could explore.

The probe packs consisted of the following activities:

- Fun technology collage: asked children to collect and paste pictures of "technology that looks fun" from the internet, magazines, newspapers or other media.
- Subject Ratings: allowed children to rate subject areas (for example reading, mathematics, art and music) on two scales: enjoyment and ease.
- Classroom Architect: required children to draw a picture of their current classroom and a picture of a classroom of the future.
- Technology Gadget Design: asked children to design and describe their own gadget to assist with learning at school.
- Brainstorming Bubbles: asked children a number of questions such as "What makes science interesting?", "What makes science boring?" and "How could I make science more interesting?"
- Excursion Day Plan: allowed children to plan an excursion as an alternative to their next mathematics lesson.
- Science Toy: asked children to create a new science toy that would help them to understand their science homework.
- When I grow up …: required children to describe the work they would like to do when they grew up.
- My Journal allowed children to record their thoughts, ideas and memories from school in text and in pictures.

DEPLOYMENT

The cultural probe was distributed to children aged between 11 and 13. These children were from two sixth grade classes at a local primary school. The cultural probe took the form of an activity pack which was distributed to children in the school classroom. The children were asked to return the completed probe in a sealed envelope to their teacher at the end of seven days. Participants who requested more time at the end of this period were given an extra two weeks to complete their probes over the school holidays. A total of eight probes were returned.

RESPONSES TO CULTURAL PROBE ACTIVITIES

The returns from the cultural probe kits were examined during a series of discussion and brainstorming sessions. The cultural probe returns provide glimpses into mental models of classrooms, mindsets surrounding the concept of learning, popular culture and fads among the participants, and future career aspirations. They also allow an exploration of the effectiveness of the cultural probe as a means of inspiring technology design for children.

Instructions included with the probe activity pack made it clear that children could complete as many of the tasks as they desired. As a result it was possible to determine which activities captured the participants' attention and interest. Table 1 below outlines the number of responses for each of the cultural probe activities.

Activity	Responses
Technology Collage	0
Subject Ratings	7
Classroom Architect	5
Gadget Design	7
Brainstorming Bubbles	4
Excursion Plan	6
Science Toy	2
When I grow up …	7
My Journal	1

Table 1: Number of completions for each of the probe activities

It is clear that children became more engaged in activities which required them to be creative and constructive. In response to the gadget design activity a number of children showed an interest in 'high-tech' features such as finger print recognition, solar power, voice recognition, wireless communication and artificial intelligence. Most children tended to want all-knowing machines that could answer any question posed. A good example is the interactive learning robot (the ILR) which *"has two antennae as ears so it can catch signals in the air"* and *"just walks normally"* and *"has artificial intelligence but it can talk and think for itself too"* (see Figure 1).

In excursion planning children expressed their interest in escaping from an environment that may be perceived as educational. In their responses children choose to go to the moon (Figure 1), a theme park, the beach, ice skating and laser force (a venue for playing laser tag games). While the idea of escaping from a traditional educational forum was present in all responses, a majority also demonstrated that children recognized that learning could take place hand-in-hand with having fun. For example, one child wrote that they would go to a local theme park and that *"… the students go on rides. Then all the students would choose one ride and write a report on its mechanism and science theories involved"*. In response to the question "Who would you take with you?" all children indicated that they would take their entire class.

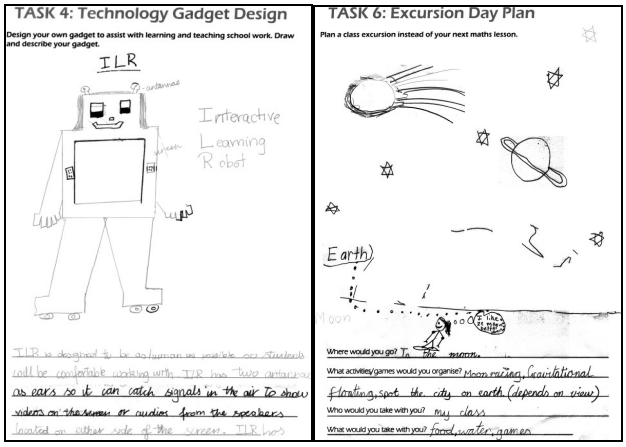

Figure 1: The Interactive Learning Robot and a planned excursion to the moon.

Futuristic classrooms included balloons, balls, beanbags, pizzas, a trampoline, a farmyard and a swimming pool. These classrooms tended to be more social in nature than current classrooms with the inclusion of clusters of chairs, a cozy fireplace and group reading areas. Technology was present in the form of desktop PCs, laptops and wall-sized interactive screens. The children enjoyed thinking about when they grow up and this activity, perhaps more than any other, demonstrated the diversity of individual preferences. Engineer, pediatrician, computer game designer, physician, journalist, marine biologist, and fighter pilot made up the list.

There appeared to be limited interest in completing a journal, nor were children interested in finding images or pictures of fun technology to create a technology collage. While four children began the brainstorming bubbles activity only one child completed it. Responses to the questions asked in the brainstorming bubbles indicated that children struggled to express themselves on issues of learning enjoyment and aptitude.

The activity which required children to rate subjects was popular. Responses to this simple rating activity demonstrated that children carefully considered the extent to which they enjoyed particular subjects and how difficult they found them. Responses appeared thoughtful and, as might be expected, in most cases there was a strong correlation between perceived ability level and enjoyment. There were no subjects that were favorites for all.

LESSONS LEARNED

Based on responses to cultural probe activities we are able to form some conclusions about their effectiveness as a lightweight interaction design technique that may be used with children early in the design process. This discussion explores the attributes of successful activities, the information we should be endeavoring to gather and the limitations of the probes.

Engagement and Cultural Probe Activities

The responses to activities demonstrated that children were best able to provide insights when the activities provided opportunities to be creative and appealed to their sense of fun. Evidence from probe returns suggested that children were prepared to spend a significant amount of time engaged in the completion of such activities. Children found futuristic explorations and activities where they could work outside traditional perceived educational boundaries appealing.

Children appeared unwilling to engage in activities that have been proven to work in participatory design groups, such as journals, brainstorming exercises and collages. The success of such activities with children seems dependent on support from others, and evidence from this study indicates that they do not translate well to individual, autonomous activities. Activities also needed to be self-contained. As demonstrated by the failure of children to engage in the technology collage activity, children were not prepared to complete activities that required material from outside the cultural probe pack to be used.

The first task in a cultural probe pack should be easy for children to complete. An example of such a task is the subject ratings activity. While not particularly useful in providing inspiration, it made the children feel that they could easily accomplish a task. Providing such as task will motivate participants to move on to other activities.

Information from Cultural Probes

Based on the content of responses it is clear that the probes are best suited to exploring children's personal interests, likes and dislikes, and their perspective on the world in general. Such activities provided us with glimpses of children's interests and passions and subsequently are useful in inspiring the design of new technology. For example, a theme that emerged throughout the responses is the class as a *social* group that engages in learning 'outside' the traditional bounds of the classroom. While general in nature, such ideas may be explored in future interactions with participants.

Cultural probes are (not surprisingly) less suited to providing specific insights into how children would like education to improve or the ways they see technology supporting the educational process. Children's views on learning, as exhibited in the design of toys to support learning, are narrow. They tend to see learning as information gathering and finding answers to questions. The brainstorming bubbles activity showed that children appeared unable to express what it was they found fun about learning or what made it boring. Activities which included an educational theme in a less direct manner, for example the design of the classroom of the future, worked much better in providing insights into children's ideas about their own educational needs as well as their personal interests.

Interestingly, the manner in which children completed the cultural probe activities provided as much design insight as the content that complete activities contained. Tasks that were unclear or too open-ended were ignored or dealt with at a superficial level. While there are obvious implications for cultural probe design – create activities which are understandable and well structured – there are also interesting conclusions which may be drawn in

relation to technology design. Any design of educational technology should carefully consider the support mechanisms when dealing with ambiguous and/or opaque content, processes or ideas.

Limitations of the Cultural Probe

The number of activities included in the probe should be carefully considered with the view of facilitating a better activity completion rate. Activities which focus on topics to which children easily relate are well received and responses are useful in guiding the early design process. However, participants are likely to avoid 'difficult' activities or complete them with little attempt at thoughtful interpretation. In addition, cultural probes are not tools that provide a view of specific learning preferences. Such information may be better gathered using alternate techniques.

DESIGN INSPIRATION

Invention, *design* and *role play* were themes that emerged as we explored the probe returns. Children were interested in robotics, artificial intelligence and the way machines work. Such features could become the foundation of new technology for scientific enquiry, which enables a group of children to work, for example, to create worlds that are driven by evolutionary algorithms or embody theories of cellular automata. The notion of children experimenting with voice recognition technology, a technology that we generally relate to research and an adult world – could potentially provide framework for a rich learning experiences within a classroom.

The idea of role play that children appeared to embrace in the cultural probes could be facilitated through a toolkit of appropriately designed devices and software which provide children with the ability to complete an in-depth examination of environmental data. Using technology to work with a team of "real" scientists who provide information, advice and support, children could engage in a community of scientific practice which operates outside the traditional classroom environment.

CONCLUSION

This project has demonstrated that cultural probes are a useful, minimally-intrusive means by which we can gain contextual insight into the lives of children. Early results have shown that well-designed cultural probes can be effectively used as a basis for inspiration to inform the design of educational technology. Our recommendation for the target age-group is a cultural probe pack which includes five or six self contained activities. These activities should focus on topics of direct interest to children and should include an educational context at the periphery. Each activity should be clear, differentiable from other activities and able to be completed in a relatively short time frame. Activities should allow for open-ended and creative responses; they should be playful, but include a supporting framework.

The cultural probe has been redesigned taking into account these recommendations. The next version of the probe is due to be deployed at schools in the near future. The data from the second deployment, in conjunction with the initial cultural probe returns, will be used to provide further inspiration into the design of an environment for experiencing science as enquiry.

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