Tangible User Interfaces for Children

Glenda Revelle
Sesame Workshop
One Lincoln Plaza
New York, NY 10023
glenda.revelle@sesameworkshop.org

Oren Zuckerman
MIT Media Lab
20 Ames Street, E15-120b
Cambridge, MA 02139
orenz@media.mit.edu

Allison Druin
University of Maryland
Human-Computer Interaction Lab
College Park, MD 20742
allisond@umiacs.umd.edu

Mark Bolas
USC School of Cinema-Television
Interactive Media Division
850 W. 34th Street, Lucas 310
Los Angeles, CA 90089-2211
bolas@well.com

ABSTRACT
Tangible user interfaces, which provide interactivity using real physical objects, hold enormous promise for children. Exploring and manipulating physical objects is a key component of young children's learning. The educational power of digital technology for children has typically been limited by the fact that users explore and manipulate abstract two-dimensional screen-based representations, and not real physical objects. Embedding interactivity into physical objects, therefore, allows the "best of both worlds" – supporting traditional exploratory play with physical objects that can be extended and enhanced by the interactive power of digital technology. Participants in this SIG are invited to share ideas regarding the design and development of tangible interfaces, and to bring demos or slides/videos showing work in this area. Participants will review as many examples as time allows, and discuss the issues surrounding design and development of such interfaces. A primary goal of this SIG is to foster the development of a community of researchers and practitioners who are focused on designing and developing tangible interfaces for children.

Keywords
Tangible, User Interface, Design, Children, Toys, Play

ACM Classification
H5.2. User Interfaces: Input devices and strategies; Haptic I/O

INTRODUCTION
The ability to use computer interfaces has typically served as a gateway to the world of interactivity and the educational power of digital computing. For young users, traditional interface use is often developmentally inappropriate and can be a stumbling block to interactive learning. Exploring and manipulating physical objects is a key component of young children's world and of their learning. The educational power of digital technology for children has typically been limited by the fact that users explore and manipulate abstract two-dimensional screen-based representations, and not real physical objects. Young children can't read text-based menu selections or type in their responses on a keyboard. In addition they are often unable to use a mouse or any of the standard point-and-click devices. This inability is due to a variety of developmental factors, including the lack of fine motor control needed to use existing pointing devices, the lack of cognitive understanding of the mapping between controller use and what's happening on screen, and the lack of abstract representational skills necessary to understand typical screen-based displays. (cf., Revelle & Strommen, 1990; Crook, 1992; Lane & Ziviani, 1997; Hourcade et al., 2004; Revelle, 2004).

There are strong cognitive-developmental reasons why interacting with task-appropriate physical objects is the best learning environment for young children. Piaget and developmental psychologists ever since have emphasized the critical importance of manipulation of physical objects for young children's cognitive development (cf., Piaget, 1962; Inhelder & Piaget, 1964). In addition, Vygotsky (1978) emphasized the importance of play in facilitating child development. The objects used in children's play can include anything that the child finds handy, such as sticks, rocks or cardboard boxes, but often include objects especially designed to be toys such as dolls, miniature cars and trucks, blocks, and so on.

A promising new approach to interface design holds enormous promise for bringing the educational power of interactivity to the play and learning style of young children. In recent years, a number of researchers have been working on developing "tangible user interfaces" for interactive experiences (Ishii & Ulmer, 1997; Resnick, 1998; Druin et al, 1999; Scarlatos & Landry, 2001; Zuckerman & Resnick, 2003; Montemayor et al., 2004). Tangible interfaces provide

CHI 2005, April 2–7, 2005, Portland, Oregon, USA.
ACM 1-59593-002-7/05/0004.

Conference on Human Factors in Computing Systems, Extended Abstracts, pp. 2051-2052, April 2005.

digital interactivity using real physical objects that are relevant to the task, instead of a keyboard or mouse and computer screen. As children's toys are increasingly equipped with interactive technology, the toys can respond to children's play in ways that support and facilitate learning. Embedding interactivity into physical objects, therefore, allows the "best of both worlds" – supporting traditional exploratory play with physical objects that can be extended and enhanced by the interactive power of digital technology.

PROCESS/SCHEDULE/AGENDA

We hope to facilitate a highly participatory and collaborative session, including group participation and open discussion among all of the participants. We encourage all participants to bring demos, videos or slides to show their projects that involve tangible interfaces for children. We envision a schedule something like the following:

15 min: Self-introductions of participants and overview of schedule/agenda

10 min: Session coordinators outline some of the issues that are relevant to the design and development of tangible interfaces for children

20 min: Demos and discussion of sample tangible interface projects by session coordinators and participants

20 min: Break into small groups to discuss reactions to demos and identify topics for discussion

20 min: Small group presentations and discussion

5 min: Discussion of next steps: creating a web site or list-serve, other mechanisms for facilitating an ongoing community of researchers and practitioners interested in tangible interfaces for children

ASSUMED ATTENDEE BACKGROUND

Interest in either research or developing applications related to tangible user interfaces for children.

RELEVANCE TO THE CHI AUDIENCE

There has been strong interest among CHI participants in both tangible interfaces and interfaces for children. Combining the two promises to be of interest to many CHI attendees.

PRIMARY CONTACT

Glenda Revelle, Sesame Workshop

REFERENCES

1. Crook, C. (1992). Young children's skill using a mouse to control a graphical computer interface. *Computers and Education*, 19(3), 199-207.
2. Druin, A. Montemayor, J., Hendler, J., McAlister, B., Boltman, A., Fiterman, E., Plaisant, C., Kruskal, A., Olsen, H., Revett, I., Plaisant-Schwenn, T., Sumida, L., and Wagner, R. (1999). Designing PETS: A Personal Electronic Teller of Stories. In *Proceedings of CHI '99,* ACM Press, pp. 326-329.
3. Hourcade, J. P., Bederson, B. B., Druin, A., & Guimbretière, F. (2004) Accuracy, Target Reentry and Fitts' Law: Performance of Preschool Children Using Mice, *Transactions on Computer-Human Interaction*, New York: ACM, 11 (4), pp. 357-386.
4. Inhelder, B. & Piaget, J. (1964). *The early growth of logic in the child*. New York: Harper & Row.
5. Ishii, H. & Ulmer, B. (1997). Tangible Bits: Towards Seamless Interfaces between People, Bits and Atoms. In *Proceedings of CHI '97,* ACM Press, pp. 234-241.
6. Lane, A. & Ziviani, J. (1997). The suitability of the mouse for children's use: A review of the literature. *Journal of Computing in Childhood Education*, 8(2/3), 227-45.
7. Montemayor, J., Druin, A., Chipman, G., Farber, A., & Guha, M. L. (2004). Tools for children to create physical interactive StoryRooms. *Computers in Entertainment: Educating children through entertainment Part II,* 2(1). http://www.acmcie.org.
8. Piaget, J. (1962). *Play, dreams, and imitation in childhood*. New York: Norton.
9. Resnick, M. (1998). Technologies for Lifelong Kindergarten. *Educational Technology Research and Development*, vol. 46, no. 4.
10. Revelle, G. (2004) Very young children and media: How young is too young and why? National Association for the Education of Young Children's 2004 Annual Conference, Anaheim, CA.
11. Revelle, G. & Strommen, E. (1990). The effects of practice and input device used on young children's computer control. *Journal of Computing in Childhood Education,* 2(1), 33-41.
12. Scarlatos, L., and Landry, S. (2001). Experiments using tangible interfaces to enhance collaborative learning experiences. In *Proceedings of CHI 2001,* ACM Press.
13. Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press.
14. Zuckerman, O., and Resnick, M. (2003). System Blocks: A physical interface for system dynamics learning. In *Proceedings of the 21st International System Dynamics Conference*.