Bonded Design

Andrew Large
McGill University, Canada

Valerie Nesset
McGill University, Canada

INTRODUCTION

It is hardly controversial to argue for user involvement in the technology design process: the issue rather is the extent of that involvement and whether or not this is related to the kind of user. In particular, can young children play a meaningful role in design, and if so, what should it be? Several design methodologies advocate a range of roles for children within the design process; this article presents a new such methodology, Bonded Design. Essentially, Bonded Design assumes an intergenerational team comprising adult designers and young users working together to produce a low-tech prototype. This team employs a variety of design techniques—conducting a user needs' assessment, evaluating existing technologies, brainstorming, discussing ideas as a group, prototyping (for example, through drawings), and consensus building—to achieve its goal.

Bonded Design emerged in 2003 from a research study to investigate whether elementary school students (specifically in grades three and six) could actively participate in designing Web portals. To accomplish this objective two intergenerational design teams were established, each including children alongside researchers, which produced two low-tech portal prototypes (Large, Beheshti, Nesset, & Bowler, 2004; Large, Nesset, Beheshti, & Bowler, 2006, 2007). These prototypes subsequently were converted into working portals that received high praise in their evaluations by elementary school students. Indeed, one of these portals, *History Trek,* is now operational on the Web, providing access to information in English and French on Canadian history (*http://www.historytrek.ca*).

BACKGROUND

Bonded Design did not emerge in a vacuum; a number of user-focused design methodologies have accommodated children in various ways and to various degrees in the design of technologies intended for use by children (Nesset & Large, 2004). The oldest and most conventional approach, "User-Centered Design," focuses on the impact of technology on users, but traditionally these users were only involved after the technology had been designed (Nesset & Large, 2004; Scaife & Rogers, 1999, Scaife, Rogers, Aldrich, & Davies, 1997). In other contexts, the term *user-centered design* has been understood by some authors to mean direct contact between users and designers throughout the design process (Rubin, 1994). Typically in User-Centered Design the users have little or no control over the design process itself. Fundamentally they are testers rather than designers, revealing design shortcomings rather than proposing design ideas. In this context, where children only act as testers of prototypes designed by adults for young audiences, their involvement is relatively uncontroversial.

Contextual Design is described by Beyer and Holtzblatt (1999, p. 32) as "a state-of-the-art approach to designing products directly from a designer's understanding of how the customer works." Designers collect data from users' own environments by observing them performing typical activities. They usually record observational data and conduct one-on-one interviews with users in order to develop a deeper understanding of the users' work practices. They then apply work modeling using such techniques as pictorial charts, storyboarding, and low-tech prototyping. In Contextual Design, therefore, the users' role is critical but passive: it is their behavior rather than their ideas that inform the process. This methodology can be applied to children as technology users when the classroom or home is substituted for the adults' workplace.

Soloway, Guzdial, and Hay (1994), based on the idea that the long-term goal of computing is to make people smarter, decided that the HCI community needed to move from the traditional "user-centered" design to what they term "Learner-Centered Design." This approach assumes that everyone is a learner, whether a professional or a student. The main focus of Learner-Centered Design is to ensure that the design is adapted to the interests, knowledge, and styles of the learners who use it. Soloway et al. (1994) believe in the educational philosophy of "learning by doing." At the heart of Learner-Centered Design are understanding (how will the learner learn the practice?), motivation (how can technology motivate a learner?), diversity (every learner is different—what kind of technology can be developed to support this?), and growth (the learner changes but the technology does not).

Kafai (1999) adapted Learner-Centered Design for use with children by making them the actual designers. She believes it is necessary that child learners be involved in the evaluation and testing processes. Her research showed that young student designers are similar to professional designers in their concern for their users. They were conscious of, and tried to address such issues as content and user motivation, but they did not always fully grasp how to address their users' other needs. Kafai is convinced, however, that children have the ability to become more than just informants in the design; rather, that they can become design process participants.

The premise behind Participatory Design is that users are the best qualified to determine how to improve their work, and that their perceptions about technology are as important as technical specifications (Carmel, Whitaker, & George, 1993). Two themes govern the implementation of Participatory Design principles: through "mutual reciprocal learning," users and designers teach each other about work practices and technical possibilities based on joint experiences; in "design by doing," interactive experimentation, modeling and testing, hands-on designing and learning by doing are employed. Like Contextual Design, Participatory Design is suitable for design projects involving children, where their school or home can substitute for the adult workplace. Its main difference from User-Centered Design, Contextual Design, and Learner-Centered Design is that the role assigned to children can be more extensive.

Informant Design was introduced specifically to address some of the perceived problems with User-Centered Design and Participatory Design when working with children (Scaife et al., 1997). In User-Centered Design, users are involved only as evaluators or testers at the end of the design process, and it is left to the designers to translate and interpret users' reactions, which can sometimes give inaccurate results. Scaife and his colleagues were critical of Participatory Design as a methodology to employ when working with children because it promotes the equality of all design team members. They considered this approach effective for a team comprising adult users who can see each other as peers, but infeasible with children who they believe have neither the time, knowledge, nor expertise to fully participate in a collaborative Participatory Design methodology. Informant Design attempts to maximize the input of the participants at various stages of the design process. Informants can help the designers "discover what we did not know rather than try to confirm what we thought we already knew" (Scaife & Rogers, 1999, p. 31). In Informant Design, each informant shapes the design at different points. Scaife and his colleagues believe Informant Design to be the best method "for the design of interactive software for non-typical users or those who cannot be equal partners (e.g., children)" (Scaife et al., 1997, p. 346). At the same time, there is a basic assumption that in the design process, children are most helpful at suggesting ideas only for motivational and fun aspects of the design rather than its totality.

Cooperative Inquiry combines techniques from different design methodologies that have proven useful when working with children. Developed by Druin (1999) and her colleagues at the University of Maryland, it involves a multidisciplinary partnership with children, field research, and iterative low-tech and high-tech prototyping. Children are treated as full design partners alongside the adult designers on the intergenerational team. Professional designers and users (children) of the technology are partnered in intergenerational design teams with the understanding that full participation of users requires training and active cooperation. The design team makes use of such Contextual Inquiry methods as brainstorming and interviewing, as well as working together in small groups and developing low-tech prototypes (Druin, 2002; Guha et al., 2004). Using Cooperative Inquiry, Druin and her colleagues (Druin, 2002, 2005; Druin et al., 2003) have designed the International Children's Digital Library (*http://www.icdlbooks.org*).

BONDED DESIGN

Bonded Design is the newest addition to this family of technology design methodologies. From conventional User-Centered Design, it takes the most basic premise—involving users. From Contextual Design have come the ideas of drawing paper prototypes, and a similar process to what it terms *work redesign* in the use of a whiteboard to set out a map at the beginning of each session for what had already been accomplished and what remained to be done. Participatory Design provides the concept of peer co-designers, drawings (low-tech prototyping), hands-on activities, and "learning by doing." It shares with Informant Design the approach of seeking new and creative ideas rather than merely confirming what the adults already knew. Bonded Design also includes aspects of Learner-Centered Design in that it provides a learning environment for all team members: children and adults alike. In designing Web portals for children, as in Learner-Centered Design, all team members are learners, and the team's objective is to ensure that the design is adapted to the interests, knowledge, and styles of its target (child) users.

Of all the design methodologies, Cooperative Inquiry is the closest to Bonded Design. Both emphasize an intergenerational partnership to achieve a common goal, and embrace the idea that children should play an active role in the design process from start to finish rather than merely being evaluators or testers at the end of the design process. These two methodologies differ, however, in the emphasis placed by Bonded Design on a very focused approach that seeks to complete a highly specified task in a limited number