

# Layered Elaboration: A New Technique for Co-Design with Children

Greg Walsh, Allison Druin, Mona Leigh Guha, Elizabeth Foss, Evan Golub, Leshell Hatley,  
Elizabeth Bonsignore, Sonia Franckel  
Human-Computer Interaction Lab, University of Maryland  
College Park, MD 20742 USA  
gwalsh@umd.edu, allisond@umiacs.umd.edu

## ABSTRACT

As technology for children becomes more mobile, social, and distributed, our design methods and techniques must evolve to better explore these new directions. This paper reports on “Layered Elaboration,” a co-design technique created to support these evolving needs. Layered Elaboration allows design teams to generate ideas through an iterative process in which each version leaves prior ideas intact while extending concepts. Layered Elaboration is a useful technique as it enables co-design to take place asynchronously and does not require much space or many resources. Our intergenerational team, including adults and children ages 7 – 11 years old, used the technique to design both a game about history and a prototype of an instructional game about energy conservation.

## Author Keywords

Children, low-tech prototyping, Layered Elaboration, co-design, Cooperative Inquiry, storyboarding.

## ACM Classification Keywords

D2.2. Design Tools and Techniques: Evolutionary prototyping.

## General Terms

Design.

## INTRODUCTION

Three children and one adult sit on the floor writing on clear acetate with colored markers. The drawing is in the middle as they take turns using the marker to draw on the clear plastic surface. As one boy writes he says, “I’m adding a longer lightning bolt. And fixing those.”

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Figure 1. Using Layered Elaboration to design a game.

“You’re making bigger waves?”

“No, just more waves... Wait, can I make the island bigger? I’m adding palm trees and stuff.”

A month later, three groups of designers stand in a circle, holding their designs. One asks, “You added a green playground?”

“The toys on the playground would, like, generate electricity.”

“The more fun you had, the more eco-friendly you would be.”

These discussions took place as our team of children and adults worked to design two new technologies, one that would enable other children to learn about history, and another about “green” approaches to life. These technologies were designed in part using Layered Elaboration, a technique that evolved through the Cooperative Inquiry design process. In this paper, we present a short description of how Layered Elaboration emerged and evolved, the strengths and challenges of using this method, and a design example of using this technique.

## THE COOPERATIVE INQUIRY METHOD

Cooperative Inquiry grew out of Participatory Design methods and uses a combination of techniques including

low-tech prototyping to enable intergenerational teams to design new technologies for children [4]. Cooperative Inquiry has been used by numerous design teams [7] in the development of children's technologies for over a decade.

There are many techniques included in the Cooperative Inquiry method. “Bags of stuff”, the name the children have given to using craft materials for low-tech prototyping; “sticky notes”, a way to critique technology for future refinement through frequency analysis; and “big paper”, where all team members write ideas directly on a large piece of paper, are three that are very often used. [6]. Team members, adults and children alike, learn how to do the techniques of Cooperative Inquiry as they use them. There are no prerequisite skills for children or adults to be design partners.

Our intergenerational design team meets two times per week during the school year and is comprised of adults, and children ages seven to eleven. In order to best meet the needs of today's independent and interactive iChild [5], our intergenerational design team has begun to develop new co-design techniques suited to designing the increasingly mobile and social technologies inherent in the lives of today's children.

#### THE FOUNDATIONS OF LAYERED ELABORATION

The concept for Layered Elaboration has its roots in storyboarding for interactive media [10], paper prototyping [13], and annotation tools [11]. Storyboards and drawings have been used as a method in participatory design research for decades [3, 8, 12]. Paper prototyping has been used for game design [9] and interface testing [1] while annotation tools have been used in humanities preservation. The technique described in this paper builds upon these and is named *Layered Elaboration* because it enables design groups to add ideas presented by others with layers of transparencies while encouraging design team members to expand on those earlier ideas.

Layered Elaboration is different from other techniques because few lend themselves to revisiting design ideas and adding upon them in a straightforward manner. Many design techniques require the permanent change of original items as additional designers modify them. Layered Elaboration enables co-designers to add and modify ideas without permanently destroying the original through the use of transparent materials.

Layered Elaboration was originally conceived during the design of a motion-controlled, history-based, instructional video game [14]. An adult team member created storyboards representative of one module in the game. We wanted a way to add to and extend the ideas without having to recreate or destroy the artifacts from this initial phase of design. Adding a layer of overhead transparencies to the storyboard fulfilled this goal.

Groups comprised of one adult and two to three child design partners met at one time to gather ideas and input on the storyboards. At the beginning of each session, the group selected one unique color with which to make their modifications. The motivation for this was to help us better see similarities and differences in the groups' modifications. The storyboard was placed on a hard piece of cardboard with a transparent overlay on top. Each storyboard had small plus signs in the corners to act as registration points and corresponding marks on the transparent overlays, as well as labels to describe which storyboard the overlay corresponded to and which group was making the modifications.

The adult design partner read a description of what was occurring in the storyboard and asked for ideas about how to make the storyboards better. The children drew on the transparency over the storyboard while narrating what they were doing (See Figure 1). The co-designers took turns with the marker and made modifications. Once the group thought the storyboard was complete, the transparent overlays were removed and replaced with new ones for the next group.

During the adult debriefing that followed these initial sessions, we placed each storyboard on a flat surface and then stacked each group's overlay on top of one another. This allowed us to see the similarities and differences of each group's modifications. These “hot-spots”, or areas of interest, in the overlays are analogous to the common themes that emerge from frequency analysis of “sticky-note” sessions; however, their visual impact is arguably, a more compelling design affordance.

#### Initial Lessons Learned

Through this initial conception and use of Layered Elaboration, we were able to identify several areas to improve for the next iteration of the technique, including:

- The lack of communication during the initial small group work between design groups made the groups feel disconnected. Although this was by design to encourage a variety of ideas, the groups were not accustomed to not seeing or knowing what others had thought or commented about. All the groups need to get back together after participating in the elaboration sessions to debrief.
- The designers thought that the use of only one color was limiting and one group insisted on using two colors. Groups should be allowed to use multiple colors when they elaborate because the “hotspots” still emerge.
- The design partners didn't feel like they owned the paper storyboards although they were created based on their low-tech prototypes and discussions. The design team should create the first iteration as a group.



**Figure 2.** Example of an elaborated design. In the first image, the group drew a school. In the second image, the next group added a playground that generates electricity, and the final group added a tree that displays how “green” a person’s activity is.

### MODIFIED LAYERED ELABORATION IN PRACTICE

Our team made some modifications to the technique based on these initial experiences. The modified technique emphasized collaboration and elaboration between groups. Our next use of Layered Elaboration focused on the content of one of our upcoming projects. The intergenerational design team was tasked with developing a technology that would help other children be more environmental-conscious at home, at school, and while visiting the White House in Washington, D.C. Our team split into three smaller groups, each consisting of two children and at least one adult. Each team was assigned one of the three locations.

#### Increasing Participant Ownership

To begin the session, each team was given drawing paper and markers to create a design to solve one of the problems described above. The groups were assigned one of those topics and given fifteen minutes to create their designs.

After the time was up, the groups got together in the middle of the room for a “stand-up meeting”, a staple of extreme programming [2]. The stand-up meeting was used to rapidly move along the process and as an interim debriefing. At the meeting, each group explained their design and answered any questions that the other groups might have had. Once a group presented, a transparent overlay with registration points was added. Although not agreed upon ahead of time, most groups used a combination of drawings and English words to express their ideas.

#### Inter-Group Collaboration

In order to solve some of the challenges of the initial implementation of Layered Elaboration, the groups exchanged designs to foster inter-group collaboration and communication. With the new designs in hand, the groups began elaborating on the ideas presented. By using the transparent overlay and markers, the design partners were able to draw on the previous group's work without permanently destroying it.

After another ten-minute period, the groups got back together in the middle of the room for another stand-up meeting. Each group presented what they added or changed to the previous design. After each group presented, another

transparent overlay was added to the design and prepped with registration points. The groups then had one more opportunity to add to the design.

After the final design period, all of the groups sat down and discussed the final designs. As in other co-design techniques [7], all ideas from the design partners were identified and written on the white board.

#### Design Ideas Resulting from Layered Elaboration

One idea of the group was the notion of powering devices in your world with energy you create. Figure 2 shows the progression of ideas for the school scenario. In the first image, the group drew a school with an electronic library. The next group elaborated by adding a garden and playground outside of the school that generates electricity when children play on the equipment. In the last image, the final group added a compost pile to the school and a tree that grows if the school is being environmentally friendly.

To further explore these ideas, “Energy House”, a prototype game, was developed after the Layered Elaboration design session. The game consisted of a virtual house with electric devices. The house had a flat-screen television, a florescent lamp, and a portable music player. Items became the target for electricity “generated” by the players jumping up and down on a dance pad (see Figure 3).

Once an item had virtual electricity going to it, it was activated and began to drain the stored energy. The drain rate was programmed to reflect the relevant amount of energy the device's real-world counterpart would actually use. The game was so popular that the design team asked to play the prototype game on several occasions.

#### LESSONS LEARNED AND FUTURE WORK

As with any co-design technique, Layered Elaboration has strengths and challenges. Its strengths include:

- The ability to add to and modify the initial storyboard without permanently damaging or altering it.
- The ability of the design team to stack the transparency overlays over the original storyboard to see common trends or “hot spots” in the different groups' feedback.



**Figure 3. Participants playing a game designed with Layered Elaboration.**

- The portability as a co-design tool. Instead of needing a large physical space for low-tech prototyping, the stackable storyboards are no larger than a clipboard.
- The relatively rapid, iterative nature of the technique allows a number of design partners to provide input and ideas in a short amount of time.
- The cost of the materials is low.

We have also identified a few challenges with the modified technique, which we intend to address in the future. They include:

- Some design team members did not pay attention to the other groups as they presented in the stand-up meetings, which led to confusion and less elaboration.
- The washable markers used by the design teams were inadequate for writing on transparent overlays because they smudged; permanent markers were required.

This technique is useful when non-destructive design annotation, limited space, and evolutionary artifacts are design requirements. Because Layered Elaboration can be used asynchronously, does not require much space or multiple resources, future work includes modifying the technique to work with geographically diverse design teams. We additionally plan to develop a computer-based work environment for Cooperative Inquiry based on Layered Elaboration.

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