KidArt: Displaying Children's Art in the Home

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Abstract
In this paper we present a device to display children's art in the home. Our primary goal was to create a device that can enhance the display of art, capturing the experience families have both when the child creates the art and when they reflect on that art together. The display device removes the burden of organizing and displaying the art children create so that families can enjoy the art in their homes instead.

Keywords
art, children, family, home

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Introduction
Children are an integral part of families and the homes they inhabit, and it is important to capture elements of their experiences as they grow and develop. Children's art often reflects these elements, but preparing and displaying children's art are constrained by time, budget, and space. Parents are busy, and children bring home a continuous stream of art from school. Parents do not have time to regularly sort through art and reorder displays, so the artwork often languishes in a storage bin or box. The personal experiences children have creating art, the experiences that art reflects, and the shared experiences of parents and children looking at art could offer wonderful experiences for collective recollection and immersion in personal creations, but that opportunity is often lost.

Our goal was to design a device that allows easy storage, retrieval, and display of children's art. We wanted a device that could capture the value and emotional attachment both parents and children place on the art, augmenting the role the art currently plays within the home. We designed a futuristic system, one

that projects a holographic "tree" with art displayed as the tree's "leaves." The tree grows and develops with the child. The tree allows users to record comments and audio in connection with different pieces of artwork. Though there are several existing devices that capture children's story-telling or that display pictures or photos, our work is novel because it provides children with the ability to share their work with their parents, siblings, and friends, while providing parents with the ability to support and encourage their children.

Background

Despite the immense quantity of artwork that children bring home, families often try to preserve all of it rather than keeping only a few favorite pieces to display. Families often face the problem of over-filled displays, because they endeavor to present that artwork to honor their children and make them feel valued within the family [1].

Where pictures are displayed in the home affects the perceived formality of the display; an arrangement of photos on a fireplace mantel is seen as more formal than pictures help taped to a wall or refrigerator [2]. Additionally, families tend to express aspects of themselves in how they design their displays.

Unsurprisingly, designers must take different guidelines into account when designing for children than they might when designing for adults. For example, it is important that children feel in control when using technology [3]. They become disinterested when a new technology limits their options for interactions, and they prefer to have the ability to explore the technology the way they want to. They also prefer technology that provides opportunities for social interaction. Children do not "create in isolation," they want to share and use technologies with others [3]. Children are inclined to tell stories about what they create, and they want technology to capture those stories. They enjoy expressing themselves through varied media, including through sound, visuals, movement, and appearance. Technology designed for them should enable multiple forms of expression, again taking care to avoid limiting children in their creative efforts [3]. Additionally, children find interface elements more intuitive when the elements' icons or images mapped closely to their function, so icons that work well in technology designed for adults might be poor choices for children [4, 5].

Family	Composition	Location & Interview Type
1	1 parent (P1), 2 children	home; CI
2	1 parent (P2), 2 children	home; CI
3	1 parent (P3)	coffeeshop, open
4	1 parent (P4)	coffeeshop, open
5	1 parent (P5), 3 children	home; CI

Table 1. Phase 1 research participants, location, and interview type. CI=Contextual Interview, Open=Open Interview.

Figure 3. Art stored in a broken laundry basket.

Figure 3. Art displayed on a closet door.

Figure 3. Art displayed on the side of a fridge.

Initial Research: Methods and Results

For our initial research we conducted contextual, in-home interviews and open interviews. We recruited five two-parent households via neighborhood mailing lists, local schools, and word of mouth. Table 1 details which family members were interviewed and which method we used with each family.

We used an affinity diagram to analyze the interview results. It quickly became apparent that ease of use and low cost were the biggest factors in parents' current choices for storage and display. Parents often re-purpose existing containers for storage, as seen in Fig. 1. Since children, especially younger children still in daycare or preschool, tend to produce an enormous quantity of art, storage methods are often not organized.

For display, families often use whatever space is available, and displays are constrained by that space. P4 uses closet doors (Fig. 2), while P3 uses picture frames, cycling pictures through as her children create new art. P1 wanted to display her sons' artwork on the refrigerator, but only its side is magnetic (see Figure 3). P4 also noted that even though she wants to display all of her son's art, "there's just not room for all of it." Primary artwork displays are located in central, family locations, but art is also displayed at work or in bedrooms. P3 chose to display art in locations all over the house "because it makes them [her children] feel proud."

Parents are the primary curators of the art displays; they are the ones who choose what gets displayed and what is stored, though children have some input. Parents' favorite pieces of art tend to be those that reflect a child's growing abilities and creativity. One of P2's favorite pieces of art is a drawing her daughter did of some stars, "because you can tell what it [the picture] is." She also really likes a strawberry picture her son did, because it has good colors and was "one of his first pieces." Similarly, P1 noted that she prefers "to keep things he's done on his own . . . It's nice to see his creativity now that he's starting to get some." Children are most proud when they do something new. In addition, some children reported feeling proud when their art is on display, others were less attached to the idea of display, but were nevertheless reluctant to throw anything away. P1 described a "meltdown" her older son had when he discovered some old art in the recycling bin. Her younger son got upset when it became apparent that the piece he was showing us was falling apart.

Personas and Scenario

We found three main divisions among our potential users: tech-savvy vs. non-tech-savvy users, younger vs. older child users, and parent vs. child users. We chose to overlap these where possible and created four personas: a tech-savvy parent; a tech-savvy, older child; a non-tech-savvy parent; and a younger child. We determined that the younger child would have some technical ability, but would probably need a parent's help for some interaction. We chose to create two child personas because of the different ways older and younger children view art. That is to say, younger children often have stories or detailed descriptions to share about their art, whereas older children tend to think their art speaks for itself, and are less inclined to describe it to others. We created parent personas because, as curators, parents interact with art and its display differently, and we drew a distinction between

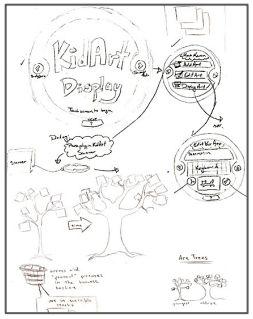

Figure 6. Early paper prototypes.

Figure 6. Top, hologram plate; bottom, tree.

Figure 6. First physical prototype.

tech-savvy and non-tech-savvy parents because research indicated those subgroups had different design needs. We created four primary scenarios to represent the main interactions we anticipated: a child adding new art, a parent adding new art, a child reflecting on old art, and a parent/family reflecting on old art.

Prototyping and System Description

We began our design work with paper prototypes (Fig. 4), and rapidly created several different designs. We chose two to refine: a 3D hologram projection plate that displayed either single pieces of art or randomized slideshows of different art pieces; and an art "tree" that displayed artwork as leaves, and the growth of which reflect the child's own growth (Fig. 5, top and bottom, respectively). Both display options would be paired with a combined scanner and drawing tablet for easy input and optional recording of the drawing process. Both displays allowed users to "play" a digital picture recorded with the tablet, and to record audio or text comments about any picture. We presented these refined prototypes to our class for feedback, and ultimately chose to combine their best elements. We designed a 3-D, projected holographic "tree" that retained the ideas of artwork "leaves" and growing with the child, but also incorporated ideas of randomization and slideshows from the 3D projection plate. The menu from the plate display became a "pond" menu, as we conceived of the new display as a kind of bonsai-style tree for a coffee table or shelf. We used this prototype (Fig. 6) for our usability testing.

The final system design consists of two parts: the combined scanner and tablet device for input (Fig. 7) and the tree display (Fig. 8). Users complete most interactions with the tree using gestures in a fashion similar to those of MIT's SixthSense project [6], so that "touching" part of the tree is like interacting with an actual, tangible interface. Ideally, "touching" the tree would provide haptic feedback, so that the user feels they are actually touching the tree. Some interactions, such as randomizing the tree's display, or selecting images of a specific theme for the tree, are carried out using the pond menu.

To add art to the tree, a user has two options: they can scan existing artwork or draw a picture digitally using the tablet. Either way, the art is automatically added to the tree. Once art has been added to the display, the user can tap the new "leaf" to add comments (e.g., "I love this picture!") or information (e.g., "This is a picture that Susie drew when she was 5."), as shown in Figure 10. These annotations can be typed in using the device's built-in keyboard, or recorded using the built-in microphone. Such annotations can also be added to older art on the tree.

Users can "grab" art to remove it from the tree if they do not want to display it anymore. The art remains in the system unless explicitly deleted through the pond menu. Art can also be restored to the display through the menu. If they want to see more detail than the tree allows, users can also use the pond menu to select single pieces of art for display, or they can choose a selection of pieces to display as a slideshow or collage.

The whole display device can be turned off for transport. When it is off and the tree is not being projected, the device is not much bigger than a laptop, so it can easily be taken on visits to extended family and friends.

Figure 8. Scanner and drawing tablet device.

Figure 8. The final tree, with close-ups of buttons and pond menu.

Usability Testing

We recruited four two-parent households for usability testing. All tests were conducted in families' homes. We were able to recruit two families that had participated in our initial research, and found two other families via word of mouth (see Table 2 for clarification of how participants overlapped). Studies were conducted with a minimum of two facilitators, one leading the test and the other Wizard-of-Oz'ing the prototype. Since holographic devices are not within the price range of the average family, participants were asked to imagine themselves in the same family situation and home, but 10-15 years in the future, at a time when this technology might be more feasible. We conducted our testing using the think-aloud protocol, and followed testing with a short debrief and reflection for more detailed feedback. Users were given three key tasks: they were asked to find and view an old piece of art; to add comments to that piece of art; and to remove another piece of art from the tree. We were able to acquire a piece of art in advance from all but one of the families (and thus, to construct necessary pieces of our prototype), so they were also asked to add those pieces of art to tree.

Prototype Problems

Because we chose to base our design in future technology, we ran into several problems constructing our prototype, and later, in testing. There is not a simple way to simulate a hologram. We conducted a pilot study with four users in which we initially tried using Microsoft PowerPoint to simulate our design, but quickly ran into problems. Users had trouble making the leap of imagination required from screen to hologram. We abandoned that design and constructed an actual, 3-dimensional tree to stand in for our device. Some functionality, such as that of the pond menu, was still simulated using PowerPoint, but most interaction was done using the tree and several paper "screens" created to stand in for holographic projection. This new prototype was easier for users to visualize, but some, particularly the younger children and less tech-savvy adult users, still had trouble imagining it as a hologram. This was the most significant challenge we faced during the design process.

Family	Initial Research	Usability Testing
1	1 parent, 2 children	2 parents, 2 children
2	1 parent, 2 children	
3	1 parent	
4	1 parent	2 parents, 1 child
5	1 parent, 3 children	
6		2 parents, 2 children
7		2 parents, 1 child

Table 2. A table depicting the overlap between initial research participants and usability study participants.

Discussion and Conclusion

Results from testing were mixed: families loved the device, but using it was not as intuitive as we had thought it would be. Children got very excited when their artwork "appeared" on the tree, and were proud to point it out to their parents. One even wanted to keep the tree, and was enthusiastic when his mother promised they would make a similar tree the next time they did crafts. Children also liked it when they got to record things about their art, and when their parents wrote comments about their art. Children had no trouble figuring out how to add art to the tree. Parents

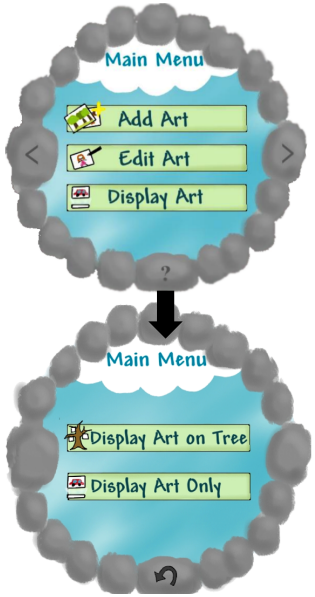

Figure 9. Changes made from usability testing version of the pond menu to the final version.

Figure 10. The updated annotation window.

were most interested in the ability to automatically redo the display, especially according to themes or events.

Almost all difficulties users had in testing the device centered on the pond menu. Users got confused once they'd navigated away from the tree and could not figure out how use the menu to return to that initial view, so we added a permanent "home" button (buttons shown in Fig. 8). Additionally, some functions we had initially included in the pond menu were redundant and confusing, so we simplified the menu options (Fig. 9) so that they were limited to customizing the tree's display. The most significant result from user studies was that we discovered we had failed to design a way for users edit artwork annotations. We'd included the "tapping" gesture to view the piece, but no way to begin adding information or comments, and we had to significantly redesign this feature. The new annotations window with options to add comments is shown in Figure 10. Without usability testing, we would have left out the most important aspect of our design, demonstrating how crucial user-centered techniques are as design moves forward.

Our solution, while technologically out of reach at present---though perhaps not as far away as we thought at the start of this project, see [7]---demonstrates one possible way to reduce the stress of not knowing what to do with children's artwork. It enables families to take advantage of the opportunity to enrich their lives and homes with the expressions of their children, in a way that is convenient and beautiful.

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