

Intergenerational Making with Young Children

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ABSTRACT

As the Maker Movement has continued to expand, there has been a complementary expansion in the spaces and contexts for engaging in Making. Most pertinent to this paper is the growing body of research on intergenerational making experiences. A hallmark of intergenerational making is its ability to promote both play and collaboration as participants learn from one another. However, the prevailing work on intergenerational making seldom includes children less than seven years old. We build on this body of work by designing and studying an intergenerational making experiences where most of the children were between 2 and 7 years old. Five parents and their family members (ages 2-10) participated in a one-week program on designing games using digital fabrication and household craft materials. Consistent with prior work, and building on designs for intergenerational making experiences, we discuss several interactions that highlight play, joint creation, and connectedness. We consider the benefits and challenges of these types of interactions and present suggestions on the design of intergenerational making experiences that include young children.

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CCS CONCEPTS

• Applied computing-Education-Collaborative learning •
Applied computing-Education-Interactive learning
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1 Introduction

Intergenerational making experiences with families provide an important way for adults and children to come together as co-designers and co-learners. Family communities hold culturally situated knowledge, skills, and experiences [1,2,3] that surface generative making practices that are meaningful and relevant to participants. These practices help build connections and provide a context for shared memories and face-to-face interactions in a world that is increasingly inundated with personal screens. Intergenerational making experiences also allow for family members to see each other and themselves in a new light, through accomplishing things together they may not have thought were possible individually [4]. Despite the growing interest in intergenerational making, many programs tend to cater to kids that are in elementary and middle school. While operating within a constrained set of ages certainly has its affordances, this practice may be overlooking an opportunity to design making experiences that include the meaningful participation of people of all ages. Hence, in this paper we describe an intergenerational making experience that surfaced unique design considerations to support young children. We present an overview of the design and consider the emergent patterns of interaction that took place among the different facilitators and participants. The analysis is guided by the question: what types of meaningful interactions take place among participants within an intergenerational making experience for families with young children? Within this question, we investigate some of the observed affordances and challenges that surfaced and propose a set of design considerations that may be beneficial to other researchers, designers, and practitioners. In the sections to follow, we highlight pertinent prior literature, describe the intergenerational making program, and then transition to the results, discussion, and implications of this work.

2 Prior Literature

Intergenerational making is a vibrant and growing body of research that builds on a strong foundation in Constructionism and “home-style” learning, a principle coined by Papert [6] that emphasizes the experiential and explorative nature of learning for children ages 3 and under [5,6]. Other work that features families in a making context is the Family Creative Learning (FCL) project [4,7,8,9]. The FCL project brings together adults and children (ages 7-12) to design games and experiences using Makey Makey and Scratch. The program emphasizes building community and knowledge through a sequence of activities that include eating, meeting, making and sharing. Roque’s work on FCL informed our initial thinking around tools, activities, facilitation and the environment [7,8]. Where we differentiate from FCL is inviting and seeking to support a broader range of ages and the tools that are utilized. We do not use the Makey Makey or Scratch, and include traditional arts and crafts materials alongside the technological fabrication tools, to include forms of making that are more age-appropriate and engaging for very young children. Additionally, in our prior work we have noted how facilitation practices affect the experiences for all participants and build on this in relation to young children in this paper [11]. Finally, we draw on a framing to consider the complex interactions within intergenerational spaces, which mirrors Siyahhan, Barab & Downton’s [10] application of activity theory to their analysis of Family Quest, an intergenerational gaming experience. Siyahhan, Barab & Downton [10] consider additional factors that speak to the division of labor and rules that impact the child-adult experience in intergenerational settings. While we do not formally apply activity theory to our analysis of participant interactions in the space, we consider some of the dimensions as reflected in the design implications at the conclusion of this paper.

3 Program Design

3.1 Motivation

The most recent iteration of this program is the result of ongoing collaborations between the research team and teachers at local schools. Specifically, the research team introduces and supports the implementation of maker tools and activities in classrooms and afterschool spaces within the surrounding community. In spring of 2019, while attending a student showcase, the research team principal investigator was approached by a middle school media arts teacher who was interested in developing her skills and techniques with laser cutting, but felt limited in her ability to fully commit to a summer workshop. Her hesitation was due, in large part, to her responsibility as the primary caregiver for her children during the summer months. The resulting program was designed to address a two-fold need: professional development that offered training for digital fabrication equipment for novices and a space that provided fun and meaningful engagement with immediate and extended family. The focus of this paper is on the latter; we consider the possibility for an intergenerational making

experience to surface generative practices that fully include three young children. Another aim, addressed in a complementary manuscript (authors, under review), examines the ways that this program both aligns with and advances models of effective professional development.

3.2 Design Provocation

The overarching theme of the program centered around playing and designing games. Families were prompted to create a personalized game that follows a given set of rules. We provided game mechanics for two games. The first was a basic card or item-matching game, where players either compete or work collaboratively. The second was a balancing game, where players attempt to balance an object on a structure that resembles a tree. Participants were also invited to borrow game mechanics from any of the games that were available in the Makerspace, which includes an assortment of more than 30 games of various age ranges. The research team created example games utilizing the provided game mechanics and available fabrication tools to help make concrete what is possible with the tools. The option to personalize an existing game ensured adequate time for families to think about how they wanted to design and make the game, rather than having to extensively focus on how the game is played. The program took place over one week in the summer of 2019. It was planned as three days of structured activities, and two days that were open for participants to come in and work on their projects if they so desired. The three structured days took place on Monday, Wednesday and Friday; Tuesday and Thursday of that week were optional days, during which participants received activities and materials to complete at-home. Optional days were meant to enable families to participate in other activities and accommodate children that might necessitate a home day after engaging with several strangers

3.3 Schedule

At a high-level, Monday centered around playing, brainstorming and a chance to practice laser cutting. At the conclusion of the Monday session, each family received a laser cut game box to hold their game pieces. Wednesday began with sharing and reflecting, and involved extended periods for making using the available tools. Participants were given 3D printing pens and filament to use at home during their optional day. Friday rounded out the week and featured time to finish up the games and play them with other participants. Each day included discussions and reflection.

3.4 Introducing Digital Tools

One objective of the program was to introduce participants to different digital fabrication technology. We introduced three primary digital tools during this workshop: a laser cutter, vinyl cutter, and 3D printing pens. For each digital fabrication tool, a research team member showed examples of what can be made with it. They also provided an overview of how the tool works. Across all of the tools, we heavily scaffolded the process through

templates and instructional walkthroughs, before having family members work individually or in groups.

4 Methods

4.1 Participants

This study involved five adults (all K-8 teachers) and several of their family members. The middle school media arts teacher who approached the research team was the first participant to agree to the program. Through our work with a librarian at one of the elementary schools, four other teachers were identified and invited to attend this workshop. These teachers were nominated by the librarian, or by someone that the librarian nominated. Importantly, not all of the adults had children. One adult attended the program with her niece and nephew, while yet another came without any family members. In total, there were five women and seven kids with ages ranging from 2-10 years. Partners were invited to attend, however none were able to. All participant names in this paper are pseudonyms to protect their identity.

While all participant adults are teachers, in this paper we highlight how their role as parents and caring adults is important in the making experience. All adult participants from this study are part of a localized network of teachers, which is in support of research goals to establish a self-sustaining community of teachers able to implement making in classrooms. Table 1 specifies families.

Table 1: Participant Families by Caring Adult

Caring Adult	Child 1	Child 2
Natalie	Sophia (6)	Zion (3)
Maddy	Lynette (2)	-
Candace	-	-
Tanya	Gus (10)	Brooklyn (10)
Samantha	Joshua (7)	Antonio (3)

4.2 Location

The program was hosted in a university Makerspace that includes many crafting materials, and digital fabrication technologies. The space includes adjustable tables and chairs, and has been painted in bright colors as to differentiate the space from a traditional university laboratory. Many of the machines available in the university Makerspace are also available in the local schools, community centers, and Makerspaces.

4.3 Data Collection

4.3.1 Videos and Fieldnotes. During each 3-hour session, we recorded video from three perspectives to capture the span of activities in the room. In addition, facilitators wrote down

observations to be used for the construction of field notes and to be discussed during daily debriefs.

4.3.2 Interviews. Within the two weeks following the workshop, we conducted interviews with the adult participants to inquire about their needs and interest in receiving on-going support. All adults completed the surveys and four of five completed interviews.

4.3.3 Coding. Here, we outline the higher-level categories of interactions which we identified based on two rounds of open coding of the video data. During the first round, research team members documented all interactions from each camera angle, paying attention to moments documented as potentially important in the field notes. Some of the initial interaction categories include checking in on kids, brainstorming, sharing what was made with others, comparing experiences, non-verbal signaling, and observing others. The team then met to identify themes in the interactions, and patterns of engagement in the space as related to families engaging in making practices together. We noticed that many of these interactions signaled unique aspects of having an intergenerational space, such as the play and facilitation that occurred between and across families. Additionally, interviews with the parent-educators provided perspective on how they and their family members experienced the space, which deepened the research team's understanding of the interactions. Looking closely at the data a second time, the next round of video review surfaced evidence and counterevidence of the themes that emerged from the first-round interviews. In what follows, we present a set of interactions from the refined subset of codes that align with our interest in the types of interactions that emerge in an intergenerational making experience with young children.

5 Analysis

This analysis focuses on three key interactions that emerged during the program and highlights the challenges and affordances of intergenerational making for adults and their families: playful, joint creation, and connectedness.

5.1 Playful: Supporting Participant Comfort and a Willingness to Fail

Participants laughed, smiled, and played games within and across families. We suggest that playful interactions contributed to the inferred sense that the activities in the program were low-stakes, and aimed at helping participants learn rather than be evaluated. This was an important consideration given the newness of the technological tools to most of the adults. For example, one teacher commented that the lower stakes implied less judgment or pressure when making mistakes. She shared: "I liked the trial and error aspect of that in the small setting with your family 'cause if [it] messes up you're with your family and it's your family so who cares. Before, you have a room full of 25 children staring at you". Hence, it is not simply that having kids around that makes a space less intimidating, it is more so that having family members

present made being vulnerable less of a concern. Playful movement was another affordance of the space and was useful when an adult could not immediately attend to a younger child's requests. For example, Lynette (age two) played a game accompanied by another family's seven-year-old, Joseph. When Lynette's interest waned, she began to signal to her mom, which Joseph deftly responded to by initiating a new competition in the game. This was a successful move to keep Lynette engaged. The format of the program allowed for the two children to play and learn together and theirs was a relationship that continued throughout the program as evidenced by Joseph creating an 3D-pen-printed object for Lynette. Finally, play was a mechanism used for growing positive interactions between young children and the facilitators. Across all three sessions, facilitators and children could be seen playing different board games with one another. In many cases, the facilitators and children would choose a game from the game cart, sit on the floor together, and engage in silly modifications to the game. These moments served as an important way for the children and facilitators to connect, while also offering parents a chance to engage with other adults, or work with one of their other children. However, the elements of play introduced some notable challenges. In particular, it was hard for children to delineate when it was appropriate to play, and when participants wanted to focus on the design of their game. In the follow-up interviews and surveys, some parents suggested having more clearly indicated moments for play and moments for discussion and instruction. One adult talked about her concern with how her child was being extremely playful during a discussion portion, saying "at that moment I felt like he was taking more away from the space, [than he was contributing]." This points to the suggestions from parents to develop designated space for play, or include frequent movement breaks. These are two suggestions that we will incorporate in future sessions.

5.2 Joint Creation

We characterize moments of joint creation as being times where kids and parents contribute ideas and have them taken up or negotiated in the process of creating their games. As this plays out, everyone is treated as a contributor to the experience. However, incorporating multiple ideas, abilities, and rules is challenging, especially when the parents had more than one child with them. During our laser cutting activity, Sophia and her mom, Natalie, decided to draw the Eiffel tower. To do this, Natalie collected the materials they needed and sketched the Eiffel tower in pencil based on a photograph that she googled on her phone. She then handed the drawing to Sophia to begin filling in parts of it. Sophia then proceeds to very intently fill in the sketch. This simple interaction signals both parties' willingness and interest to participate. The Eiffel tower idea was offered by Sophia but executed through a conversation and collaboration with her mother. The result was a co-designed project that belonged both to Sophia and her mother. This was further exemplified when Sophia's mother suggested that Sophia use a ruler; she wanted to ensure that the product being developed was aesthetically

pleasing. The weight of this interaction is seen in the follow-up discussion with Natalie, who notes that the chance to co-design with her daughter is something that she truly cherishes, but that is becoming increasingly difficult to do as her daughter gets older. For other families, the joint creation process involved parents and children collaboratively considering the limitations of the tools they were trying to use. For example, in the second session, Maddy and her daughter Lynette used the vinyl cutter. While they decided on using a gummy bear image for their game, Maddy repeatedly asked Lynette "Do you like this one?". Maddy noted that the chosen image would not look "cute" when drawn using the vinyl cutter. She switched the image and explained to Lynette why the gummy bear didn't work, and they decided to draw a banana. Here, we see an example of joint creation where parent and child balanced the interests and ideas of each family member. This was an opportunity for Maddy to experience what the limitations are of the technology, but it also impacted the vision that her family had aimed to create.

5.3 Connectedness

We identify connected moments as being interactions mediated by the materials and tools that occurred across spaces. Between the makerspace and home, participants had many opportunities to make and think through material utility in and outside of classroom settings. This was accomplished by assigning take home activities, so that participants could continue working on their projects. One of the educators in the program mentioned they "wish we could take it [the 3D pen] home and think". This highlights how many of the digital fabrication tools were seen for exclusive use in lab or school setting, rather than being accessible and transportable home. Additionally, as an object to think with [1], the material conditions of the 3D printing pen generated opportunities for additional ideation and creation. We adjusted this take home activity to include the 3D printing pen and support parent-educators in finding relevance for their classroom settings. This sets up opportunities for making to happen at home, because a precedent for engaging in this sort of activity as a family is established in the lab space. While brainstorming with Natalie, she asked her daughters "What would Daddy like to play with you guys?". This was a move on her part to include the entire family in the consideration of the project, not just those who were present. It also signals her interest in making something they will actually use in the future once the program is over. When Tanya's family went home, she recorded videos of her family members, Gus and Brooklyn, working with the 3D printing pens at home, and shared them with facilitators when they returned to the lab space. She highlighted how her whole family was excited about the technology and was curious as to what else they could create. This was further extended with the requests for her niece Brooklyn to make artifacts for other family members. She created artifacts that included her extended family: name tags that they could proudly display at work. In these ways we see this experience as facilitating connections between home and the makerspace. Moreover, it establishes a precedent for involving

family members that may not be present, extending the space itself and anticipated opportunities for future engagement with the making technologies and experiences.

6 Discussion

Based on prior work with families and educators in formal and informal learning spaces, the research team designed a week-long professional development program that centered all participants in a making activity. Through our analysis of participant interactions, the research team found that the families enacted important interactions to negotiate their making with each other and shape a meaningful making experience. These types of interactions map onto prior work on intergenerational making, and include playfulness, joint creation and connectedness. Playfulness was embedded in the design of the program through the use of games to help families generate ideas and have fun. However, feedback from exit interviews suggest that future iterations of the program should consider formats that are conducive to substantial discussion. Thus, while playfulness supported engagement of all participants, it hindered the extent to which discussions spurred useful and deeper insights for the educators. The ability for families to incorporate their existing knowledge, skills, and experiences into their projects, and to continue engagement with making outside of the makerspace, was a design implication we term connectedness. Moments of connectedness aimed to challenge notions of accessibility to tools, ideas, and practices in a makerspace as well as notions around what counts as making. Participants were given take-home kits with materials and tools they could use to continue making outside of the makerspace. However, the contents of take-home kits presented constraints for participants that lacked access to certain tools at home. Neither did the kits account for ideas that would be generated, requiring unforeseen access to tools or materials that were not included. Joint creation provided opportunities for guardians and children to contribute equally to the making activity through learning to use various tools in the space. It also surfaced opportunities for participants to negotiate design decisions and the use of different tools and materials. For educators, working alongside children allowed them to see the limitations of these tools, and how it might unfold in the classroom.

7 Implications

Concretely, we suggest that individuals intending to support intergenerational making with younger children should consider the following design suggestions.

7.1 Variable and Accessible Media and Technological Tools

Given the broad range of ages, it is beneficial to provide variable and accessible media and technological tools. One way that this is realized is through the physical layout of the space and in the

selection of the tools. In the case of our workshop, Play-doh and childrens' games on a physically accessible cart served as focal components of the experience. Furthermore, selecting a laser cutter that facilitated the process of laser cutting a hand-drawn picture provided a meaningful space for parent-child collaboration. Beyond this, however, the interactions related to connectedness remind us of the need to think about ways that families may continue to engage with making activities outside of the laboratory space. In order for the experiences to continue, and for participants to incorporate making as an ongoing, at home activity, there is a need to ensure that they have ready access to the necessary resources. This could be achieved through local community centers, but is even better when the materials are themselves recycled, or, can be readily acquired at a local craft or retail store.

7.2 Renegotiating Rules

The playfulness code speaks to the need and challenges to renegotiate the rules of the space. The rules, norms and expectations are something that should be discussed and co-designed with participants. However, in the case of young children, these norms will be misunderstood, ignored, or, at times, be entirely unreasonable. These moments, however, can serve as an opportunity for adults and facilitators in the space to rekindle some of the excitement and playfulness of their youth. An example of this from our workshop was the tendency for young children to find any open space on the floor and start playing a game, or building something with Play-doh, also while seated directly on the floor. While this may disrupt typically adult sensibilities about maintaining passable aisles, and getting Play-doh stuck to the ground, our research facilitators validated this move by joining the child on the floor, and contributing to the mess. In this way, the use of space became a negotiated practice.

7.3 Role Fluidity

Finally, from the code of joint creation, comes a design consideration around facilitation. This code connects with role fluidity, both in terms of recognizing the ebb and flow of activity, but also in terms of parents, facilitators and children and serving as joint creators of the workshop experience. Facilitators need to be cognizant of the fluidity of roles that parents might be playing, in shifting between leading and supporting their children. Effective facilitation with young children at times meant stepping in or stepping back depending on student actions, or, sitting on the floor and playing peek-a-boo with a child who sought distraction. At other times, it meant sitting down with a child whose parent had to briefly step away to work with one of their other children. Within these different scenarios the facilitators take cues from parents and children around what is needed in the moment, and also engage with parents about how to structure the experience for them and their families. Hence, the experience as a whole is a joint creation or activity system.

8 Conclusion

Intergenerational making presents an exciting and productive space for engaging families in meaningful experiences designing and inventing. Traditionally, intergenerational making programs have focused on designing for elementary and middle school students. The current paper argues that inclusion of children ages 2-7 years old can still maintain many of the core benefits of intergenerational making experiences. Notably, the interactions that emerged surfaced instances of playfulness, connectedness and joint creation. The implications for further research attend to the ways that making with young children is unique within broader making experiences. We identify three design considerations that would benefit all members of the making experience in these cases: using accessible and media and technological tools, renegotiating the rules of the space, and assuming highly fluid roles across time. Ultimately, each interaction afforded opportunities for engagement and meaningful making with families, and at the same time, surfaced unique challenges of space, access, and long-term sustainability around making.

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REFERENCES

- [1] F. Barajas-López, & Megan Bang. 2018. Indigenous Making and Sharing: Claywork in an Indigenous STEAM Program. *Equity & Excellence in Education*, 51(1), 7-20. doi:10.1080/10665684.2018.1437847 8
- [2] Ananda Marin & Megan Bang. 2018. "Look it, this is how you know:" Family forest walks as a context for knowledge-building about the natural world. *Cognition and Instruction*, 36(2), 89-118.
- [3] Megan Bang, Lori Faber, Jasmine Gurneau, Ananda Marin & Cynthia Soto. 2015. Community-Based Design Research: Learning Across Generations and Strategic Transformations of Institutional Relations Toward Axiological Innovations, Mind, Culture, and Activity, DOI: 10.1080/10749039.2015.1087572
- [4] Ricarose Roque, Karina Lin, and Richard Liuzzi. 2016. "I'm Not Just a Mom": Parents Developing Multiple Roles in Creative Computing. Retrieved September 19, 2019 from <https://repository.isls.org/handle/1/177>
- [5] Seymour Papert. 1980. *Mindstorms: Children, Computers, and Powerful Ideas*. Basic Books, Inc., New York, NY, USA.
- [6] Seymour Papert. 1996. *The connected family : Bridging the digital generation gap*. Atlanta, Ga.: Longstreet Press.
- [7] Ricarose Roque. 2016. Family Creative Learning. In Pepler, K., Kafai, Y., & Halverson, E. (Eds.) *Makeology in K-12, Higher, and Informal Education*. New York, NY: Routledge.
- [8] Ricarose Roque & R. Jain. 2018. Becoming facilitators of creative computing in out-of-school settings. *Proceedings of the 13th International Conference of the Learning Sciences*. London.
- [9] Ricarose Rose & Melissa Braaten. 2019. Designing and Researching a Program for Preparing Teachers as Facilitators of Computational Making Activities in Classroom and Informal Learning Environments
- [10] Sinem Siyahhan, Sasha Barab, & Michael P. Downton. 2010. Using activity theory to understand intergenerational play : The case of Family Quest. In: *International Journal of Computer-Supported Collaborative Learning*, Vol. 5, No. 4, 12.2010, p. 415-432.
- [11] Stephanie T. Jones, Melissa Perez, Sarah P. Lee, Kira Furuichi, and Marcelo Worsley. 2019. *Facilitation in an Intergenerational Making Activity: How Facilitative Moves Shift Across Traditional and Digital Fabrication*. In *Proceedings of IDC Boise conference (IDC'19)*. ACM, Boise, ID, USA, 6 pages.