

The Stamp Plate and the Kicking Chair: Playful Productivity for Mealtime in Preschools

Ying-Yu Chen¹, Kelda Baljon, Bonnie Tran, Daniela K. Rosner¹, Alexis Hiniker²

1. Human Centered Design and Engineering, University of Washington

2. The Information School, University of Washington

Seattle, WA, USA

{yingyuc, kbaljon, bonnielt, dkrosner, alexisr}@uw.edu

ABSTRACT

Most technology designed for young children at mealtime centers around conceptions of how the child should eat or behave at the table. Expanding this view to include children’s perspectives, we present a two-part study to explore the design of technology for mealtimes in preschools. We first worked to identify existing value tensions through interviews and observations, then designed three prototypes to address different value tensions (e.g., the tension between children’s interest in experimenting with food versus the teachers’ interest in cleanliness). Although there are specific ways adults’ and children’s values are in conflict, our work suggests the potential for novel designs to provide creative and meaningful experiences such as playful productivity that support the needs of both parties.

Author Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous;

ACM Classification Keywords

Child-computer interaction; preschool; meals; value tensions

INTRODUCTION

Meals are a necessary part of any full-day preschool program; teachers and administrators must plan and facilitate meals, and children must engage as active participants. The overt purpose of any meal is to provide nourishment, but meals also serve to socialize children in the practices and values of their community [24]. Meals offer opportunities to bond and socialize [4], and across cultures, sharing meals is seen as a sign of friendship [6]. Prior work has shown that meals are important social and learning experiences in schools in particular [1,2,4].

Prior work has shown that technology designed for this context can shape children’s behaviors and attitudes toward

food, and it can play a role in defining their mealtime experience. For example, persuasive apps [16] and augmented reality applications [10] have each been shown to be an effective medium for reducing picky eating habits. To date, the majority of the work in this design space has explored how technology might nudge children toward pre-defined societal norms, such as adopting healthy eating habits, understanding nutrition, trying more foods, or eating larger portions (e.g., [17,19]).

The goals of this project were, first, to explore the design space of supporting classroom meals through technology, and second, to do so in a way that elevates children’s perspectives and values in addition to considering those of adults. Some prior work suggests that imposing adults’ attitudes on children can have a negative impact on children’s eating habits, for example, diminishing their ability to self-regulate and listen to their own hunger and satiation cues [25]. And a large body of work in child-computer interaction has shown that moving beyond the conceptualization of the all-knowing adult and including children’s perspectives on the designs is a valuable means of creating technologies that best serve their needs [38].

Thus, we conducted a two-part project to explore the design of technology for mealtimes in preschools that incorporates both teachers’ and children’s perspectives. We did so using the lens of *value tensions* [23], the conflict that occurs “when supporting one value in a technology challenges another value” [7] in order to surface insights that may not have been captured by prior work with an adult-centric viewpoint. After Houston, et al. [13], we define values as the “the myriad ways in which social and ethical concerns may be built into and out of artifacts, systems, and infrastructures through the process of design.” We examined the values held by children and the values held by teachers related to meals at school, and we explicitly looked for tensions or conflicts between these. We then explored how we might design tools that are sensitive to both teachers’ and children’s needs and sought to help resolve inherent tensions in their perspectives.

Thus, this project involved two phases:

- 1) Interviews and observations at preschools to understand existing practices and identify value tensions

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- 2) User-centered design exercises to design and implement prototypes to address three value tensions we identified in our observations

As a result, we created three prototypes, which we called the cat fork, the kicking chair, and the stamp plate. Each was designed to address a different value tension identified through our observations and interviews. The cat fork was intended to support children's autonomy while also encouraging children to use utensils. The kicking chair was designed to provide children with fun and playful feedback as they wiggled at their seats, thus urging them to stay at the table while eating. Finally, the stamp plate was designed to account for children's sensory needs while simultaneously encouraging them to keep their food on their plate to reduce the mess they created while eating.

RELATED WORK

Designing for Children and Meals

A number of prior studies have explored the design of technologies for children's meals. This work has focused on designing tools to facilitate healthy habits, such as apps and games to reduce picky eating habits [10], help children distinguish healthy foods from unhealthy ones [20], or foster awareness and self-reflection about healthy eating [27]. Similarly, EducaTableware is a pressure-sensing fork-and-cup set designed to persuade children to eat healthy food [17], and Healthy Spoon and Healthy Cradle are part of a smart flatware set to incentivize children to eat vegetables [15]. Other work has leveraged user-centered design practices to create smart objects for meals that support children with developmental disabilities who struggle to use traditional utensils [9]. These studies and others demonstrate that technology can play a valuable role in children mealtime experiences.

Many of these studies have explicitly designed to facilitate playfulness and make the user experience enjoyable for children. Here, we build on this prior work to encouraging healthy eating habits (a worthwhile undertaking on its own) but also by treating children's interests and values as a design goals in their own right. We particularly wanted to understand whether there are underexplored design opportunities in this context that might become clearer by valuing children's goals as equal to those of adults.

Meals in Preschool Classrooms

A number of studies have examined meals and meal-related interventions in preschool with regard to their nutritional value. Prior research has found that food-insecure children have trouble performing well in school [33], suggesting that it is important to ensure that children are well-fed in the classroom. Other research has examined the social characteristics of classroom meals, for example, demonstrating that meals provide children and teachers with the opportunity to engage in extended conversations [4], and that the quality and quantity of teacher-child interactions are greater during

meals than during other semi-structured classroom activities [2].

Although we are not aware of any prior research to design digital technology for this setting, several studies have examined the design of the classroom environment for its impact on meals. For example, Snack Talk cards—pictorial flash cards with child-preferred topics—have been shown to increase social conversation during meals in inclusive preschool classrooms [12]. Other work has shown that the design of mealtime structure can influence children's behaviors and interactions. For example, serving food family style can increase the incidence of preschoolers' meaningful participation in social aspects of the meal [11].

Other work has examined the design of digital technology for activities in preschool classrooms that are unrelated to meals or eating. A number of apps have been designed to teach preschool math concepts in classrooms [36]. Westlund and colleagues found that robots in the classroom can increase inclusion and provide opportunities for social learning that teachers are excited about [18], and in a long-term classroom deployment in preschools, Sylla demonstrated the Touch-Organize-Create system can scaffold the development of literacy skills [31].

Together, this body of work suggests that: 1) meals are an important part of the preschool experience, 2) the design of mealtime structures, activities, and tools can shape children's and teachers' experiences during the meal and the value they derive from it, and 3) thoughtfully designed digital experiences can play a positive role in classrooms. Here, we combine these related strands of research to explore design opportunities for classroom meals.

Value Tensions

Value tensions refer to instances in which two important values are in conflict in a given situation [7]. A number of studies have examined such conflicts as a part of the design process. Yassae and Winter identified a number of value tensions in the design of health-surveillance technologies for the workplace, such as the conflict between privacy and well-being and the conflict between work and leisure [35]. Miller and colleagues examined conflicts related to privacy and reputation in a groupware system and demonstrated that value-sensitive design practices can successfully address these tensions [22].

Many prior studies have shown that examining value tensions can be a productive framing for contexts that involve children and the adults who support them. Existing research has identified tensions between academic success and personal fulfillment [34], children's autonomy and online risk [5], the need for play and the need for safety [21], among others. Given that the purpose of this project was to better understand and design for children's values while continuing to support the values of teachers, we built on this prior work by examining value tensions in the context of preschool meals.

METHODS

Part 1: Identifying Value Tensions

First, we conducted eight interviews with preschool teachers from two different preschools about their values at mealtimes and the routines they perform. We also observed 23 meals (including lunch, morning and afternoon snacks) at those two preschools with classes of about 10-20 students. Either one or two researchers went to each meal and conducted ethnographic observations by jotting notes about children's and teachers' motions, interactions, emotions, styles of eating, and speech on paper or a laptop, and later transcribing these into field notes. The two schools represented two different philosophies and social demographics; the first is a university Montessori preschool and the second is part of a federally funded program to increase low-income children's school-readiness. The first school also served lunch communally (with all classrooms eating together) while the second school served lunch within individual classrooms. Despite these differences, we observed the same value tensions develop within the two schools. We did not collect demographic data on individual children.

Part 2: Creating Prototypes

After conducting observations and interviews at preschools, we held weekly design workshops as a research group over three months. The research group of six consists of designers, UX researchers and engineers. As part of this workshop series, the group held several sketching sessions to generate design ideas and iteratively derive three key value tensions: (1) sitting still versus feeling comfortable, (2) using utensils versus having autonomy, and (3) prioritizing cleanliness versus prioritizing creativity. We then held two design workshops wherein we used affinity diagramming to group important themes from our original field notes and interview data, followed by ideation and sketching. Together, we used this iterative process of data collection, analysis, and prototyping to create three smart object prototypes for children's mealtime in classroom settings (each discussed further in the sections that follow).

RESULTS PART 1: VALUE TENSIONS

Value Tension 1: Sitting Still vs. Comfort

In the classroom, we observed teachers working to maintain order by restricting children's ability to wiggle and move about, and many children continuing to wiggle nonetheless. Rather than sit in their chair for sustained periods, children seemed more comfortable letting their bodies fidget, twist, and turn. They regularly stretched their arms, bounced in their chairs, stood up aimlessly, and walked around the room during the meal. Although children did not show evidence of willful rebelliousness (expressing disobedience for its own sake), their inclination to move about the room appeared to conflict with teachers' desires. We observed that when a teacher was supervising a classroom of preschoolers, roaming children created stress for the teacher, and teachers were constantly reminding those students to sit in their seats.

Teachers repeatedly referred to kids standing up as “*movement*” and “*chaos*” and they spoke of these terms in contrast to their hope for children to sit still themselves. During interviews, several teachers indicated that the classroom lunch felt tense and demanding. Some mentioned that they sometimes needed to step out for five minutes when things “*heated up*” at lunch. The pause provided time to de-stress and return to the classroom with more patience than when they left. They valued keeping the children seated in order to create a more relaxed environment. In interviews, preschool teachers talked about their desire to have kids sit still. Teacher P11 described children, “*getting up and down a lot, wanting to get out of their chairs, and go get more food, stuff, or just run around*” as a primary “*difficulty*” at mealtime, suggesting that it is one of the biggest stressors for her at mealtime.

In one school, teachers talked about strategically rearranging children's lunch set up in order to prevent them from needlessly standing up and walking around the room. Previously, the teachers had served lunch cafeteria style, such that children would serve themselves at a counter and then sit down. But the teachers had recently switched to a family-style meal, with food served at the table to be passed and shared, mainly to minimize children walking around without permission. With the new arrangement, teacher P9 told us they were able to “*cut back on the movement and chaos,*” suggesting that this movement had a notable impact on teachers' experience at lunchtime.

“Before, the food was all on a counter. We wanted them to raise their hand and ask. Sometimes they would, sometimes they wouldn't. The fact that they don't have to get up and walk across the room, it just cuts back on the movement and the chaos. Now, they're sitting at their table, and they don't have to get up.” (teacher, P9)

However, we observed that even with the new arrangement, the kids still wanted to bounce, stand up, turn around, or just wiggle on their seats. They seemed to move without intending to explicitly disobey or undermine their teachers, but rather as part of the natural rhythm of their routine. At a couple points, we observed children beginning to walk across the room, and then pause and return to their seat, as though they suddenly remembered they should not have done this. When teachers asked children to sit down, the children would never verbally oppose, though they would sometimes not seem to hear the teacher or process the teacher's remarks.

Around the mealtime table we observed two main types of movement: walking around the room and wiggling or standing at a seat. When children left their seat it often seemed to impact whether they ate, but when they wiggled or stood near their seat, they typically continued eating.

The boy is active and restless (he was singing and talking earlier). He's sitting on his knees, shaking the chair as he faces the carpet (where kids from other tables have started to congregate). His shaking moves the chair

toward the carpet, and once he's gone a foot or so, he gets off and puts the chair back, facing the table again. He eats his bread, but uses his free hand to pull the chair onto its front legs.

Although the teachers expressed discomfort with a lot of motion, they seemed to accept children moving in their seats while eating. T2 was acutely aware of this tension in her interview, bridging this tension a bit with her understanding of the children's positions. She described how the children's movement was unconscious and how it was difficult for children to sit still. For this reason, she explained, she found it difficult to manage children who moved because moving feels good. Her understanding suggests that teachers may have the capacity to accommodate wiggling and motion, provided that they still feel that the room is under control and not "chaotic."

Value Tension 2: Using Utensils vs. Autonomy

Teachers viewed it as their responsibility to teach children basic life skills, including how to use shared and personal utensils. They explained wanting to do so both to keep the classroom clean and sanitary, and because they wanted kids to learn an important life skill. Teachers' reminders for children to use their utensils occurred repeatedly throughout the meal. The children sometimes responded positively to this prompt, but other times they ignored it. They seemed to prefer eating their meal independently over being asked to adjust how they ate.

The skill of using utensils to pick up food was visibly important to the teachers—an ability the teachers wanted the children either to practice or develop quickly. When teacher P9 noticed that a child was not using a fork, she pointed it out to teacher P11 who was supervising that child, and P11 began to help the child use his fork. Justifying this type of prompt, teacher P15 explained that the children need basic motor skills—like the ability to use a fork and spoon and pour milk into a cup—to feed themselves when they go on to elementary school. Teachers felt it was their responsibility to help children cultivate this skill.

Despite discouragement from teachers, the children readily and repeatedly ate comfortably with their hands. When they found the opportunity to do so, they appeared cheerful, comfortable, and ate quite a bit.

A girl is eating the meatball using her hands after finishing her pasta with her hands as well. Most of the kids are eating the pasta with their hands. There are two girls sitting at different tables doing the same thing: eating with their right hand and touching the meatball pasta bowl with their left hand.

Although focused on their hands, children did not appear to actively rebel against using utensils. Many were able to avoid utensils but would still try them. Although children often did not appear fully comfortable using utensils, they showed interest in learning. At times, children tried to use their utensils in peculiar ways. For example, they would use their hands to

put a blueberry or a piece of chicken on their utensil, and then bring the utensil to their mouth. In another instance, a little boy used a spoon in his right hand to eat cottage cheese, then moved the spoon to his left hand so he could pick up pieces of fruit with his right hand. Then, once he ate all the larger pieces of fruit, he used his right hand to push the fruit onto the spoon, which was now in his left hand. This dance-like process between utensils and children's hands suggests that picking up food with a utensil was still a bit difficult for these preschool-aged children. However, it simultaneously demonstrates some interest in using these tools.

Although Children did not appear to be staunchly against learning to use utensils, the teachers' constant reminders did not appear to effectively encourage this skill. The children did not seem to want to be continually interrupted and corrected by verbal reminders from teachers. For example, we saw numerous instances where a teacher would remind a child to use a fork, and the child would simply ignore what the teacher was saying.

Although teachers wanted children to use their utensils to eat their food, they had few strategies for encouraging this behavior. Directing the children to use utensils did not appear to be the most effective strategy, since children often ignored these reminders, despite their willingness to practice using their utensils on their own.

Value Tension 3: Cleanliness vs. Creativity

Throughout our observations, we saw that children loved building and playing with anything on hand, including food. The adults we observed aimed to foster a tidy and hygienic eating space around children, which meant treating food as something to consume rather than something with which to explore and play. Thus, we continually observed competition between teachers' need for cleanliness and children's need for creative and playful expression.

Children's interest in food as a playful object was evident in many instances. For example, one child pretended the top of her banana was a straw, and placed it in her cup, pretending to suck it. Another child crumbled crackers and used the stickiness of his banana to lift up crumbs and take bites of the two together. Other children blew bubbles in their drinks and aligned foods in artistic arrangements on their plates and spoons before they ate.

In addition to the food itself, the spoons, forks, and bowls were a part of this playful activity. Consider the below episode where a preschooler flips the script between utensil and food:

One child's mother asked him to sit down. He sat down and used the fork to crumble one of the crackers. A teacher came and said hello. Before eating anything, he then picked up the banana and tried to peel the skin off. Half way through his mother helped him to peel it off and he took a bite. Then he picked up a piece of cracker and ate it. His mother asked him what he was going to do with the crumbled cracker. He did not say a word but picked

up a banana and dipped it into the cracker crumbs like a stamp and then took a bite. He used the fork to further crumble the other crackers, while his mother was describing what he was doing. He picked up the banana and dipped it into the crumbs again and then ate the big chunk of banana.

Mess did not have the effect on children that it seemed to have on the adults. Whereas the adults often expressed feeling uneasy around mess, children did not tend toward feeling upset or uncomfortable when the table became messy. Sometimes they reacted with intrigue or fascination. Other times we observed children spill liquids and drop foods without exhibiting any reaction to it at all.

Although children approached food as a creative medium, the teachers we observed did not see this as a practical or appropriate way of engaging with food at mealtime. Teacher P13 described this divide, explaining that when a child has a sensory need, the teachers do their best to support that interest during playtime, so the child is not as tempted to apply his or sensory need to the food by playing with the food.

Additionally, teachers were concerned about staying on schedule and saw children's food play as an impediment to this. In the classroom, teachers expected children to focus on their food, so that they would eat enough in the short amount of time allotted for the meal. Teacher P14 told us her students have 30 minutes for lunch, which included washing their hands, getting to the table, eating the meal, and cleaning everything up. There was really only 15-20 minutes for eating, she explained. The structure of mealtime at these schools did not create much time for open, unrestricted play.

RESULTS PART 2: PROTOTYPES

Drawing on ideas from our design workshops, interviews, and field notes, we constructed a set of three prototypes inspired by each of these three value tensions described above.

The Cat Fork

This prototype included both a plate and fork styled in the shape of a cat (see Figures 1a and 1b). Each time the fork touches the plate, different parts of the cat's face light up, with 10 lights of different colors illuminating the cat's eyes, nose, whiskers, and mouth. The prototype is built with an Arduino board and a Makey Makey [37]. The prototype is designed to encourage children to use utensils while

maintaining their autonomy by choosing for themselves when to do so.

The Stamp Plate

This prototype presents a smart plate that enables the child to create a collage of images through eating. As the child eats, the plate keeps track of the food that is eaten by displaying a shadow-like image on the plate in the shape of the item that was eaten, eventually creating a layered graphic of the child's food consumption (see Figures 1c and 1d). This design is intended to support children's interest in making and creative play, and to enable them to engage in making with food without necessitating mess.

To simulate interactivity, we designed the prototype such that a researcher places a stamp on a separate, adjacent plate every time the child picks up a snack from her own plate and eats it. The researcher places the stamp in the corresponding spot on the stamp plate to match the spot on the child's plate where the food item originated. We created the prototype by crafting stamps from rubber to resemble snack items. After testing the analog version of the prototype, we plan to build a digital version of the stamp plate.

The Kicking Chair

The kicking chair is a prototype of a smart chair designed to support movement and wiggling while simultaneously encouraging the occupant of the chair to stay seated at a meal. It is composed of a long elastic band attached to the front to chair legs that reacts with sound whenever the child kicks (see Figures 1e and 1f). The object is designed to give children fun and playful feedback when they wiggle at their seats, thus rewarding both wiggling and staying at the table while eating. The elastic band could be detached and reattached to any chair. We implemented this concept with two folded pieces of aluminum foil on the rubber band and connected to a Makey Makey board and a laptop. Every time the child kicks the rubber band, the two pieces of aluminum foil touch and trigger the sound of a piano note.

We noticed in the field that teachers prohibit children from walking about the room during mealtimes but do not seem to mind when children wiggle in their seats. The kicking chair is designed to invite children to wiggle on their chairs but incentivize them to stay seated to minimize chaos for

DISCUSSION

This paper revealed several ways in which value tensions may arise from children's mealtime experiences in the



Figure 1: (left to right) a) Child tries to pick up a pretzel with cat fork, b) cat fork prototype, c) child looks at the stamp plate to count the goldfishes he's eaten, d) stamp plate prototype, e) kicking chair, f) child giggles while using kicking chair.

classroom. Although teachers tended to prompt children to sit in their chairs while eating (valuing a low-stress environment), children tended to enjoy moving on and around their chairs (valuing movement, active play, and bodily autonomy). Where adults invited children to use their utensils (valuing the acquisition of life skills), children enjoyed directly engaging food with their bodies (valuing eating on their own terms). While adults hoped children would keep food on their plate (valuing cleanliness), children often relished exploring their food in creative ways (valuing imaginative play). Yet, neither these expectations nor the conditions they valued proved entirely opposed. We witnessed teachers acknowledge and support children's movement on chairs and appreciate children's playful experimentation with their eating approach (within limits). Even as children and teachers articulated conflicting goals, those goals seemed to work in tension, shaping the classroom mealtime experience in meaningful ways. Through iterative rounds of data analysis and design sketching, we showed how these observations could be used as inspiration for designing three prototypes for mealtime.

With these observations and prototypes in mind, we turn to broader lessons for the IDC community that come out of this work around playful productivity, a concern for design within heterogeneous groups. Here, productivity around classroom mealtime was not merely a matter of reaching instrumental ends such as learning how to use a fork. Instead, it was entangled with emotional play and creative exploration. As teacher P10 mentioned: "*creativity [is] not restricted to what would be defined as the arts. It's throughout our day.*" This conceptualization of creativity is reminiscent of the Montessori teaching philosophy, which labels what is commonly referred to as "play" as "work" to reflect the purposeful and valuable nature of children's play activities [3]. We see this insight as pointing to the possibility of moving beyond a playful-productive dichotomy (separating the child's interests from those of the overseeing adult) and opening opportunities for developing playful productivity as embodied in the stamp plate.

Like traditions of constructivist learning [26], designing for playful productivity might highlight the development of important knowledge and understandings through everyday acts of creative construction. This observation suggests attending to how value tensions become, as Houston et al. [14] point out, "process[es] by which value (and valuation) are achieved, sustained, and evolved through time," but also processes that may serve as key opportunities for design. This design-orientation toward value tensions as always in motion—produced, maintained, and adjusted through practice—complements a rich body of work exploring the possibility of playful interaction without concerns for efficiency, ease, or speed around digital technology (see [28–30,32]). Pushing beyond slow or ludic concerns, our work suggests attending to tensions in value as routine accomplishments made possible with and through expressions of embodied creativity. When we examine playful productivity within this

frame, we deepen our understanding of how value tensions work as materially embodied processes, as one of many conditions that require care and repair through sensory engagements.

CONCLUSION

This paper contributed a case study in the application of the value tension framing (a component of value sensitive design [8]) to interaction design for preschool meals and reflections on examining value tensions in this context. We presented a two-part study to understand the current mealtime experiences of children within preschools and identified value tensions in the field. Using insights from field observations and interviews, we iteratively designed and developed three smart object prototypes to address those value tensions. Our work suggests attending to playful productivity, the entanglement of generative attentiveness and creative play, as a fruitful design space for developing technology with and around children.

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SELECTION AND PARTICIPATION OF CHILDREN

We followed an informed consent process in accordance with US federal human subjects research requirements (45CFR46.102f) and Institutional Review Board approves all study procedures. We have waiver of consent of children in the two preschools we observed from Institutional Review Board because we did not have any interaction with the children and we did not record any of their personal information.

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