Lights, Music, Stamps! Evaluating Mealtime Tangibles for Preschoolers

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ABSTRACT
We present an evaluation of three prototype tangible user interfaces (TUIs) for preschoolers during mealtime. Building on past work identifying value tensions between adults' and children's perspectives at meals, we examine how the TUIs address different tensions in this context (for example, the tension between children's interest in experimenting with food versus adults' interest in cleanliness). Thirteen preschool children and their parents tried out the prototypes, as did an additional seven preschool teachers. Adults and children alike were excited by the prototypes; parents were surprised by children's increased food intake, and children used the prototypes to engage in artistic expression with food traces. We also found that the prototypes motivated children's increased consumption, sometimes displacing their own hunger cues. We conclude that TUIs have the potential to enhance shared meals between children and adults but also have the potential to distract or persuade children in inappropriate or harmful ways. We present design guidance differentiating these two outcomes, such as incorporating the TUI into pre-existing mealtime objects and routines.

Author Keywords
Tangible-user interfaces; child-computer interaction; preschool; meals; value tensions.

CCS Concepts
Human-centered computing → Ubiquitous and mobile computing design and evaluation methods

INTRODUCTION
Meals and the social practices surrounding them feature centrally in the lives of children [11]. In response, a growing body of literature across HCI and tangible computing has argued that tangible user interfaces (TUIs) and other digital experiences work as effective mechanisms for persuading children to enact mealtime practices that adults value (e.g., [10,15,27]). However, the role technology can play in explicitly promoting children's interests at meals remains under-examined.

In this exploratory study, we address this gap by examining prototype TUIs for shared meals that include adults and children. We used our prototypes to foreground the interests and needs of child and adult alike, focusing in particular on value tensions between adults and children (i.e., instances where designing to support one value challenges another [13]). To understand these value tensions, we examined children's and adults' responses to these prototypes. We found that the prototypes shaped children's mealtime experience by encouraging consistent utensil use, holding children's attention, and prompting creative expression with food traces. Parents, teachers, and adults alike indicated that children ate more when using these prototypes than they typically do. These findings suggest the potential for TUIs to resolve common mealtime struggles, such as coping with picky eating habits, but they also suggest the potential for TUIs to introduce unwanted distraction or persuasion.

RELATED WORK

Family Meals and Children's Nutrition
Engaging in mealtime is a complex practice with the potential for both positive and negative experiences that require work and intentionality on the part of adults and children. Research has identified that parents' struggles with children at mealtimes include spending more time at meals, children's food pickiness, new recipes and meal ideas, and conflict at mealtimes [14]. Emphasizing adults' roles (both parents and teachers) with children's well-being at mealtimes may place greater responsibilities and pressure on adults. Understanding adults' struggles and attitudes about mealtimes is essential to determine when and how technology can play a role in this context.

Novel Technologies for Children's Meals
With a few exceptions [2] [29], scholars have largely overlooked how preschoolers interact with TEI-related objects, a growing body of work in tangible computing, UbiComp, and HCI incorporates smart sensors into everyday objects for children to encourage healthy eating behaviors. ChilDish uses sensors placed around a cup and dish to make sounds corresponding to the drawings on the tableware, with the intention of encouraging children to make healthy food choices through playful feedback [17]. Similarly, Edutableware embeds sounds into children's fork and cup to encourage

TEI '19, March 17–20, 2019, Tempe, AZ, USA

ACM 978-1-4503-6196-5/19/03□$15.00
https://doi.org/10.1145/3294109.3295645

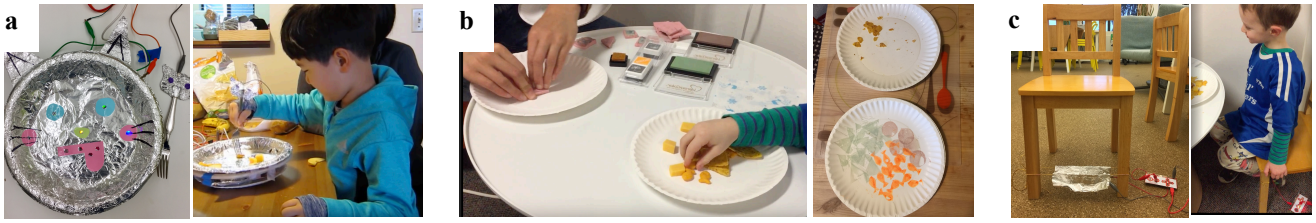

Figure 1: a) Left: Cat Fork; right: a child using his fork to pick up goldfish cracker; b) Left: The Stamp Plate; right: a child's stamp plate after he finished eating; c) The Kicking Chair; right: a child kicking the chair without eating.

healthy food choices [22], and Playful Tray embeds a game into children's mealtime materials using a weight sensor and responds to children's eating behaviors [24].

Whereas these prior studies leverage smart objects to encourage healthy eating behaviors, a smaller body of work explores novel interactions to support creativity while eating [1,4,21]. These studies demonstrate the research community's interest in supporting the complex processes surrounding shared meals. We expand on this existing work by evaluating new prototypes that are designed to accommodate both adults' values about appropriate mealtime behaviors and children's values about play, self-expression, and autonomy.

Respecting the Expertise and Autonomy of Children

Research in child-computer interaction increasingly emphasizes children's agency and the importance of respecting the inherent dignity and self-ownership of every child. Prior work advocates for incorporating children in the design process [7] and recognizes that children are experts on childhood with insights that cannot be accessed by probing adults' perspectives alone [6]. Research into the design of novel technologies for children also increasingly treats children's values as core design principles [12,19,23]. As a result, a number of methodological innovations seek to draw out children's perspectives and access their design insights (e.g., [8,9,16]). In what follows, we extend this orientation to the design of technologies for children's meals. By using the value tension lens [26], we are able to highlight not only children's perspectives, but also the interplay between children's and adults' values and the ways in which they might come into conflict.

METHODS

Our research team included six interdisciplinary researchers and engineers. Together we held weekly design workshops over three months to generate design ideas and iteratively develop sketches based on three value tensions. We read fieldnote and interview snippets and grouped them into affinity diagrams to surface important themes and generate more than fifty sketches in total. We further grouped the sketches and discussed the ideas based on the affinity diagram.

Participants

We recruited thirteen 4-to-6-year-old children (six boys and seven girls) to participate in our study via email lists at our institution and at local family housing communities. There are five white and five Asian families, and an African American and a multiracial family in our study[31]. We evaluated all three prototypes with each child and one or more parents. We also recruited seven preschool teachers to evaluate the three prototypes and participate in a semi-structured interview about the feasibility and usefulness of each of the prototypes. The teachers we interviewed include teachers and teaching assistants in preschool classrooms in a metro area in the United States. The researchers brought the three prototypes, showed the teachers and asked for their thoughts.

Prototypes

We asked children and teachers to evaluate three novel prototypes, presented in prior work and created through observations, sketching exercises, intergenerational participatory design [32], and user interviews [3].

The Cat Fork: The first prototype, The Cat Fork (see Figure 1a), consisted of a metal fork and plate that both represent a cat's face. As a child touches the fork to the plate, the connection prompts different parts of the cat's face to illuminate. A total of 10 distinct color lights light up the cat's eyes, nose, whiskers and mouth. Our motivation for designing the prototype involved supporting the child's utensil use at the same time as supporting the child's independence. We designed the light interactions to offer children colorful and whimsical feedback while using their own fork and plate together (in contrast to eating off another child's plate or picking up another child's utensils). We built the prototype using an Arduino board and a Makey Makey [16].

The Stamp Plate: Our second prototype, the Stamp Plate (Figure 1b), comprises a series of stamps that correspond to food items eaten off the plate, leaving behind silhouette-like shapes that create food-inspired illustrations. We designed the plate to record the shape of the food children eat off the plate and then display that shape much like a lasting shadow. For instance, a cube of cheese leaves behind a square shape next to a goldfish-shaped cracker, which leaves behind a small fish shape. The plate provides children with a space to explore their sensory needs at the same time as supporting caretaker's concern for minimizing mess and keeping food on the plate. We simulated this design concept during our study by having a researcher print pre-designed custom stamps with multi-color inks on an adjacent plate each time the child picked up a snack and ate it.

The Kicking Chair: Our last prototype, the Kicking Chair (Figure 1c), consisted of a chair with a long elastic band

wrapped around to its front two chair legs. Kicking the band triggers a playful sound play. The chair allows children a platform for whimsical expression as they move and wiggle in their seats while supporting caretaker's interest in encouraging children to stay in their chairs while eating. We designed the elastic band to be attachable at any leg height and on any chair (to adjust for child size. To implement the concept in our study, we used two folded pieces of aluminum foil connected to a rubber band, a Makey Makey board, and a laptop. The two pieces of foil touched every time the child kicked the band, prompting a piano note to play.

Procedures

Children's Evaluations

To examine responses to our prototypes in practice, we conducted a user study with thirteen children (one at a time) within the spaces they would normally eat their snacks (e.g., children's own homes). We began each user study during the children's regular afternoon snack time and organized the study period as a three-part snack. For each part, researcher(s) asked the children to choose from a selection of snacks to put on their plate (including goldfish-shaped crackers, pretzels, bananas, apple slices, cheese cubes, tortilla chips, and crackers). These snack selections were familiar to children and most of them ate the varieties of food items we provided. The children picked a new set of snacks at the beginning of each new prototype. We randomized the order of prototypes explored during the study. A parent and a researcher accompanied each child in the study. The researcher occasionally prompted children to share their opinions about the prototype in order to glean a deeper understanding of their experience. We asked children to select their own snacks, but we did not limit or suggest any food items to the children. We tried to make the field trial as naturalistic as possible by letting children eat snacks at their usual snack time and inviting parents to accompany them (following recommendations from Hiniker et al.[20]).

Teachers' Evaluations

We took three prototypes into preschools and show teachers the prototypes during their breaks. We did not let the teacher use the prototypes because they are meant for children. Instead, the researchers showed and explained how each prototype works without telling the design processes and intensions. After demonstrating each prototype, we asked what teachers thought about it and how they would use it in the classroom, using semi-structured interview questions. We also randomized the orders of the prototype showings.

Analysis

We audio- and video-recorded all lab sessions. Members of the research team iteratively watched videos and documented examples of interest using an inductive-deductive approach [5]. Using Trello organizational software, we created cards to represent all examples, creating a dataset of 230 vignettes. We then grouped these data points into themes to create a hierarchical affinity diagram. The teacher interviews were also audio-recorded and transcribed by a third party. We repeated our open-coding process to extract examples and cluster them into themes.

FINDINGS

Discovering Affordances

As children encountered the objects for the first time, most of them took some time to understand how each of the three prototypes worked. In some cases, children understood the prototype right away, for example, C13 explained "*I want a fish here,*" as he pointed to the stamp plate and then ate a fish from that spot on his own plate. Other children immediately pointed out the connection between the triangle stamp and the chips (e.g., C8) or the half circle to the apple (e.g., C1).

In other cases, children did not immediately discover the prototype's affordances. Many children did not understand how the Kicking Chair worked even as they used it to produce noises, and in these cases, children claimed the computer, the wire, or the chair itself was responsible for making the instrumental sounds. Eventually, most children came to understand how all three prototypes worked, although occasionally children developed unexpected mental models, such as believing the stamps on the stamp plate represented images of food that other children had eaten (C6).

Once children understood the prototypes, their reactions varied. Some continued to explore the prototype and ask questions, while others focused on eating the food. When children liked the prototype, it was often quite obvious, and they responded with exuberance. C3 and C10 responded to the Kicking Chair by giggling hysterically each time they heard the sound it made. C4 checked the lights on the cat fork and plate as she took a bite carefully and beamed when the light came on. She commented: "*when more lights are on, it [the Cat Fork] is happier!*"

Influencing Children's Practices

Across our observations, we noticed children's practices change in the presence of the prototypes in four central ways. Here, we describe these cross-cutting shifts.

Increased Eating

Parents expressed that both the Cat Fork and the Stamp Plate led children to eat more food during the study session. C4's mother commented several times on how much more her child was eating during the session than usual. And after the study, she remarked: "*Oh my baby ate so much more. Actually, more than what she eats in a whole day!...I hope we [could someday] have all these at home."* In another instance, C1 kept eating many of the goldfish-shaped crackers and pretzels to produce stamp artifacts for these items.

Like the Stamp Plate, the Cat Fork also led children to eat more. C5 wanted to know if the plate made sounds, and he started to eat more from the plate to explore the plate's capabilities and the effects of eating. C13's mom claimed the Cat Fork caused her child to eat much more because he liked using it. Another participant, C4, ate very intently using the Cat Fork until all available food was gone. The children tended to keep their attention on the meal while using the Cat Fork.

We asked our child participants which prototype they liked the most at the end of the study, and we asked if they would eat their least favorite food if they could do so using their preferred prototype. While some said they would not, others said they would eat a bell pepper or cheesecake (a non-preferred food) to produce stamps on the Stamp Plate. C3 said she would eat broccoli to make the Cat Fork's light up. C13 asked for more crackers because he wanted more circles to appear on the stamp plate. And a few children who said they were already full before testing the third prototype still finished the third snack. Parents commented on the amount children ate throughout the session, saying things like, "*She was certainly paying attention to what was happening...that certainly had an impact. She's certainly eaten a lot"* (C3).

Increased Use of Utensils

We observed that when using the Cat Fork, children were more willing to use their utensils to eat. Children were encouraged to explore the fork initially, but were not required or continually asked to do so. However, many children continued to engage with the fork and the lights as they ate, even using the fork for snacks that are typically eaten as finger foods. C2 loves cats and when using the fork to eat an apple slice, she said: "*Guess what? I've never used a fork to eat an apple.*" C3 used the fork for every bite on her plate. And several children tried to use the fork to eat the goldfish-shaped crackers or tortilla chips. A few participants gave up on using the fork to eat these challenging foods after several attempts, but most of them switched back to using the utensil when they ate cheese cubes or bananas slices, which were easy to stab.

Prior work reports on children "half using" utensils while eating during typical meals; that is, using their hands to pick up food and put it onto the utensil before putting it into their mouths [3]. Children performed this same action when using the Cat Fork. Although we designed the object in part to address this practice, we saw that children continued to maintain it when using the prototype.

Increased Distraction

While the Cat Fork and Stamp Plate tended to encourage children to focus on their utensils and their food, the Kicking Chair routinely redirected children's attention away from eating and toward the prototype. Although some children giggled and seemed to enjoy making sounds at the table as they ate, most of the time children either ate or played with the chair but did not integrate the two practices. For example, children sometimes squatted down and used their hands to make sounds by touching the band around the base of the chair, and some alternated between sitting while kicking and sitting while eating.

One child (C3) explicitly stated that the object was a distraction and explained that she was going to use the Kicking Chair to distract her dad, so she could steal his candy. She went on to say she would use it to distract people in public places. C13 believed he should not use the Kicking Chair during meals. He played with the chair initially and then politely asked the researcher, "*Can I eat now?*"

Creative Exploration

We observed that participants engaged in creative exploration when using the Stamp Plate. C1 intentionally continued eating to see the image that the resulting artifacts would form on the plate. C13 wanted a goldfish-shaped cracker on a specific spot on the Stamp Plate, therefore he ate one from the analogous location on his food plate. When we asked why he wanted to eat the goldfish-shaped crackers at that specific spot, he explained: "*Cause I want the fishes to pile around*."

Children also made creative comments as they looked at and reflected on the Stamp Plate after the meal. They made sense of the shapes of the food and created their own stories, which they retroactively fit onto the images they had produced. For example, C3 explained that she had made a pretzel maze for a goldfish to swim through. She went on to describe how she would make a maze using the plate in the future, saying, "*I would turn the plate in the direction I wanted the fish to go in.*" C13 also described his Stamp Plate as a scene deep under the sea, saying that the triangles are sea plants, the circles come from people dropping balls in the sea, while the fish are trying to help give the balls back to the people.

Prompting Self-Tracking

When using the Stamp Plate, several children spontaneously engaged in tracking their food intake. We did not ask the first few children how many pieces of food they had eaten, but we observed that they proactively counted the fish stamps, the triangles, and circles as they were eating, and we were stamping. After we observed this practice in multiple sessions, we modified our protocol to include asking children how much they had eaten. Most children easily linked the composition of the Stamp Plate to the food they had eaten. For example, when asked how many tortilla chips he had eaten, C11 counted the triangles on the Stamp Plate and responded correctly.

C9 reminded the researcher that he had eaten a cracker and that the researcher had not yet placed a corresponding stamp on the plate. Many children similarly pointed to missing stamps if the researcher had yet to stamp the plate, suggesting children found the link between eating and the immediate effect that followed to be meaningful.

Teachers' Responses to Prototypes

Teachers' and children's reactions to the prototypes were mostly well-aligned. Here, we describe teachers' general impressions of each of the three prototypes as well as themes that emerged across all of them.

General Impressions of Each Prototype

The Cat Fork: Teachers predicted the Cat Fork would help children develop fine motor skills and encourage them to use utensils. Some teachers felt the Cat Fork may be more appropriate for younger children (under the age of 3) who are learning to use utensils for the first time. A few teachers worried the lights on the plate could be distracting for children

and anticipated that children might poke the plate with the fork persistently to see the light.

The Kicking Chair: All teachers loved the concept of the Kicking Chair and thought it was innovative and likely to be engaging for children. However, they did not feel it was appropriate for mealtime and envisioned using it during playtime when it could be the focus of the activity. They predicted 20 children making noise while eating would be chaotic, and a couple of teachers said they already struggle to prevent children from kicking each other's chairs at mealtime.

The Stamp Plate: Almost all teachers felt that the Stamp Plate would encourage children to try new foods and would generate conversation at mealtime, and almost all teachers said that conversations with children are what they value most about meals. For example, T1 anticipated that children would have conversations with her about how and where the food is placed on the plate. She explained that she could model placing the food, such as putting a goldfish cracker on a plate next to a piece of cheese, and the children might put another goldfish cracker on the plate, this time above the cheese, or to the left of the cheese, fostering conversations about spatial relationships.

They also appreciated the Stamp Plate's support for children's creative expression. T7 commented that she thought the resulting images that the foods left behind on the plate, and the artistic form it would take, could generate many new conversations in the classroom.

Comparing Teachers' Predictions with Children's Actions

In this section, we compare teachers' predictions of how children will react to the prototypes with children's reactions in practice, drawn from our observations during our exploratory evaluations.

The Cat Fork: Teachers expected the illuminating parts of the plate and fork to distract children form their meal. Although a few teachers acknowledged the lights might direct children's focus to the plate, more teachers thought the lights would encourage children to focus on playing with the plate, instead the food itself. T1 said: *"It would be a bunch of kids hitting their plates, and then really causing food to kind of go everywhere."* Other teachers imagined that the Cat Fork would prompt children to fight with each other at the table, more so than a regular fork. They were also concerned that focusing on the plate would take children's attention away from conversations with others.

In the test sessions with children, we did not observe the Cat Fork distracting children from their eating. On the contrary, most children were pleasantly surprised to discover that the cat plate illuminated. They ate tentatively with their forks to pick up the food, paying careful attention to which part of the cat plate lit up. Some of the children even used the fork to pick up pretzels (a food commonly eaten with hands).

The Stamp Plate: Children's reactions to the Stamp Plate corresponded to teachers' expectations. Teachers imagined children would make connections between the food they ate, and the images left behind on the plate, and in practice, children were able to do so. Teachers also thought the plate would encourage children to try new foods that they normally would not eat. During evaluation sessions, children expressed willingness to eat foods they do not like in order to generate stamps on the plate. Lastly, teachers expected the plate to help regulate mess and encourage creativity at mealtimes. While exploring the plate, all children in our evaluations kept their food on their plates and demonstrated creative expression, such as storytelling from the stamp-imagery they prompted by eating.

The Kicking Chair: Teachers' predictions about the Kicking Chair also matched children's experiences in practice. Teachers worried about the potential for distraction, a concern that held up when testing it with children. Children would kick and laugh so happily and completely forget about eating; one boy was constantly troubleshooting to see why the Kicking Chair did not work the way he expected and forgot about eating altogether. In addition, teachers predicted the Kicking Chair would decrease conversation at mealtimes. In fact, teachers expressed strong preference for the Kicking Chair idea, but they thought it would be more appropriate to use it other than the mealtime. For example, multiple teachers suggested using it in communal circle time to promote conversion and musical engagement.

DISCUSSION

We saw that these tangible prototypes offered affordances and experiences that excited both children and adults. And we saw systematic ways in which they shaped children's interactions with and responses to food, such as engendering creative expression and self-tracking and increasing children's willingness to try new things. However, we also observed patterns in which these prototypes undermined mealtime goals and distracted children from the meal itself. And we saw the potential for these systems to persuade children in ways that might undermine their sense of autonomy or disrupt their relationship with the food they consume.

Tangibles as a Tool for Mealtimes

Across our evaluations, both children and adults told us that the Kicking Chair served as a distraction and undermined children's focus on the meal. Although most children enjoyed engaging with the prototype, and teachers were enthusiastic about incorporating it into their classrooms for playtime, all parties agreed that the chair demanded attention as an object in its own right, rather than as an integrated component of the larger mealtime context.

The Cat Fork and the Stamp Plate designs, on the other hand, allowed children to easily attend to the novel object as a part of enacting existing mealtime practice. Although teachers predicted that the Cat Fork would cause distraction, we saw that by focusing on the fork, children were in fact also focusing on the meal and their eating practices. Children engaged more deeply in these practices than usual, incorporating the

utensil into every bite and using a fork for finger foods like pretzels and apple slices.

This distinction suggests that TUIs may support children's meals most effectively when they treat pre-existing materials and practices as first-class priorities and augment existing routines without upstaging them. Prior work has found that adding interesting but unrelated content to reading materials for children (known as "seductive details" [18]) engages children but decreases their comprehension of and attention to the core material. Similarly, we found that the Kicking Chair created a new experience to attend to rather than augmenting the experience to which the child was already attending, providing design guidance for future TUIs. The Cat Fork, in contrast, added a new dimension to an existing practice, leading children to continue to engage in this practice (eating with utensils) with renewed focus.

These findings also suggest that TUIs may be uniquely well-suited to provide support in mealtime contexts, relative to other forms of technology. Tangibles, by their very nature, integrate with the physical world in a way that goes beyond what stand-alone devices like smartphones and tablets are capable of.

Value Tensions and Persuasive Tangibles for Meals

In conducting this study, we set out to explore how we might design for all members of a shared meal, giving the same consideration to children's in-the-moment values and interests as to adults' long-term goals for children's eating practices. We saw that the tangible prototypes we evaluated eased existing value tensions between children and adults and largely encouraged the practices we set out to incite. But these prototypes also surfaced new value tensions we did not anticipate. For example, the Kicking Chair successfully facilitated wiggly play while keeping children in their seats, but it introduced new tensions wherein: 1) children valued attending to the chair and adults valued children attending to the meal, and 2) children valued using the chair as an instrument while adults valued a quiet environment that is conducive to conversation.

Similarly, we saw many indicators that our prototypes incentivized children to change their practices in ways we did not anticipate. We observed that both the Cat Fork and the Stamp Plate encouraged children to eat more than they normally do, opening serious questions about the consequences of these designs for long-term health and well-being. Many parents and teachers were enthusiastic about this development and felt certain that such tools would increase children's overall food intake. Children themselves gave us insight into the mechanisms underlying this shift in practice. They told us, for example, that they were eating chips not because they were hungry, but because they needed triangles for their picture, or because they wanted LED lights to illuminate. These findings urge caution and suggest the potential for tangibles to promote harmful food-related habits. Persuading children to eat foods they dislike or persuading them to overeat could potentially create unhealthy patterns, such as undermining children's sensitivity to their own hunger and satiation cues. Designing to change children's eating habits without their awareness also suggests the kind of paternalism for which persuasive technology is often critiqued [30]. As work in HCI increasingly acknowledges children as experts on their own experiences [6] and seeks to support their autonomy, it is important for designers seeking to resolve tensions between children and adults to consider how to support children in advocating for their own needs and directing their own practices.

Mealtimes as Sites for Expressivity and Exploration

As children engaged with the Stamp Plate in particular, we observed that they used traces of their eating activity to provoke creative storytelling and reflection at the table (see [28]). In designing the Stamp Plate, for example, we had no fixed goals with respect to traditional notions of productivity or education. But by providing children with an opportunity to tap into their pre-existing interest in experimenting and playing with food [3], we inadvertently created an informal learning context in which children counted what they had eaten and linked their artistic creation to their autonomous activities. These insights suggest the potential for tangibles to enhance meals in meaningful ways, expanding beyond support mechanisms for nutritional goals to opportunities for tangible data sense-making and play.

Future Work and Limitations

We see a number of ways for future work to build on the themes we encountered in this study. For example, to further probe whether TUIs can address families' struggles with children's food pickiness while simultaneously respecting children's autonomy, future designs might explore the design of interfaces that make the mealtime experience and the post-mealtime experience equally enticing, potentially encouraging children to eat without incentivizing them to continue to do so beyond their intrinsic hunger. Although we saw behaviors in this initial session that parents said were atypical, we do not know if the novelty would quickly wear off, or conversely, if such a tool might become a problematic long-term crutch. In the future, we hope to study the relationships that children form with these prototypes over time.

Our approach enabled us to prototype rapidly and to standardize the environment where children encountered the prototypes. Therefore, the child might be also interacting with the adults presented, and not the stamp plate alone. Other approaches, like Wizard of Oz [25] or more naturalistic setting, might be a clearer separation to test if the child is solely interacting with the prototype. We hope that some of these limitations are mitigated in part by the fact that children regularly engage in meals communally with.

There are also a number of ways in which the context of our study is limited. This data was collected from a small number of individuals in a single metropolitan area who likely did not struggle with food insecurity. Meals, educational environments, parenting practices, and family structure varies dramatically across communities, both within the United

States and around the world. The particular experiences we report here are not representative of any larger group. However, we hope that they generate questions for future designers and yield insights into how those creating future TUIs might engage with this.

CONCLUSION

In this paper, we a conducted an exploratory evaluation with children and teachers to gather their feedback on three TUI prototypes designed to resolve adult-child value tensions in mealtime contexts at home and at school. Our results show that although our prototypes addressed certain value tensions, they seemed to ignite new ones, highlighting the complexities of value alignment in practice. The effectiveness of these novel tangibles in changing children's behaviors prompt us, as designers of technology, to consider what we do when we seek to address value tensions. We see how designers may nudge users with competing perspectives toward a compromise in ways that unevenly respects the parties involved. In view of this work, value tensions invite not quick resolution but thoughtful consideration of whom designers seek to persuade and why. In this sense, our findings also offer insight into the ways TUIs may shape children's practices in mealtime contexts by offering prompts to designers who seek to do so with care.

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