



The Playful Potential of Shared Mealtime: A Speculative Catalog of Playful Technologies for Day-to-day Social Eating Experiences

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In this paper, we present an annotated portfolio of speculative ideas that emerged from a co-design process where we investigated the playful potential of day-to-day mealtime. Our portfolio illustrates the learnings from our participatory engagements: it embodies ours and our participants' ideas of how technology might support increasingly playful and socio-emotionally rich experiences around food. We contribute: (1) a list of *play potentials* of mealtime—i.e. people's existing playful practices with food—that will point designers towards socio-emotionally desirable play-food experiences; (2) a portfolio of speculative design ideas that illustrate how mealtime technology could help to realize that playful potential; and (3) a discussion of our participants' experiences with and responses to lo-fi prototypes of our ideas. Our work will provoke designers to carefully consider the impact of food-tech innovation on the quality of people's social eating experiences and inspire them to cultivate forms of food-play that are socio-emotionally rich.

CCS Concepts: • **Human-centered computing** → **Interaction design**

KEYWORDS: Human-Food Interaction; Situated Play Design; Play potentials; Mealtime; Play; Playfulness; Participatory Design; Co-design

ACM Reference format:

Ferran Altarriba Bertran, Alexandra Pometko, Muskan Gupta, Lauren Wilcox, Reeta Banerjee, and Katherine Isbister. 2021. The Playful Potential of Shared Mealtime: a speculative catalog of playful technologies for day-to-day social eating experiences. In *Proceedings of the ACM on Human-Computer Interaction*, Vol. 5, CHI PLAY, Article 267 (September 2021), 26 pages, <https://doi.org/10.1145/3474694>

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1 INTRODUCTION

Technology is increasingly present in our lives. Food practices are no exception. More and more, we use technology to cook (e.g. [66]), track our consumption and disposal habits (e.g. [28]), share photos of the food we eat (e.g. [49]), or enhance our eating and drinking experiences (e.g. [9]),

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2573-0142/2021/9 - 267

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<https://doi.org/10.1145/3474694>

among others. As a result, technology increasingly shapes the way we think about, engage with, interact around, and experience our food. Recent research (e.g. [26]) stresses the importance of paying close attention to that impact, to ensure that food-tech innovations are not only efficient but also sustainable from a social, cultural, and ecological perspective.

The field of Human-Food Interaction (HFI) studies the human-food-technology interplay. A recent study showed that HFI research is often techno-solutionist: it seeks to ease, scale up, automate, or make otherwise more efficient our food practices [1]. While there is value in such a utilitarian agenda, here we argue that food-tech innovation should also care for other values that are intimately related to food. Eating is far more than an act of biological survival [27]; designers should acknowledge (and design for) the social, emotional, and cultural role it plays in our lives. Here we tackle this challenge: we turn to play and playfulness to explore how computation might help to enrich the ludic and social dimensions of mealtime. Our work is inspired by research that suggests that, if carefully designed for that purpose, technology can add value to social food experiences (e.g. [20][23][29][30][31][52]). We are also inspired by HFI designs that playfully enrich our mealtime regardless of utilitarian aims (e.g. [7][53][68]).

Our study followed a Situated Play Design approach [4], wherein we engaged diverse people to co-design technology concepts that responded to their playful cravings. We began by learning about 35 participants' opinions about and lived experiences with play and technology use at mealtime. We integrated those findings with relevant literature to identify *play-food potentials*—i.e. people's existing playful eating practices that carry socio-emotional value [4]. Inspired by those, we created a catalog of speculative mealtime tech ideas. We shared the catalog publicly to collect people's responses. We invited 37 respondents to participate in follow-up co-design activities where we experimented with, challenged, and rethought our early design ideas. Here we present the results of a *reflexive thematic analysis* [13][14] of our process: (1) a list of play-food potentials that can inspire technology design that adds socio-emotional value to our mealtime, (2) a collection of speculative ideas that hint at how to respond to those play potentials, and (3) our reflections from experimenting with those ideas with participants, including 5 actionable recommendations for designing playful mealtime technology. We hope our work provokes, inspires, and empowers food-tech designers to embrace increasingly playful and socio-emotional approaches in their practice.

2 BACKGROUND

2.1 Human-Food Interaction Research: Transcending Techno-Solutionism

Human-Food Interaction (HFI) is an emergent, dynamic, and heterogeneous research space that studies the growing presence of technology in people's food lives to propose desirable design directions. A recent study showed that, though there are exceptions, HFI research often seeks to ease, scale up, automate, or make otherwise more efficient our food practices; less attention is put to exploring how to make those practices more ecologically sound, culturally stimulating, socially connected, or emotionally rich [1]. Recent research warns us that that trajectory can potentially have negative implications: privileging utilitarian views of the human-food-technology interplay might compromise the socio-ecological sustainability of our food systems, local and global [25]. According to [26], there is a need for “nurtur[ing] food experiences that are socially engaging, culturally aware, and playful by taking inspiration from diverse local food knowledges and traditions [...] rather than deliver[ing] quick-fix solutions aimed at consumer convenience”. Here we turn to play and playfulness to respond to that call.

Our work explores how play can be a lens through which we can rethink food-tech innovation in ways that transcend productivity and embrace (and cherish) the social, cultural, and emotional functions of mealtime. Designing technologies that neglect those facets of food experiences will

compromise their capacity to holistically contribute to our wellbeing. Humans are not productivity tools—we are motivated by pleasure, social and emotional connection, agency, and positive feelings [16]. As an activity that is known to be far more than a biological need and to play a central role in our routines [27], eating should respond to those values.

Here we argue that play can be a way reclaim the social, emotional, and cultural dimension of our food lives: it is a fundamental human need [1][16][18][39][38] that enriches our experience of the world we live in. Sharp and Thomas call this the *eudaimonic* function of play: even if it does not yield materially productive results, it can be considered socio-emotionally productive [38]. We center three important experiential qualities of play: First, play brings joy to otherwise unstimulating situations because it is intensely pleasurable [1]. Playful tech can help us to experience our tables as ephemeral playgrounds where we can express ourselves and detach from feelings of boredom and isolation—feelings we increasingly experience at mealtime and that are known to have negative nutritional [19] and psychological [45] effects. Second, play provides us with a feeling of agency: it allows us to choose, act, and express ourselves in ways that feel meaningful [38][60]. Technology should help us to cultivate those qualities in our food engagements, empowering us to take a more active, conscious, and creative stance towards those practices. Finally, play brings people together [41][42], which is highly relevant as social interaction is key to our wellbeing [41] and an important reason why people eat [26]. These experiential qualities of play—joy, agency, and social connection—are desirable social goods that can have positive effects on our wellbeing. In a world where tech is increasingly present—in and beyond mealtime—designers should cultivate them. Tech can surely help us to make our lives more efficient, but it should also care for the experiential texture of our day-to-day. We hope our work inspires increasingly playful and socio-emotionally sensitive food-tech design.

2.2 Socio-Emotional Approaches to Playful HFI

The use of play- and game-inspired strategies in Human-Food Interaction is often referred to as Playful HFI. Just like the broader field of HFI, Playful HFI often gravitates towards making our play-food time productive [8], e.g. to promote healthier habits [56], support dietary change [53], or teach food safety regulations [46]. While there is value in that approach, here we argue for an equally relevant agenda: exploring how technology could enable socio-emotionally rich food experiences regardless of productive gains. As [8] suggests, echoing [34], “ludic design can support values such as curiosity, play, exploration and reflection, which are not only important, but essential to wellbeing”. We see those values as highly relevant in the context of mealtime.

The idea of designing technology that enhances the experiential texture of our mealtime is not new. *Celebratory technology* [36] was introduced about a decade ago as a provocation to inspire the design of technology that affords joy and wonder while eating. Some works have explored that idea in practice, designing technologies that playfully enrich interactions with and around food. Here we review some of them, highlighting their potential and limitations.

The work of Mueller & Khot et al. has explored the design of technology that enables novel ways of interacting with and around food. They have produced several design exemplars (see [53]), e.g.: *Arm-a-dine* [48], a robotic arm that feeds diners in purposefully bizarre ways to stimulate social interaction; or *iScream* [67], a technological ice cream cone that plays hilarious sounds when one licks the ice cream scoop, creating estrangement and affording free-form exploration. Behind these designs is the idea of using technology to enable surprising forms of playful eating—an idea that inspires our work. Yet, the play forms foregrounded by those exemplars are not explicitly contextually grounded: the authors explore interesting ways of designing food-play experiences, without necessarily engaging in participatory design with a

wide range of stakeholders. Thus, there is an opportunity to expand upon their interesting innovations by asking diverse stakeholders why playing with food is fun (and how).

Altarriba Bertran & Wilde et al. have also explored how to playfully enrich our mealtime, in this case through multi-stakeholder co-design (e.g. [68]). Their work explores how to playfully reconfigure gastronomic experiences, e.g. *the Mad Hatter's dinner party* [3], in ways that are disruptive yet contextually sound [7]. As opposed Mueller & Khot et al.'s work, they take a bottom-up approach to shaping playful food futures; they involve both expert (chefs) and non-expert (average diners) stakeholders to co-design technologies and experiences that resonate with diverse playful cravings and sensitivities. A limitation of their work is that it centers on a specific kind of eating experience, gastronomic dining; thus, the play forms it foregrounds may or may not apply in more mundane mealtime scenarios.

However inspiring, existing Playful HFI works are either: *productivity focused*, i.e. play responds to utilitarian agendas; *de-contextualized*, i.e. the play forms explored may or may not be grounded in stakeholders' playful desires; or *out-of-the-ordinary*, i.e. they target exceptional food experiences that are out of the scope of people's day-to-day. If we want to design technologies that playfully enrich our mealtime in ways that are contextually sound, we need to transcend those limitations. We must explore how to realize the inherent playful potential of our mealtime. Recent works have begun to explore how to design for play that is contextually sound, both in the food domain (e.g. [1]'s design of food-play experiences inspired by culture and traditions) and beyond (e.g. [51]'s work on designing *social catalysts*). Here we contribute to this body of research with a co-design exploration of forms of food-play that might be meaningful at mealtime and how technology could afford them.

3 METHOD

We followed a participatory [54] research through design [35] approach. In particular, we used the Situated Play Design methodology [4]: we learned about and empathized with people's existing playful practices (i.e. *play potentials* [4]), ideated technology concepts that responded to them; and co-experienced, -challenged, and -disrupted our early design ideas with participants. Our human subjects research protocol was approved by UC Santa Cruz's ethics board (#HS3631); participants were asked for signed consent in compliance with our protocol.

We began with contextual research, with the aim of identifying *play-food potentials*, i.e. playful things people already do at mealtime and that, according to them, might contribute to the quality of social eating experiences. Play potentials extend other play theory constructs, e.g. *modes of play* [24], as they focus on play forms observed in people's in-the-wild, spontaneous activity within a targeted design context—they represent contextual playful practices that carry valuable situated design knowledge. Building on the results of our contextual research (see Section 4), we produced a *Speculative Catalog of Playful Mealtime Technology* (see Section 5): a collection of early design ideas that embodied the main learnings from our exploration of people's existing playful mealtime practices. Following this, we prototyped some of the ideas in the catalog and play-tested them at a series of remote co-design sessions. Using a combination of co-design techniques (e.g. *wizard-of-oz* [22] and *design fiction* [65]), we enabled our participants to co-experience, challenge, and rethink our prototypes. That allowed us to bring our technology speculations back to the domain of people's ordinary routines, helping us to: (1) sense which ideas did and did not resonate with people's playful cravings; (2) better understand how they might work in practice; (3) explore how they might be different if our participants could re-invent them; and (4) more generally, gauge people's thoughts on the value of using those kinds of technologies during their mealtime.

In Section 6, we describe our co-design process in detail and share the most valuable learnings from our engagements with participants.

As a result of the above process, here we contribute insights that can support playful mealtime tech design: (1) play potentials that can inspire designers to pay closer attention to play-food experiences that are socio-emotionally valuable, (2) speculative ideas that hint at how to respond to those play potentials by design, and (3) reflections from experimenting with and critically discussing those ideas with participants, distilled into 5 actionable recommendations for designing playful mealtime technology. Our work will support the design of technology that enriches the social, cultural, and emotional dimensions of our food lives.

4 CONTEXTUAL RESEARCH: THE PLAYFUL POTENTIAL OF MEALTIME

4.1 Method

4.1.1 Online survey. Our research began with an online survey focused on learning about people's lived experiences with technology use at mealtime. The survey² included 29 questions (both quantitative and qualitative) and covered three topics:

- Demographics, e.g. "How would you describe your knowledge of technology related to internet, computers, and smartphones?", formatted as a Likert scale between "far less than average" and "far above average".
- Mealtime habits, e.g. "On a scale of 1-5, how important is it for you to feel socially connected during a meal?"
- Technology use during mealtime, e.g. "Can you think of a situation where tech improved or enriched your social interaction around food? Please explain".

To recruit participants, we: (1) shared the survey with our personal and professional networks via personal correspondence, social media and mailing lists; (2) distributed 200 flyers in local cafeterias and restaurants; and (3) reached out to food experts whose expertise we deemed would be valuable, e.g. food journalists and chefs. Appendix A features examples of our recruitment messages. 35 people answered the survey. 54.3% were 25-34 years old; others were 35-49 (22.9%), 18-24 (8.6%), and 50-64 (8.6%). Only one participant was older than 65 and one chose not to disclose. 18 countries were represented in our participant pool: participants were originally from Spain (11), the US (9), the UK (2), Portugal (2), and Colombia, Ukraine, Hungary, Israel, Italy, Lithuania, Mexico, Germany, and Russia (1); and they were currently based in the US (14), Spain (9), Portugal (3), the UK (2), Denmark (2), and Sweden, Italy, New Zealand, Russia, and Canada (1). Different household configurations were accounted for: 28.6% of participants lived with their partner; the same amount with housemates; 22.9% with their family (including children); 17.1% alone; and one with a host family. Finally, regarding familiarity with digital technology, all participants reported using their phone every day, and 97.1% had used a laptop computer to access the internet within a week. Two researchers analyzed the data using inductive thematic analysis [12]. The analysis was shared with two other researchers to ensure cross-researcher reliability. We identified a number of themes, i.e. relevant opinions and lived experiences related to mealtime, from which we distilled a series of design recommendations. We produced a report³ of our findings; in 4.2 we synthesize of the most relevant insights.

² Link to the survey: <https://bit.ly/3rB0ijt>; Link to the dataset of unfiltered survey responses: <https://bit.ly/3eVJTka>

³ Link to the report: <https://bit.ly/3xjWILC>

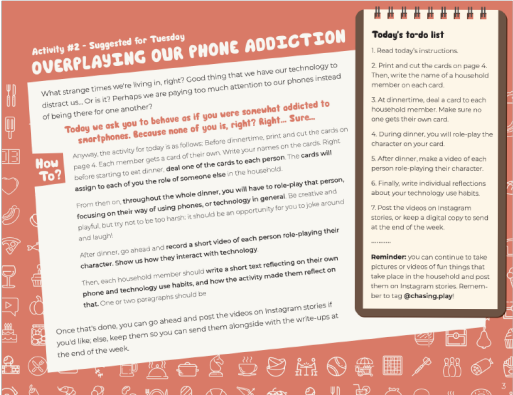


Fig. 1. Some pages of the cultural probe booklet we sent out to 12 households, including: the cover and instructions page, framed as a one-week food-play adventure (top); the day 2 activity, which invited participants to performatively overlay their phone use habits and reflect on them (left); and the day 6 activity, which prompted participants to design a food-based game (right).

4.1.2 Cultural probes. Building on the survey findings, we conducted a follow-up *cultural probe* [33] intervention to learn about people's situated food, play, and technology use practices and identify forms of playful and social eating that were socio-emotionally desirable. We distributed a digital booklet⁴ with 7 playful activities (Figure 1), one for each day of the week—though we allowed participants to adapt the timeline if needed. Activities involved playing with, reflecting on, and discussing their eating and technology use habits. For example, one activity prompted participants to recall fun past experiences with food and enact them in a short video; another encouraged them to put their phones aside for a day, come up with fun punishments for those who did not, and reflect on how the day without phones went.

We invited our survey respondents to participate in the cultural probes. We also shared a call for participation with our personal and professional networks, using the channels described in 4.1.1 (see examples of recruitment messages in Appendix B). 12 households decided to participate (37 total participants). 45.9% of participants were 25-34 years old; others were 35-49 (21.6%), 50-64 (21.6%), 18-24 (5.4%), and 3-8 and +65 (2.7%). Participants were originally from Spain (15), the UK (7), the US (5), New Zealand (2), France (3), Ukraine (2), Germany (1), and Vietnam (1); they were currently based in Spain (15), the US (8), the UK (6), France (4), and New Zealand (4).

Participating households were sent the booklet by e-mail. Their responses varied: some completed all activities, while others completed only some. Responses were sent through a mechanism of participants' choice, e.g. by e-mail or social media. Three researchers participated in the analysis. We combined inductive thematic analysis [12], for text-based data (e.g. a written reflection), and visual content analysis, [10] for visual data (e.g. a photo of a food-based game). Each researcher led the analysis of the results of some of the households; then, we shared our findings to find commonalities. Below we distill the key findings from our contextual research, including: (1) design recommendations for designing playful mealtime technology that cultivates pro-social behavior, and (2) play-food potentials that might inspire socio-emotionally sensitive food-tech design. To refer to the data behind our findings, we use the conventions S (e.g. S1 means survey participant 1) and CP (e.g. CP1 means cultural probe household 1). These insights here inspired our subsequent design work (see Section 5).

4.2 Recommendations for Designing Pro-Social Mealtime Technology

Our participants' thoughts about and lived experiences with technology use at mealtime foregrounded a few issues that are relevant to mealtime tech design. Here we concretize them into a list of design recommendations (DR); where applicable, we relate them to existing literature on HFI and technology design.

DR1: Mealtime technology should encourage (and support) collective use. Individual technology use made participants feel “ignored” (S18), “awkward” (S31), “unimportant” (S11) “forgotten” (S20), “uncomfortable” (S34), or “annoyed” (S7). That resonates with existing research on the effects of technology interruption in social situations (i.e. *technoference* [47]). Individual phone use should be consensual (“when it's not something we both agreed upon [...] I feel left out”, S2) and contextually meaningful (“answering phone calls during meals, unless they are urgent, it is rude”, S33). Participants proposed ways of addressing those issues. Some argued that “we don't need [technology] while having the meal” (S22) and suggested to “downplay the use/ubiquitous-ness of smartphones” (S2), e.g. through “an ‘eating mode’ on the phone” (S32), by “block[ing] WiFi” (S15), or “remov[ing] social media” (S11). Others did not see tech as necessarily harmful, if it

⁴ Link to the cultural probes booklet: <https://bit.ly/3rDt7vE>

served communal uses: “if [it] is used to entertain everyone, great!” (S20). That aligns with research that suggests that tech can add value in social food experiences if it provides shared experiences [20][23][29][30][31][52]. Participants proposed ways of fostering communal technology use, such as: avoiding small interfaces such as phone screens (S13); synchronizing people’s screens (S7); or using interfaces that were “embedded on the table” (S16), “tangible” (S17), or “hands-free” (S5).

DR2: Technology can help to stimulate conversations. Participants talked about situations where technology contributed to the quality of the social experience by acting as an information source that fed the conversation. Some participants used it as a “conversation starter” (S30) while for others it helped to “add detail to a conversation and expand it beyond what was naturally occurring. [...] What is lost in communication with others at the table can be filled in with additional data retrieved via phone [and] spur the conversation” (S3).

DR3: Technology can propose communal activities that bring people together. Participants talked about communal activities as a fun way to connect people, as they remove the pressure of maintaining a lively conversation and challenge the group with a common goal. S11 called for activities that give people “something to do together and serve to bring us together in later interactions when we can talk about what we saw and things that we found funny”. S17 noted “how cool it would be if we had different way[s] of eating/sharing food based on the game outcome. [...] Maybe even educational learning about spices or desserts while consuming them.”

DR4: Moments for passive (or even non-) use of technology are common and necessary. According to participants, technology should not demand one’s continued attention, as in leisurely activities like mealtime people do not necessarily want to be focused all the time. Technology can support experiences that do not require full attention, e.g. using the TV to “relax” (S6), or music to create “the right mood” (S14). Designers should think about how to design artifacts that afford passive experiences that are still pleasant. They should also reflect on whether tech is needed in a particular scenario and provide options for ignoring it whenever it is not necessary.

4.3 An Emerging List of Play-Food Potentials

Our research also surfaced playful food practices our participants naturally and spontaneously engaged in during their mealtime, which we frame as play-food potentials. According to [4], play potentials can inspire interaction design as they shed light on types of play experiences that are already meaningful in certain contexts. They can be a useful design resource because they embody forms of play that align well with and enrich mundane activities that might not originally be focused on play. Here we present a selection⁵ of the play potentials (PP) we found in our contextual research, focusing on those that might better inspire the design of tech that responds people’s desire for shared experiences around food:

PP1: Mimic each other’s anti-social behavior to make everyone laugh. CP1 and CP11 enjoyed imitating and making fun of one another throughout the meal. They playfully mocked each other’s excuses for using phones at the table, turning a potentially negative behavior into an opportunity for laughter. Designers should think about how to encourage people to playfully mimic each other’s anti-social behaviors at mealtime, in ways that are fun yet respectful.

⁵ The complete list of play potentials we identified in our contextual research can be accessed at: <https://bit.ly/2Vgt64I>

PP2: Competition with custom-made rules and real-life consequences. CP1 turned the phone detox activity into a competitive game, and teased each other to lose. That helped them to be more present in the moment and pay more attention to their actions. An important part of that experience was to create provocative punishments and house rules, e.g. the loser would do the winner's chores the next day (see Figure 2, left). Designers may want to explore ways of allowing people to incorporate lightweight competitive challenges into their mealtime, in ways that they can appropriate them and regulate their underlying structure (i.e. the rules and outcomes) to their own will.

PP3: Explore and learn new things together while eating. CP2 shared an interesting ritual their family often did when he was a child: his “originally British family gave kids placemats with maps on them [...]. Kids would take turns thinking of a city in the map and the others would try to guess what it was”. S32 talked about the potential of technology to turn the meal into a fun educational experience, and S17 suggested that it would be fun to learn things by “eating or sharing food based on a game’s outcomes”. Designers should think about how to afford open-ended experiences where people can explore and challenge one another to learn new things.

PP4: Silly miscommunication. CP2 experienced a hilarious situation where two of the household members who did not speak a common language tried to communicate during mealtime by using Google Home as a translator. The translation algorithm made silly errors, which brought about playful reactions, laughter, and a spontaneous sense of connection between participants. Designers should explore how, by constraining communication channels, they might be able to provoke funny types of misunderstandings during a meal.

PP5: Playfully disrupt social roles and power structures. CP7 shared an experience they enjoyed a lot: a meal where people dressed up in ways that were in stark contrast with their social status. For example, the college dean wore a holiday costume, which produced playful estrangement and changed the social dynamics (see Figure 2, right). Similarly, CP9 noted how much they enjoyed family traditions where each person had their own role in food preparation. In both stories, participants reshaped their social roles and were performative (and sometimes, even silly) about it. Designers could explore how to create opportunities for playfully disrupting power structures to help people to loosen up and be spontaneous at mealtime.

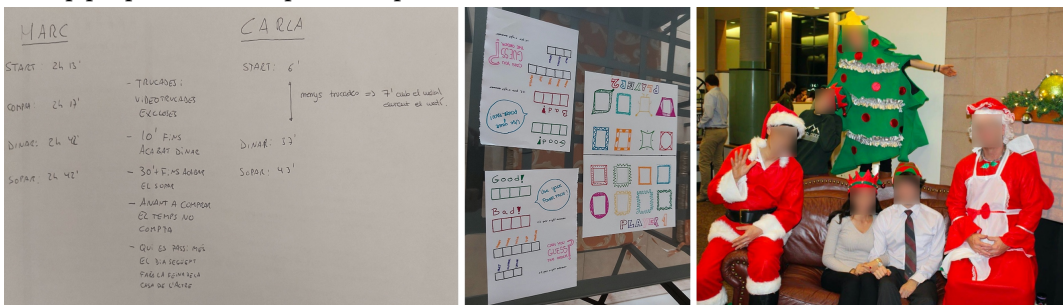


Fig. 2. Some of the cultural probe responses we received, including: CP1’s custom made competitive rules to spice up their day-to-day food practices (left), an edible board game they designed to make exploring new ingredients and flavors more fun (center); and CP7’s photo of a past mealtime experience where the social situation benefitted from people disrupting social norms.

PP6: Let technology be the judge. CP11 enjoyed using phones to settle arguments, e.g. to pull up new information that clarified who was right and who was wrong. That often brought about thrill and, depending on the outcome, laughter. S12 suggested to use a similar mechanism for a different purpose: “an app that shames you for using non-communal tech too much in social situations” and helps co-located eaters to call out each other’s negative behavior while minimizing the risk of offending someone—putting the blame on a somewhat funky device might help to make the situation less serious. Designers could be inspired by these examples to explore how to provide technology with the role of a judge that playfully mediates in the interactions between diners.

PP7: Take over the technology to create interesting social situations. Participants proposed different ways of using tech to create interesting social situations. S12 shared their experience of “‘pranking’ others by changing smart speaker settings”. On a less sneaky note, S14 reported using tech to create “the right mood for people [to] be more cheerful and open up to a social experience during a meal”. Designers should think about how to enable people to appropriate tech to craft custom provocations that enhance their and their peers’ experience of mealtime.

The above play-food potentials complement, rather than substitute for, existing works that have explored people’s preferences of and lived experiences with playful eating. Altarriba Bertran et al.’s design-led exploration of play forms embedded in food culture and traditions [1] surfaced other play potentials, such as: using strange utensils and vessels to challenge or estrange while eating or drinking, which seems to be “especially fun when one is in the spotlight”, or sitting and acting strangely throughout a meal, “bringing [people] together in an uncommon space and inviting them to act in ways that are different from a regular meal”. Mueller and Khot et al.’s work on playful eating tech [53] also foregrounds opportunities for playful intervention in mealtime scenarios: their designs show how mealtime technology can create estrangement and be hilarious, in ways that afford creative exploration. Our list of play potentials contributes to enriching the palette of play-food forms explored in HFI. In our own design work (see Section 5), we were equally inspired by our findings and by the play forms proposed in related work.

5 A SPECULATIVE CATALOG OF PLAYFUL MEALTIME TECHNOLOGY

Building on the findings from our contextual research, we set out to produce early speculative ideas of playful technology that might enrich the socio-emotional quality of mealtime. We based our ideas on the play potentials and design recommendations that stem from our contextual research, as well as on the insights we found in the related literature. Our goal at this stage was not to produce fully fleshed ideas that could be readily implemented into advanced prototypes; nor did it matter that ideas were completely realizable from a technical perspective. Rather, inspired by *provotypes* [11], we were after early, half-baked, and even poorly executed design concepts that could be used as provocations in a subsequent participatory process—as ambiguous starting points that could trigger diverse people to creatively contribute to a design space they would likely be unfamiliar with.

Four designers were involved in idea generation. First, working individually, we produced a collection of 23 ideas inspired by our contextual research. We then clustered them by affinity to find interesting design directions and brainstormed to narrow down to a final set of 11 design ideas. Throughout that process, we kept a record of how the design ideas related to the play

potentials and design recommendations from our contextual research, to ensure that the resulting collection represented the breadth of our findings and resulting design directions⁶.

Inspired by *design fictions* [65], in particular by the *Future IKEA Catalogue* [17], we decided to create a catalog to communicate our early ideas. Our aim was not to simply get people to understand what the ideas were so they could provide feedback; we wanted to get them excited, to help them to relate to our technology speculations and imagine how it might be to try them out. We also wanted to entice participants to think about what kinds of similar products they would like to see in the future, so they could help us to carve this emerging and underexplored design space. Our resulting *Speculative Play-Food Technology Futures* catalog⁷ was thus meant to be both a tool for recruiting participants and a first provocation to trigger a (creative) response. We wanted to see which ideas (and hence, which underlying design qualities) created more excitement. We also wanted to hear people's thoughts on how such future-oriented concepts did or did not resonate with their playful cravings. Here we present the ideas in the catalog, framing them as speculative concepts that build on play potentials and design recommendations that emerged from our situated contextual research. Section 6 describes the co-design process that was enabled by the catalog, where we brought our ideas back to local mealtime scenarios and confronted them with the perspectives of our diverse research participants.

FoodLand (Figure 3, top-left) is a table centerpiece that allows diners to build a virtual ecosystem with the food they eat over time. When users take a photo of their dish, food will come to life in the centerpiece as a hologram. To decide what their next meal will be, users can have a look at their centerpiece and see the foods they ate recently. If they do not keep a balanced diet, their *FoodLand* ecosystem will progressively decay.

Food Bingo (Figure 3, top-center) is a table centerpiece that suggests a food combination, a (likely strange) way of eating, and a person who will eat it. To use this funny food recommender, diners simply need to yell “bingo!”—the device will take care of the rest.

Screen-ED (Figure 3, top-right) is a mobile app that teaches people not to use their phones during mealtime. When someone uses their phone, an integrated projector in their device projects funny messages on their face, effectively turning it into a screen. Other diners are allowed to customize the message projected on that diner's face. Thus, diners must beware of their behavior: if they use their phone screen, they will become a screen for their peers.

PlaceMap (Figure 3, center) is a tablecloth full of food culture knowledge. During the meal, it highlights countries and sends prompts to the diners' phones with fun food rituals from these places, so they can try them out. Diners can experiment with new and fun ways of eating while learning about foreign customs. Using *PlaceMap*'s phone app, diners can choose different modes for their experience: random, if they want *PlaceMap* to decide what to feature; or themed, if they want to see rituals of a specific type or from a specific origin, to pair well with the meal.

The **Table Manners Bomb** (Figure 3, bottom-left) is a table centerpiece that allows people to call out their co-diners—or to just mess around with them, if they prefer. Whenever someone does something wrong (or ridiculous, or...) diners can call that person out on their phone and their name will appear on the screen next to a punishment. After a while, the bomb will “explode”, and whoever's name is on the screen will be duly punished. Then, a new punishment will appear, and the cycle will start over again. The 360° camera on top of the bomb will record the diners' reactions throughout their meal.

⁶ A table linking early ideas, shortlisted concepts, design recommendations, and play potentials can be found here: <https://bit.ly/3eY9mK6>

⁷ The full catalog can be accessed here: <https://bit.ly/3BE1Nlj>

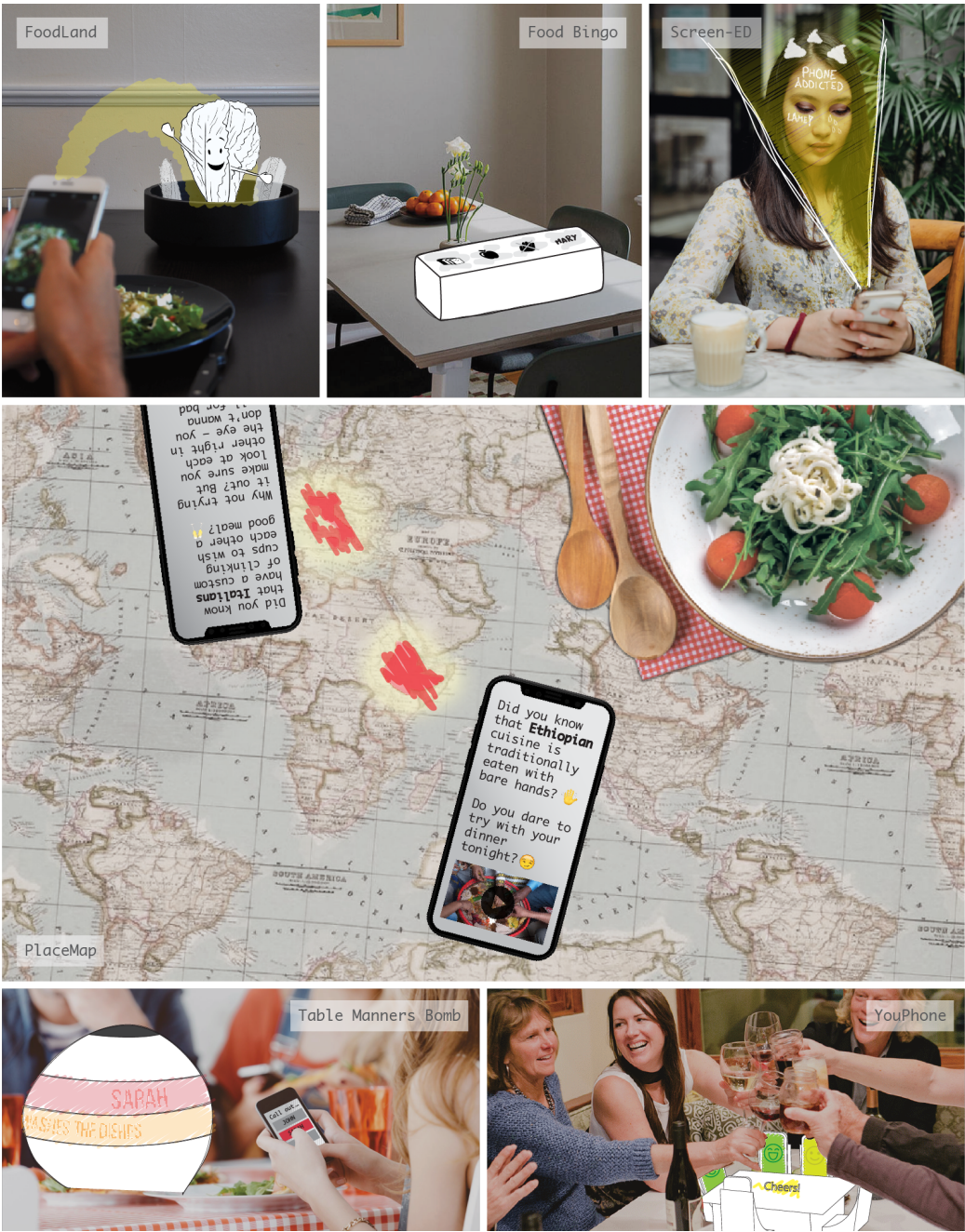


Fig. 3. The first six design concepts included in our speculative catalog of playful mealtime technology: FoodLand (top-left), Food Bingo (top-center), Screen-ED (top-right), PlaceMap (center), the Table Manners Bomb (bottom-left), and YouPhone (bottom-right).



Fig. 4. The last five design concepts included in our speculative catalog of playful mealtime technology. First, the components of the Playful Tableware Series: the Sassy Cutlery (top-left), the Talky-talky Cups (top-right), the Bossy Plates (center-left), and the Anxious Plates (center-right). Then, the Lonely Coffee Machine (bottom).

YouPhone (Figure 3, bottom-right) is a table centerpiece that serves as a phone charging station. It looks like a cute tiny replica of a dining table. To charge their phone, diners simply need to make it “seat on the table”. But that comes at a cost: as soon as they are connected, the phones will begin to imitate their owners, amplifying and exaggerating their actions to make them aware of their behavior throughout the meal.

The **Playful Tableware Series** is a collection of plates, cutlery and cups that diners can use to customize their own playful mealtime experience. Using the *PlayfulTableware* app on their phone, they can activate the devices they want to use in each meal. They can also set the parameters of their experience: “Would they like an explorative one? Or would they rather laugh a lot? Or maybe it is a good day for messing around with one another?” Whatever it is they are craving, the unfolding of the mealtime will be totally up to the diners. The *Playful Tableware Series* includes four design concepts: **Sassy Cutlery** (Figure 4, top-left) items have a personality of their own and react to people’s eating interactions, either by making sounds that add amplify those actions or by talking to them. **Talky-talky Cups** (Figure 4, top-right) allow people to signal their current mood to other diners. They also use a flickering light on the inside of the cup to send subtle cues when their owners are talking too much. **Bossy Plates** (Figure 4, center-left) have an integrated projection system that displays secret messages to the owner of the plate. They prompt diners to act in ways that will lead to fun and laughter, e.g. feeding one another, imitating someone else, eating in bizarre ways... **Anxious Plates** (Figure 4, center-right) get nervous when their owners do not participate in the mealtime conversation. When a diner is not talkative, their plate will start shaking. If the owner does not react, the movement accentuates, making it difficult to eat. If the owner does not change their attitude, the plates move to another diner’s area, in the hopes of finding someone who is more fun.

Finally, the **Lonely Coffee Machine** (Figure 4, bottom) is the last concept in our catalog. As its name indicates, this machine easily feels lonely and nostalgic. The only way to cheer it up is to have lively conversations in front of it. If the diners want to enjoy delicious coffee after their meal, they must do their best to contribute to a delightful shared mealtime; the quality of the coffee they get at the end of the meal will depend on the quality of their conversation. If the conversation gets stuck, the machine will provide fun facts diners can use as ice breakers.

6 PARTICIPANTS’ RESPONSES TO OUR SPECULATIVE DESIGN IDEAS

Once the catalog was ready, we set out to explore diverse perspectives on our early, speculative design ideas. We wanted to engage diverse populations to collectively imagine how our ideas might afford mealtime experiences that responded to their socio-emotional needs. To do that, we conducted a series of remote play-test sessions where we allowed co-located participants to experience malleable prototypes they could easily rethink. Our aim was to help participants to get an embodied understanding of important qualities of our design ideas, in ways that they could build on their own lived experience to contribute to a (likely unfamiliar) design space.

6.1 Method

We recruited participants by distributing our catalog on social media (see Appendix C), and inviting participants from our earlier contextual research. We presented the catalog as a collection of ideas of future food-tech, showing 2-3 examples in each post and inviting interested people to see the full catalog. Those who reached out were sent the catalog and were invited to playtest some of the ideas. We scheduled one-on-one follow-up video calls with them to (1) answer questions, (2) describe the co-design activity, (3) ask which ideas they liked most and least, and

(4) schedule the co-design sessions. We asked participants to recruit a group of their acquaintances for the co-design sessions—we offered our support to make it easier for them to have that participant-ambassador role.

In the co-design sessions, participants were co-located. Researchers attended via video call. The sessions were ~2h long and unfolded as follows: First, we initiated the video call and had an introductory conversation (~15 min.). We described the project, made sure participants understood the procedures, and answered their questions. We also invited participants to share their early ideas about the catalog, so we could begin to gauge their reactions.

After the introduction, we moved on to a meal (~1h) where participants experienced their choice of a technology from our catalog. During the meal, we moved behind the scenes to *enact* the prototype: we muted our microphones, turned off our camera, and used screen-sharing to turn the participants' computer into a physical representation of the prototype. That allowed the meal and social interactions to unfold more naturally than if we had been physically present. For example, to prototype *PlaceMap*—a smart tablecloth displaying a world map that highlights parts of the map and sends playful food traditions from those locations to participants (see Figure 3, center)—we did not build a technology-augmented tablecloth. Instead, we shared our computer screen displaying Google Maps, to indicate location changes, and used WhatsApp to send playful food traditions to participants' phones (Figure 5).

Once participants decided the meal was over, we moved on to the third phase of the session: a conversation (~30 min.) focused on unpacking how participants experienced the prototype. Here, we stopped enacting the prototype and returned to our facilitator role. We wanted to use participants' fresh experience of the prototype to stimulate a creative response, to challenge and advance our early design ideas. To spark the discussion, we invited participants to share their thoughts about the mealtime they had just experienced. Then, we encouraged them to build on, modify, and even rethink the prototype—or to discard it and come up with new ideas altogether, if that was what they wanted. Researchers took notes throughout the sessions, which we later analyzed through inductive thematic analysis [12]; we also video recorded the sessions and analyzed them using an interaction analysis approach [43].

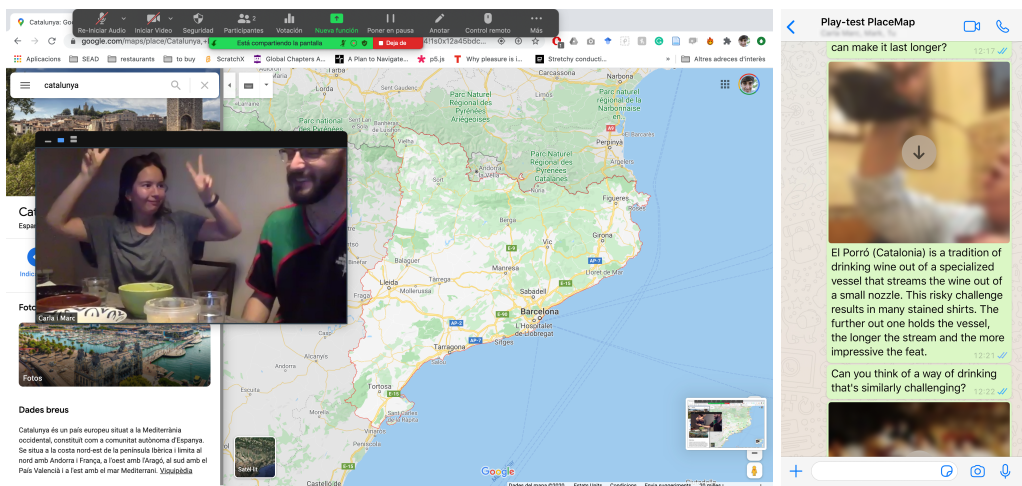


Fig. 5. *PlaceMap* in action, behind the scenes. Left: Screenshot of the view from the designer's perspective, including the Google Maps interface (which was also visible on the participants' end) and a small window displaying the feed from the participants' camera. Right: Screenshot of the shared WhatsApp group message where some of the food traditions were sent.

Overall, we conducted 13 co-design sessions that involved 37 participants in total. They were originally from or currently resided in 9 different countries: Spain, India, USA, France, the Netherlands, Belgium, Germany, Russia, and Mexico. They had different relationships: groups of friends, couples living together, families with older children, or housemates. Participants chose which design ideas to experience and creatively disrupt. 6 of our catalog ideas were selected: *PlaceMap* (6 times), *Table Manners Bomb* (2), *Talky-talky Cups* (2), *Sassy Cutlery* (2), *Screen-ED* (1), and *YouPhone* (1). Below, we share the most relevant findings from our analysis of the co-design sessions. We use the convention S to refer to the sessions (e.g. session 7 is “S7”).

6.2 Results

6.2.1 The playful potential of “fun facts” to promote pro-social activity. We observed that, by delivering relevant information, some of our prototypes stimulated lively conversations. When prompted with relevant “fun facts”, participants reacted in pro-social ways. For example, when *PlaceMap* provided food traditions, participants often decided to talk about them (S9). In some cases, they used that as an opportunity to share stories or traditions of their own (S3&4). In others, participants responded more actively, e.g. by enacting the traditions (S4) or by inventing new food games inspired by them (S6).

Overall, “fun facts” showed a great potential for stimulating social food-play—which aligns with findings from both our contextual research and the related literature (see 4.2.1). However, some participants raised concerns about the delivery channel. Many of our ideas, including *PlaceMap*, used phones as the main interaction mechanism. According to participants in S3&9, that created tensions: even when used to deliver facts that might stimulate a conversation, phones often tempted people to individual uses that might be socially disruptive (e.g. checking social media). Participants suggested trying to avoid individual technology use, e.g. by only using one phone at the center of the table, or by discarding phones altogether and using a dedicated device that did not afford individual use.

6.2.2 Who should drive the rhythm of a play-food experience? In many of our design ideas, technology played an important role in setting the rhythm of the experience. We quickly realized that people might prefer to have more agency on that front, especially regarding pace and timing. When it came to those qualities, our prototypes fell short in many ways. For example, S3,4&9 thought *PlaceMap* was too invasive: it imposed a rhythm that was too intense as it forced diners to constantly jump from one food tradition to another, even when they did not want to. Participants suggested alternative approaches to decision-making, where diners (as opposed to the technology) could choose when (and when not) to request a playful prompt. Participants in S2 were also critical about the role of technology as a driver of food-play experiences. After playing with *Screen-ED*, they proposed to frame technology as an invitation to social play that diners may or may not pay attention to; one that should not be perceived as an imposition, but rather as something that sits on the background and can be paid attention to only when the diners see fit. S5 discussed the implications of disrupting conversations: building on their experience of *Sassy Cutlery*, they warned us about the risks of interrupting conversations with prompts that are not contextually sensitive. They suggested designers should consider: “How is the technology disruption fun? What meaningful conversations might it displace? Is that a desirable tradeoff?”

Interestingly, we found that misalignment in the rhythm of play-food experiences did not only occur between diners and the technology; it also emerged between the diners themselves. For example, in S12, a participant felt that the pace set by *PlaceMap* was too slow, while others appreciated the time between prompts to enjoy their food. We also observed situations where participants enjoyed concrete ways in which technology took the initiative. For example,

participants in S4 visibly enjoyed themselves when *PlaceMap* interrupted them by sending new food traditions that were relevant to the ongoing conversation topic. Participants also enjoyed when technology stepped in and playfully teased them. For example, in S8, there was an occasion where the *Table Manners Bomb* arbitrarily (rather than prompted by another diner, as was the usual mechanism) punished a diner, to the enjoyment of others; or, in S3, *PlaceMap* sent a food tradition that involved “making the drink last longer” right when a diners’ cup was almost empty, which initiated a clearly unfair competition that made the party laugh. In S7, some technology-driven prompts also contributed to the quality of the social experience, e.g. in moments of awkward silence, participants appreciated that the *Table Manners Bomb* “decided” to explode and revitalize the conversation.

An important take-away from our co-design sessions is that, rather than being told when to play and when not to, participants appreciated being able to determine the scaffolding of the food-play experience. They proposed ways of reclaiming that decision-making capacity, e.g. through a button for requesting *PlaceMap* to move on to the next tradition (suggested by S4,9&12). While it appears that some people enjoy being guided more than others, it may be a good design decision to provide them with agency when it comes to the rhythm of food-play experiences. It may also be interesting to strategically create moments for technology-driven interventions, in situations where it is technically possible for technology to read the social situation and intervene in contextually meaningful ways (e.g. when there is a prolonged silence). Importantly, current technology may not yet be capable of sensibly intervening in scenarios of a more complex nature; we suggest the need for more technical research that enables food-tech designs to better read a social situation and intervene in ways that do not disrupt, but rather enrich, people’s ongoing conversations and interactions.

6.2.3 Towards technology that plays an active role and is socially aware. Our participants seemed to enjoy interacting with technologies that appeared as not neutral, i.e. that seemed to have agency and, on occasion, a personality. For example, participants in S4 wanted *PlaceMap* to be a sassy character they could tease: they often taunted it, daring it to propose traditions that were crazy enough to discomfort them. S4 participants also pretended to be able to become friends with *PlaceMap*, as if it were a living thing. After receiving more individual prompts than their partner, one of the diners celebrated “oh, I got a personal one!”; her partner answered “you got another one?”, to which she responded “yes, I’m special”. In S8, participants quickly became used to playfully blaming the *Table Manners Bomb* for being partial and having an agenda; they tried to convince it to punish other people, as if the tech had its own agenda. Similarly, in S7, one of the participants felt that the *Table Manners Bomb* was deliberately targeting him, and reacted by flipping the middle finger to the camera. The researcher, who was operating the prototype behind the scenes, reacted by increasing the punishment, which led to a hilarious moment all the diners enjoyed (including the participant who had been punished).

Importantly, the technology’s involvement as an active “thing” with agency and/or a personality only made sense when it was contextually sound. Several participants noted that they wanted the technology to be context aware. For example, in S12, participants appreciated that, at the beginning of the experience, *PlaceMap* prompted them with food traditions that made sense in the context of the first minutes of a meal, e.g. clinking glasses. Similarly, in S13, a participant mentioned that she wanted the *Sassy Cutlery* to be attuned to her emotions so as to enhance them. Again, from a technical perspective, it may still be complicated to develop technologies that are able to read a social situation and actively participate in it; we highlight the need for technical research that provides designers with new possibilities in this space. In the meantime, we suggest that designers might want to focus on designing technologies that carefully intervene in concrete situations they can control or, alternatively, that they leave it to the diners to decide when they

should participate, rather than carelessly disrupting people's conversations. We also suggest that there is a huge opportunity to further explore how to design technologies that can be perceived as personas with the capacity to intervene in the social space; we see it as a largely underexplored design space that may bring about interesting opportunities for playful technology design.

6.2.4 The importance of encouraging messy, embodied, hands-on food interactions. In the spirit of focusing people's attention on their in-the-moment engagement with their food and their peers, we found it important to encourage participants to get hands-on and experiment with their food. Participants in S12 suggested that *PlaceMap*'s prompts of eating with their hands made the meal more satisfying; they noted that this design can help people to find ways of eating that are more fulfilling and sensual. Yet, they also talked about the importance of being aware of cultural idiosyncrasies and designing for diverse levels of (dis)comfort: for example, they noted that they all felt comfortable with eating with their hands because it was a common thing in their culture, but thought that others with different lived experiences and cultural assumptions might not; they also noted that one of them felt grossed out by the idea of burping as a show of appreciation (as is common in many Asian countries), while others found it extremely fun. In S6, the embodied and messy nature of the prompts delivered by *PlaceMap* contributed to bringing people together: by inviting the diners to eat in strange, unusual ways, it helped them to focus on enjoying each other's company and brought about a great deal of laughter—often, by allowing the diners to act in performative, silly ways.

Interestingly, participants also highlighted the potential of technology to create moments for pause where they could take a break from eating. Recalling a *PlaceMap* tradition that prompted people to throw paper into each other's cups, participants in S12 suggested that creating a pause in eating opened a window of opportunity for both socializing and helping their bodies to digest. Food-play technology might benefit from inviting diners to fluctuate between eating and resting, to the benefit of both the social and the bodily mealtime experience.

6.2.5 Engagement depends largely on the idiosyncrasies of participants and their context. Finally, in our co-design sessions, we observed notable differences between people's ways of approaching, experiencing, and reflecting about our proposed food-play experiences. Different groups leaned towards different forms of play, e.g. while those in S9 preferred open-ended prompts that privileged explorative and conversational play, in S8 participants loved to be presented with robust game-like rules that allowed them to compete, tease one another, and experience the thrill of seeing each other's struggles. Likewise, some groups responded actively to the technology prompts (S4,6,7&8) while others took a more conversation-based stance (S2,3&9). Even within one group, we observed different ways of reacting to the prototypes, e.g. in S1, some people actively and embodiedly enacted the traditions proposed by *PlaceMap*, while others simply commented on them. From a design perspective, we suggest that a useful strategy for responding to such diversity of approaches might be to allow space for appropriation: framing technology as an invitation rather than an imposed experience, a tool of sorts that enables diners to craft their very own play experience in ways that feel meaningful to them. In our experience, allowing people to "finalize" the technology and have a say in their functionality led to contextually meaningful fun and laughter, e.g. when participants in S7 came up with their very own way of telling us that their *Table Manners Bomb* meal was over: "screw the bomb!". Existing works have explored how to design technology that is flexible and allows space for interpretation (e.g. [32]'s *ambiguous design*) and user appropriation (e.g. [40]'s *suppleness*). Designers should consider how to leverage those design principles to create mealtime technology that acts as a graceful facilitator: an appropriable device that allows them to project and answer to their very own playful cravings.

7 DISCUSSION

This paper presents the outcomes of a co-design process exploring how to use tech to support playful and socio-emotionally rich experiences with and around food. It foregrounds insights that emerged in our diverse designerly engagements with participants, and thus embodies ours and other people's ideas of how tech could contribute to increasingly fun and socio-emotionally sensitive mealtime futures. Our work consolidates existing ideas that have already been discussed in recent literature (e.g. the fact that using technology to deliver information can stimulate mealtime conversations [23][29][30][31]) and proposes new ideas that can help to further discussions in this design and research space (e.g. the set of play-food potentials that emerged from our contextual research). Overall, we present a three-fold contribution playful HFI practitioners can leverage in their own work:

First, we provide a set of design guidelines for envisioning new play-food technologies, in the form of: (1) a list of *play potentials* of mealtime that point designers towards food-related experiences that are socio-emotionally rich (see 4.2.2), and (2) a series of design recommendations that foreground qualities that might be important in the design space of mealtime technology (see 4.2.1). Those design guidelines stem from our research participants' activity and responses. We present them as inspirational design material that can help designers to inform ideation processes focused on creating technology that supports social mealtime experiences that are contextually sound.

Second, we present a portfolio of speculative design ideas that concretize the above design guidelines into tangible and relatable technology concepts. Our *Speculative Play-Food Technology Futures* catalog (see Section 5) serves a dual purpose in our work: on the one hand, it enables us to illustrate how the findings from our contextual research can be translated into design practice; on the other hand, it enabled us to further our conversations with participants, empowering them to contribute concrete design ideas that built on the early contributions they made in the contextual research phase. We present our portfolio as a collection of provocative ideas that can inspire novel designs in ways that extend existing works in playful HFI. However half-baked and speculative (and, in some cases, technically questionable), our ideas embody design choices that respond to real people's playful cravings; as such, they bring forth valuable design knowledge. We hope they provoke and inspire designers to embrace increasingly playful and socio-emotionally sensitive approaches to mealtime tech design.

Third, we share the insights from a series of co-design sessions where we experimented with, challenged, and creatively disrupted the early ideas in our catalog. Those insights raise important considerations designers should take into account when developing playful mealtime technology. They point designers' attention towards design choices they will likely have to make, and discuss our participants' perspectives regarding those choices. In particular, our findings suggest that: (1) using technology to deliver fun facts during the meal can stimulate social eating experiences; (2) in social mealtime experiences, it might be better to provide diners with agency over the unfolding of events rather than letting the technology scaffold the experience; (3) providing technology with some kind of personality, as opposed to making it appear neutral, might help people to see it as a fun agent that is socially aware and can be interacted with; (4) technology should embrace the messy, embodied, and hands-on nature of eating, leveraging it to the benefit of a rich mealtime experience; and (5) designers should consider how the idiosyncrasies of each context might impact how people experience a playful and social meal, since food, play, and social interactions are remarkably culturally loaded. We hope that these learnings help designers to attune the interaction mechanisms and underlying design qualities of their food-tech designs, in ways that the experiences afforded by the final outcomes are playful and socially stimulating.

While our findings cannot be considered universally applicable, they embrace the views of people from diverse countries, from different socio-cultural backgrounds, and with different household configurations. We thus see them as a step forward towards imagining the future of

playful mealtime technology from the bottom-up. Another limitation of our work lies in its scope: while some of our speculative ideas slightly tapped into food preparation (e.g. *Food Bingo*) or sourcing (e.g. *FoodLand*), our work mostly looked at mealtime as an experience of food consumption. Future work should build on our findings and broaden the scope of possible activities included in (or, at least, intimately connected to) mealtime, such as food preparation and disposal—to better understand and respond to the rather organic and multifaceted nature of mealtime practices.

Another take-away from our research is the methodological approach we took and the kinds of co-design dialogues it enabled. Our process allowed us to shed light on a design space that is rather new, where existing work has either focused on exceptional, out-of-the-ordinary mealtime experiences (e.g. fine dining) or has not embraced a participatory angle. We have begun to scratch the surface of this underexplored domain by engaging diverse people in ways that they can have a say in carving the foundations of this novel design space. We point at interesting design qualities, directions, and ideas that could be further explored in future work. Our approach enables a bottom-up process where average citizens (as opposed to technology or gastronomy experts only) can co-imagine the future of play-food technology. It gives rise and presence to diverse takes on the questions of: How should this emerging design space be? What values and agendas should it respond to? And ultimately, why should we be designing playful mealtime tech, and how? We see that approach as an interesting way of beginning to explore emergent design spaces where technology might not yet be a relatable part of people's day-to-day; spaces where people may have little lived experiences with technology, to a point that they have a hard time contributing new design ideas. By engaging diverse participants in playful, speculative, and embodied co-design activities, we were able to help them to connect with a rather unfamiliar design space at an experiential level; that, in turn, enabled them to relate to our design goals and contribute insightful ideas that advanced our thinking in valuable directions. Our group is currently exploring how that approach might be helpful in other areas of interaction design research, beyond play-food tech (e.g. in smart cities, or in playful drones). We hope that ours and other people's efforts in this direction will continue to shed light on how to envision new technology design spaces from the bottom-up, empowering diverse stakeholders to shape these emerging areas by co-carving their foundations as design partners.

8 CONCLUSION

In this paper, we shared the outcomes of a co-design exploration where we investigated the playful potential of day-to-day, mundane mealtime experiences and imagined how technology might respond to that potential. We presented an annotated portfolio of speculative design ideas that emerged from our interactions with diverse participants. We grounded those ideas by describing the contextual research that motivated them, and unpacked and discussed their potential by reporting on the insights that emerged through a series of co-design sessions where we co-experienced, -discussed, and -creatively disrupted them with our participants. Our *Speculative Play-Food Technology Futures* catalog illustrates the learnings from our co-design engagements: it embodies ours and our participants' ideas of what technology could do to support mealtime experiences that are increasingly playful and socio-emotionally rich. Our contribution will provoke designers to carefully consider the impact of food-tech innovations on the quality of people's social food experiences. We hope it will also inspire them to design technologies that cultivate forms of food-play that are both fun and socio-emotionally desirable.

A SURVEY RECRUITMENT MESSAGES



Fig. 6. Front and back of the flyer we left at local restaurants and cafeterias. For anonymous review, we have covered the identifiable information about the authors with red rectangles.

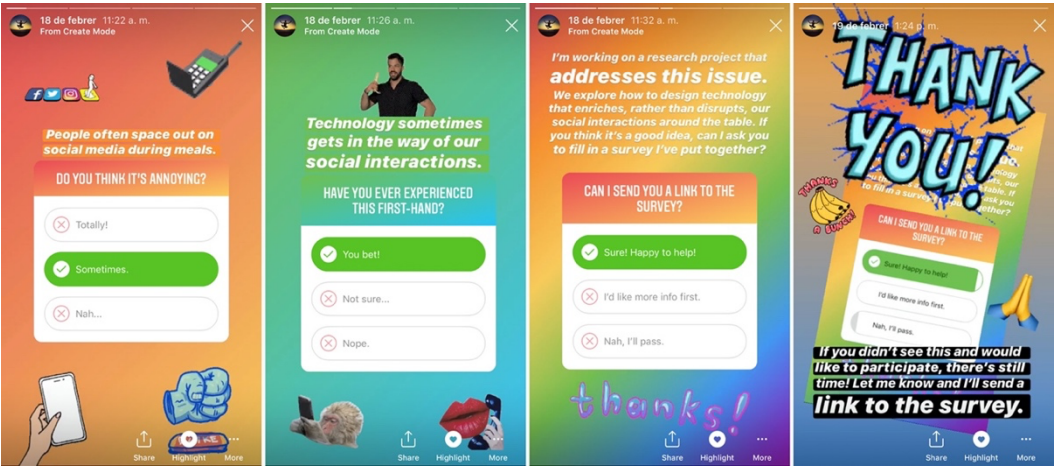


Fig. 7. Sequence of Instagram story posts we used to recruit participants for our online survey.

B CULTURAL PROBE RECRUITMENT MESSAGES



Fig. 8. Sequence of Instagram story posts we used to recruit participants for our cultural probe intervention.

C CO-DESIGN RECRUITMENT MESSAGES



Fig. 9. Sequence of Instagram story posts we used to recruit participants for our co-design sessions.

REFERENCES

- [1] Ferran Altarriba Bertran, Jared Duval, Elena Márquez Segura, Laia Turmo Vidal, Yoram Chisik, Marina Juanet Casulleras, Oscar García Pañella, Katherine Isbister and Danielle Wilde. 2020. Chasing Play Potentials in Food Culture: Learning from Traditions to Inspire Future Human-Food Interaction Design. In *Proceedings of the 2020 ACM on Designing Interactive Systems Conference (DIS '20)*. Association for Computing Machinery, New York, NY, USA, 979–991. DOI:<https://doi.org/10.1145/3357236.3395575>
- [2] Ferran Altarriba Bertran*, Samvid Jhaveri, Rosa Lutz, Katherine Isbister and Danielle Wilde*. 2019. Making Sense of Human-Food Interaction. In *CHI Conference on Human Factors in Computing Systems Proceedings* May 4–9, 2019, Glasgow, Scotland UK. ACM, New York, NY, USA, 13 pages. <https://doi.org/10.1145/3290605.3300908> (* joint first-authors)
- [3] Ferran Altarriba Bertran, Rosa Lutz and Katherine Isbister. forthcoming. Where Interaction Design Meets Gastronomy: Crafting Increasingly Playful and Interactive Eating Experiences. In *Proceedings of the 2nd International Conference on Food Design and Food Studies, Experiencing Food, Designing Sustainable and Social Practices (EFOOD'19)*. November 28–30, 2019, Lisbon, Portugal. (pre-press copy available)
- [4] Ferran Altarriba Bertran, Elena Márquez Segura, Jared Duval and Katherine Isbister. 2019. Chasing Play Potentials: Towards an Increasingly Situated and Emergent Approach to Everyday Play Design. In *Proceedings of the 2019 on Designing Interactive Systems Conference (DIS '19)*. ACM, New York, NY, USA, 1001-1015. DOI: <https://doi.org/10.1145/3322276.3322325>
- [5] Ferran Altarriba Bertran, Elena Márquez Segura, and Katherine Isbister. 2020. Technology for Situated and Emergent Play: A Bridging Concept and Design Agenda. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems (CHI '20)*. Association for Computing Machinery, New York, NY, USA, 1–14. DOI:<https://doi.org/10.1145/3313831.3376859>
- [6] Ferran Altarriba Bertran, Laia Turmo Vidal, Ella Dagan, Jared Duval, Elena Márquez Segura, and Katherine Isbister. 2020. Chasing Play with Instagram: How Can We Capture Mundane Play Potentials to Inspire Interaction Design? In *Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems (CHI EA '20)*. Association for Computing Machinery, New York, NY, USA, 1–8. DOI:<https://doi.org/10.1145/3334480.3382913>
- [7] Ferran Altarriba Bertran & Danielle Wilde. 2018. Playing with food: reconfiguring the gastronomic experience through play. *Experiencing Food, Designing Dialogues; Bonacho, R., de Sousa, AP, Viegas, C., Martins, JP, Pires, MJ, Estêvão, SV, Eds*, 3–6.
- [8] Ferran Altarriba Bertran*, Danielle Wilde*, Ernő Berezvay and Katherine Isbister. 2019. Playful Human-Food Interaction Research: State of the Art and Future Directions. In *Proceedings of the 2019 Annual Symposium on Computer-Human Interaction in Play (CHI Play '19)*. ACM, New York, NY, USA, 1001-1015. DOI: <https://doi.org/10.1145/3322276.3322325> (* joint first-authors)

- [9] Takahiro Arakawa and Masa Inakage. 2007. Mamagoto: playing with food. In ACM SIGGRAPH 2007 posters. ACM, 161.
- [10] Phillip Bell. 2001. Content analysis of visual images. *Handbook of visual analysis*, 13.
- [11] Laurens Boer and Jared Donovan. 2012. Provotypes for participatory innovation. In Proceedings of the Designing Interactive Systems Conference (DIS '12). Association for Computing Machinery, New York, NY, USA, 388–397. DOI:<https://doi.org/10.1145/2317956.2318014>
- [12] Virginia Braun & Victoria Clarke. 2006. Using thematic analysis in psychology. *Qualitative research in psychology*, 3(2), 77–101.
- [13] Virginia Braun & Victoria Clarke. 2019. Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health*, 11(4).
- [14] Virginia Braun & Victoria Clarke. 2020. One size fits all? What counts as quality practice in (reflexive) thematic analysis?. *Qualitative research in psychology*, 1–25.
- [15] Scott L. Brown. 2009. Play: How it shapes the brain, opens the imagination, and invigorates the soul. Penguin.
- [16] Barry Brown and Oskar Juhlin. 2015. *Enjoying machines*. MIT Press.
- [17] Barry Brown, Julian Bleecker, Marco D'Adamo, Pedro Ferreira, Joakim Formo, Mareike Glöss, Maria Holm, Kristina Höök, Eva-Carin Banka Johnson, Emil Kaburuan, Anna Karlsson, Elsa Vaara, Jarmo Laaksolahti, Airi Lampinen, Lucian Leahu, Vincent Lewandowski, Donald McMillan, Anders Mellbratt, Johanna Mercurio, Cristian Norlin, Nicolas Nova, Stefania Pizza, Asreen Rostami, Mårten Sundquist, Konrad Tollmar, Vasiliki Tsaknaki, Jinyi Wang, Charles Windlin, and Mikael Ydholm. 2016. The IKEA Catalogue: Design Fiction in Academic and Industrial Collaborations. In *Proceedings of the 19th International Conference on Supporting Group Work (GROUP '16)*. Association for Computing Machinery, New York, NY, USA, 335–344. DOI:<https://doi.org/10.1145/2957276.2957298>
- [18] Roger Caillois. 2001. *Man, play, and games*. University of Illinois Press.
- [19] Wonjeong Chae, Yeong Jun Ju, Jaeyong Shin, Sung-in Jang, & Eun-Cheol Park. 2018. Association between eating behaviour and diet quality: eating alone vs. eating with others. *Nutrition journal*, 17(1), 1–11.
- [20] Ying-Yu Chen, Ziyue Li, Daniela Rosner, and Alexis Hiniker. 2019. Understanding Parents' Perspectives on Mealtime Technology. *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol.* 3, 1, Article 5 (March 2019), 19 pages. DOI:<https://doi.org/10.1145/3314392>
- [21] Mihály Csikszentmihalyi. 1997. Finding flow: The psychology of engagement with everyday life. Basic Books.
- [22] Nils Dahlbäck, Arne Jönsson, and Lars Ahrenberg. 1993. Wizard of Oz studies: why and how. In *Proceedings of the 1st international conference on Intelligent user interfaces (IUI '93)*. Association for Computing Machinery, New York, NY, USA, 193–200. DOI:<https://doi.org/10.1145/169891.169968>
- [23] Hilary Davis, Hasan Shahid Ferdous, and Frank Vetere. 2017. 'Table Manners': Children's Use of Mobile Technologies in Family-friendly Restaurants. *Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 969–978. DOI:<https://doi.org/10.1145/3027063.3053353>
- [24] Sebastian Deterding. 2013. *Modes of play: A frame analytic account of video game play* (Doctoral dissertation, Staats- und Universitätsbibliothek Hamburg Carl von Ossietzky).
- [25] Markéta Dolejšová, Hilary Davis, Ferran Altarriba Bertran and Danielle Wilde. 2020. Feeding the Futures of Human-Food Interaction. *interactions* 27, 5 . (September - October 2020), 34–39. DOI:<https://doi.org/10.1145/3414471>
- [26] Markéta Dolejšová*, Danielle Wilde*, Ferran Altarriba Bertran and Hilary Davis. 2020. Disrupting (More-than-) Human-Food Interaction: Experimental Design, Tangibles and Food-Tech Futures. In *Proceedings of the 2020 ACM on Designing Interactive Systems Conference (DIS '20)*. Association for Computing Machinery, New York, NY, USA, 993–1004. DOI:<https://doi.org/10.1145/3357236.3395437> (* joint first-authors)
- [27] Mary Douglas. 1972. Deciphering a meal. *Daedalus*, 61–81.
- [28] Jeremy Farr-Wharton, Marcus Foth, and Jaz Heejeong Choi. 2013. EatChaFood: challenging technology design to slice food waste production. In Proceedings of the 2013 ACM conference on Pervasive and ubiquitous computing adjunct publication. ACM, 559–562.

- [29] Hasan Shahid Ferdous, Bernd Ploderer, Hilary Davis, Frank Vetere, and Kenton O'Hara. 2015. Pairing Technology and Meals: A Contextual Enquiry in the Family Household. In Proceedings of the Annual Meeting of the Australian Special Interest Group for Computer Human Interaction (OzCHI '15). Association for Computing Machinery, New York, NY, USA, 370–379. DOI:<https://doi.org/10.1145/2838739.2838780>
- [30] Hasan Shahid Ferdous, Bernd Ploderer, Hilary Davis, Frank Vetere, and Kenton O'hara. 2016. Commensality and the Social Use of Technology during Family Mealtime. ACM Trans. Comput.-Hum. Interact. 23, 6, Article 37 (December 2016), 26 pages. DOI:<https://doi.org/10.1145/2994146>
- [31] Hasan Shahid Ferdous, Frank Vetere, Hilary Davis, Bernd Ploderer, Kenton O'Hara, Rob Comber, and Jeremy Farr-Wharton. 2017. Celebratory Technology to Orchestrate the Sharing of Devices and Stories during Family Mealtimes. Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems. Association for Computing Machinery, New York, NY, USA, 6960–6972. DOI:<https://doi.org/10.1145/3025453.3025492>
- [32] William W. Gaver, Jacob Beaver, and Steve Benford. 2003. Ambiguity as a resource for design. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '03). Association for Computing Machinery, New York, NY, USA, 233–240. DOI:<https://doi.org/10.1145/642611.642653>
- [33] Bill Gaver, Tony Dunne, and Elena Pacenti. 1999. Design: Cultural probes. interactions 6, 1 (Jan./Feb. 1999), 21–29. DOI:<https://doi.org/10.1145/291224.291235>
- [34] William Gaver. 2002. Designing for homo ludens. I3 Magazine, 12(June), 2–6.
- [35] William Gaver. 2012. What should we expect from research through design? In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '12). Association for Computing Machinery, New York, NY, USA, 937–946. DOI:<https://doi.org/10.1145/2207676.2208538>
- [36] Andrea Grimes and Richard Harper. 2008. Celebratory technology: new directions for food research in HCI. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '08). Association for Computing Machinery, New York, NY, USA, 467–476. DOI:<https://doi.org/10.1145/1357054.1357130>
- [37] Lars Hallnäs & Johan Redström. 2001. Slow technology—designing for reflection. *Personal and ubiquitous computing*, 5(3), 201–212.
- [38] Deepi Harish. 2017. #FoodPorn Is Changing The Way Millennials Eat. In Huffington Post. Published on March 24th, 2017. Accessed on October 23rd, 2018 at https://www.huffingtonpost.ca/deepi-harish/foodporneating-habits_b_15574714.html
- [39] Johan Huizinga. 1950. Homo Ludens: A Study of the Play Element in Culture. Beacon Press.
- [40] Katherine Isbister and Kristina Höök. 2009. On being supple: in search of rigor without rigidity in meeting new design and evaluation challenges for HCI practitioners. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '09). Association for Computing Machinery, New York, NY, USA, 2233–2242. DOI:<https://doi.org/10.1145/1518701.1519042>
- [41] Katherine Isbister. 2016. *How games move us: Emotion by design*. MIT Press.
- [42] Katherine Isbister, Elena Márquez Segura, & Edward F. Melcer. 2018. Social Affordances at Play: Game Design Toward Socio-Technical Innovation. In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (CHI '18). ACM, New York, NY, USA, Paper 372, 10 pages. DOI: <https://doi.org/10.1145/3173574.3173946>
- [43] Brigitte Jordan & Austin Henderson. 1995. Interaction analysis: Foundations and practice. *The journal of the learning sciences*, 4(1), 39–103.
- [44] Dhruv Khullar. 2016. How social isolation is killing us. *New York Times*, Dec 22, 2016.
- [45] Yumi Kimura, T. Wada, K. Okumiya, Y. Ishimoto, E. Fukutomi, Y. Kasahara, W. Chen, R. Sakamoto, M. Fujisawa, K. Otsuka, & Kozo Matsubayashi. 2012. Eating alone among community-dwelling Japanese elderly: association with depression and food diversity. *The journal of nutrition, health & aging*, 16(8), 728–731.
- [46] Brian Mac Namee, Pauline Rooney, Patrick Lindstrom, Andrew Ritchie, Frances Boylan, and Greg Burke. 2006. Serious Gordon: using serious games to teach food safety in the kitchen. 9th. International Conference on Computer Games: AI, Animation, Mobile, Educational and Serious Games (CGAMES06), 211–217, Dublin, 22–24 November 2006.

- [47] Brandon T. McDaniel & Sarah M. Coyne. 2016. "Technoference": The interference of technology in couple relationships and implications for women's personal and relational well-being. *Psychology of Popular Media Culture*, 5(1), 85.
- [48] Yash Dhanpal Mehta, Rohit Ashok Khot, Rakesh Patibanda, and Florian 'Floyd' Mueller. 2018. Arm-A-Dine: Towards Understanding the Design of Playful Embodied Eating Experiences. In Proceedings of the 2018 Annual Symposium on Computer-Human Interaction in Play (CHI PLAY '18). Association for Computing Machinery, New York, NY, USA, 299–313. DOI:<https://doi.org/10.1145/3242671.3242710>
- [49] Yelena Mejova, Hamed Haddadi, Anastasios Noulas, and Ingmar Weber. 2015. #FoodPorn: Obesity Patterns in Culinary Interactions. In Proceedings of the 5th International Conference on Digital Health 2015 (DH '15). Association for Computing Machinery, New York, NY, USA, 51–58. DOI:<https://doi.org/10.1145/2750511.2750524>
- [50] Punyashloke Mishra & Kathryn Hershey. 2002. A framework for designing etiquette for educational technology. In *Etiquette for human-computer work. Proceedings of the American Association of Artificial Intelligence, Fall Symposium. Technical Report FS-02-02* (pp. 68–71).
- [51] Robb Mitchell. 2009. Physical contraptions as social interaction catalysts. In *3rd International Workshop on Physicity* (pp. 37–42).
- [52] Carol Moser, Sarita Y. Schoenebeck, and Katharina Reinecke. 2016. Technology at the Table: Attitudes about Mobile Phone Use at Mealtimes. Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems. Association for Computing Machinery, New York, NY, USA, 1881–1892. DOI:<https://doi.org/10.1145/2858036.2858357>
- [53] Florian 'Floyd' Mueller, Yan Wang, Zhuying Li, Tuomas Kari, Peter Arnold, Yash Dhanpal Mehta, Jonathan Marquez, and Rohit Ashok Khot. 2020. Towards Experiencing Eating as Play. In Proceedings of the Fourteenth International Conference on Tangible, Embedded, and Embodied Interaction (TEI '20). Association for Computing Machinery, New York, NY, USA, 239–253. DOI:<https://doi.org/10.1145/3374920.3374930>
- [54] Michael J. Muller. 2002. Participatory design: the third space in HCI. The human-computer interaction handbook: fundamentals, evolving technologies and emerging applications. L. Erlbaum Associates Inc., USA, 1051–1068.
- [55] Rita Orji, Julita Vassileva, and Regan L. Mandryk. 2013. LunchTime: a slow-casual game for longterm dietary behavior change. *Personal Ubiquitous Comput.* 17, 6 (August 2013), 1211–1221.
- [56] Joongsin Park, Bon-chang Koo, Jundong Cho, and Byung-Chull Bae. 2015. SnackBreaker: A Game Promoting Healthy Choice of Snack Foods. In Proceedings of the 2015 Annual Symposium on Computer-Human Interaction in Play. ACM, 673– 678.
- [57] Jenny Preece. 2004. Etiquette online: From nice to necessary. *Communications of the ACM*, 47(4), 56–61.
- [58] Larry Scheuermann & Gary Taylor. 1997. Netiquette. *Internet Research*.
- [59] John Sharp and David Thomas. 2019. Fun, Taste, & Games: An Aesthetics of the Idle, Unproductive, and Otherwise Playful. MIT Press.
- [60] Miguel Sicart. 2014. *Play matters*. MIT Press.
- [61] Henrik Sproedt. 2012. *Play. Learn. Innovate*. Books on Demand.
- [62] Staff, J. 2014. Why is everyone so busy. *The Economist*. Retrieved from <http://www.economist.com/news/christmasspecials/21636612-time-poverty-problempartly-perception-and-partly-distributionwhy>
- [63] Jaakko Stenros. 2014. In defence of a magic circle: the social, mental and cultural boundaries of play. *Transactions of the Digital Games Research Association*, 1(2).
- [64] Pekka Sulkunen. 2009. The saturated society: Governing risk & lifestyles in consumer culture. Sage Publications.
- [65] Tess Tanenbaum, Karen Tanenbaum, and Ron Wakkary. 2012. Design fictions. In *Proceedings of the Sixth International Conference on Tangible, Embedded and Embodied Interaction* (TEI '12). Association for Computing Machinery, New York, NY, USA, 347–350. DOI:<https://doi.org/10.1145/2148131.2148214>
- [66] Thermomix USA. 2019. Healthy eating and easy home cooking with Thermomix. Website. Accessed on February 15, 2019 from <https://thermomix.com/>

- [67] Yan Wang, Zhuying Li, Robert S. Jarvis, Angelina Russo, Rohit Ashok Khot, and Florian 'Floyd' Mueller. 2019. Towards Understanding the Design of Playful Gustosonic Experiences with Ice Cream. In Proceedings of the Annual Symposium on Computer-Human Interaction in Play (CHI PLAY '19). Association for Computing Machinery, New York, NY, USA, 239–251. DOI:<https://doi.org/10.1145/3311350.3347194>
- [68] Danielle Wilde & Ferran Altarriba Bertran. 2019. Participatory Research through Gastronomy Design: a designerly move towards more playful gastronomy. *International Journal of Food Design*, 4(1), 3-37.
- [69] Eric Zimmerman. 2015. Manifesto for a ludic century. *The gameful world: Approaches, issues, applications*, 19-22.

Received February 2021; revised June 2021; accepted July 2021.