

Celebratory Technology to Orchestrate the Sharing of Devices and Stories during Family Mealtimes

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ABSTRACT

While the idea of “celebratory technologies” during family mealtimes to support positive interactions at the dinner table is promising, there are few studies that investigate how these technologies can be meaningfully integrated into family practices. This paper presents the deployment of *Chorus* – a mealtime technology that orchestrates the sharing of personal devices and stories during family mealtimes, explores related content from all participants’ devices, and supports revisiting previously shared content. A three-week field deployment with seven families shows that *Chorus* augments family interactions through sharing contents of personal and familial significance, supports togetherness and in-depth discussion by combining resources from multiple devices, helps to broach sensitive topics into familial conversation, and encourages participation from all family members including children. We discuss implications of this research and reflect on design choices and opportunities that can further enhance the family mealtime experience.

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous.

Author Keywords

Family; mealtimes; commensality; smartphones; collocated interactions; collaborative use.

INTRODUCTION

Family mealtimes are often occasions for fostering togetherness, sharing personal experiences, and nurturing bonding amongst family members [17]. While the social foundation of shared mealtime practices have long been an important concern within sociological and anthropological fields [3, 37, 49], HCI has only more recently become interested in the area [5,

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Figure 1: *Chorus* enables sharing contents through family members’ devices and bring them together by creating a single display, thereby symbolizing the communal aspects of commensality (published with permission).

22]. Research in HCI regarding family mealtimes has largely focused on either creating innovative technologies for familial interaction [20, 54, 57] or solving food related problems using technologies [25, 52]. Less common is research that attends to the familial experience of eating together [13, 14, 15, 38] and focuses on the interactions around available information and communication technologies (ICTs), particularly the personal smart-devices.

Along with many other aspects of everyday life, family mealtimes have been affected by the popularity of networked and personal mobile technologies such as smartphones and tablets. However their presence and usage at mealtimes has been criticized because it may undermine family time by distracting family members with matters unrelated to family [28, 38]. Much of this criticism, mostly in journalistic accounts [12, 31, 43], has led to attempts to forcefully limit the use of technology at mealtimes [11, 12]. But more recent research [16] has demonstrated that there are both positive and negative aspects of usage and that the potential of smart-devices to enhance family experience of togetherness is not fully explored.

Grimes and Harper [22] recast the role of technologies at mealtimes by proposing that they be considered *celebratory* and called upon researchers “to create applications that embrace the positive, pleasurable, and delightful aspects of food and eating as a social experience” (p. 475). A few have responded to this call. O’Hara et al. [41] demonstrated the potential of a custom 4-faced photo display to facilitate interactions and engage everyone in the table. Ferdous et al. [16] developed

TableTalk, a smart phone app to transform individual devices to be a shared resource for displaying random photo or tweets, and playing music during family mealtimes. While these experimental studies demonstrate the potential for technologies specifically designed for family meals as an interaction space, their aim is to demonstrate the potential of ICTs to facilitate familial interaction and do not go beyond investigating the brief experience of a novel technology. What is missing is a detailed understanding of how such celebratory technologies have changed existing familial interactions. How do they affect the conversation in the family, and which of these conversations are unique due to the presence of these technologies? What are the implications for the use and design of celebratory mealtime technologies beyond the novelty effect?

We aim to address these gaps in this paper. We build upon existing works [16, 41] to investigate how families use their already available smart-devices and data to facilitate familial interaction during shared meals. We investigate this question through a system called *Chorus*, a celebratory technology designed to engage everyone in the family and support their interactions at the dinner table (Fig. 1) through sharing personal contents of their choice (photos, music, tweets, etc.). We explore how the technology is integrated into everyday actions and the evolving behaviors around this device ecology by contributing an empirical investigation of *Chorus* in practice. From our field deployment study with seven families for three weeks each, we derive practical insights regarding how digital technology can be designed as a part of commensal experience to moderate storytelling of the day, encourage participation, influence conversation topics and quality, and subsequently enhance togetherness in the family.

In this paper we: (1) present the findings of study comparing family interactions during mealtimes with and without *Chorus*; (2) discuss the challenges, tensions, and expectations in making mealtime technologies work over long periods; (3) explore the ways mobile devices can be used to enhance togetherness through commensality; and (4) identify the family dynamics and features that make such interactions meaningful. The paper offers new opportunities for design and novel understandings of the potential role of technology for enhancing togetherness through shared mealtimes in the family home.

RELATED WORK

First, we provide an overview of *commensality*, i.e., the shared experience of eating together and various features of it. We then discuss existing literature investigating the influence of technology in this space and attempts to enhance experience through technological interventions. Finally, we review approaches that support the sharing of narratives and content within these configurations.

Commensality in Everyday Family Life

Meals have always been a source of social interaction, cultural identity, heritage, enjoyment, and celebration [3]. This in part relates to the organization of food consumption, such as the work done to encourage children to eat [20, 34] or the etiquette of sharing and coordination in eating [17]. But there are additional social manifestations when families come

together to share a meal [10]. The practices of shared eating is said to inspire social integration and establish or reinforce common identities among the participants [50]. Eating then does not just serve to nourish the body but develops functional relationships between individuals as part of critical social functions [17].

We are interested in everyday commensality, typically defined as “*the practice of sharing food and eating together in a social group such as a family*” [40] (p. 37). The simple act of ‘eating together’ extends far beyond the meal itself. Historically, sharing meals together have deep significance in the social culture. This is somewhat represented in some common everyday words. For example the word ‘family’ originated from Greek word *oikos* that means ‘those who feed together’ [32] (p. 15); ‘prince’ (Latin: *princeps*) means ‘he who gets served first’, ‘participate’ (Latin: *part capere*) means having share of a sacrificial meal [17] (p. 536). Commensality thus alludes to shared dependency, reciprocal commitment, storytelling, educating and socializing children, meal as a gift, encouraging healthier eating practices, manners, accountability, everyday planning, and other social, political, and cultural aspects of eating together [17]. In the next section, we discuss how ICT usage in this space have altered and influenced the commensal experience and different efforts to enhance the familial experience of eating together.

Technology Usage at Family Mealtimes

Television and mobile phones have come under particular scrutiny [27, 38], since these are the most commonly used technology in this space. It has been reported that about 50% of US families have a television in their dining area [9, 27] and as much as 60% families watch television during mealtimes [31, 47]. Recent studies have also noted widespread availability (and occasional use) of mobile technologies during family mealtimes [15, 26, 38], despite the general consensus about refraining from doing so [46]. Parents are often found using smartphone or tablet devices to keep their children distracted while eating [43, 45] or using it themselves for recreational or professional purposes [7, 26, 28, 48].

Much of the discussion about the role of ICTs at mealtimes has focused on the negative consequences on the social functions of commensality. For example, TV watching during meals could result in as much as 15% increase in food consumption [6], lower fruit intake [18] and have positive correlation with more frequent visits to fast-food shops [30]. It has also been accused of hampering familial conversations and other interactions [19], detracting from enjoyment of the meal [51], and not achieving satiety [8].

Barkhuus and Brown [2] challenged these assumptions to unpack the social interactions around television usage and concluded that television watching, even when done alone, is always done in a social context. James Lull [35], in this regard, shed light on how television narratives can trigger discussions among the parents and children to reinforce family values and interactions. Ferdous et al. [15] explored this further, showing how particular characteristics of technologies actively contribute to both a positive sense of commensality as well as tensions that may emerge through their use or non-use.

While shared communication technologies (e.g., television, radio, etc.) are often welcomed during family meals [29], personal devices are viewed as creating tension amongst family members and are often managed through varying family norms and restrictions [14, 15]. Moser et al. [38] identified different factors influencing family members' attitudes towards technology usage during mealtimes and argued for incorporating social awareness features into mobile phone systems to alleviate tensions and conflicts among the family members regarding such usage. Hiniker et al. [28], on the other hand, discussed the differences and consequences of restrictions parents impose on their children's technology usage vs. their own during family mealtimes and recommended finer control over contextual constraints regarding technology usage.

These works demonstrate that mobile devices are easily available at the dinner table and increasingly used at mealtimes and show that each family has their own way of managing interactions with these devices during these times. Despite tensions around their presence and usage, when personal devices are used for a common purpose, they can enact various features of commensality in the family. In the next section, we discuss various efforts to utilize technologies, particularly mobile devices, to enhance familial interactions at mealtimes.

HCI: Celebratory Technology for Family Mealtimes

Family mealtimes is not just about eating well and eating politely, but are sites for the exchange of personal and collective narratives [37, 40]. Through these exchange, we find the social construction of shared family knowledge, sensibilities, and moral perspectives [33].

HCI has invested significant interest in the facilitation of interaction among remote family members. Wei et al. [56, 57] augmented video-conferencing with NUI techniques in an interactive dining table to create a sense of coexistence among remote family members. Using existing and available ICTs, Grevet et al. [21] demonstrated that even very minor social connectedness could improve the dining experience of solitary eaters. Nawahdah and Inoue [39] and Tsujita et al. [54] took this further to share video recorded meals with others in a time-shifted environment.

Recent research has also explored how the personal devices can often be used as a shared resource [4]. Mobile and smart devices held our personal data in a never-seen-before scale [1], and researchers wanted to leverage this opportunity for enhancing the exchange of shared narratives during family meals. Gldenpfennig and Fitzpatrick [24] developed a mobile app, which allows to curate the captured images already on the phone along different story lines. Poppinga et al. [44] has developed *StoryTeller* app that helps individuals on mobile phones to create stories along a day. Since mealtimes (typically dinner) are often the only time all family members come together at the same place and time, we focus on how such 'prepared stories' change and contribute to the commensal experience.

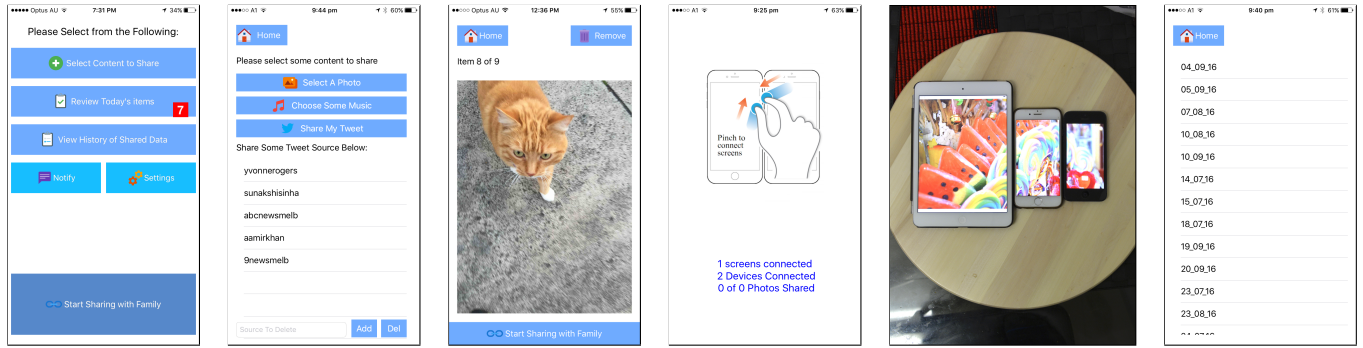
The role of technology, in particular, collocated photo sharing in social groups has been used as a means to stimulate conversation and to engage in shared reminiscence [55]. One notable

usage of photos in family mealtime settings is the *4Photos* table centerpiece concept [41, 53]. In this system, photos from diner's Facebook collections were displayed on the *4Photos* system. The role of the photos was not specifically to promote conversation (which they did) but rather to provide meaningful objects through which contextually appropriate identity and relationship work could be conducted. Ferdous et al. [16] took this further and developed *TableTalk* to utilize participants already available smart mobile devices to reconfigure as a single shared display for sharing different types of contents (photo, music, or tweets). Their work demonstrated that personal technologies can be designed to become a shared resource and can augment the commensal experience rather than disrupting it.

We use the work of O'Hara et al. [41] and Ferdous et al. [16] as a springboard to understand the ways in which personal smart devices can be utilized to enhance the families sharing of narratives and enhance togetherness during mealtimes. While *4Photos* were deployed for one meal only and *TableTalk* for two meals, we aim for longer deployment to understand the adoption of such interventions and associated challenges. We evaluate family meals both with and without *Chorus*, with a focus to compare the interactions and investigate why and how family members choose any particular content to share with other members and how such contents are utilized to change and augment mealtime conversations from their regular experiences. *Chorus* also serves as a digital repository of previously shared contents during meals. We investigate if such collections can work as a tool for revisiting shared moments of family mealtimes.

THE CHORUS SYSTEM

Chorus is conceived and created through three phases of user-centered design entailing an in-depth observational study [14, 15], a pair of design workshops [16] and initial developments with brief field deployment of an earlier prototype [16]. The aim of *Chorus* is to explore how technologies can assist the celebration of family togetherness achieved through their combined interactions during family mealtimes. Family members can use the *Chorus* app on their personal device anytime before the meal begins (Fig. 2(a)), and save their contents (e.g., photographs, tweets, or music) for sharing later (Fig. 2(b)). They can also review these items and remove contents from the app anytime before sharing (Fig. 2(c)). All members of the family receive a small notification on the home screen of the app indicating the total number of contents shared by the rest of his/her family (Fig. 2(a)). They can also send an autogenerated text message to other members prompting the number of contents s/he has shared with them. Those who prefer not to share any data are still able to participate by simply loading the app and choosing no content. During the meal, family members place their individual devices on a 'Lazy Susan' (or rotating tray) on the dining table so that they are touching each other. This act symbolizes a willingness to be part of the commensal experience and to engage in conversation. A pairwise 'pinch' action between all devices creates an enlarged single screen that spans all the devices (Fig. 2(d)). Thus, the personal devices come together to form a new integrated shared display (Fig. 2(e)). The rotating Lazy Susan facilitates easy viewing from any position (Fig. 2(e)).



(a) Participants open up the app (b) They can save contents anytime during the day (c) Participants moderate the contents before sharing (d) They place devices together and pinch to join screens (e) Items are displayed in random order. Families can rotate Lazy Susan (f) Participants can revisit their shared items anytime later

Figure 2: Interaction steps for *Chorus*. (a, b, c, & f) denotes activities anytime, (d & e) are performed during the meal.

Items from the individual devices are randomly presented on this enlarged display. Photos and tweets are displayed for 30 seconds, while music is played for its whole duration and then faded out. Family members can interact with the system using simple touch and swipe gestures. For example, a single touch on any device pauses the system, allowing families to discuss the item on the screen for a longer period of time. A swipe left gesture brings up the next item, so families can skip any item they found uninteresting or inappropriate, or swiping right allows families to return to an earlier item for reference.

During mealtimes, if families were interested in any particular photo or music and wanted to find more related items related to that, they could put a long tap (for 1 second or more) on any screen. The *Chorus* app will look for similar items based on location and timestamp for photos and same album or artist for music files in all the devices. If found, it will add these items in the queue; otherwise does nothing. It will then bring the next item in the queue for display or playing. We name this feature *SIMPLE* (Similar Items from Multiple Persons to Lengthen Expression). In doing so, we aim to utilize family members' overlap in their data. Since families have a long shared history, it can often be found that their devices captured data of the same event too. As noted previously for collecting health information of family members [23], their knowledge and familiarity of each other and their data overlap can be utilized for better interactions. Participants can revisit their already shared contents from previous meals in their own devices (Fig. 2(f)), except music shared from others' devices, or join the device screens together. We aim to investigate if such repositories can support family reminiscence about previous mealtimes.

FIELD DEPLOYMENT

We conducted a field study to examine the ways through which *Chorus* influences and changes the social interaction during family mealtimes. We were particularly interested in the influence of the following aspects: (1) preparation, i.e., choice and moderation of contents for the meal (2) influence on conversation topic and quality (3) challenges and opportunities for long term usability for such systems.

Participants

We deployed the prototype with seven families from United Kingdom and Australia (referred to hereafter as families 1-7). Families were recruited through university mailing lists, notice boards, authors' extended social networks, and local community Facebook groups. As criteria for participation, families had to regularly engage in shared mealtimes and consist of at least two members. As summarized in Table 1, we recruited families from different socio-economic backgrounds, with and without children - aiming for diversity in terms of family dynamics and experiences rather than generalizability. The participants varied across their educational qualifications (Diploma degree to Post-Doctoral studies), income (50K to 200K AUD), and ethnicity (Anglo-Celtic and Asian). As is normal HCI practice in early stage prototyping, we did not seek a representative sample of participants across socio-cultural indicators. The interaction with technology is unique to the individual family and the mealtime context. Although the details may differ, the significance of mealtimes is not bounded by socio-cultural norms, hence a comparison and detailed discussion of such is not the objective of this paper. While appropriate to the exploratory nature of our work, we acknowledge the limitations of our small sample size and lack of discussion around cultural contexts.

Study Protocol

We began the initial visits at participants' home with an interview with all members of the family including children (aged over 5 years). When available, family members installed the *Chorus* app in their own personal iOS device. Otherwise, we offered them iOS devices to use during the study period. The aim of this first visit was to introduce the technology and to discuss the typical organization of mealtime routines in the context of the normal day-to-day life of the family and how these practices might relate to the pragmatic demands and moral order of their family life. We are motivated by published approaches with technology probes in domestic settings. For example, interview and video recorded observations of family mealtimes are encouraged by [12, 21], and longitudinal studies of the system was inspired by Ganglbauer et al. [53].

	Family Members	Commonly Used Technologies	Data Sources and Number of Items Shared
Family 1	Wife (private job)*, Husband (academic)	TV (news, reality shows, sports, etc.)	Personal Photos (49), Screenshots (11)
Family 2	Wife*, Husband (both private job)	TV (movies, TV series)	Personal Photos (23), Internet Memes (14)
Family 3	Mother (academic), Father (academic), 3 Child (10, 16, 18 yo)	No technology	Personal Photo (80), Music (15), External Tweet (4), Personal Tweet (1), Other Screenshots (8)
Family 4	Husband (part-time job)*, Wife (student)*	Laptop or TV (movies, TV series)	Personal Photo (60), Music (12), External Tweet (43), Other Screenshots (16)
Family 5	Mother (private job), Father (public job), 4 Child (1,2,12,17 yo)	TV (reality shows)	Personal Photo (75), Music (6)
Family 6	Mother (academic), Father (business), 3 Child (12, 16, 18 yo)	TV (any program)	Personal Photo (94), Music (19), Personal Tweet (2), Internet Memes (20), Anime (30)
Family 7	Wife, Husband (both student)	Phone (Facebook), TV /Laptop (movie, series)	Personal Photo (68), Music (8), Screenshots (22)

Table 1: Description of participants, commonly used technologies at mealtimes and contents used by them during the study.
* Denotes devices given to the participants (existing data from their own device was migrated to the given device).

We gave the families a video camera to self-record their mealtimes. Each family was asked to record two regular meals (without *Chorus* usage), and then use the app for three weeks. Families were requested to use the app for at least 3 times per week. Families were asked to video record four of these mealtimes – two at the first week and two at the third week. This enabled us to collect longitudinal data about the impact of the *Chorus* system as well as compare between the familial interactions with and without the app. The video recordings of the mealtimes were about 20 - 30 minutes long. Additionally, we collected log data of user interactions with the app and the shared contents for all meals with app usage. We analyzed the first interview along with video and app data, and returned for a second interview. We used this data to generate discussion and focused on any episodes during the meals that related to their commensal experience. Each family received a 30 AUD iTunes gift card as an expression of gratitude.

Data Analysis

We used an inductive, qualitative analysis approach [36]. In particular, we focused on how *Chorus* channeled mealtime conversations, how it changed the common mealtime dynamics and interactions, and how the families used *Chorus* at the last week compared with the first week of the study. Further we were interested in any relationship between individual interaction and the group dynamic. We analyzed the interview transcripts, video recordings, and app data to add detailed notes of all interactions with *Chorus* and among the family members. These notes were refined through discussions of the authors. This analysis was done iteratively to identify common themes across families as well as unique family practices.

FINDINGS

The introduction of *Chorus* changed the nature of familial interactions during mealtimes. Below we discuss changes in the preparation phase before the meals, the intentions of family members to share content, our observations regarding the nature of changes in family conversations, and the challenges

that emerged only after repeated use of *Chorus* during the 3-week study period.

Changes in Preparation for Family Mealtimes

Chorus encourages participants to prepare for meals by considering what digital content they wish to share and discuss at the dinner table, hence we expected to see several changes in the way families prepared for their mealtimes. We report on how participants prepare for the meal, before and after *Chorus*.

Preparing the ‘story’ along with preparing the meal

Before introducing *Chorus*, the choice of mealtime media (typically the television program) was generally not discussed in the families. Often one member chose the content for watching without much deliberation:

“Whoever comes up with an idea, for example if [name of husband] previously was watching something, or found something, for example a program that we usually watch, we continue watching that.” (Wife, family 7)

Chorus changed this by allowing everyone to select their own contents (typically photographs) for sharing with the family. When compared with TV watching, *Chorus* allowed the media consumed at mealtimes to be more personalized and more specific to family experiences. But more importantly, it also encouraged everyone including children to raise topics of their own interest. The excitement of children when their shared contents came into the screen, particularly the young ones, was very much prominent in our observations. Even participants who were unable to contribute through their own device (e.g., because older devices did not support the app), chose to engage by selecting items from other’s devices. When one family member was absent from the meal, other members of the family chose something that represented them – so no one was excluded from the family discussion.

In designing *Chorus*, we expected families to prepare anecdotes and stories throughout their day, ready for sharing at mealtimes. However, in practice, all families (except family 7)

did not use the app much during the day. Instead they selected content and prepared their stories just minutes before their meal. This is because of the extra step required in opening the app and selecting specific content there. However, almost all of the participants reported taking mental notes about what to share during meals and prepared for it throughout the day:

“We gathered the content throughout the day, so that’s kind of selection as well, so I knew what I was going to share throughout the day, but the actual process of putting it in the app and sharing it happened just before the meal.” (Husband, family 1)

All of the participants (except family 4) reported that they generally did not take photos purposefully for sharing through *Chorus* only. While they took photos, the app reminded them of the opportunity to share those. This suggests the app was integrated into the daily routines of the participating families or at least did not disrupt them significantly.

Choice and Moderation of Media for Mealtimes

During the regular meals (without *Chorus*), families generally watch or stream various television programs, such as reality TV show, games, movies, news, etc. (Table 1). They would watch ‘anything’ without giving much thought on it, but generally preferred something that did not require intense watching:

“The programs [we choose] are mostly the comedies, but for the movies, they are more of the drama. Not that much thrillers, because we are watching movies in the evening. We like something that cool us, I mean help us to relax, not something that put stress.” (Husband, family 7)

Families without children do not have any explicit restriction on technology usage at shared mealtimes. However, they sometimes consciously avoid technology usage that is not shared. In the mealtime context, sharing is not limited to shared interactions, but includes the awareness of the interaction and implied connectivity. One of the families explained:

“If we are having a meal, and I am checking my email or things like that or messages, [name of wife] would not like that.” (Husband, family 7)

“Maybe I am more concerned specially if it is work related things, for example, if he is checking his university or the work email, I am more concerned about that as opposed to when he is just casual, for example someone texted him, someone that I know - there is a kind of shared kind of interaction.” (Wife, family 7)

With *Chorus*, majority of the shared items are photographs – either taken through the smartphone camera, screenshots of social media or news, or photos of desktop or laptop screens. Photos include chore-related documents (e.g. bills paid, items purchased, etc.), interesting events of the day occurring when family members were not together, celebrations or emotional memories, photos of extended family members, interesting and funny quotes (from social media), planning for shopping or other reminders, etc. Families also shared music and tweets (mostly from accounts that they follow. There were different motivations for sharing these contents, which we discuss next.

Intentions for Sharing Content through Chorus

While our participants sometimes reported that there was no specific reason for choosing any particular item, nevertheless several themes, concerning motivation, emerged from our discussion and subsequent analysis.

Updating Family Members and Retrieving Facts

We observed several motivations behind sharing content through *Chorus*. A main motivation was to **update family members** about notable (or sometimes mundane) events of the day. Photos served as a very good cue to trigger discussion about an event. This was evident when the husband in family 1 how he shared a banal photo of a walkway across a local park:

“This is a walk I went for [over] lunch; so it [the photo] was more a way of sharing this, to say, to tell her, later on that what I did throughout my day when she wasn’t there.” (Husband, family 1)

In many times, families took multiple photos around one topic and used the SIMPLE feature to show more photos related to the current one. Some content was related to local and international news or other interesting topical events, shared in the hope that more family members may find them interesting. The husband in family 7 explained:

“Usually it is me who update her about the political events around the world, so I shared these Facebook posts [screenshots of news about political events].”

Some content was informational, serving the purpose of **retrieving** factual events to discuss at meals. The youngest daughter in family 4, who is a gymnast of her school team, was interested in the Olympic Games. She was particularly proud to share when Australia was on top of the medal-list for gymnasts. In another instance, when the wife in family 2 did not like the weather in her city, she searched and shared weather information about a US city to bring the topic into their mealtime conversation. While we could see families updating each other and sometimes discussing notable news events (particularly by parents) during regular meals, *Chorus* made it easier to explain their day with visual cues.

Recollecting and Reminiscing

One motivation for sharing content was **recollecting**, i.e., the opportunity to discuss something by mentally recalling it. An example of recollecting occurred when the wife in family 1 shared a photo of a bottle of wine to convince her husband about their previous experience with having it:

“We could not remember whether we liked it [wine] or not, but the fact that [wife] shared it in the app, means that we actually do like it, so we note that next time we go there, we can buy that one.” (Husband, family 1)

We also observed acts of **reminiscing**. Family members shared old photos or music to remind others about a past experience, hoping relive an emotion or sentiment. Our study revealed many occurrences of reminiscing, which was the main motivation for sharing photos or music of earlier times. For example, the wife in family 4 shared a photo of her husband’s Master’s degree project to remind him of their common

memories. In another instance, the husband in family 1 shared a photo of a house cat from their previous locality:

“This is a cat in [name of town], he used to visit us quite often. When I went back to [name of town], and I walked by this place where we used to live and saw the cat, so I took a picture. But the reason for sharing it this time was just because that’s a nice memory, I suppose.”

We did not observe any act of recollection during regular meals in our participants. In a few occasions while watching television, the families related the content with something from their past – for example, once the wife in family 4 discussed about the shops in her home town and how they looked similar to the shops in the current television series they were watching.

Reflecting and Reminding

A key theme that emerged was **reflecting**, i.e., some contents had less to do with memory, but more about lessons from that memory and about self-identity.

“[about a photograph of local food] this is called chutneys. If you even been to [name of city], you must go there – curries, chutney, and puri!” (Husband, family 4)

Often content was shared with the intention of **reminding** others. *Chorus* served as a cue to remind families bring certain topics into the dinnertime conversation and plan accordingly. Examples include the husband in family 4 sharing a movie poster photo because he has partially watched it before and wanted to remind him about watching it together after the meal. However, this is not just about a reminder cue, but participants used this as a way of sharing their interests with other members, and discuss it before watching. As the husband in family 1 explained about sharing a poster about a TV series:

“I saw it in a TV ad, so it was just putting it out there something that I actually wanted to watch that night. But I suppose it wasn’t merely a reminder; it was something to share with [name of wife], because she hadn’t seen that advertisement, I suppose.”

Reflecting and reminding were not observed during regular meals without *Chorus* usage.

Entertainment

The final motivation was to **entertain** family members. The participants shared content that other family members might find funny, e.g., Internet memes, screenshots of funny games, and even photo or cartoon about political and religious figures.

“This was a funny photo about the topmost religious leader in our [home] country. We do not like them, so it was fun to read those memes about him.” (Wife, family 7)

Regular mealtime television watching practices also supported this intention. Most of the families preferred to watch something relaxing during their meals, for example, comedy shows, reality TV shows, etc.

Changes in Family Conversation

Unsurprisingly, *Chorus* supported conversations between family members, i.e., it provoked conversation and more importantly, it provided content largely without interrupting ongoing

interactions. We could notice significant changes in the conversation topic, duration, and participation from all members in the family.

Orientation from TV towards the Family

The introduction of *Chorus* to the mealtime changed various aspects of the ways in which way families interacted at the dinner table. One of the prominent was a change in orientation away from TV towards other family members. All the participating families (except family 3) watch television or other streaming media during meals (Table 1). During their regular meals, these families had little conversation around how the meal was, some affairs of the everyday life and some planning for everyday activities. Notable here is that there was little or no eye contact during these conversations and these were very brief exchange of words – usually a couple of word or incomplete sentence, as they were more focused into the television watching. For example, in one of the video observations, we notice how the wife in family 1 finished her quick remarks and stopped to wait her husband’s response. However, the husband missed the cue and did not respond until the wife stared at him for a few seconds and he noticed the irregularity. In another instance with this family, we note this conversation snippet:

“Heating okay?” (Husband, family 1)

“[Looking at the TV] It will be alright. [After 15 seconds, she laughs, referring to the TV program] It’s fashion week [After another 20 second, still focused on the TV] Oh no . . . oh no . . . [laughs and looks at husband]” (Wife, family 1)

With the usage of *Chorus*, such interactions were greatly improved. The conversations were natural and progressed smoothly without causing any significant issues. Most of the families (except family 4 and occasionally family 2, which we discuss later) enjoyed discussing about these personalized contents from *Chorus* than TV programs:

“I think it got us talking more, talking on things more about the family, about experiences during the day or other days, and highlight memories. It’s good; I enjoyed this.” (Father, family 6)

“Even on a couple of nights, we did not use TV at all after the meal.” (Mother, family 6)

Focus on Intimate Exchanges

One interesting use of *Chorus* involved how the families used it as a way to bring sensitive personal topics into the conversation. For example, during one meal, the family 1 discussed about a photo showing a banal list of hand-written list. When asked, the wife explained:

“That was my long to-do list. So that was me, sharing a bit of my day to [husband’s name]. It was probably explaining why I was stressed last night, and also it’s just sharing something that he is not part of.” (Wife, family 1)

The purpose of showing the list here was not for seeking help in doing the works or other practical suggestions, but bringing

up the topic of experiencing stress and seeking moral support. In another observation with family 3, the mother shared a photo of her father. The main motivation she explained later was to commemorate his death anniversary that went a couple of days ago. The whole family was engaged to discuss about the photo and him.

Adolescent children in the families were more difficult to engage during both regular mealtimes as well as with *Chorus*. “*They are secretive*”, as the mother in family 3 explained. So it brought delight to the family during one meal with *Chorus* when the youngest son willingly shared two photos of him with his girlfriend. He later explained the purpose: “*I wanted to show her to my family, as they have not seen her before*”. The whole family was excited, because otherwise he does not want to discuss matters of personal interest with the family.

The parents in family 3 chose to share some music of their personal choice, some of which has significance with their previous life experience. Though the children’s music taste varied from their parents and they made humor about the songs, they were much interested to know the history of the song when the mother explained how the singer “David Bowie” and his songs inspired their generation on many aspects of fashion and lifestyle.

Orientations towards Food

One interesting difference was that the *Chorus* app brings the attention back to their food. During the usage period, we noted how the families discussed about their meals and paid more attention to it. It was in stark contrast with their regular meals, when they were focused onto the TV and rarely talked about or looked upon the meal. For example, one frequent topic of discussion by the husband in family 7 is the food itself:

“[name of husband] will search for the nutrition, vitamin, calories and these sort of things of the meal and read it aloud for me.” (Wife, family 7)

During the study with *Chorus*, he would often take his phone and search for this information (*Chorus* would pause in all devices and was resumed later).

Engaging Children

One of the main changes between meals with and without *Chorus* was the participation of the children. For example, in family 6, the children remained mostly silent during regular meals, focused on the television, and occasionally responded to the queries made by the parents. *Chorus* gave them the opportunity to bring topics of their interest, which again sometimes resulted in some tensions and moderation by the parents. In this family the elder daughter shared many items of her favorite anime characters, which other members did not find very interesting. So during the first week, they just swiped through these photos, but when she continued to share similar contents in subsequent meals, they decided to exclude her phone while using *Chorus*.

During a meal with *Chorus*, this family also got engaged in a small game provoked by an Internet meme shared by the youngest daughter. It involved word transformation to find one’s ‘Dragon Name’ from his/her real name. It generated a

lot of interest among the children and at one stage they used sticky notes to calculate the names. In family 3, the father once shared photos of people near his office playing ‘Pokémon Go’ (a trending game at that time). The whole family, especially the youngest daughter, were enthusiastic about the topic, and on the following weekend the parents took the daughter and her friend to that place. In these instances, *Chorus* helped to engage children in interaction. It was by no means the sole platform for such interactions, but it provided children with a tool highlight their interests and engage in interaction.

Children also intentionally brought sensitive topics of their interest, often in a humorous way. For example, the youngest daughter in family 6 wished if they could live near to her best friend’s home. So when she saw an advert of a nearby house being up for sell, she took a photo and during the meal poised like a ‘real-estate agent’ trying to convince her parents about buying that house. The second daughter in this family could not participate with her device, because it was an older iPhone 4 that the system could not support. She used this opportunity to emphasize her desire for a newer device (again in a humorous way).

Challenges for Long-Time Deployment

Despite the fact that *Chorus* facilitated families to engage with each other, its usage was not always just positive.

The Chore of Creating Content

One of the major challenges faced by all families (except family 3) was the difficulty to create sufficient content for each meal with *Chorus*.

“This app was not sufficient for us for dinnertime. Most of the times we finished contents before dinner finished.” (Wife, family 4)

The chore of creating content became notable as families used the system over the extended period of time. They noted how they exhausted to find notable happenings in their everyday life and resorted to share old photos and funny quotes instead. Exception of this happened in families with children – young children were much more enthusiastic to share their contents and their usage remained unchanged over time. For example, in family 6:

“I did not [find it difficult] because I take a lot of photos. And I would also open my album and look for memories way back, and I would choose interesting ones, it was really easy. [At the beginning] Me 20, [eldest daughter’s name] 5, mom 10 in the first, and then smaller, smaller, smaller . . . ” (Youngest daughter)

“My one became bigger.” (Eldest daughter)

“Until we stopped using your device.” (Mother)

Gradually, the families used *Chorus* in a way that reflected their regular mealtime habits. For example, the participants in family 4 initially shared photos mostly of personal significance. But later, they resorted to movie related news, tweets, and photos – things that they regularly discuss during their mealtimes.

“We became more familiar with the system. We knew what we could expect with the system. And we tried to make it better, in terms of what we were sharing. Earlier we tried with photos, but later we tried with Twitter.” (Husband, family 4)

For these challenges, most of the families concluded that aside from the study period, they would prefer to use such systems rather infrequently, for example once in a week (family 1, 2, 4, 6), when notable events happen (family 3, 5) or in one family (family 7), regularly. The husband in family 1 remarked after the study ended:

“It made me kind of conscious of how it is difficult to fit any more organization into our current mealtimes. Because it did involve organization beforehand, and sometimes, well, it was a little bit more work involved for us. Especially if it was getting late in the day and you did not really have anything, or if you had forgotten to get something, then there is a little bit of anxiety around this.”

Keeping Stories for Discussion at Mealtimes

A second challenge was that family members sometimes found themselves cutting conversations short to preserve a story for later discussion at the mealtime. While travelling back home and preparing the meal together, the couple of Family 1 usually updates each other about happenings of the day and about other daily chores. The same routine continued with *Chorus*, except it introduced an additional consideration into their minds – since they had *prepared* a story to share during meals, they hesitated to break it early:

“One time, for we were walking home, when I was thinking, I was about to say something, and then I paused to think - should I say it or should I save it for later, and then it was just ridiculous. I don’t think it actually changed it in the end, but it made me conscious that I was thinking of changing it.” (Husband, family 1)

Conversation as a Burden

Having conversation around the content shared via *Chorus* was not always an enjoyable experience. Family 4, and in some instances also family 2 and 7, preferred to watch TV programs during mealtimes rather than talk about contents shared via *Chorus*. These families reported that sometimes they preferred not to talk during meals and recommended to include video sharing in the *Chorus* app:

“I think there were more silences [with Chorus]. What do we talk about? We have already talked about what happened during the day. There was nothing more to talk about, I guess. This was a bit weird.” (Wife, family 4)

The example in this family then challenges the assumption that it is always desirable to have family members interact with each other during mealtimes. Hence we do not expect *Chorus* (or any other technology for that matter) to be incorporated seamlessly in for all families or for every meal. Different families have different levels of acceptance of technology, power dynamics, etc., which would make use idiosyncratic to particular family structures and routines.

DISCUSSION

This paper investigates the potential role and associated challenges of technology usage in augmenting the celebration of togetherness achieved through the experience of family mealtimes. While we acknowledge the criticism of technology (particularly television and mobile device) usage in this space [6, 28, 51], our research draws attention to the fact that television, while being one of the few shared technologies in the home, is not designed for mealtimes specifically and takes the attention away from the meal and from those eating it together. Mobile devices are innately personal, in the sense of their form factor, ownership, and applications (personal email, social media, etc.) are designed around the individual, and so not ideal for supporting shared experiences. In response, we present *Chorus* – a celebratory technology specifically developed for mealtime usage that transforms personal devices and data into shared resource. Our field study with *Chorus* deployment shows interesting ways in which its usage contrasted with the regular experiences of family meals.

First of all, TV watching practices during family mealtimes serves as form of relaxation and a distraction from the meal itself. In contrast, contents from *Chorus*, though mundane to an outsider, often carries significance for the family through the stories underpinning the content. Family mealtimes are then supported as a venue for storytelling of the day, encouraging everyone to speak about their current day as well as plan for future events. Such storytelling occurs occasionally during regular meals, but with *Chorus* there are provisions to assist family members to think ahead about what others might find interesting and to stimulate as sense of anticipation. Often we found our participants had specific intentions for sharing content, which generally could not be achieved through regular TV experiences. With *Chorus*, one member specifically shared something purposefully to remind others about a memory of personal or familial significance. We noted how families used *Chorus* intentionally to provoke different kind of memory aspects – retrieving, reminding, recollecting, and updating each other – many of which are generally not achieved (at least intentionally) with traditional media.

Second, these intentional sharing of media contents had profound implications in the ways families interacted with each other, both verbal and non-verbal ways. *Chorus* brought the attention back on to the family members and also on the food itself. We could observe better eye contact and interest towards what other member have shared during the meal. We also note how children were more enthusiastic and pro-active with sharing contents of their choice, their voice typically unheard during regular meals. In this way, *Chorus* or any other technology that concerns mealtimes are not ‘solutions’ in themselves, but can support the creation of democratic practices around the table. Another interesting observation included how technologies could help the families broach sensitive topics in a smooth, sensible, and humorous way.

Finally, designing an effective technology that does not interrupt the enjoyable experience of family meals is by means no trivial task. While most of the families enjoyed the enhanced conversation with the help of *Chorus*, some of them also felt

the burden of curating media for sharing, setting up the system, and especially, engaging in conversation at mealtimes. Our study thus sheds light on the popular belief that having family interaction at mealtimes is a ‘goal’, and highlights other opinions as well.

Having now investigated how different aspects of *Chorus* impacted our mealtime configurations, what might this mean for HCI researchers and for future technological advancements? Next we discuss how our findings from the field study of *Chorus* can be further utilized to sensitize interaction designers and other technologists to some of the challenges and opportunities involved in designing new technologies to support commensality at family mealtimes.

Implications for Media Selection at Mealtimes

While our participating families liked the capability of hand-picking media of their choice, they also recommended having serendipitous experiences by automatic or random choice of media contents from their devices. Such random display of contents or bringing up related contents to the current one in display during the meal without moderation raises privacy concerns, but the families (especially without children) were not much concerned. More important to them was minimizing the setup time for the system, partially because they selected items immediately before the meal (though had some plans for which items to share) and because the devices required to sync with each other to exchange shared contents.

Implications for Device Ecology in Home and Workplace

The participants often used different devices throughout the day - e.g., laptop, desktop, smartphone, tablet devices, etc., but they typically used one of the mobile devices for *Chorus*. So when they encountered something to share from another device, they sometimes took screenshots from there or took a quick photo of the screen of that device. So our study recommends developing more transparent and seamless transformation of contents between all devices and platforms used by the family members. Another notable aspect is that the devices serve multiple functions and that it is necessary to consider how different tasks (e.g., information retrieval by the husband in family 3, work related call or text in family 5 and 6, respectively, or SnapChat notifications in family 3) can impede on the social enjoyment of togetherness at mealtimes. But while this is an interruption to both the meal and the experience around *Chorus*, families could not avoid such interactions.

Implications for Storytelling in the Family

While the media items shared through *Chorus* facilitated storytelling in the family during mealtimes, there might be two types of story-telling with the content – one which is fragmented (each piece of content tells its own story) and one which is connected (all the content tells one story, e.g. ‘my day’). For instance, the sharing of ‘sensitive’ or new contents (picture of girlfriend, picture of deceased father) show the way in which the artifact and story come together to create a new space. Here the artifact or picture does the introduction – which might be the hardest part of the story. There is also some sense from some families that they have a prepared

‘story’ and they then struggle not to ‘break’ it in the course of other activities.

Implications for Adoption of Celebratory Technology at Family Mealtimes

Our study shows that celebration is found not through the contents, which are very trivial and banal in many cases – but the expression of caring for each other that we can see behind the intention of sharing these contents. However, in many cases families also struggled to identify interesting contents among their surrounding life and finally resorted to sharing old photos and Internet memes. This draws our attention back to the routinely routine nature of family mealtimes. Our study recommends that any design for celebratory technology needs to carefully consider these aspects – inclusion of everyone in the family by media contents related to them or matching their interests, a balance between recent and older contents, and the technology should remain in the background to allow families focus on each other and the meal itself.

CONCLUSION

In this paper, we aimed to bring the attention back to the sense of togetherness achieved through regular family mealtimes. Our goal was not developing any particular technology for this space, but we focused on how a system designed to support family interactions could augment the celebration of the meal, and we compared the experience with regular meals to understand the contrast and impact on familial interactions. In doing so, we note how the attention shifts from individual to collective significance and ways technologies can support memories and experiences shared between family members. We reveal scenarios where this celebratory technology encouraged participation, helped to introduce sensitive topics into discussion, and brought the attention back to the family and food. Finally, we discuss the challenges associated in using such systems over a long period of time and discuss implications for future refinements. We challenge the assumption of technology hampering the togetherness during family mealtimes and investigate the issues with long time usage and adoption of such technologies in the family dinnertime. To the best of our knowledge, this is the first study in the domain of family mealtime that investigates the use of novel technologies for extended durations and compares them with regular family mealtimes. Overall, our study demonstrates that through sensitive design and deployment celebratory technologies can positively enhance the family interaction at mealtimes.

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