Technology at Family Mealtimes

A dissertation submitted in fulfilment of the requirements for the degree of Doctor of Philosophy for

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This thesis is dedicated to my mother and my father.
Declaration

1. Except where otherwise indicated, this thesis is my own original work towards the PhD and has not been submitted for any other degree.
2. I have made due acknowledgement in the text to all material used from others’ works.
3. The thesis is less than 100,000 words in length, exclusive of tables, maps, figures, bibliographies, and appendices.

Hasan Shahid Ferdous
March 2018
Publications

The following is a list of peer-reviewed publications arising from the time of my PhD candidature. These include co-authors alongside my formal PhD supervisors Frank Vetere and Hilary Davis. Kenton O’Hara has been a mentor for all my PhD projects and I have benefitted tremendously from our discussions. Bernd Ploderer has been a supervisor till the end of my second-year candidature, and he has been actively involved in the discussion, design, and writing of all these papers. I have worked in close collaboration with Rob Comber and Geremy Farr-Wharton during my three-month long study away at the Open Lab, Newcastle University, UK which resulted in the refinement of TableTalk paper (No. 4 below) and the design, study, and writing of the Chorus paper (No. 5 below). In each of these publications my contribution is greater than 60%.


and Ubiquitous Computing (UbiComp’16), p. 132-143, DOI: 
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5. FERDOUS, H.S., PLODERER, B., DAVIS, H., VETERE, F., O'HARA, K., 
FARR-WHARTON, G. AND COMBER, R. 2017. Celebratory Technology to 
Orchestrated the Sharing of Devices and Stories during Family Mealtimes. In 
Preface

I started my PhD as a full-time research student at the School of Computing and Information Systems of the University of Melbourne, Australia in August 2013. I received my PhD confirmation in October 2014 and submitted the thesis for review in May 2017.

The first research question of this thesis came up in a discussion with my supervisors and Kenton O’Hara, while exploring how the family members as a group use technology in different segments of their daily life. During this meeting, we were rather surprised that to the best of our knowledge, no one in HCI explored this question – how family members currently manage their technology usage at mealtimes. It appeared as if we were missing something, and I invested the next few weeks frantically looking for literature to the contrary. I could not find a satisfactory answer, and hence decided to run a study to contribute in this direction. It is worth noting here that while these studies form the contribution of my thesis, it would not have been possible with constant guidance and active contribution of my supervisors.

While this thesis is my original work, my panel of supervisors oversaw and guided me for all the studies throughout the PhD duration.

My first publication, titled *Technology at Mealtime: Beyond the ‘Ordinary’*, was accepted for presentation at the CHI 2015 doctoral consortium. There I had the opportunity to present about my overall thesis proposal and discussed it in details in a two-day long session with academic mentors and peers. This further reassured me that I was progressing on the right track. Few months later, I had the first full paper “*Pairing Technology and Meals*” from this study accepted at the OZCHI 2015 conference. It demonstrated that technological practices during family mealtimes are varied across different temporal and social factors, including the meal itself. I published a detailed account of how families manage their technological practices and how ICT usage influences the interaction in the families in a TOCHI journal article next. Among other things, this study showed that the overall *strongly negative* narratives regarding technology usage at mealtimes that are often found in scholarly works and journalistic accounts are somewhat overstated, and there is a mixed bag of
positive and negative attitudes. This encouraged me to think how we can alleviate the negatives and if we can actually enhance the experience of family mealtimes through the use of technologies.

The first study showed that the personal devices are widely available during mealtimes, but family members (typically adults) generally impose some restrictions (typically on children) regarding its usage. This study also revealed the existence of occasional tension in the family when some members are too much engrossed into the technology. This guided me towards designing a technology that can transform the personal devices into a shared resource during the family mealtimes. I was inspired by the Pinch platform developed by Ohta and Tanaka [2012]. Prof. Ohta was kind enough to share the protocol code with me. I extended the Pinch platform to develop TableTalk – an app to enable people share content from their personal devices and to produce an ad-hoc display by combining all the devices of the family members together. The field deployment study supported the hypothesis that such technologies can be confluent with various aspects of the commensal experience in the families. Results from this study is published as a full paper in UbiComp 2016 conference.

I received positive comments as well as constructive criticisms from the paper reviewers and audience at these conference presentations in CHI 2015, OzCHI 2015, and UbiComp 2016. Among these were the question that guided me to the next study and retrospectively think about the whole thesis later – “Do we find family mealtimes so broken that we required intervention to make it work?” I modified TableTalk to develop another app Chorus to probe further into the role of technology for enhancing interaction during the family mealtimes and find which of these interactions are unique due to the presence of this technology. This study established that Chorus enabled all the family members to express their voice and can help family members to broach sensitive topics into familial conversation in a subtle way. Findings from this study also revealed the challenges for long-term deployment and adoption of these technologies in the families. I published the study findings as a full paper in CHI 2017 conference and presented it along with my TOCHI journal article there.

These three studies collectively form the core contribution of this thesis. The research is problematized around the fact that despite the criticism of technology usage at mealtimes, different forms of information and communication technologies are
widely available and used in the families. However, their presence, usage, and acceptability vary across different families and each family develops their own ways to manage these. My study two and three revealed opportunities for design in this space and demonstrated that technology that is sensitive to the needs of family interactions can augment the commensal experience and contribute, rather than disrupt, family mealtimes.
Acknowledgements

This thesis would not have been possible without the generous support of the participating families who donated their time to my research studies. I am in forever debt to my supervisors and advisory board members Prof. Frank Vetere, Dr. Hilary Davis, and Assoc. Prof. Egemen Tanin for their constant guidance, insightful advice, helpful criticism, valuable suggestions, commendable support, and endless patience towards the completion of this thesis. I am also particularly thankful to Dr. Bernd Ploderer, who was a part of the supervisory team till the end of my second-year candidature and an invaluable co-author in all of my PhD publications. I must acknowledge Prof. Steve Howard, whose sudden demise deprived me of the luck to work with him, but his work always remained an inspiration to me. Throughout my PhD, Dr. Kenton O’Hara made invaluable suggestions and accommodated my visit to Microsoft Research, Cambridge. A part of my PhD tenure was done at the Newcastle University, UK, where I had the fortune to work closely with Dr. Rob Comber and Dr. Geremy Farr-Wharton. I am very proud to have such a team of wonderful mentors. I also must thank the reviewers for their insightful comments in shaping up this thesis.

The School of Computing and Information Systems at the University of Melbourne provided me with an inspiring and supportive environment for my research. I would like to thank the school administrators, specially Rhonda Smithies and Julie Ireland, whose sincere support has made my work easy and enjoyable. I am grateful to my colleagues in the Interaction Design Lab and Microsoft Research Centre for Social NUI who helped me to complete this work, and in the course of it, became very close friends - Deepti Aggarwal, Fernando Estrada, Mellisa Rogerson, Fraser Allison, John Downs, Kat Franks, Nicole Barbee, and so many wonderful people around me.

I am immensely thankful to my family in Bangladesh. Both my parents and parents-in-laws have visited us, and always inspired as well as supported us. My wife Farhana has been by my side to support and encourage me in situations when I faced any trouble, despite her own PhD works. Also, I was the guinea pig for all her wonderful dishes, and she taught me cooking (while I taught her cycling).

Finally, I am grateful to Allah almighty for His constant grace bestowed upon me.
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Abstract

In this research, I investigate the potential role of information and communication technologies during domestic mealtimes. The research aims to:

1. Examine the everyday interactions of familial uses of technology around mealtimes and investigate how family members configure the dining space and the technologies within it.
2. Understand how technologies are used and negotiated amongst family members and the influence of these technologies on the content and context of their interactions.
3. Investigate how the everyday technologies can be used to enhance the familial experience of eating together and create new experiences for togetherness in this space.

In the first study, I conducted an ethnographic observation of six families as they use technology in their dining space. The findings from this study show how technologies are integrated into the mealtime activities in a dynamic fashion and provide a balanced account of the affordances and challenges of technology usage during family mealtimes. This study reveals certain circumstances in which background technologies come to the foreground, visible devices are hidden, unwanted distractions become desired, and ordinary technologies support celebratory occasions. I identify four patterns of arranging technologies and family members around the dinner table and discuss how technologies contribute to satiety and commensality. The findings from this study also show that a technology does not require being special or separate from the ordinary technology used in everyday life to support the special occasions in the family, rather it achieves this feat through its usage in special ways. So, my objective for the next studies was to look beyond this ordinary, elaborate on how these technologies are playing a role in our everyday life, and how we can support augmenting the experience of togetherness during family mealtimes.

In the second study, I developed a technology probe TableTalk to investigate how the personal communication devices (e.g., phones, tables, etc.) can be used in social settings to facilitate familial interactions. I discuss how technology that is sensitive to
the needs of family interactions can augment the commensal experience in the family. In the third study, I built upon this and conclude this research by investigating how the experience of using these personal technologies are different from regular mealtimes and what are the challenges for long time usage and adoption of such technologies in the family home.

I hope that the findings from this research will contribute to better understand the evolving technology space in the domestic settings and how these technologies can enhance the shared experience of eating together. Technology usage during mealtimes is traditionally viewed as impeding social interaction at family mealtimes. However, this research demonstrates how technologies can support, enhance, and augment social interactions, mediate usage, and resolve tension among the family members during mealtimes.
Chapter 1: Technology at Family Mealtimes

1.1 Introduction

The family dining place is an important space for fostering togetherness, sharing personal experiences, and nurturing familial ties. In many families, the dinnertime is one of the very few times that brings everyone in the home to come to the same place at the same time. However, information and communication technologies (ICTs) at the dining space (e.g., television, phone, etc.) are generally accused of detracting from the familial interactions and thereby negatively impact the mealtime experience. HCI researchers respond to this criticism with the celebratory technologies agenda, i.e., technologies can be designed in a way to encourage interaction among the family members or participation in the mealtime activities and thus enhance the experiences. Celebratory technologies do not refer to technologies that are used during festive occasions, but rather concern the design of technologies that support positive interactions during everyday meals. While a few experimental studies demonstrated the potential benefits of designing such technologies for enhancing interaction with and around food, none of these work with already used and available devices in the family. Also, there are few studies that investigate the usage and adoption of celebratory technology over extended periods of time, or studies that compare the family experience with these technologies to regular mealtimes. In this thesis, I have addressed these gaps.

I began the research with an ethnographic study to understand how families currently use and manage ICTs at mealtimes. This study suggests that content from the personal devices can be used to enhance face-to-face interactions between family members during mealtimes. I then built upon the use of existing and widely available personal smart-devices to develop TableTalk, a smartphone app that transforms personal devices into a communal shared display on the table to enrich mealtime interactions and experience. My field study shows that TableTalk does not undermine togetherness, but supports familial expectations and experiences by stimulating conversation, encouraging reminiscence, reinforcing family bonds, supporting
education and socialization of children, etc. To further explore and compare the changes and challenges brought about by such interventions on familial practices at mealtimes, I developed Chorus - another 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 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 family members to broach sensitive topics into familial conversation, and encourages participation from all members including children. I discuss implications of this research and reflect on design choices and opportunities that can further contribute to enhance the family mealtime experience, and the collocated interaction space in general.

1.2 Background and Context

1.2.1 The Notion of Family and Family Mealtimes

Consistent with DeVault [1994] and O'Hara et al. [2012], in this thesis, I use the term *family* in the sense to be more loosely defined as household, going beyond the traditional account of the nuclear family to include the extended household network, such as uncles, aunties, cousins, friends, colleagues, etc. Having meals with the family and friends is an everyday activity. The activities related to food consumption spans the daily life and are often inseparable with one another. Meal planning, shopping, preparation, religious rituals (e.g., prayers) in some families, food consumption, cleaning residues, and managing leftover food – all can have very minute details, implications, and interactions, such as making notes of shopping list, coordinating with different members of the family about those purchases, cleaning kitchen artifacts before and after the meal preparation and consumption, etc. The term *family mealtime* is generally used in association with the activities related to consumption of meals in the family. The process of having meals is a complex one spanning an overlapping chain of activities closely associated with it - for example, warming up the meals, placing the already cooked meals on the table, purchasing ready-made meals to share together, eating those meals, cleaning or disposing the dishes, etc. One can go into much more details of the process and consider many more
activities as associated with family mealtimes. While there is not a clear definition of what constitutes a family mealtime [Cook and Dunifon 2012], in this research, I consider the immediate activities preceding or following the actual consumption of meals as the mealtime activities, in addition to the actual event of consuming it.

1.2.2 Family Mealtimes in Different Time and Culture
The landscape of family mealtimes is a dynamic one that has significantly changed over the last couple of centuries. For example, having regular family meals with all members together is considered as an important part of the family life in many cultures nowadays [Ochs and Shohet 2006], but anthropologists explain that this is rather a modern phenomenon and mealtime practices can significantly vary across different cultures. For example, the practice for the whole family being together at the same place and time to have meals was not much of a norm in the US society before the mid-nineteenth century [Cinotto 2006]. The historian John Gillis explained, “Early Americans of European descent felt free to eat wherever and whenever they could or wanted to in ways that resemble today’s snacking” [Gillis 1997]. A dedicated place for the family dining table was not generally available then, and even when family members eat together, the male members would be seated separately from the women and children [Cinotto 2006]. Gillis [1997] explained that the families in the agrarian society of that time interacted with each other throughout the day, so the idea of mealtimes as a special occasion for family togetherness was not very prominent. The practice of a shared family meal first emerged within the Victorian middle class in the late nineteenth century as a formal affair that served in part to reinforce status differentiations both between and within families, and later was adopted by the richer immigrant families as a status symbol [Gillis 1997]. Even during this period, the practice of having family meals together was not adopted by the poorer white and African American families, due to various practical and economical concerns (e.g., different work hours for different family members, lack of space etc.). This scenario started to change at the outset of twentieth century, when the home-economists, social workers, nutritionists, and others began a decades-long campaign to encourage family mealtimes, specially among the working-class and immigrant families. While this movement aimed to promote family mealtimes as an instrument of cultural assimilation, strengthening families, improving nutrition, and facilitating child development, it did not gain much momentum till the post-war 1950s.
In this period, the economic prosperity among general US population permitted the majority of them to join the middle class [Cinotto 2006]; urbanization and industrialization are also often considered as the main catalyst for this change [Larson et al. 2006]. As the family started to spend less time together, that little time for family dinner became more important, sometimes giving it the “ritual significance” of being the only time of the day when all the family gathered together [Cinotto 2006]. Since then, contrary to some popular beliefs and discourse in the media, the frequency of having meals together in the family have not changed significantly. However, the forms and functionalities of family meals have adopted to the work-life changes and the technological practices in the families, at least to some degree.

The American society have experienced much changes since 1950s, including but not limited to women’s increased rates of employment, nonstandard working hours for many family members, longer commutes for more people, and children’s greater participation in extracurricular activities, etc. [Doherty and Carlson 2002; Neumark-Sztainer et al. 2010; Neumark-Sztainer et al. 2000]. However, existing surveys and studies have shown that the rates of family meals have remained stable at least since 1998 and may even have increased [Larson et al. 2006]. Another nationwide survey in the USA have shown that having meals with all members of the family is a regular activity for children across different age groups – 80% of the young children (6-11 years old) and 69% of the adolescents (12-18 years old) reported having shared meal with the rest of the family four or more times a week [Larson et al. 2006]. Over 80% of the US parents and 79% of teens view family dinners as a very important family activity [Zollo 1999]. However, the traditional values and expectations about the proper form of family meals (e.g., home-cooked food, regular and fixed dinner time, prescribed etiquette, manners, and assigned seating of family members, etc.) have somewhat changed from the 1950s [Larson et al. 2006].

The changes involve different mealtime practices. For example, while the female members of the family (particularly mothers) still have the major responsibility for both preparation of food and management of mealtimes activities [Bird 1999], participation of the male members in food preparation and associated tasks in the families are gradually increasing [Marche 2017]. Also, the busy schedule of the family members has resulted in take-out food intake in the families or eating out in restaurants more often than they did twenty-five years ago [Guthrie et al. 2002].
Practices associated with technology usage during family mealtimes have also changed. While it was considered a luxury in the 1950s, television, radio, and other assorted technologies are very much available to most of the families in the western societies nowadays, and families are using them during their mealtimes. For example, a national survey in the USA on children of 8 to 18 years old stated that in 63% of those households, the television is usually on during family meals [Rideout et al. 2010]. The proliferation of television and other technologies in the family homes has changed the ways family interact with one another and their meals during the mealtimes. Hence the technological landscape and controversy around their usage have been under scrutiny ever since, particularly from sociological and health perspectives [Hersey and Jordan 2007; Neumark-Sztainer et al. 2010], which has considered its usage for negatively impacting the social interactions and for promoting unhealthier eating practices.

The social interactions during family mealtimes have changed a lot too - mealtime interactions between the family members have become more casual, and the nineteenth-century emphasis on formal manners has been replaced by “unspoken, almost subconscious guidelines and constraints” [Visser 2015] (p. 341). Family mealtime interactions nowadays are less hierarchical and more inclusive of children than in the Victorian era [Blum-Kulka 2012; Ramey and Juliusson 1998]. But despite the continuous adjustment of the actual practices of family members during mealtimes and the different cultural and/or economic contexts, the idealized conception of the proper family mealtime, i.e., family members gathered around the table and enjoying food and intimate conversation, has been a remarkably constant symbol of unity and stability for the American family [Cinotto 2006].

The practices of family mealtimes also varies widely across different cultures. Bell and Kaye [2002] presented the differences in family mealtime practices in different European countries and the USA, and proposed to design technologies for experience rather than for efficiency in the family kitchen. Their study highlighted the minute details of the kitchen artifacts, interactions, and other human aspects that influence the family experience and gradually becomes a part of the “family ritual”. Other studies have explained the cultural differences in mealtime activities and expectations too. For example, Ochs and Shohet [2006] discussed how Peruvian culture demands family members to remain silent when they are eating together, while in American
culture, the opposite is generally the norm. In another study, Martini [1996] illustrated how the mealtimes of Japanese-American families were less structured and more relaxed, and involved less overt conflict than in the Anglo families. She attributed the differences to their contrasting emphasis on family harmony vs. individual expression. In encouraging the children to be quiet or speak up, they may reinforce cultural notions of hierarchy and child deference, or the idea that children have equal status, respectively. However, despite these differences in the functional organization and behavioral expectations, family mealtimes are considered important in almost all cultures across the world nowadays.

1.2.3 The Significance of Family Mealtimes
Family mealtimes are an important site for the construction of social capital, fostering togetherness, sharing personal experiences, nurturing bonding amongst family members, and several other interweaving social functions [Fischler 2011]. This in part relates to the organization of food consumption, such as the work done to encourage children to eat [Ganesh et al. 2014; Laurier and Wiggins 2011] or the etiquette of sharing and coordination in eating [Fischler 2011]. But there are additional social manifestations when families come together at the same place and same time to share a meal [DeVault 1994]. Mealtimes become a site for the exchange of narrative accounts of personal and collective significance [Mintz and Du Bois 2002; Ochs and Shohet 2006]. Through such exchanges, there is a social construction of shared family knowledge, sensibilities, and moral perspectives [Larson et al. 2006].

In this thesis, I focus on the contemporary manifestations of commensality, “the practice of sharing food and eating together in a social group such as a family” [Ochs and Shohet 2006] (p. 37). The simple act of eating together extends far beyond the meal itself. Family mealtimes are considered a critical site for the construction of family routines and a complex assemblage of practical and social dynamics. Historically, sharing meals together have deep significance in the social culture. The notion of family is deeply rooted in the practice of eating together. In ancient Greece, oikos (family) was defined by “those who feed together” [Lacey 1968] (p. 15). This is also somewhat represented in some common everyday words. For example, the word ‘prince’ (Latin: princeps) means “he who gets served first”, ‘participate’ (Latin: part capere) means “having share of a sacrificial meal”, etc. [Fischler 2011] (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 [Fischler 2011]. Commensality is also observed in ceremonial occasions, which are often marked by festivities around elaborate banquets. Here, however, in this thesis, I direct the attention to more prosaic occurrences of commensality. I am interested in mundane commensality, as it plays out in the social and cultural experiences of everyday family meals.

1.2.4 Technology Usage during Family Mealtimes

It is unsurprising that many of the communication technologies we commonly use found its way into the family mealtime space. Some of the technologies are directly related to food preparation and consumption, while some others emphasize the social experience of enjoying food and company. The social foundation of shared mealtime practices associated with technology usage has long been an important concern within sociological and anthropological fields [Beardsworth and Keil 2002; Mintz and Du Bois 2002; Simmel 1997] or health domains [Coon et al. 2001; Hersey and Jordan 2007], but HCI has only more recently become interested in this area [Bell and Kaye 2002; Comber et al. 2013; Grimes and Harper 2008]. More often than otherwise, the use of information and communication technology (ICT) during mealtimes is considered problematic. It is accused of encouraging unhealthier food practices [Bellisle and Dalix 2001], detracting from positive familial interaction [Fulkerson et al. 2008], or taking the attention away from enjoyment of the meal [Stroebele and De Castro 2004]. Research in HCI regarding family mealtimes has largely focused on either creating innovative technologies for familial interaction [Ganesh et al. 2014; Tsujita et al. 2010; Wei et al. 2012; Wei et al. 2011] or solving food related problems using technologies [Hamada et al. 2005; Kanai and Kitahara 2011; Svensson et al. 2005]. Less common is research that attends to the familial experience of eating together [Hiniker et al. 2016; Hupfeld and Rodden 2012; Moser et al. 2016] and focuses on the interactions around available information and communication technologies, particularly the personal smart-devices. These works have established that the interrelationship between the dining place, people, and technologies are evolving complex phenomenon that are posing new challenges for this collocated interaction space and requires careful design considerations.
The social construction of family relations and the organization of family mealtimes are also bound up in the spatial and material arrangements of the dining setting [Hupfeld and Rodden 2012; O'Hara et al. 2012]. Fischler [2011] provides a historical account of how different spatial arrangements of people around a campfire or a dining table marked hierarchy during commensal eating. In modern times, commensal experience in the family is typically more egalitarian [Fischler 2011], with spatial configurations supporting equal opportunities for conversation and interaction. Hupfeld and Rodden [2012] discussed the role of space and the placement of artifacts (both technological and otherwise) in the familial interaction during mealtimes.

Increasingly, the dining setting has become infiltrated by various technologies (e.g., televisions and mobile devices), which are likely to have a discernable impact on mealtime practices. Certain technologies have come under particular scrutiny. The most notable is television, for the ways it has influenced the arrangement of many eating spaces [Hersey and Jordan 2007]. Much of the discussion about the role of television during mealtimes has focused on the negative consequences on the social functions of commensality and little attention is given to any potential positive aspects of mealtime technologies. That is, television is often portrayed as a distraction and hindrance to shared conversation and enactments of family togetherness. Television is typically seen as something that distracts from the sensory joys of eating or from attending to healthy eating practices. As I shall discuss later, research by Barkhuus and Brown [2009] challenge the assumptions bound up in these narratives around the television watching in the family, offering a more nuanced perspective on how we might understand its influence on commensality.

Modern technologies such as smartphone and tablet devices have been subjected to similar critical scrutiny. These technologies offer new opportunities for family mealtimes to be distracted by people checking emails and updating their social media status. Even though much of this criticism is found in journalistic opinion pieces rather than scholarly research, it nevertheless highlights a certain lack of balance in the critical discourse surrounding the position of technology in family mealtimes. There is relatively little research exploring the roles, practices, and attitudes relating to the broader set of digital technologies (smartphones, tablets, laptops, etc.) which are now finding a place in everyday mealtime routines [Spence and Piqueras-Fiszman 2013]. However, recent research has demonstrated the potential of more positive
outcomes from ICT usage during mealtimes. For example, technology can be used to encourage children to eat [Ganesh et al. 2014], provoke familial conversation [O'Hara et al. 2012], or enhance the experience with the meal through digital augmentation [Spence and Piqueras-Fiszman 2013]. These developments, albeit experimental, warrant a deeper examination of the practices associated with technology usage at family mealtimes.

1.3 Research Gap
When considering the potentially beneficial aspects, prior research has largely focused on either creating innovative technologies or redressing problems associated with technology use during mealtimes. While there has been a growing interest in the relationship between food and interaction design [Grimes and Harper 2008; Spence and Piqueras-Fiszman 2013; Wei et al. 2011], surprisingly little attention has been given to understanding the current practices of using interactive technologies at family mealtimes. Mobile networked devices such as smartphones, tablets, and laptops are easily available during mealtimes, yet depending on familial norms, these technologies may be embraced warmly, used discretely, or forbidden entirely. Understanding the interplay between mealtime practices, family routines, and opportunities offered by personal devices is important to provide new insight about the role of technologies at mealtimes. In this thesis, I first seek to address this gap by presenting a contemporary account of the evolving role of digital communication technologies during family mealtimes, beginning with an enquiry about the practices associated with technology usage during mealtimes in the family homes. In the first study, I explored the influence of technologies on the content and the context of mealtime interactions and framed food practices in the households as enacting of the complex relationship encompassing the meal itself, the participating members and their interrelationships, and surrounding elements. The study findings showed how meals and technologies are often paired. Food connoisseurs use the word “pairing” to compare the taste of the food and that of the wine, which helps to match wines with meals, which I followed here to discuss the relationship between technology and meals. I examined current practices and sought to investigate how common beliefs, assumptions, and understandings underpin technology usage during mealtimes. In this study, I also investigated how different factors impact the technology choice during
mealtimes and how family members often make conscious (and unconscious) choices in this regard. I explain how particular characteristics of the technologies actively contribute to both a positive sense of commensality as well as the tensions that may emerge through their use or non-use. Furthermore, I look to the ways that these contributions and tensions are oriented to, managed, and normalized in the social construction of family mealtime practices. This analysis provides valuable insights about how social concerns are enacted in relation to the characteristics of particular mealtime technologies.

The concept of “celebratory technologies”, as coined by Grimes and Harper [2008], helped me to refocus on the shared experience of family members in the collocated interaction space of family mealtime. Grimes and Harper [2008] 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). They argue that everyday meals are occasions for celebration and togetherness in the family and explain that while technology design in this space traditionally aimed at solving food related problems, there is a need to address this celebratory nature of meals and support them. I adopt a framework proposed by Toyama [2015] to explain family members’ attitude towards technology usage at mealtimes, and my understandings from the ways each family manages their technological practices. Then I focus on both the positive and negative aspects of technology usage during mealtimes, and consider ways to design for enhancing the positive experience of mealtimes.

In response to this challenge, I developed TableTalk, a smartphone app to transform individual devices into a shared resource for displaying random photos or tweets, and playing music during family mealtimes. What I have set out in this work, however, is to design and explore how technologies can support and mediate familial concerns and interests, and contribute to commensality by enriching familial experiences of shared mealtime. In doing so, I note how the attention shifts from individual to collective significance and the nuanced ways in which technology usage can correspond to different aspects of commensality including reminiscing, educating, socializing, and bonding between the family members.
While the field-deployment study of TableTalk demonstrated the potential for technologies specifically designed for family meals as an interaction space, this study does not go beyond investigating the brief experience of a novel technology. What is missing here is a detailed understanding of how such celebratory technologies can change existing familial interactions that goes beyond the novelty effect. I address these gaps in my third and final study by investigating how families use their personal smart-devices to nurture familial interaction during their shared meals. Building upon my previous works, I extended TableTalk to develop another smartphone app named Chorus, a celebratory technology designed to engage everyone in the family and support their interactions at the dining table through the sharing personal contents (photos, music, tweets, etc.). In this study, I explored how the technology is integrated into everyday actions and the evolving behaviors through an in-situ investigation of Chorus in family homes. From the field deployment of Chorus with seven families over three weeks, I distilled practical insights regarding how digital technology can be designed as a part of the commensal experience to moderate storytelling of the day, encourage participation, influence conversation topics, and subsequently enhance togetherness in the family. To the best of my knowledge, this was the first study in the domain of family mealtime that investigated the use of novel technologies for extended durations and compares them with regular family mealtimes.

1.4 Unit of Analysis

Based on the research gap as identified above, the unit of analysis in all the three studies of this research is the intersection of family, their technology usage, and mealtimes. But before I proceed further with description of this research, it is worth clarifying the indicative notion of family mealtime that I use throughout the thesis and the technologies I focus on.

As discussed before in Section 1.2.1 and Section 1.2.2, the conceptual notion of family mealtimes varies across time and culture. While a detailed analysis of cultural influences about family mealtimes and cross-cultural comparison is outside the scope of this research, I nevertheless acknowledge the different orientations, arrangements, and perspectives for family mealtimes. I recognize that this research is more aligned with the idealized notion of family mealtime in the North American family context (where most of prior research has been undertaken), and western cultural perspective.
in general. However, as I shall discuss in detail in the later chapters, while the mealtime practices, expectations, and interactions can be significantly influenced by family-specific values and meanings, and hence, not generalizable in many ways, there are commonalities in the participating families that is immediately noticeable. Each of these families actively endeavor to bring the family together (both physically and figuratively) during their family mealtimes. And while their practices of technology usage vary, each family has developed their own sets of norms and practices that serves as a loose guide for the family members which they implicitly agree and adhere to. Hence it is worthwhile to focus on these practices, analyze how families manage their mealtime technology usage, and discuss its implications for future design.

Also, it is worth clarifying what I mean by “technology” in my research studies for this thesis and how or why I consider a technology being “successful” (or not) for its use during family mealtimes. For the study descriptions, I considered only the information and communication technologies as technologies, unless otherwise stated. I also want to clarify that I am not problematizing the family mealtimes; the thesis does not aim to find fault with family mealtimes and seek to remedy them with technology. Instead, the research is problematized around the fact that despite the criticism of technology usage at mealtimes, different forms of information and communication technologies are widely available and used in the families. However, their presence, usage, and acceptability vary across different families and each family develops their own ways to manage these, and hence there is a need to better understand their role and how these technologies could be better designed. I ask why some technologies (e.g., television) are widely accepted and used, whereas some others are much more criticized (e.g., mobile phones). And while the “success” of a technology is very subjective, generally I considered it successful when the use of a particular technology did not create commotion in the family, that is, its usage is accepted in the respective family and it aligns with the norms of that particular family. Also, as I shall discuss later, there are certain aspects of commensality (e.g., inclusion of all the family members, supporting family bonding and interactions, accountability, etc.) and commonly used technologies during family mealtimes often require to support these features too. The exploratory study (study one) discusses particular aspects of technology and family members attitude towards its usage during their
mealtimes. This study revealed opportunities for design in this space, and I present two such interventions in study two and three to demonstrate that technology that is sensitive to the needs of family interactions can augment the commensal experience and contribute, rather than disrupt, family mealtimes.

1.5 Contributions of the Thesis

In this thesis, I aim to unveil the role of mundane technology in everyday mealtimes, elaborate on how these technologies influence familial interactions, and how technologies can support enhancing the togetherness during family mealtimes.

Viewed from the perspective of commensality, family mealtimes are typically considered an almost sacrosanct time and space for social interactions. Hence any technology used in this context, whether it is a mobile phone or TV, is typically regarded with concern as it can diminish or even displace social interactions [Fullkerson et al. 2008; Stroebele and De Castro 2004]. Personal technologies like mobile phones are of particular concern, because they can isolate and exclude individuals from the shared experience of a meal [Hiniker et al. 2016]. The purpose of this work is not to diminish social interactions during mealtime, nor do I aim to replace naturally-occurring interactions with technology-mediated interactions. What I have set out in this research, however, is to explore how technologies that consider the family and their shared concerns and interests as a whole can contribute to commensality. In this research, I seek to address some of these gaps by presenting findings from research into the evolving role of digital communication technologies during family mealtimes. My aim is to articulate how particular characteristics of the technologies lend themselves to the material configuration of family mealtimes. I explore how such characteristics actively contribute to both a positive sense of commensality as well as some of the tensions that they can bring about in familial interactions. Further I look to the ways that these contributions and tensions are oriented to, managed, and normalized in the social management of family mealtime practices. I aim to focus and probe into the ordinariness of everyday domestic technologies, how they can blend into the regular mealtime practices, and how they can support the celebratory occasions during family mealtimes. One of the goals of this research is then understanding the use of communication technologies during
family mealtimes, whether they are used as an information source, entertainment, or enabling social connection, among many other uses.

With this in mind I have shown how my technology prototypes TableTalk and Chorus can contribute to enrich shared mealtime experiences in the families. It does this by allowing all family members to contribute content for sharing personal experiences and concerns that are relevant for the family as a unit. TableTalk and Chorus has also provided children (sometimes through the deliberate action of adults) with a voice in choosing content to share, and in responding to content from others. These contents sometimes provoked and often supported ongoing conversations between family members. The conversation appeared to flow naturally, and new content did not disrupt conversations or take away attention from the meal (except for music), but rather provided an invitation to engage. What is important here is not that conversation was supported, but that we could see a range of commensal activities through these conversations that brought the whole family together, for example, shared reminiscing, bonding, gifting, socialization of family members, educating children, etc.

So, this research breaks away from the traditional view that sees technologies at family mealtimes negatively or that proposes very sophisticated experimental technologies to augment it. Rather I aimed to understand why and when ICTs are used and how the family members typically manage them. I take these insights to develop TableTalk and Chorus that converts personal devices into shared resource and thus enable all members to positively contribute towards commensal experience at the home. While I do not expect TableTalk or Chorus to be incorporated seamlessly in all families or for every meal (as individual families have different levels of acceptance of technology, power dynamics, etc.), but I hope that this work will reveal novel insights about technology usage during family mealtimes.

1.6 Thesis Structure
I have discussed the overall research problem and the contribution of the thesis in this introductory chapter. The rest of this thesis is organized into the following chapters.
Chapter 2: Commensality and Technology in the Family Home

Chapter 2 begins by introducing the basic background knowledge and terminologies that I have used in this thesis. Then I review current literature relevant to this research. I begin with an overview of research about technologies in the family home and group activities in particular. From there, I critically examine literature related to family mealtimes in the domain of sociology and health first, and then from HCI perspective that discusses the implications of technology usage in this space. I discuss how HCI has taken upon the agenda, and divide them into two major themes depending on the approach they have followed – namely problem solving and celebratory research. First, I discuss the dominant approach in research related to family mealtimes, i.e., various projects to understand and solve problems associated with food preparation and consumption. The celebratory research approach complements this research, and I discuss various works that address this agenda. I discuss different research projects in these two directions and identify the research gap that I address in this thesis. I introduce the Toyama [2015] framework that I use throughout this thesis for explaining the potential role of technologies at family mealtimes. Finally, I introduce the main research question and explain different sub-questions that I explore in different studies of this thesis.

Chapter 3: Research Design

In this chapter, I explain the human centered research approach that I take throughout this thesis. I briefly explain the objectives of the three studies I conducted, the data collection process and data analysis methods undertaken for each of the studies. Then I explain the rationale of the research methodology, the data collection tools I used, discuss the limitations in my methodology, and justify different choices I made in designing the studies.

Chapter 4: Understanding the Current Practices of Family Mealtimes

I present the first field study in this chapter. I began this research with an open discussion in an online forum. It helped me to design an in-depth observational study of technology usage at family mealtimes in the home with six families. I wanted to critically examine the usage of ICTs during mealtime and various ways through which families manage such usage. I identified the technologies available in the families’ homes and created maps to illustrate how families, technologies, and other
household items were spatially arranged on and around the dining table. I conducted a thematic analysis to characterize the family norms and practices regarding mealtimes and technology use to understand how these shaped various aspects of commensality (e.g., sociality, satiety, etc.). This study showed that the spatial interplay between people, furniture, and technologies plays a crucial role in understanding and negotiating the commensal experience. Finally, I discuss how technologies contribute to mealtime satiety and commensality.

1.6.4 Chapter 5: Designing Technology to Support Commensality

Study one demonstrates that while the emerging presence and usage of these personal ICTs are managed through varying norms, restrictions, and occasionally tension among the family members, the enactment of family routines and expression of family values remains important to these practices. For example, when a family member used mobile phones for purely personal purposes and his/her attention was diverted away from other members of the family, these usages were typically frowned upon. But when these devices were used for shared interest, scrutiny, and commentary, then it was deemed acceptable and even welcomed. This study suggested that shared materials from the personal devices could be used to enhance face-to-face interactions between family members during mealtimes.

This led to the initial idea of TableTalk, a system that transforms personal devices into shared resources by combining devices to create a single display. The content on the display and access to it is negotiated amongst the family. TableTalk exploits the pervasiveness of mobile personal devices and their encroachment into mealtimes. The system offers a way to bring devices together in the context of collocated interaction in shared environments. When used this way, the devices are no longer available for personal use, but the devices and data within can be used to provoke interactions among the family members. I conducted two design workshops to generate ideas for various design aspects of the TableTalk system, e.g., different types of contents to generate, number of contents, duration for display, etc. Then I developed a prototype of TableTalk and refined it through pilot studies in lab settings and field deployment in family homes. I discuss this study and findings in the next chapter.
1.6.5 Chapter 6: TableTalk and Commensality
The broad aim of designing TableTalk is to investigate how today’s mobile and ubiquitous computing devices can be used during family mealtime to enhance the experience of togetherness. Based on the findings from study one, I developed this smartphone application that supports the sharing of content (e.g., photos, music, social media, etc.) between smartphones and tablet devices of the family members during mealtime. The aim of the study two was to evaluate the application with families in their homes. My field study showed that TableTalk does not undermine togetherness, but supports familial expectations and experiences by stimulating conversation, reminiscing, bonding, education, and socializing. I discuss how technology can augment the commensal experience and reflect on design choices and opportunities to enhance family mealtimes.

1.6.6 Chapter 7: Celebratory Technology for Familial Commensality
The field deployment of TableTalk, while for a brief duration, demonstrated the potential for technologies specifically designed for family meals as an interaction space. However, it poses interesting questions to further extend the research field and the challenges to successfully adopt celebratory technologies in the collocated interaction space of family mealtimes. In the third study, I investigated the implications for the use and design of celebratory mealtime technologies that goes beyond the novelty effect. I also asked how these technologies affect the interactions in the family, and which of these interactions were unique due to the presence of these technologies.

All these questions guided me towards revising the developed app and designing a modified version for the third study. I developed Chorus and conducted a qualitative study to compare meals with and without it. In this study, I investigated which of these interactions among the family members were unique to the introduced technology and what were the challenges of long-term usage and adoption (of Chorus, and potentially of other celebratory technologies). I was interested in understanding how and why family members shared any particular content, and whether such a system could work as a repository for the family history of togetherness. Finally, I deployed Chorus for an extended period of three weeks with each family to investigate the effects of deployment over this period.
1.6.7 Chapter 8: Discussion and Concluding Remarks

After conducting these three studies, I take a retrospective look at the findings to investigate what is the relationship between family members and the technologies available to them in the dining space, how families managed their usage, and what I have learnt from my participants’ use of TableTalk and Chorus. My analysis shows that families have the good motivation to manage their technology usage and work towards making their mealt ime experience more positive. I draw together the understanding of family mealtimes as an interaction space for people with their digital contents and reflect upon how it has responded to the main research question of this thesis. I discuss implications of this research and what it means for future initiatives. Finally, I conclude the thesis with a discussion of the significant contributions of this thesis, pointing out how they build upon and extend current theory and understanding. This chapter closes with a discussion of some open research problems in this domain and suggestions for future research directions.
Chapter 2: Commensality and Technology in the Family Home

2.1 Introduction

There has been a general resistance to technology usage at the dinner table, despite the evident coming together of individuals and families during mealtime, and the proliferation of information and communication technologies (ICTs) in this space. Use of ICTs during mealtimes has been accused of promoting unhealthier food practices [Bellisle and Dalix 2001], causing distraction from interactions with the family [Fulkerson et al. 2008], and from enjoyment of the meal [Stroebele and De Castro 2004]. Yet, recent research has demonstrated the potential for positive outcomes from ICT usage during mealtimes. For example, technology can be used to encourage children to eat [Ganesh et al. 2014], provoke familial conversation [O'Hara et al. 2012], enable dining with remote family members [Nawahdah and Inoue 2013], or enhance the experience with the meal through digital augmentation [Spence and Piqueras-Fiszman 2013]. In the following sections, I summarize existing works about this intersection between commensality and technology. I discuss two major trends in related research in HCI – one that focuses on solving food related problems, and the other that focuses on enhancing food related experience. Building on this, I explore the significance of the social and material configuration of family members, dinner table artifacts, and technologies. Finally, I review approaches that support the sharing of narratives and content within these configurations.

I begin this chapter with a succinct survey of literature related to domestic family life, and the technology landscape that impacts it. The most commonly used technology at mealtimes in the family home is the television. It is therefore appropriate to begin the review of mealtime related research by considering the literature investigating the consequences of watching television during mealtimes. This is followed by a review of technology used for food preparation and for informing eating practices. Then I explore the spatiality of dining spaces, the artifacts within, and how the spatial configuration contributes to the use and experience of technology at mealtimes. I show how research about human-food interactions has progressed from a focus on the
functional aspects of eating (e.g., nutrition and dieting) to exploring celebratory eating, which affirms the social and cultural aspects of cooking and eating together. Finally, I discuss the intersection of this research and identify the research gap and research questions that I address in this thesis.

2.2 The Family and the Family Home
The HCI community has taken interest in designing and developing interactive technologies for families for quite some time now [Bell and Kaye 2002]. There has been a steady growth in the number of publications involving technologies for families [Fails et al. 2012]. However, the notion of family varies among these researches and requires clarification before I discuss further.

In most part of the world, if not all, the family is defined in censuses and surveys as two or more persons related by blood, marriage, or adoption, and living in the same residence [Fields 2004]. Throughout the thesis, I use the term family to be more loosely defined as people residing within a household that could include members of the extended household network, such as uncles, aunties, cousins, friends, colleagues, etc. along with the nuclear family members. Similar notion is adopted by DeVault [1994], O'Hara et al. [2012], and many others in their research about families. While I do not engage in the theoretical debate of who are included in a family (or not), this research focuses on the families as a household group who may or may not be related by marriage (or de facto and romantic relationships), or parenthood (e.g., single parents with children).

In this section, I open up by discussing relevant literature that differentiates the technology usage in the home from the work environment and how the mobile and networked devices sometimes challenge that orientation. From there, I present literature about sharing narratives among family and other social groups through the use of interactive displays and digital photographs. Finally, I focus the attention on work about designing technologies that consider family as a special group and emphasize on their relationship than on the functional aspects of family life.

2.2.1 Technologies for the Family Home
The family home is considered an important place for creating and participating in rich individual and social works [Pink 2004] and technologies in the home become
intertwined with household relationships [Berker et al. 2005]. Technological practices in the home and designing technologies for this space have been of interest to researchers in sociology and HCI for quite some time now, ranging from cultural aspects [Bell et al. 2003], intergenerational interactions [Durrant et al. 2009], gender and power gap between family members [Bell and Dourish 2007], social class [Ames et al. 2011], and many other interrelated topics. Researchers have for long been concerned that the proliferation of ICTs will reach and affect every sphere of life, including the family home [Hess et al. 2012; Neustaedter et al. 2012]. In doing so, there is a concern around the migration of office culture and values into the home that may be inappropriate for domestic life [Gaver et al. 1999]. Bill Gaver [2001] further explained the concerns regarding this transition in his web article:

“There is a danger that as technology moves from the office into our homes it will bring along with it workplace values such as efficiency and productivity at the expense of other possibilities ... unless we start to respect the full range of values that make us human, the technologies we build are likely to be dull and uninteresting at best, and dehumanizing at worst.”

Davis et al. [2010] conducted a three-year long study to explore the implications of these new technologies in relation to work, family time, leisure, and other everyday activities and identified the changes in temporal patterns of daily life. They highlighted the role that technology plays in constituting and reordering the rhythms of contemporary domestic life. Particularly, they discussed how the “always-on connection” of broadband Internet has altered their participants’ interaction with ICTs and with other members of the family. Hindus et al. [2001] focused on the social aspects around communication devices in the home and how they go beyond the current focus on information and knowledge work and expose us to the demands of new user groups, including the elderly, the disabled, and the mentally impaired. These discussions are furthered by Crabtree et al. [2003] who highlighted the requirements and implications of having smart connected ubiquitous devices in the home. Rodden and Benford [2003] discussed how inhabitants continually reconfigure domestic spaces and the technologies within to meet particular demands – both functional and social. Crabtree and Rodden [2004] sought to inform the development of computing for the home environment by unpacking the notion of domestic routines in the family. They compared the digital communication technologies (e.g., email) with their analog
equivalents (e.g., paper mail) to identify the ecological habitats, activity centers, and coordinated displays where technology is at the core. Alongside the formal rules of work or performance issues, there is another class of research that is concerned about the rich detail of the domestic home and the life within it. Obrist et al. [2008] suggested that there is still a lack of studies about the context of ICT use in the home. Haines et al. [2007] recognized the lack in our understandings of the issues surrounding social relationships and constraints in the smart-home related research. This topic is frequently overlooked, as Haines et al. [2007] presented how the technology design is often motivated by the capabilities to do so, rather than the social context and associated values. They took this research further in [Davidoff et al. 2006] to discuss the discrepancy from developers’ and users’ viewpoint regarding features and functionalities of smart-homes.

Harper et al. [2003] provided a succinct survey of family members’ usage of mundane communicational artifacts (such as paper notes, paper mail and whiteboards) in the home and the interactional objectives in their usage. Based upon their findings, Sellen et al. [2006] designed HomeNote – a custom display to support situated messaging in the home. In doing so, they showed how the ICTs usage at home goes beyond efficiency and mere entertainment, and rather are used to request action, express awareness and affection, reassure social touch, and mark identity in a household – thus ultimately contributing to the enrichment of home and family life.

Nansen et al. [2010] analyzed the temporal, spatial, and technological strategies that families employ to negotiate permeable boundaries between the competing demands of work and family life in the home. They investigated how people negotiate the spatialities and temporalities of this diverse and shifting technology field. Their analysis focused on when, where, and how there technologies are used to navigate and manage daily life at work or at home, specially the ways in which work within the family home is perceived, conducted, and negotiated. They concluded that the role of technologies in the working-home is not just as an instrument of facilitating information or work at a distance, but also in defining and shaping the spatial and temporal strategies of the working-homes. Bernhaupt et al. [2008] focused on interactive television and other potential enhancements of the television technology to understand the concerns around personalization, privacy, and security as well as communication. Their study highlighted that while television watching is the major
activity in the living room, it is often consumed passively along with other familial interactions and shared activities (e.g., taking part in guessing on quiz shows broadcasted in the television) among the family members. I now discuss the use of different technologies as a social group, particularly by the family members, for enabling the experience of shared narratives in order to provide the readers with a context of family members’ technology usage during their shared mealtimes.

2.2.2 Technologies for Sharing Narratives in Social Groups
The field of conversation analysis, developed by sociologist Harvey Sacks [Sacks 1992], is an approach to study both verbal and non-verbal social interactions in everyday settings. Sacks established the necessity and significance of collecting data in situ, instead of contrived usage scenarios. The data is often collected using video or audio recording of conversations of the participants in their natural settings, which is then transcribed with minute details and analyzed inductively to find recurring patterns of interactions, and finally results in a rule or model to explain these patterns [Sacks 1984]. Alongside establishing the significance of these purely qualitative methods as a tool for sociological research, Sacks made notable contributions in analyzing how topic develops and where topic comes from in the course of everyday conversations.

Sacks discussed the ways in which our everyday activities, events, and artifacts often provide an excuse or a basis for opening a conversation, even between strangers, in a natural way. He identified various aspects of conversation, e.g., turn taking, repairs, adjacency pairs, sequence expansion, preference organization, action formation, pauses and topic changes, etc. as essential features through which the interactional objective of conversation is achieved. Sacks discussed how these aspects can be used to make analytical sense of particular conversation. For example, about adjacency pairs, Sacks [1992] noted how the words of children may not be treated in the same way as those of an adult, nor are they expected to contribute to the conversation to the same extent, or in the same manner. Without taking that into account, one may not be able to make sense of why an involved stakeholder have responded in a particular way to an outburst or unusual statement by a child. Sacks’s work has inspired generations of researchers to analyze verbal and non-verbal interactions among people and to identify patterns in it.
Despite the widespread criticism of technologies to provide meaningful and deep interpersonal connections [Turkle 2012], there is plenty of evidence to the contrary. Information and communication technologies have paved new forms of interactions or made it easier to have communications which was either too expensive (in terms of time, energy, or money, for example), or even not possible otherwise. For example, many grandparents spend precious moments on a weekly, even daily basis with their families over webcams [Judge and Neustaedter 2010]. Since 2009, as many as 20% romantic relationships have started online [Rosenfeld and Thomas 2012], and Facebook has reconnected many long-lost friends [Miller 2011]. In this section, I discuss various efforts to design technologies to promote and support group interactions. Some of these interactive technologies are designed for non-mealtime settings, but I shall discuss later in this chapter about how these technologies can have implications for family mealtime space.

There has been a growing interest on using interactive surfaces as a collaborative tool for both official [Wigdor et al. 2007] and informal [Block et al. 2015] environments (e.g., museums) as a medium for promoting social engagement. Block et al. [2015] contributed with a mechanism to identify groups within a dynamic flow of visitors through a busy exhibit hall. From there, they progressed to statistically measure group-level engagement. Finally, their analysis showed that groups of two, groups with both children and adults, and groups that take turns in their discussions spend longer at the exhibits and engage more with the scientific concepts.

Harris et al. [2009] compared multi-touch surfaces with its single-touch counterparts to investigate and compare their effect on children’s collaboration and learning in classrooms. Interestingly, their study showed that both of these devices resulted in similar frequency of touch-interactions and equal access among the children. However, it influenced the topic of children’s discussion. In the multiple-touch condition, children talked more about the task; whereas in the single-touch condition, they talked more about turn taking. Yuill et al. [2013] took this further to investigate the social interactions achieved through shared tablet interfaces among a group of children. They demonstrated that by doing so, the focus shifts from personal work to shared interactions, togetherness in ownership, and the engagement with digital content as a group. In my studies (discussed later), I investigate if such a display can engage the family as a whole, promote conversation, and enhance togetherness.
The role of digital artifacts such as photographs has received significant attention in terms of supporting social activities. Collocated photo sharing, particularly in social groups, has been used as a means to stimulate conversation [Van House 2009] and to engage in shared reminiscence [O'Hara et al. 2012]. Frohlich et al. [2002] compared conventional and digital photos to investigate spontaneous photo-sharing conversations in the family home. Their study focused on users’ activities surrounding paper photos, its subsequent conversion to digital format, and how the use of digital photos is different to its paper version. Their findings showed how photos provoke and support storytelling as well as reminiscence through shared discussion among people who were present and not during the depicted event of the photo. Moreover, their analysis revealed that photos generally serve as a memory cue within the context of some other social activity – thus giving it a meaning associated with that memory. So, it is the embedded social context that is of significance here, the photo material is just an instrument for achieving the social experience. They recommended future digital photography products to extensively support conversations and sociality by extending the sharability of digital photos across a range of use contexts, for example, among family and friends, or to support relationships over distance and time.

Crabtree et al. [2004] analyzed how the photo sharing practices enable collaborative construction of photo-talk in social groups. Their study highlighted the significance of material properties of the photo artifacts on the embodied nature of photo-talk, the spatial organization of people during such event, and the interactions with these artifacts. Hilliges et al. [2007] focused on social interaction, visualization, and collaboration around digital photos displayed in interactive tabletops. They developed a novel interface named PhotoHelix and recommended flexibility in the interface to allow individual users customize different aspects (e.g., size, orientation, grouping) of their photos displayed. A later analysis of their study data [Hilliges and Kirk 2009] showed how users connected apparently incoherent photos to artfully craft the ongoing discussion. Overall, their work highlighted the agency of the user in effectively structuring a dialogue within the group using available resources to serve a variety of linguistic social functions.

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.
[Patel and Clawson 2011; Van House 2009]. Lucero et al. [2011] explored collocated interactions around photo sharing with mobile phone apps that conforms with the metaphor of passing paper photos around. Their prototype encouraged people to share their devices in an ad-hoc network configuration and use them interchangeably while discussing photos face-to-face. Cosley et al. [2012] presented Pensieve, a tool to support everyday spontaneous reminiscing through memory triggers, e.g., snippets from user’s social media posts or generic questions that encourage people to reflect on their past. They demonstrated the potential value and utility of such technologies for supporting reminiscence, the importance of reminder notifications for both reminiscing and lifelogging systems, and provided insights into people’s current practices of reminiscing in social media.

In addition to this, Van Gennip et al. [2015] presented a qualitative observation of involuntary memory cueing in everyday life. Their analysis showed that everyday physical objects (e.g., food items) are more frequently occurring cues for memories of everyday life, locations, and repeated activities, while digital items and photos are shown to be less frequent stimulants. Relevant to this research, their study demonstrated that eating and food-related materials or activities often came up in the discussion, e.g., ingredients, recipes, related tools, and experience of shared mealtimes, etc. Food-related cues prompts memories on social gatherings, past events, people’s preferences, and the relationship with family members, which often accumulates meaning over time.

One notable aspect of collocated photo sharing is the asymmetrical nature of interactional control in such groups. This control concerns the ownership of the photo or the device [Lindley et al. 2009], and the conversational asymmetry arising in this context [Van House 2009]. There are three different approaches to configure these control dynamics. The first approach is distributed content, where digital material is pushed to the personal devices of all participants so that everyone views the content independently on their own device, as illustrated by Ah Kun and Marsden [2007]. A second approach involves using a shared resource, for example, a projector, an interactive surfaces [Schmidt et al. 2010], or a television screen to display content from all family members. The third approach is illustrated by Nielsen et al. [2014], who brought together personal devices to create an ad-hoc shared display for all users to see. I extended this concept and will discuss further on this in later chapters.
2.2.3 Technologies for the Family Group

In recent years, researchers have raised questions about the relationship between contemporary ICTs and values such as family-bonding [Turkle 2012], autonomy [Leshed and Sengers 2011; Mazmanian et al. 2013], business [Mark et al. 2008], connectivity [Harmon and Mazmanian 2013], multi-tasking [Wajcman 2008], productivity [Mark et al. 2012], speed [Leshed 2012], etc. Researchers studying ICTs within the context of everyday life have pointed to the interplay between everyday practices, values, and broader cultural dynamics such as social expectations, class, or norms [Ames et al. 2011; O'Brien et al. 1999; Strengers 2011; Venkatesh 1996].

This is evident, for example, in research that looked at the family from the point of organizing and planning. Plaisant et al. [2006] developed a digital calendar prototype to facilitate coordination and awareness between distributed family members (e.g., grandparents and grandchildren) by the sharing of calendar information. While it encouraged an open exchange of information between family members about their day-to-day activities (e.g., collecting children from school, or managing packed lunches), another objective of the system was to create a sense of awareness among multiple generations of the family members (e.g., finding a suitable time to watch movie together) and thus promote family togetherness in a subtle way. In another initiative, Brown et al. [2007] developed *Whereabouts Clock* to investigate emotive aspects of family life along with family co-ordination through sharing of their coarse location data (e.g., “Home”, “Work”, “School”, or “Out”) - particularly the ways in which family members’ awareness of each other’s schedules and activities contribute to a sense of their identity as a family.

Wyche and Grinter [2009] investigated the values associated with religious practices in the families, and how they influence the material artifacts, routines, and ICT usage. Petrelli and Light [2014] took this further to explore the family traditions and rituals associated with the celebration of Christmas, specially focusing on the artifacts (both technological and otherwise) and processes that constitute family life at that particular time of the year. They discussed how family members re-use some technologies (e.g., Christmas lightings, Christmas tree ornaments, etc.) and then store them for retrieving in the next year. Their study showed that the celebration of Christmas goes above the religious rituals and in fact families form their own rituals (e.g., exchanging cards, playing particular music or games, etc.) over the time that has nothing to do with the
event’s religious origin. Relevant to this research, they discussed how the use of technologies evolved over time and influenced the changes in communicating with family members, enabled recollection of past events, and blended into the family practices. They recommended designing sympathetic technology that holds potential for augmenting family rituals sensitively and possibly creating new ones.

There is a special research interest about families focusing on communication between remote family members, particularly from intergenerational perspectives. For example, videoconferencing technologies between the family members [Ames et al. 2010] or between the grandparents and grandchildren [Judge et al. 2011; Judge et al. 2010; Judge and Neustaedter 2010] have highlighted the potential scope for enhancing engagement and togetherness in the family. However, there are requirements for technical skills to set up and troubleshoot the technology [Ames et al. 2010; Vaisutis et al. 2014] as well as the privacy issues of family members [Judge et al. 2010]. Vaisutis et al. [2014] investigated about the difficulties older adults face about configuring and using modern technologies (e.g., email or Skype). They came up with a prototype Messaging Kettle [Brereton et al. 2015] to foster communication and engagement with remote family and friends using the routine of boiling water in the kettle to prepare tea. Through this system, elderly people could signal each other that they were using the kettle at any particular instance. If they like, they could also write a message on a dedicated tablet screen that the other party would receive live. Through this prototype, they investigated remote connection and communication with elders by augmenting an existing habituated object (i.e., the kettle) and the comfortable routine of boiling water to make tea. Lindley et al. [2010] tried to solve this by developing a Message Tablet which shows that both practical task-fulfilling and entirely ludic uses can co-exist on the same platform. Additional themes, for example, keeping in touch at a distance [Lottridge et al. 2009], organizing activities and people [Plaisant et al. 2006], and facilitating togetherness [Barden et al. 2012], etc. have also emerged in HCI research about family life and home in general. There have been many other attempts to promote intergenerational interactions [Zhang and Kaufman 2016] in the family through different means, for example, sharing photos [Davis et al. 2012; Rowan and Mynatt 2005], using social networking sites [Cornejo et al. 2013], playing card games [Kerne et al. 2012], designing smart furniture for the household [Patel and Agamanolis 2003], or even using gesture and video [Tang et al.
The overlap between functional and social uses of technology is often apparent in these research projects.

On the contrary, the Ludic Design approach encourages digital interventions that can be made with no real intended “function” beyond inspiring active engagement of the family members with each other [Chirumamilla and Pal 2013; Helmes et al. 2009], indicating opportunities for designing for social fun within the family boundaries [Voida et al. 2010]. Rooksby et al. [2015] tried to unpack how people manage the presence and usage of multiple devices in the living room. Their study showed that mobile devices are routinely used to access media that is unconnected and unrelated to media on television running in the background, for example, sending and receiving messages, browsing social media, and browsing websites. Hence they concluded that ICT usage at the living room often does not have specific media consumption as the objective (e.g., communicating with a particular person or watching a specific TV program), but to enhance the leisure time in general. Another approach embraces slow technology [Hallnäs and Redström 2001] to foster reflection and tranquility in the family using sound and light along with information display. These affective interventions contrast with the more functional work of living together.

Among all these initiatives, a special focus of the research on the family homes are dedicated towards efforts in relation to food and mealtimes. Hence, in the family home and among various activities that binds the family members together, this research focuses on the space and time when family members gather together to share their meals. My interest in the family dining space is confluent with what Oldenburg [1999] terms as the third places - casual social places where individuals purposefully co-inhabit with the intention of conversation and socialising in a relaxed and unimposing environment. Harrison and Dourish [1996] was one of the first in HCI to refocus on the tension between connectedness and distinction, rather than the physical space in design of collaborative and collocated systems. They argued that the behavioral framing of interaction between people is rooted in sets of mutually held and mutually available cultural understandings about behavior and action in any specific space, e.g., an office room, family bedroom in the home, or the dining space. As they have put it “Space is the opportunity; place is the understood reality” (p. 69).
Hence it is very important to understand the social and relational significance of the interactions and activities of the family members during their mealtimes. It is one of the few times when all family members come together at the same place at the same time [Larson et al. 2006]. So, before I discuss the technology space in the mealtime context of the family home, now I review the related research in the sociology and the health domain that focuses on the experience of family members sharing their meals together, also commonly known as *commensality*.

### 2.3 Commensality: The Shared Experience of Eating Together

Mealtimes have been a major research interest in different disciplines related to social and health sciences (e.g., anthropology, gender studies, behavioral science, child-development, etc.). Each of these disciplines has brought its own approaches and perspectives to the topic, highlighting the physical, mental, social, cultural, and other dimensions of domestic food practices. For example, anthropologists have investigated how food preparation, distribution, and consumption relate to culture and social order in society [Ochs and Shohet 2006], health researchers and practitioners have studied the relationship between mealtime behaviors and health outcomes [Coon et al. 2001; Willett 2011], and gender and family studies scholars have explored how mealtimes perpetuate or disrupt roles and relationships within the family [Bell and Dourish 2007; Neuhaus 2003]. With increasing demands on time in the everyday family life, regular activities such as food purchasing, preparation, and consumption have become somewhat habitual and casual. Indeed, modern food values are often focused on convenience and effortlessness, overshadowing other values such as environmental sustainability, health, and pleasure [Choi et al. 2012]. At the same time, the ubiquitous presence and usage of networked computing devices are impacting every sphere of human life. While extensive research has explored ICT usage in contexts such as the workplace, public spaces, classroom, etc., family mealtime as a social collocated interaction space has received comparatively little attention. Hence the rethinking of how to approach everyday technology usage associated with family interactions during their shared mealtimes appears to be a particularly timely concern.
2.3.1 Commensality in Sociology

The focus of this thesis is on commensality, i.e., the shared experience of eating together in a social group such as a family [Ochs and Shohet 2006]. Family mealtimes are a critical site for the construction of family routines. The notion of family is deeply rooted in the practice of eating together. The very word family has its origin in the Greek word oikos that means “those who feed together” [Lacey 1968]. This in part relates to the organization of eating practices in the family or the instructions about etiquette of communal eating. But family mealtimes are not just about eating well and eating politely; they are a complex assemblage of practical and social dynamics. Mealtimes are important part of everyday social life in almost every country and culture around the world. While the busy schedule of the 21st century can sometime result in having a quick meal on the go or at desk [Keogh 2014], sharing meals with family and friends, for regular mealtimes or special occasions is a practice embedded with traditions and values [Blum-Kulka 2012]. It is hardly surprising that food is fundamental to culture as well, with food practices reflecting ethnicities and nationalities [Bell and Valentine 1997].

Gender studies, in particular, have contributed to an understanding of social practices surrounding food consumption in the family home. Kemmer et al. [1998] discussed the symbolic importance of eating patterns and shared meals on the young couples who are setting up home together. They found how it is often women who hold the main responsibility for (but not always control over) doing the “feeding work” for the family. Women’s role in organization and preparation of the food has been characterized as the expression and reflection of both care and affection [Murcott and Gamarnikow 1983], a gift to the family members, relatives, friends or acquaintance [Shuman 2000], and their subordination to men [DeVault 1997]. Along this theme, Kaufmann [2010] presents how various practices associated with cooking and eating are central to the formation, continuity, breakdown, and reconstitution of a family.

Family mealtimes also correlate with a number of positive outcomes for children and adolescents. It can impact the development of language and literacy skills [Beals 1997] and can generate a decrease in risk-taking behaviors [Fulkerson et al. 2006]. Existing studies have also uncovered the role of food in the personal, social, and cultural construction of memory [Sutton 2001] and in the establishment of social bonds or rivalries through food exchange [Mauss 2000]. Mealtimes are especially
important in families as mechanisms for children’s socialization into language, customs, and social expectations both for individual families and in the broader society [Fulkerson et al. 2006; Ochs and Shohet 2006].

In these ways, commensality signifies more than the simple act of eating together. Commensality alludes to the human co-dependency, reciprocal commitment, and the social, political, and cultural aspects of eating together. Commensality is also observed in festive and ceremonial occasions, which often incorporates elaborate banquets. In this thesis, however, I direct the attention to more regular occurrences of commensality, as it plays out in the social and cultural experiences of everyday family meals in the home.

The consequences of sharing food with others extend far beyond the food itself – it brings people together both in its preparation and in its consumption [Lupton 1996]. Meals have always been a source of social interaction, cultural identity, heritage, enjoyment, and celebration [Beardsworth and Keil 2002]. In this sense, family mealtimes are an important site for the construction of social capital. This in part relates to the preparation and arrangement of food consumption, for example, encouraging children to eat [Ganesh et al. 2014; Laurier and Wiggins 2011], or the etiquette of sitting arrangements, sharing food items, and coordination of other food related activities [Fischler 2011]. But there are additional social manifestations when families come together at the same place and same time to share a meal. Mealtimes are occasions for the exchange of personal and collective narratives in the families [Mintz and Du Bois 2002; Ochs and Shohet 2006]. This is considered very important for the construction of shared family knowledge, sensibilities, and moral perspectives [Larson et al. 2006]. As for an extreme example in some cultures, having a meal together itself may symbolize a couple’s intention to marry [Wrangham 2009], while in some others, eating alone may not even qualify as a meal [Fischler 2011]. The practices of shared eating are said to inspire social integration and establish or reinforce common identities among the participants [Sobal and Nelson 2003]. Sharing a meal nourishes the body, but it also creates a bond between those at the table and brings them closer to each other in a unique and undeniable way [Fischler 2011]. Eating then does not just serve a biological need for consumption, but is done in a social context and as part of critical social functions [Fischler 2011].
2.3.2 Commensality in Health Domain

Family mealtimes are associated with more positive dietary intake and healthful behaviors among adolescents [Cason 2006], among both parents and children [Larson et al. 2007], and a focus point for a variety of wellbeing outcomes for the family in general [Fulkerson et al. 2006]. Fulkerson et al. [2006] hence recommended promoting family meals to reduce dependency on eating outside of the home and to promote greater nutritional intake. Parental monitoring of child’s eating and modelling of healthy food related behaviors during mealtimes are of vital importance to the child’s future food related behaviors [Savage et al. 2007]. For example, a study of 200 families found that positive communication during family mealtimes predicted a higher quality of life in children [Fiese et al. 2011]. It has been a general consensus that family meals have a significant impact upon the nutritional quality of children’s diets [Gillman et al. 2000; Neumark-Sztainer et al. 2003; Videon and Manning 2003]. These research have all agreed that a higher frequency of family meals is associated with a greater intake of fruits, vegetables, and milk, and a lower intake of fried foods and soft drinks. Cason [2006] hence recommended promoting the family meal as a potential public health measure for improving dietary quality, reducing overweight, and improving educational and social outcomes.

In a more recent work, Grimes et al. [2009] focused on the implications of collecting, sharing, and reflecting upon health information within the family. They identified four aspects in which these practices are unique in the family context. First, family members share a lot of meals together, thus gaining multiplexed data of other people than oneself. Then, there are competing values of openness, caring, and privacy in sharing the data among family members. Third, explicit comparison is often considered as negative in the family context, whereas in personal level, it is well within the practice. Finally, there are broader meaning of the data than only the health aspects; family members can make the process of collecting and reflecting on these data much more enjoyable than possible otherwise.

So now that I have reviewed the significance and impact of family meals on the sociality of the family members and on their health-related concerns, next I discuss the technological landscape and its potential impact on commensality.
2.3.3 Commensality and Technology

It is unsurprising that many of the communication technologies that are commonly used in the course of everyday life are also being used during the family mealtimes. It has been reported that almost fifty percent of families in USA have a television in their dining area [Coon et al. 2001; Hersey and Jordan 2007] and as much as sixty percent families watch television during mealtimes [Kirkova 2013; Rideout et al. 2010]. Recent research has demonstrated the growing presence of mobile and networked devices at the dinner table [Hiniker et al. 2016] and the emerging trends of technology to augment food and drink with multimodal sensory inputs and to contribute to the overall experience [Spence and Piqueras-Fiszman 2013]. What is underexplored here is the possible role and significance of technologies in contributing to togetherness during such commensal meals. If commensality is considered as melding “the public and private spheres” [Hirschman 1996] by including some people (who have been invited to share in the meal) and excluding others (who are not), I ask if the same can be said about associated technology and media consumption. I ask if the current and commonly available technologies (e.g., television, smartphones, etc.) can be designed to create this inclusion among the family members that commensurate with their commensal experience. Is technology able to act as a socially integrative force during mealtimes?

Before proceeding further, I want to clarify what I mean by sharing technologies in the families. Throughout this thesis, I refer to technologies as “shared” when multiple members in the family use them together (e.g., watching a TV show) or are aware of the contents within (e.g., one member showing a photo in his/her smartphone to another member in the family). It may or may not involve handing over the mobile device. I consider some technologies as inherently being shared – for example, I generally consider television and music systems as shared device (unless listening with headphones), as all the members in the vicinity can see or listen to the content being played there. On the contrary, I consider personal smart devices as “personal”, unless the user deliberately chooses to show its contents to another. This type of sharing can be done in several ways, for example, the user may pass the phone to another, held it so that the other person can see it, connect it to a television for easy viewing by everyone, play some games on the same tablet device together, etc. When these happen, I refer to these as being a “shared device” or a “shared resource” for
that family for that particular instance. So, it is not a property of a device per se (though some device might be more suitable for sharing) but arises from the context of its particular use at that particular instance in that particular family.

Whereas shared use of communication technologies (e.g., television, radio, etc.) are often welcomed during family mealtimes [Hupfeld and Rodden 2012], personal devices are viewed as creating tension amongst family members and are often managed through varying family norms and restrictions [Moser et al. 2016]. But recent research has focused on how such personal devices can often be used as a shared resource [Bell 2006]. It has been noted that people use technology in shared ways (e.g., handing over a phone or multiple persons looking at the phone screen and engaging with its usage to perform a task while one of them operates it), even when devices are specifically designed for individual use [Rogers et al. 2009]. Yuill et al. [2013] investigated the social interactions and associated enjoyment of shared drawing activities amongst a group of children using one tablet device. Aside from technological affordance, their work demonstrates how the use of personal devices is shifting from personal work to shared interactions, togetherness in ownership, and the evaluation of creative content as a group. I ask if such togetherness is also reflected in the social and material configuration of technologies through which commensality is achieved.

2.4 An Overview of Technologies at Mealtimes

There have been efforts to digitally augment dining tables [Gaver et al. 2006] and kitchen artifacts [Gellersen et al. 1999] with sensors and displays to become smart, context-aware, and trackable. An early example of a digitally augmented kitchen artifact is the MediaCup [Gellersen et al. 1999] which can communicate various usage information including location, orientation, and temperature of the liquid in it to remote participants. Similarly, the Lover’s Cup [Chung et al. 2006] lights up when used by remote users to promote intimacy. But there is less work that explicitly aims to understand the social context of technology usage during mealtimes. Meals and technology are often considered separate independent entities.

Television and mobile phones have come under particular scrutiny [Hersey and Jordan 2007; Moser et al. 2016], since these are the most commonly used
technologies at mealtimes. Recent studies have noted widespread availability (and occasional use) of mobile technologies during family mealtimes [Harmon and Mazmanian 2013; Moser et al. 2016] despite the general consensus about refraining from doing so [Rainie and Zickuhr 2015]. Parents are often found using smartphone or tablet devices to keep their children distracted while eating [Orlando 2016; Radesky et al. 2014; Radesky et al. 2016] or using it themselves for recreational or professional purposes [Bruce 2010; Harmon and Mazmanian 2013; Hiniker et al. 2016; Rimer 2009]. Now I discuss the usage and implications of television watching practices in the families during their mealtimes, and then focus on the more recent advancements in this context.

2.4.1 Television Watching during Mealtimes

For many decades, research about the use of technology during mealtimes has been dominated by the television [De Bourdeaudhuij and Van Oost 1998; Mintz and Du Bois 2002]. This is understandable given that almost 50% of families have a television in the area where they commonly eat [Coon et al. 2001; Hersey and Jordan 2007], and that the television-watching during mealtime can be as high as 60% [Kirkova 2013]. A US national survey has found 63% of 8 to 18 year olds said that the television is usually on during meals [Rideout et al. 2010]. So, the use of television as an information and communication technology during family mealtimes remains an important part of my investigation in this research.

In terms of usage, the television is clearly a popular technology at mealtimes. In terms of the impact, the evidence is less clear. Much of the discussions about the role of ICTs at mealtimes have focused on the negative consequences on the social functions of commensality. For example, TV watching during meals has been negatively linked with obesity [Bellisle and Dalix 2001], lower fruit intake [FitzPatrick et al. 2007] and has a positive correlation with more frequent visits to fast-food shops [Jeffery and French 1998]. It has also been accused of hampering familial conversation and other interactions [Fulkerson et al. 2008], detracting from enjoyment of the meal [Stroebele and De Castro 2004], and not achieving satiety [Brunstrom and Mitchell 2006]. As a result, families are often encouraged to eat meals together devoid of distractions like television [Fiese 2008].
The role of television with regard to the family in food culture and health has been well discussed, from sociological [Mintz and Du Bois 2002] or health perspective [De Bourdeaudhuij and Van Oost 1998]. In those works, the use of communication technology during mealtime is specifically focused on television as a home gadget. Neumark-Sztainer et al. [2010] did a longitudinal (decade long) study of family mealtimes in the USA. They identified the diverse nature of family mealtime in terms of participants and the settings in which it is conducted along with its consequences. Though their main focus was around the socio-cultural effects and health concerns, they discussed the extent and impacts of watching television during the family mealtimes, which they find is very common. They found no significant correlation with television viewing and the frequency of shared meals. Boutelle et al. [2003] delve into this further and analyzed the dietary nature of family meals with pre-planned meals and the use of television during mealtime. Fulkerson et al. [2008] also discussed the role of television in family mealtimes and highlighted the adverse effect it may have on family conversation. Both of them linked this habit with poor dietary intake and childhood obesity. Bellisle and Dalix [2001] found that food consumption could be increased by as much as 15% when people are distracted by the television (or radio) while eating. This research links watching television during mealtimes with poor dietary habits or childhood obesity, and cites possible detrimental effects to familial interactions during mealtimes. These studies focus on tensions between the use of television during mealtimes and possible risks to sociality and healthier living in general. However, this approach, which aims to identify the negatives aspects of technology usage, tends to obfuscate any positive ways in which the technology might be implicated in the configuration of commensality.

Barkhuus and Brown [2009] challenged these assumptions by exploring the social interactions around television usage. They concluded that television watching, even when done alone, is always done in a social context. While their work is a general commentary on television viewing practices than specifically focusing on mealtimes, they raise a number of key points that are relevant to my concerns in this research. First, they noted that much of the television watching practices in the family could be characterized as ambient rather than focused watching. That is, in ambient form, the television is positioned as a backdrop to other everyday activities and practices in the home. The television here is something that is dipped into and out of, as other
everyday activities are performed. Second, their work also highlighted that shifting between ambient and focal attention was distributed in different ways across family members. The focused viewing of one family member could occur at the same time as the ambient viewing of other family members. Of significance is that television viewing cannot be simply regarded as just a distraction from familial interactions, as it is often portrayed. Rather, mealtime television viewing is an activity that is integrated into the broader social practices and arrangement of certain households. It is always something that is socially performed even if being used to be deliberately antisocial. Lull [2014] took this research further to shed light on how television narratives can trigger discussions between the parents and the children to reinforce family values and interactions. As I shall discuss later in Chapter 4, particular characteristics of technologies (both television and other mobile technologies) actively contribute to both a positive sense of commensality as well as the tensions that may emerge through their use or non-use.

There are far fewer studies concerned with the use of ICTs other than television at mealtimes. This is surprising, given the growing proliferation of new technologies such as mobile phones, tablet computers, and laptops in the domestic sphere. There is, however, a growing interest in the use of ICTs for food related activities generally. This is relevant because this emerging use suggests a new possible relationship between technology and food; hence I review this research next.

2.4.2 Mobile and Other ICT Usage at Mealtimes

The controversy surrounding the use of mobile and networked devices in social settings like family mealtimes is not new. Green [2002] explored how the mobility of computing and communications technologies mediate the time and spaces from a sociologist’s perspective. This study showed that mobile phones encourages both short conversations and more frequent engagement with more people than beforehand. He argued that a reconfiguration of space, time, and relationship is taking place, and the usage of ICTs are changing in terms of individualization, availability, duration, cycles, and overall, the rhythms of everyday life. Harmon and Mazmanian [2013] identified two conflicting viewpoints in peoples’ adoption of the mobile networked devices - one calling for increased technological integration, the other urging to dis-integrate the smartphone from our daily life. One group of techno-enthusasts invest
efforts in greater integration of new technologies to fulfill the promise of mobility and connectivity that transform users into “multi-task masters”. In contrast, there is another significant approach that figures the smartphone user as a “distracted addict” and calls for individuals to dis-integrate the smartphone in order to become “authentic humans”. Porcheron et al. [2016] investigated how people organise mobile device usage in casual social settings such as in pubs, to explore the ways in which interleaving practices (between conversation and device usage) may be supported or disrupted by design. Their ethnographic observations revealed the methods through which device usage is occasioned, sustained, and disengaged from conversations, unpacked the machinery of interaction that underlies these methods, and the ways in which their usage were problematic as evidenced in apologies, interruptions, or inattentiveness.

Even before the smartphone era, Palen et al. [2000] observed that people reacted negatively to the use of mobile phones in public spaces, which has since become more persistent with the proliferation of smart network connected mobile devices [Bruce 2010; Nickerson et al. 2008]. The level of acceptance of course varies with the nature of the public space in consideration. For example, Campbell [2007] found that mobile phone usage in restaurants was perceived as more appropriate than its usage in theaters and classrooms, but less appropriate than using it in buses, stores, or sidewalks. Lipscomb et al. [2007] found that mobile phone usage in church, class, libraries, or movie theaters was perceived as inappropriate, while their participants were evenly split about its usage in restaurants. In recent years, Pew Research reported that most people are okay with using mobile phones in some public spaces (e.g., while walking down the street, on public transportation, while waiting in line, etc.) but have reservations about its usage in some other public spaces (e.g., at a restaurant, movie theater, church, etc.) [Rainie and Zickuhr 2015].

With the advent of smart-devices (phones, tablets, etc.) in the last decade, the focus has shifted to the presence and use of these mobile and networked devices during family mealtimes, particularly because most diners will have their own personal device while they eat [Moser et al. 2016]. Blackwell et al. [2016] explored the underlying tensions between parents and teenage children regarding personal mobile technology usage in the family home. Their study revealed that while families often agree upon norms regarding technology usage in specific contexts (e.g., no phone use
at the dinner table), both parents and children occasionally break those rules. Such usage is often complicated by the inherent limitations of the technology itself, for example, limited visibility or practical obscurity of small screens of these personal devices (compared to the television), constant networked connectivity, and subsequent encroachment of work related activities into the family life, etc.

Existing research have agreed that people’s attitude about mobile device usage using collocated mealtimes are generally negative. For example, Humphreys [2005] found that when face-to-face conversations in restaurants are interrupted by a mobile phone call, the excluded party adjusted their own behavior to address feelings of vulnerability or awkwardness. Other research have shown that even the mere physical presence of a mobile phone during a face-to-face conversation negatively impacted relationship formation [Przybylski and Weinstein 2013]. So mobile phone usage at mealtimes could be considered as disrupting, or at least altering the individual and social behavior during the occasion. These understandings have even resulted in commercial technologies designed to forcefully limit the use of networked technologies at mealtimes [Dunn 2016; Hutchings 2015]. Whether these technologies get widespread acceptability and usage is a matter of investigation in the future.

While less discussed, some research also highlighted positive aspects of technology usage during family mealtimes. Television has for many years been effectively used as a strategy to calm children [Orlando 2016]. Smart mobile devices have encouraged it further – due to both the portability of such devices and the availability of contents through different apps. Parents can now often use it to calm down or digitally sedate wherever and whenever they feel they may lose control over a child’s behavior [Orlando 2016]. A new term digital babysitting has arisen to depict the scenario. In a recent work, Davis et al. [2017] focused on children’s use of mobile and networked devices in family friendly restaurants, and highlighted how both the parents and children actively negotiate and manage the usage of these devices while focusing on their food and engage in group activities. Rather than creating tension, their usage of these devices in those settings assisted in creating and maintaining family togetherness and harmony.

While shared communication technologies (e.g., television, radio, etc.) are often welcomed during family meals [Hupfeld and Rodden 2012], personal devices are
viewed as creating tension amongst family members and are often managed through varying family norms and restrictions. Moser et al. [2016] identified different factors (e.g., age, presence of children, mobile phone usage throughout the day, etc.) influencing family members’ attitudes towards technology usage during mealtimes. They recommended for incorporating social awareness features into mobile phone systems, so that all members could be aware of the purpose of usage – thus bringing the personal devices into shared concerns to alleviate tensions and conflicts among the family members regarding its usage. Hiniker et al. [2016], 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. While their study showed how children find it difficult to comply with the restrictions imposed by their parents and how parents share more information online than their children are comfortable with, both parents and children share a common desire of attention to one another when they are together for the family meals. They recommended finer control over contextual constraints regarding technology usage in the family.

All these works demonstrate that mobile devices are easily available at the dinner table and are increasingly used at mealtimes. This research shows that each family has their own way of managing interactions with these devices during mealtimes. Despite tensions around their presence and legitimate concerns about their inappropriate usage, when personal devices are used for a common purpose, they can enact various features of commensality in the family. Therefore, rather than branding the usage of mobile technologies at mealtimes as malign, it is important to interrogate their emerging and evolving nature at the dinner table. Instead of problematizing technology usage during mealtimes, I believe that we need to better understand the challenges, risks, and opportunities of ICTs to enhance togetherness through integration of technologies and people during family mealtimes.

2.4.3 Configuration of Technologies and People during Family Mealtimes

The interplay between technology and people in the family dining area have caused changes in its social and material configuration. Some recent works have probed deeper to inspect how technology usage is adapted based on social, ambient, or other aspects, for everyday life in general as well as mealtimes. Stroebele and De Castro [2004] discussed the impact of social (presence of other people) and physical or
ambient factors (e.g., smell, temperature, time, etc.) on food intake and food choice. They concluded that manipulation of these factors has profound impact on food consumption. The social and material configuration of participants around mealtimes reflects and influences interaction between them [Fischler 2011]. Technologies may contribute or detract from any idealized notions of family order. In either case, it is important to understand the ways that families orient themselves to the perceived opportunities or threats. Critics argue that technologies at mealtimes detract from the commensal experience, impacting negatively on collocated familial interactions [Bellisle and Dalix 2001; Hersey and Jordan 2007]. Therefore, it is important to examine and understand how families orient themselves and manage both traditional and mobile technologies at the dining table. Televisions, for example, demand a particular seating arrangement and may dominate other features of the spatio-material environment. Mobile and wireless devices (e.g., smart-phones, remote controls, etc.) may offer greater latitude in terms of their spatial demands, but are likely to shift socio-spatial arrangements differently. We can see these shifts, for example, by comparing the presence of screens in the middle of the table [O'Hara et al. 2012] vs. at the end of the table [Barkhuus and Brown 2009], or alongside each individual diner [Wei et al. 2011]. Understanding these arrangements can provide opportunities for the design of technologies whose aim is to encourage or support co-located familial interactions at the dining table.

For families today, commensal experience is typically democratized, with spatial configuration supporting equal opportunity for each member [Fischler 2011]. Domestic ecologies of eating vary between household arrangements, as well as across socio-economic and cultural contexts [Wood 1995]. Hupfeld and Rodden [2012] focused on the everyday practices associated with domestic food consumptions and how the mealtime artifacts and spaces (both technological and otherwise) influence our interactions with food and among each other. They particularly discussed the material aspects of food consumption in the home, i.e., the dining space, the tabletops, and the artifacts in that space that plays a distinctive role in the activities of the family members and the social organization of domestic eating practices. They took an ecological approach to understand the mutual relations between the artifacts, spaces, and people in the domestic dining settings. These relations are significant for expression and reconfiguration of family values and identity [Csikszentmihalyi and
Halton 1981], as well as resources for social relationships [Mauss 2000]. Their study highlighted the significance of everyday mundane processes, practices, and meanings surrounding food consumption in the home and various design considerations to successfully develop technologies for family mealtimes.

Hupfeld and Rodden [2012] began their analysis by explicating the placement and preparation of the dining tables, serving food items, seating order of the members, and the overall orchestration of the meal in the family home. They noted how the families often varied in their eating places for formal occasions and for everyday informal meals. The formality of a meal, while is defined by individual households, was constructed out of several factors, such as occasion, social context, and type of food. Informal spaces, typically the kitchen, would be used on weekdays mostly for meals involving only the core members of the household. During everyday meals, the seating order often depends on the social relationship (e.g., mother-children) or food related tasks (e.g., serving); hence the seating arrangement enables family members to claim a certain role within the family.

Finally, Hupfeld and Rodden [2012] focused on the artifacts found on dining tables to investigate their meaning and ownership for the family members. They compared between structured and unstructured meals. These differ not only about the process of having food (e.g., duration or a clear beginning and end), but also on artifacts used. For example, special plates, glasses, or table-clothes were used for special occasions; family members also tended to be aware of each other’s preferences and avoided using other’s marked artifacts during regular structured meals. This was not always the same for unstructured meals (mostly breakfast).

I take inspiration from Hupfeld and Rodden [2012] in this thesis by focusing on the spatiality and interaction around commonly found ICT devices (e.g., television, smartphones, etc.) in the family dining space. In this research, I discuss how family members configure their dining space and technologies within it to enhance the experiences for all members in the home. One design objective here is to support equal opportunity for all members both in accessing the shared devices and their content. I discuss related design implications in Chapter 5 and then explore how such augmentation impacts the shared narrative and togetherness during family mealtimes in Chapter 6 and Chapter 7.
In the next two sections, I discuss various efforts to utilize technologies, particularly mobile devices, to solve food related problems and to enhance familial interactions at mealtimes.

2.5 Problem Solving Technologies Related to Mealtimes
Much of the prior works in HCI focusing on the mealtime context tried to solve different food related issues using ICTs. A significant amount of research effort has been invested to assist people in dealing with shortcomings regarding their food planning, preparation, consumption, and managing the leftover food. These projects are often targeted (but not limited) to alleviate uncertainty about recipe choice, managing distraction during cooking, providing nutritional information about ingredients and the food consumed for better managing health objectives, reducing inefficiency, assisting inexperienced cooks in food preparation, etc. I discuss some of these projects next. While this research does neither problematize mealtimes, nor aim to find ICT solutions to address problem in this context, it is valuable to discuss how existing works have done so.

2.5.1 Alleviating Uncertainty about Recipe Choice
A stream of research is directed with the aim to help people who are unsure of the ingredients they have in home or are overwhelmed with the choice of recipes. Aberg [2009] developed a system that uses data collected from user’s available grocery items and takes factors such as nutrition content, cost, variation, etc. into account to suggest a detailed meal plan for the upcoming days, which can then be customized by the user. Svensson et al. [2005] took a social approach in recipe choice and used the social network to select, find, and recommend recipes. It broadcasted user activity in real-time and developed a recommender system based on the choice of similar users, ratings, and past experiences. In this way, these projects provide help to individuals who need help in effectively making decisions about food.

2.5.2 Managing Distraction while Cooking
A second stream of research is dedicated towards managing distraction during food preparation. Tran et al. [2005] designed Cook’s Collage to help individuals follow recipes accurately even in the midst of different distractions that may occur in the home (e.g., managing kids, phone calls, etc.). In a related but different direction
Hamada et al. [2005] designed *Cooking Navi* – a system that tracks user activities in following multiple recipes for cooking multiple dishes simultaneously. It can show the user at which step s/he was in when the distraction happened. These projects are guided by the assertion that while cooking, individuals can be distracted by a number of factors and developed ICTs for managing the consequence of those distractions.

### 2.5.3 Reducing Inefficiency in Cooking and Leftover Food

Third, there are many efforts that tried to improve our efficiency in dealing with food. For example, Bonanni et al. [2005] developed an augmented kitchen by projecting information onto various surfaces such as refrigerator doors, cabinets, drawers, etc. to assist people in finding ingredients in the fridge and artifacts in the kitchen. In another project, Ganglbauer et al. [2013] developed *FridgeCam* to allow the users viewing the refrigerator contents remotely, so as to help them efficiently manage the food ingredients and reduce wastage.

### 2.5.4 Assisting Inexperienced Cooks

The design of technologies for kitchens have mostly focused on the tasks related to food preparation rather than the social significance or context in which it occurs. For example, Uriu et al. [2012] used sensors attached to frying pans to measure temperature and movement as part of a system to train domestic cooks to follow professional recipes. Similarly, Kranz et al. [2007] augmented a cutting board and kitchen knife with sensors to provide users with data about food weight and cutting techniques, to provide cooking tips and instructions.

Bradbury et al. [2003] presented *eyeCOOK*, a multimodal cookbook to help a non-expert person cook a meal. The user communicates with eyeCOOK using eye-gaze and speech commands, and it responds visually and verbally, promoting communication through natural human input channels without physically encumbering the user. Nakauchi et al. [2005] designed an intelligent kitchen system that tries to identify the next step in the cooking process and guides the user using both audio instructions and visual cues (e.g., by saying that the sugar is in the cabinet whilst simultaneously pointing to the appropriate cabinet). The *CounterActive* [Ju et al. 2001] application is another attempt to help users by providing a multimodal recipe that include pictures and videos alongside textual instructions as a way of helping users to learn cooking new dishes. In all of these projects, the researchers
tried to compensate for the individuals’ lack of experience by displaying recipe steps and other relevant information, and thus supporting users in completing those tasks.

2.5.5 Providing Food Related Information

Finally, a long line of research has focused on the use of communication technologies and social connections to solve specific health-oriented problems and has tried to ensure balanced nutrition in everyday meals. An example of this trend is the diet-aware dining table [Chang et al. 2006] that monitors the diner’s food intake. Mankoff et al. [2002] tried to develop a low cost and easy to use system to capture the nutritional values in the food items that people purchase. Using a scanner to capture the list of items from the grocery invoice, it analyzes the nutritional values with the assistance of a database and shows summary of them. Grimes et al. [2008] focused on collectivism to solve the same problem of nutritional awareness. A collectivist approach suggests that the community holds the knowledge required to affect change. In their work with African American communities, Grimes et al. suggested it as a key resource for the design of promotional interventions within the community for healthier living, prioritizing the overall health of the community above the health of the individual. They demonstrated the effectiveness of their proposal using inexpensive phone-based crowd-sourced feedback mechanism.

The role of social interaction is also recognized by Linehan et al. [2013], where they developed two systems to demonstrate social belief about the food items people procure from supermarkets and the food contents they eat during each meal. Images of supermarket receipts and the food plate during consumption were uploaded in these systems respectively, where they were seen and judged by other users and ratings provided. They identified the benefits and drawbacks of the system and discussed the design implications for developing social technologies for healthier eating. Kanai and Kitahara [2011] took these initiatives further to enable neighbors share their ingredients and cook together by using the social networking sites.

Chi et al. [2007] designed a smart kitchen to detect user activities in the cooking process and provide feedback regarding the nutritional facts of the ingredients being used. Another stream of research used photography as a medium for increasing individuals’ awareness of their eating practices. [Brown et al. 2006; Frost and Smith 2003]. Fogg [2002] discussed in general about what aspects of computing
technologies are more important to be design as persuasive, with particular focus on designing for changing human behavior and impression about the technology. Orji et al. [2013] developed LunchTime - a goal-based slow-casual game that facilitates learning and reflection upon user’s meal choices in restaurants and promotes positive dietary attitude change. Brown et al. [2006] tried to help users visualize the relationship between their diet and exercise patterns by keeping photographic diet and exercise journals using camera phones. Smith et al. [2007] also designed a visualization system whereby diabetes patients could view their blood sugar levels in the context of digital photographs of their meals taken throughout the day.

2.5.6 Corrective vs. Celebratory Theme for Mealtimes

All of these works fall into the theme of corrective technologies or the problem-solving technologies as they focused on design aspects that we need to consider while solving different problems associated with food preparation and consumption. This research prioritizes the instrumentality of food by helping people to make choices about the nutritional aspects of food, by providing dietary information, or by seeking to improve culinary skills in preparing meals. Noticeably, as Grimes and Harper [2008] also identified, HCI solves problems in interaction design with food not because people have problems with the ICTs or the food itself, but in most cases these projects are aimed to improve shortcomings in people’s capabilities or behavior. As discussed above, these projects try to alleviate uncertainty or indecision that people have about their recipe choice, help to cope up with their inexperience and inaptitude, assist in following health guidelines in general or for specific objectives (e.g., diabetic patients), etc. In all these examples, the technology is designed based on individuals’ interactions with food that might need fixing (e.g., uncertainty about what recipe to choose), thereby improving the food-related behavior (e.g., selecting recipes).

Alternatively, the celebratory theme of research focuses on the experience with food; the aim here is not to solve any problem with this experience, but to enhance the ways people enjoy their meals. As Grimes and Harper [2008] proposed, next I shall discuss how treating individuals’ interactions with food as positive, as something in which they find delight, pleasure, excitement, and fondness opens up a very different space for research and design.
2.6 Celebratory Technologies Related to Mealtimes

As discussed in Section 2.3 and Section 2.4, technologies at the dinner table are generally accused of detracting from familial interactions and thereby negatively impact on the mealtime experience. In response to this challenge, HCI researchers proposed a celebratory technology agenda to encourage the design of technologies that support positive interactions at the dinner table. Technology designers have long recognized that ICTs can both bring people together as well as set them apart; hence recommended designing its functions for shared places and tasks in the family [Frohlich and Kraut 2003]. Hassenzahl et al. [2012] put a succinct survey on 143 design concepts and prototypical technologies that goes beyond the explicit audio/visual communications. All these technologies were aimed to mediate and enhance togetherness among couples in long-distance relationships. They discussed experience-oriented design of technology and suggested six key aspects of it, namely, awareness, expressivity, physicality, gift giving, joint action, and memories. Their investigation showed that relationships and bonding could often be enjoyed through subtle use of technologies (e.g., synchronizing two desk lights of remote partners to indicate one’s activity to the other [Tsujita et al. 2007], or streaming ambient sound to create feelings of co-presence [Lottridge et al. 2009]). They also discussed some projects that are more forthright about the interactions, e.g., an inflatable vest that creates the feeling of being hugged [Mueller et al. 2005]. In this section, I discuss the core concept of celebratory technology first, and then discuss various projects that embraced this philosophy.

There are many examples of research that have explored the significance of meals beyond the opportunities to develop culinary skills and nutritional values. HCI researchers in recent time have recognized this space as an opportunity for family interaction and have considered the experience, affect, and desire of eating and sharing time together [Bell and Kaye 2002]. Bell and Kaye [2002] first discussed the need for food-related research to go beyond efficiency, and to consider the experience, affect, and desire of eating and sharing time together. They highlighted the social and cultural aspects of food consumption and argued that technology design in this area should be conducted with greater socio-cultural sensitivity. Food related research should focus less on correcting food related problems and more on understanding the social values and meanings through food related activities. Several years later, Grimes
and Harper [2008] extended these ideas to explore the aesthetic aspects of mealtimes. Interested in the ways in which people find pleasure through their interactions with food, they emphasized the creativity, endowment, relaxation, and nostalgia found in the togetherness of family meals. When viewed this way, food preparation and consumption become celebratory. To avoid any confusion, celebratory technologies for mealtimes do not refer to some special technology used during festive occasions, but it concerns the design of technologies that support positive interactions during regular and everyday family mealtimes. This theme of research is not concerned about food related information, but is more interested in the social aspects of eating. Now I discuss some of the existing research that focused on this celebratory technology agenda for family mealtimes.

2.6.1 Celebration in Food Preparation
A notable study of the vernacular cooking skills in the family kitchen by Short [2006] demonstrated that cooking is not simply a purposive activity in which a specific task is achieved, and that learning to cook is not a solely cognitive process passed down from expert sources using written or verbal communication, such as recipes or instructions. Instead, her research showed that learning and communicating in the domestic kitchens occurs through informal arrangements, tacit knowledge, and embodied interactions involving the senses of sight, sound, smell, taste, and touch. Thus, cooking traditions, recipes, and techniques are shared within families over time and are shaped through many non-verbal interactions including physical proximity, bodily movement, and gestural communication.

Motivated by the social and celebratory aspects of eating, several other researchers have drawn inspiration from the pleasurable aspects of food consumption. For example, Terrenghi et al. [2007] and Paay et al. [2012] explored the pleasure of shared cooking experiences through video recordings. Davis et al. [2014] investigated the joy of recounting family histories through recipes, which have been passed down over generations of cooking. Kanai and Kitahara [2011] explored how the community neighbors can share their ingredients and cook together to enhance the experience of their togetherness.

Nansen et al. [2014] focused on intergenerational family members cooking together in their homes to analyze the social, material, and embodied contexts of the non-verbal
gestural interaction and communication observed in family cooking. Some recent screen-based technology designs have addressed this limitation by supporting social interaction in and between kitchens [Jaffe and Gertler 2006; Terrenghi et al. 2007]. They highlighted that gestures in the kitchen is dependent and embodied upon the context, i.e., the social circumstances, the time and place in which it is oriented, the social relationships in which gesture is located, specific skills related to cooking techniques, and familial histories that are called upon to create and share knowledge about a particular dish. Finally, gestures operate in relation to the material context, i.e., in reference to the food, appliances, and technologies utilized in the domestic kitchen.

Particularly interesting to me, Paay et al. [2015] went beyond the functional aspects of co-presence in the kitchen and focused on the togetherness of people while cooking and the exchange of personal stories and narratives in the process of cooking a meal together. They analyzed 61 YouTube videos of people cooking together using the proxemics framework [Hall 1963] and F-formations [Kendon 1990; Kendon 2010]. Their findings unfold and illustrate relationships between people's spatial organization, their cooking activities, and physical kitchen layouts. They identified eight different spatial formations of people cooking together. Their study also identified three distinct task-related configurations: working on related tasks, working on independent tasks, and working on shared tasks; and four related collaboration-oriented actions: observing, checking, showing, and helping.

2.6.2 Celebration in Innovation or Augmentation of Food

Kuznetsov et al. [2016] focused on food enthusiasts that routinely experiment with preserving, fermenting, brewing, pickling, foraging, and healing with their homemade food for a living. Their study showed that interaction with food often goes beyond the scientific knowledge of these experts and other factors such as human senses and intuition, specialized usage of everyday tools, community knowledge, social co-operation, and habitual practices become important.

Lee et al. [2007] developed Tea Place, an ambient multimodal display responding to the color of tea placed on the table. Another notable effort was the History Tablecloth by Gaver et al. [2006], which is a digital layer on top of the dining table and traces the food prints of objects placed on it, thereby subtly revealing various social patterns within the home. Wei et al. [2014] investigated the potential of food as a social
message carrier to investigate how people accept, use, and perceive 3D printed edible food as a message. Their analysis implies that food messaging embodies characteristics of both text messaging and gifting. Khot et al. [2017] took this research further by investigating the potential of food printing technologies to enhance the established practices about how people grow, shop, cook, and eat. They introduced *EdiPulse* [Khot et al. 2017], a novel system that uses 3D printed chocolate to offer playful reflections of users’ everyday physical activity.

Spence and Piqueras-Fiszman [2013] provided a succinct survey of various experimental efforts towards augmenting the food with digital technologies. For example, existing research (and usage in some restaurants) demonstrated how various augmented reality (AR) techniques can be adopted to enhance the food by adding additional textures to it [Okajima and Spence 2011; Sakai 2011], by including appropriate audio feedbacks alongside the food to create an ambience [Spence et al. 2011] or crunching sound [Zampini and Spence 2004], by providing with tactile feedback to augment the experience of eating or drinking [Hashimoto et al. 2006], etc. Existing works have shown how these visual or auditory augmentations of the food and the surroundings have brought upon positive changes in the way people experience their food and drinks [Gal et al. 2007; Piqueras-Fiszman et al. 2013]. While in many cases these applications can be considered as experimental gimmicks for entertainment than warranting widespread adoption, nevertheless they demonstrate the potential to augment the food with digital technologies.

### 2.6.3 Tele-presence during Mealtime

There has been a growing interest in designing technologies that mediate and create a feeling of relatedness and togetherness among geographically separated family members, beyond the explicit verbal communication and simple emoticons available through voice call and messaging technologies [Wei et al. 2011]. This research sometimes concerns remote dining experience enabled through the use of videoconferencing technologies, such as Skype or FaceTime. Here a screen-based technology is used to facilitate the sharing of a meal with distant family or friends [Judge and Neustaedter 2010]. These remote forms of commensality are explored by Barden et al. [2012] who created an audio and video-based **telematic** dining experience during family mealtimes. Instead of the typical videoconference
configuration, Barden and colleagues employed a pair of networked tables on which representations of remote parties were projected. In addition, features of the table could be manipulated to trigger actuation of corresponding components at the remote site. Wei et al. [2011] extended this notion of remote shared-eating experience to create a dining table embedded with interactive subsystems, which included gesture-based screen interaction, ambient pictures on tablecloth, and 3D printed edible messages. Using existing and available ICTs, Grevet et al. [2012] demonstrated the use of a simple system to share the location (i.e., home or outside) and activity (cooking, eating, cleaning, or none) with friends, and discussed how such minor social connectedness could improve the dining experience of the solitary eaters. Tsujita et al. [2010] took this further to share video recorded meals with others in a time-shifted environment. Nawahdah and Inoue [2013] compared this with their proposed adaptively synchronized video playback system to enhance the perceived presence of the remote person in a time-shifted tele-dining experience. Though experimental, these developments highlight the potential of technology to augment the physical/virtual dining space to enhance the commensal experience in the family.

### 2.6.4 Technologies to Enhance the Experience of Family Mealtimes

This theme of research concerns mealtime experiences that are both celebratory (rather than informational) and collocated (rather than remote). Even under the celebratory technology agenda, there has been less work that focused on enhancing the experience of the family as a group while they have their meals together. One notable aspect in this regard is that the family members are often using their own mobile networked devices to document their meal and their presence or experience while dining through capturing and sharing photographs through social media [Corporation 2013]. Aside from the controversy of such activities and interactions, these technologies have augmented the social experience of dining together. It was predicted by Spence and Piqueras-Fiszman [2013] that the mobile networked devices would be instrumental and the primary means for augmenting the mealtimes with technologies. This is echoed in more recent research, which has demonstrated the growing presence of mobile and networked devices at the dinner table [Hiniker et al. 2016; Moser et al. 2016]. However, how the presence and usage of these mobile and networked devices have impacted the social settings of family mealtimes remain largely uninvestigated.
Another notable example about technology usage to enhance family mealtimes is the 4Photos table centerpiece concept [Bhömer et al. 2010; O'Hara et al. 2012]. In this system, photos from diners’ Facebook collections were displayed on the 4Photos system. The system was designed to sit comfortably in the middle of the dining table amongst the other mealt ime items. Control of the system was available to all diners around the table. It could be viewed and be interacted with regardless of where one was seated, accommodating the other material and spatial factors organizing the bodily configuration of the family during the meal. 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. Importantly, the system was not something that was singularly foregrounded or backgrounded during the meal but rather dynamically brought in and out of the conversation as contextually and socially appropriate throughout the meal. Next, I discuss research that explored technologies to support sharing narratives among the family members.

2.6.5 Technologies to Support Sharing Narratives during Family Mealtimes

Family mealtimes provide an opportunity for conversations around issues related to personal and collective significance of the members [Mintz and Du Bois 2002; Ochs and Shohet 2006]. Blum-Kulka [2012] conducted a cross-cultural study about family discourse through family conversation at the dinner times. He was intrigued with the richness of dinner-talk as a prime site for pragmatic socialization of children in the family. For many families, mealtimes are the only time of the day when all members come together [Larson et al. 2006]. The mealtime conversation of the family members around happenings of everyday activities is considered an important part for family identity. So, it is not the family conversation per se as the concern, but the bonding nurtured through such means, and other practical (and sometimes intentional) opportunities, i.e., family accountability, event planning, educating and socializing children, etc. that have been of interest to the research community [DeVault 1994; Fischler 2011; Ochs and Shohet 2006].

With the rapid proliferation of mobile networked devices, researchers have been concerned about its impact on social order, particularly during collocated interactions [Juhlin and Önnevall 2013; Lundgren et al. 2015; Lundgren and Torgersson 2013;
Oulasvirta et al. 2012]. However, HCI and CSCW literature contains many use cases of collocated mobile device use such as photo-sharing [Counts and Fellheimer 2004; Durrant et al. 2011], video watching [O'Hara et al. 2007], collaborative searching tasks [Church et al. 2012; Cole and Stanton 2003], etc. that often involve interactions with additional screens or multiple mobile devices [Bergstrom-Lehtovirta et al. 2013; Lucero et al. 2013]. This work refutes the simplistic and popular views that mobile devices create social isolation [Su and Wang 2015] and demonstrates the beneficial uses of technology during collocated interactions.

On another research path, recent scholarly works have explored how personal devices can often be used as a shared resource [Bell 2006]. Mobile and smart-devices hold user’s personal data in a never-seen-before scale [Abowd 2012], and researchers have leveraged this capacity for exchanging of shared narratives. Güldenpfennig and Fitzpatrick [2015] developed a mobile app, which allows curating the captured images already on the phone along different storylines. Poppinga et al. [2013] developed the StoryTeller app that helps individuals with mobile phones to create stories throughout a day. While these works are not focused on any particular social settings, I extend their findings by investigating how such prepared stories can be used to change and contribute to the commensal experience in the family.

All these works indicate that personal technologies can be re-configured to be a shared resource and can augment the commensal experience rather than disrupting it. While experimental, these projects demonstrate the potential of the broader set of digital technologies (smartphones, tablets, laptops, etc.) that are now finding a place in the everyday mealtime routines.

2.7 Research Gap

It is clear from the literature review that there have been two major trends in research related to family mealtimes and associated technology use. From the sociological and health practices, the presence and usage of ICTs at mealtimes are considered with much negativity. From HCI perspectives, research has mostly focused on developing technologies either for solving food-related problems or for designing novel interaction techniques. Most of the existing works adopt technology in a problem-solving way, aim to improve efficiency in cooking, knowledge regarding nutrition,
decision making about the recipe, etc. There is a more recent trend to consider the celebratory aspects of mealtime and utilize technology as a means to achieve that celebration. In this research, I contribute in this direction.

There are exploratory studies that have focused on television specifically, which is unsurprising since the television is the most common technology found around the dining space. However, there are very few works that considered the impact of mobile and other networked communication technologies, which are already finding their way into family mealtimes. How these technologies, particularly the mobile networked devices are used and managed during family mealtimes, and the implications of their presence and usage are not well investigated. In this thesis, I ask how do families manage the ever-increasing presence of information and communication technologies in the family mealtime space? And can technologies be beneficial to the enhancement of familial interactions during mealtimes? Is it even worth trying, since so many research have shown detrimental effects of existing technologies (television and mobile devices) and reflect on an overall negative attitude [Hiniker et al. 2016; Moser et al. 2016] towards their presence and usage among the family members? In this research, I investigate these and explain the findings with the help of a framework proposed by Toyama [2015], which has its root in the sociological understanding of the implications of technologies on a social system, often named as “The Amplification Theory” by many researchers. I ask if it is even possible for technologies to amplify or enhance the togetherness among family members during their mealtimes. Now I take a step back to explain the Amplification Theory in brief, and then discuss the Toyama Framework in relation to this research focusing on family mealtimes.

2.7.1 The Amplification Theory

The role of technologies to support and amplify existing features of a system, intrinsic or extrinsic, is widely discussed in sociological literature and more recently in the ICT for Development domain. The Amplification Theory emphasizes that when we adopt a technological solution for any system, it generally works like a magnifying glass, metaphorically, amplifying both the positives and negatives aspects of that system. It requires conscious effort among all the stakeholders and appropriate design strategies to channel the amplifying capacity in the right direction (metaphorically, putting the
right object under the magnifying glass to amplify). This theory draws from historical experience of technology usage – both successful and unsuccessful deployment of projects. For example, it has been argued that the more educated part of the society are better able to utilize the benefits of the available public services than their less educated counterparts [Tichenor et al. 1970]. In these cases, the better educated segment of the society has better intrinsic capacity to understand, plan, and utilize the resources that are available for everyone. Or, another discussion about the role of social media during the “Arab Spring” emphasized how the civil society in some of the countries could use Facebook and Twitter in a much more beneficial way than some other countries in the same region for their revolution [Lee and Weinthal 2011]. It was explained that though the technology remains same, the more successful countries already had more active, organized, and experienced civil societies amongst them even before the Arab Spring, while others had very limited or no such civil infrastructure and experience - hence the online efforts of this second group did not materialize in any successful demonstration in field. It is hence argued that even in a technology-based project, human factors are more important in deciding the outcome, as technology cannot amplify human forces that do not exist [Toyama 2015]. Agre [2002] provided a detailed account using recent examples of the amplification theory and how it explains the implications of current technologies to various aspects of the society. A detailed discussion of this theory is out of scope for this research.

Toyama [2015] extended on these works to explain the impact and consequence of many technology-based initiatives of modern times, ranging from educational projects in developing countries to developed ones, social movements during the Arab Spring to the eradication of poverty, technology usage in agriculture to sophisticated medical industry, etc. In each of these cases, he highlighted how the human aspects of the system is amplified by the adopted technology, and how it resulted in the apparent success or failure of that project. Toyama [2015] was very critical of creating technology-centric solutions, especially those which are aimed at solving social issues (e.g., corruption, illiteracy, etc.). He acknowledged that technology is a powerful tool and undoubtedly is an important element in such initiatives, but he explained with examples of different projects, how often the role of technology is over-emphasized and how it results in the human-factors being much overlooked, leading to failure in achieving the desired outcome. One important aspect of his work is that it provides a
clear guide to evaluate the potential of a technological intervention for a social cause. With examples of both successful and failed projects, Toyama [2015] identified the aspects behind those outcome and proposed a framework to harness the power of amplification by technology adoption in the right way to bring about positive changes in the society. I discuss this framework next and discuss its relevance to this research.

2.7.2 The Framework Proposed by Kentaro Toyama

Toyama [2015] explained that any successful technological intervention for a social cause needs to have three essential features present in all the relevant stakeholders: **good intention, discernment**, and **self-control**, or the “**heart, mind, and will**” as he coined it. As he explained with several successful and failed projects that aimed to introduce technological interventions to bring positive changes in the society, absence of any of these features can result in unwanted outcomes. This is because, he argued, the social problems have the origins in **human factors** - it is not technologies that create (or solve) the problem, but it is always the people. Problems can even be exacerbated by technologies, which brings its own burdens. Also, technologies cannot make up for non-technological deficiencies. So Toyama [2015] argued that we need to identify and solve human deficiencies first, as technologies cannot make up for lack of human’s inner forces:

“**Technology by itself do not budge social and psychological inertia. Human context is what matters most. Technology is not the deciding factor even in a technology project. The right people can work around a bad technology, but the wrong people would mess up even a good one. What people can get out of technology depends on what they can do and want to do even without technology.**”

(p. 26)

Now I explain each of the three terms - **heart, mind, and will** as Toyama [2015] has adopted in explaining his framework and discuss how I integrate them in relation to this research.

2.7.2.1 Good Intention (Heart)

First and foremost, Toyama [2015] proposed to identify the human forces that are aligned with a project’s objective. With examples, he repeatedly emphasized the requirement of good intention in all the relevant parties, including the beneficiaries, the developers, the project implementers, and the supervising team. Any technology,
however good it is, will not be able to solve a social problem if the people of that society do not want to solve it. One notable example he presented is the difficulty and apparent failure of the polio vaccination program in some parts of the world [Organization 2011], where technology is not the problem, but the misconception of the participating population led towards resistance in its usage and subsequent failure. Another example was the failure of an anti-corruption program, where the developed technology-based solution failed as both the governing body and the population it serves took steps to circumvent the technology. So, Toyama [2015] claimed that it is of utmost importance to recognize the good intentions of the relevant parties (if there is any), or work towards developing that good intention first. Once there is a positive force of intention, one can try to develop a technology that would build on that platform and assist in “magnifying” the good intention to bring about a change. He argued that technology can only magnify what good intention is already there, it cannot create good intention itself.

While Toyama [2015] explained this framework with regard to technology adoption for solving social problems, I believe the same applies to enhancing social experiences too. In adopting the Toyama Framework, it is of utmost importance for this research to understand and evaluate the existing practices in the families during their mealtimes in order to identify if there are positive intentions among the family members. I ask if there are positive intentions in the ways family members use and manage their ICTs. If any positive intention exists, then it is possible to design technologies that support those intentions and enhance the human capacities. To achieve this, Toyama [2015] brought the next aspect of his framework – discernment.

2.7.2.2 Discernment (Mind)

The second element of Toyama’s framework is discernment among all the relevant parties – all of them required to have sufficient capabilities (both technical and non-technical) to carry on the project at hand. Knowledge is one requirement for discernment, but it also requires the ability and expertise to make shrewd judgement that goes beyond the information itself. The developers must have the technical capacity to design and implement the right technology, the supervising team must have the organizational knowledge and capacity to supervise the process, and the participants must also have the relevant expertise to use it so as to get the desired outcome from the developed technology. Only when this requirement is fulfilled,
technologies can try to enhance the capacities of the target social group in achieving their objectives.

Toyama [2015] explained that any successful technological intervention should “amplify the right human force”. I ask if the technologies that are typically found during family mealtimes nowadays, particularly TV and smart mobile devices, amplify the positive intentions in the family. I also ask if the contents in these devices have potential to engage the family as a whole and support togetherness among them. Based on the first study, I then consider which aspects of their mealtime experience can be enhanced by judicious application of ICTs and how.

2.7.2.3 Self-Control (Will)
Finally, Toyama [2015] advocated for self-control or will, i.e., All the relevant parties also need to have a resolve in achieving the goal so as not to get side-tracked by any distractions. More importantly, Toyama [2015] advised against indiscriminant application of technology, i.e., replicate a successful technology for one context to another different application. Each problem may have its own features that requires a careful scrutiny before deploying a technology solution for it.

I design the third set of research sub-questions (discussed below) and the third study to investigate this issue, i.e., comparing the currently used technologies with the proposed design (in study 2) during family mealtimes. The final study (study three) focuses on the changes brought upon the commensal experience by the developed technology. In this study, I investigate how everyday happenings become mealtime conversation topic, form a storyline in that way, and become a repository of notable happenings throughout the day for the families. Thus, the third study completes a story that investigates the potential role of technologies during family mealtimes.

2.7.3 The Research Questions
Existing literature have shown that despite the criticism, television is widely available and used during family mealtimes. And while the use of personal mobile devices in the family dining space are open to similar critique, their usage is increasing nevertheless. Apparently, despite all the criticism and research, families are managing their usage of these technologies quite harmoniously, but a detailed understanding of their activities and interactions around these technologies are missing. Encouraged by the Amplification Theory and the Toyama Framework, I begin with asking if the
ways television or personal mobile devices are used currently can enhance the commensal features in the family, and if there is potential for ICTs to support and reinforce the experience of togetherness during mealtimes. While technology design in this space traditionally aimed at solving food related problems, I believe there is potential and a need to address the celebratory nature of meals and support them. In this research, I consider a technological intervention to support and enhance the experience of shared family mealtimes. Hence, the main research question of this thesis is:

**RQ: “How can the use of information and communication technologies contribute to familial commensality in the home?”**

In investigating this research question, I do not problematize the mealtime itself, but I am concerned that the ICTs currently being used in this space are not well-designed to address commensal aspects and hence may not be able to realize its full potential in enhancing the commensal experience in the family. I divide this main research question into sub-questions that I address during the three studies outlined later in this thesis. The research firstly requires to have a solid understanding of the current practices around technology usage during dining. However, to the best of my knowledge, existing works do little to discuss the current practices in this regard. With the advent of mobile and ubiquitous computing era, a lot of changes have occurred around the domestic technology space over the past two decades [Davis et al. 2008; Hess et al. 2012], and yet, how they have impacted family mealtimes is not clear. This is the first research gap that I identify, i.e., what are the devices that are used during family mealtimes and how families manage their usage. So, the first set of research sub-questions are:

**RQ1a. Which communication technologies are generally used and shared during the family mealtime?**

**RQ1b. How are they used and managed by the family members?**

**RQ1c. How does the presence and usage of ICTs impact the commensal experience in the family?**

I begin with an investigation of the current practices of families including an examination of how they negotiate and manage technologies in their everyday
mealtime practices, and how these technologies influence the content and context of social interactions taking place during mealtimes. I provide a balanced account of the ways these technologies are impacting the family experience during mealtimes. My field-study shows that personal and mobile communication technologies (e.g., phones, tablets, laptops, etc.) are widely available during family mealtimes, but each family develop their own set of norms and restrictions to manage these. While there is a general tension around the usage of personal devices, but when these devices are used purposefully to address issues that concern the whole family, their usage is welcomed. I argue that family bonding, concerns about each other, and family members’ effort to make the mealtimes a successful place for nurturing family ties is behind the apparent successful (or unproblematic) management of the current technological practices of family mealtimes. So in accordance with the Toyama Framework [Toyama 2015], I could identify the positive intention among the family members to manage their mealtime activities to make it an enjoyable experience for everyone. Hence, I deem that there is potential to design technology to support and enhance the commensal experience in the family. These findings guide me towards my next set of research sub-questions that I explore in study 2:

**RQ2a. How personal devices can be transformed into a shared resource to support interactions and enhance the shared experience of eating together?**

**RQ2b. What is the impact of the developed technology on various aspects of commensality in the family home?**

I conduct design workshops with the aim to build a technology probe to investigate how personal devices can be transformed into a shared resource and whether it can alleviate general concerns about their presence and usage during family meals. Existing works have identified the shared and unremarkable nature of televisions in the family context and the recent changes around this technology [Barkhuus and Brown 2009; Tsekleves et al. 2009]. Barkhuus and Brown [2009] discussed how people share their television watching together, both during their mealtimes and otherwise. They discussed how people do not watch television all the time, but look and invest their interest intermittently and then focus on another task or topic. *Background watching* as they have put it, or *unremarkable* technology as Tolmie et al. [2002] have described it, carries immense interest to me. I do not expect current or
future technologies in the dining space to hamper the social experience of eating itself, but to create another way for family coherence in a relaxing way – rather than detracting from the family time, technology can provide another avenue for enjoying it. So, another research objective is whether the developed technology can achieve this feat.

This field-study (study 2) of the developed technology probe TableTalk shows that technologies can be designed in a way to support togetherness and promote interactions among the family members. My understandings from this study motivate me towards the final study of this PhD. Now that I have investigated how particular design aspects of the systems have the potential to influence families experience of their mealtimes (i.e., discernment in the Toyama [2015] framework), I require to understand how the introduced technologies are changing the familial interactions in the dining space, and which of these changes are due to the intervention. So I take various commensal features into account and investigate the impact of the technology on these features, which is the third step in the Toyama [2015] framework. I do a comparative study for prolonged time to mitigate the novelty effect and understand the opportunities and challenges for introducing celebratory technologies in the family mealtime space. I investigate the following set of research sub-questions in this third study:

**RQ3a. What are the implications for the use and design of celebratory mealtime technologies beyond the novelty effect?**

**RQ3b. How do these technologies affect the conversation in the family, and how is the experience of mealtimes including the use of the developed technology different from the regular experiences of family mealtimes?**

Answering all these research questions through the three studies than allows me to reflect on the overall findings and helps me to discuss the main research question in the final discussion chapter of this thesis.

### 2.8 Summary

The proliferation of ICTs in the domestic home have encouraged researchers to conduct studies and develop novel interventions targeting the family group. Among
these topics, research around family mealtimes have received significant interest in the HCI community in recent years. However, most dominant are those works that focus on solving food related problems and there is a considerable gap in our understandings of how the mobile networked device are changing the mealtime interactions in the families. Also, the overall negative narrative around technology usage have obfuscated the ways through which these ICTs can potentially enhance the experience of having meals together. So, in this PhD research, I first investigate the ways families currently manage the presence and usage of ICTs during their mealtimes. From there, I focus on the potential of designing novel interventions to augment and enhance the mealtime experiences in the family home.
Chapter 3: Research Design

3.1 Introduction
The review of existing scholarly works about technology usage during family mealtimes in the previous chapter has highlighted that the potential role of technologies in this space is not well investigated, and there is much more to explore than the overall negativity about television and other mobile networked devices. The main objective of this PhD research is to investigate the potential role that technologies can play in bringing about positive experiences in the family and enhance their mealtime experiences.

I begin this chapter with discussing the celebratory research agenda that I aim to adopt in this thesis. I describe the three studies that I designed to answer the research questions stated in Chapter 2 and explain the research methods I would use in these studies. Then I discuss the rationale behind the study design, and justify the choice of research tools. I conclude this chapter with a brief discussion about the participants, protocol, and data analysis of the three studies.

3.2 Research Agenda
There have been two clear and distinct tracks of research that focused on the domestic technology usage associated with food and family. The first one of these tries to identify problems associated with food that can be solved or mitigated using technology as a tool, e.g., [Aberg 2009; Grimes et al. 2008; Svensson et al. 2005], or uses technology as a lens to collect and analyze data, e.g., [Ganglbauer et al. 2013]. This is, I find, the dominant track of research and there are many notable works that have taken this perspective to solve different important issues associated with the family meals.

This is a completely valid and important line of research, but there are other perspective and opportunities that are generally ignored in this trend. Raised by Bell and Kaye [2002] and later emphasized in the HCI community by Grimes and Harper [2008], the other agenda is often termed as celebratory technology. This line of research tries to focus not on the problems associated with food, but the ways people
savor and enjoy the food, relish the practice of making it, and above all enjoy the sense of togetherness experienced during their mealtimes [Grimes and Harper 2008].

Throughout this thesis, I have embraced this celebratory research agenda. Because I believe, an important aspect of home and family meals are the social connection it enables, through which it becomes a convivial moment of their daily life. It is true that people may have problems or complications associated with their mealtimes, but it is also very true that they find pleasure and enjoyment through their family meals. When I discuss technology usage during family mealtimes, it is neither technology nor meals that remains the central focus, it is the achievement of commensality that interests me, and that is why I think the celebratory research agenda suits my research objective.

In the first study, I focus the attention on analyzing the technology usage during mealtimes, and the ways family members manage such usage. To understand the relationship between family members and their technology usage, I divide these technologies into two groups. First, some technologies are immediately available and their usefulness is clearly apparent within the dining context (e.g., a television remote control placed on the dining table ready to be used by any family member). The second group includes technologies that are still available but somewhat removed from the dining activity (e.g., a mobile phone switched to silent in a handbag). The first types of usage refer to technologies that are available (socially and cognitively) for immediate use; while the other type includes technologies that require a little more effort to discern their whereabouts and role in the social milieu. The distinction does not reside within the capabilities or functionality of the technology itself; rather it resides in the everyday practices (behaviors and attitudes) of family members at mealtimes. I discuss how the family members actively manifest and maintain a set of norms and practices regarding their technology usage, and by doing so, demonstrate their positive intention towards making the mealtime an enjoyable family occasion. Based on this, I design an intervention to support this positivity, and conduct the next two studies.

My second and third study focuses on particular aspects of commensality – how family members share their everyday life stories with other members of the family and associated concerns. This is because, eating is not just the primary biological
consumption, but is done almost always and in every society in a social context as the primary social function [Fischler 2011]. I develop a technology probe (*TableTalk*) to investigate the role technology can play to facilitate the social interactions around domestic mealtimes. The field study of *TableTalk* deployment showed that personal devices can in fact be used during family mealtimes to assist the family members share stories of their everyday life, encourage participation, and support various commensal features, for example, reminiscing, bonding, education, socializing, etc. Findings from this study encouraged me to design the third study that focuses on which of the interactions in the family are novel due to the introduced technology and what are the challenges for long-term usage and adoption of it.

For all three studies, I encouraged the participating families to include whomever was in the household at the time of the study and did not place limitations on who should or should not be included. While in most of the participating families, only the core family members participated in the studies, sometimes the recorded data included external family members and guests and we discussed about their participation during the interviews.

### 3.3 Research Methodology and Methods

Throughout this thesis, I followed human centered design as the overall research methodology. The HCI community have invested a significant amount of research on technology use in home life with a range of methods being created, adapted, and used in combination. Existing research has acknowledged the substantial challenge in studying interactions and experiences in the home and recommended rich qualitative approaches to understanding home life and the influence of technologies on it [Coughlan et al. 2013]. Throughout this research, I took a qualitative research approach through ethnographic means to have a deeper understanding of families’ technological practices and subsequent interactions. I was aware that the research questions addressed in this thesis are subjective, and details of family norms and practices associated with technology usage during mealtimes would vary across different families. Hence, it was of utmost importance to collect detailed information about not only what technologies are used, but more importantly, how they are used and what do the families actually do instead of what they *think* they do with these technologies.
Table 3.1: A summary of research methods used for different studies.

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<th>Study 3</th>
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<td>Phase 1</td>
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<td><strong>Type of Study</strong></td>
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<td>Technology Probe</td>
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<td><strong>Settings</strong></td>
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<td><strong>Pre-Interview</strong></td>
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<td><strong>Video Observations</strong></td>
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<td><strong>Focus-Group Workshops</strong></td>
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<td><strong>Post-Interview</strong></td>
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All the three studies I present in this thesis were conducted in Australia and UK. The participating families mostly have originated from different western and Asian countries. The families were recruited through university mailing lists, notice boards, extended social networks of me and my supervisors, and local community Facebook groups. I tried to recruit families from diverse background and composition, as I shall discuss in detail in the later chapters. As is normal HCI practice in early stage prototyping, I did not seek a representative sample of participants across sociocultural 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 the socio-cultural norms, hence a comparison and detailed discussion of such is not the objective of this thesis. However, due to the qualitative nature of the studies, my aim here was neither to focus on any particular segment of society nor to obtain a representative sample for generalizability. Instead I sought some diversity of family setting as a context for an in-depth examination of the familial practices with technologies at mealtimes. The small sample size ensured a rich description of the collected data and a greater understanding of the use of technologies at mealtimes. I carefully checked for recurring patterns among our data and kept recruiting more families to validate that I have reached data saturation. But I acknowledge that with a study of this kind, there is always the possibility of obtaining more information by collecting further data. However, I believe I have identified the major themes in this research. Next, I discuss the qualitative research design and methods that I have used throughout this thesis.
3.3.1 Different Research Designs Followed in This Thesis

Table 3.1 summarizes three different research designs that I have adopted in the three studies of this thesis. I started with an exploratory study to understand the technological practices in the families, which then inspired me to probe deeper into the potential use of mobile ICTs for domestic mealtimes. My understandings from these two studies finally led me into a design intervention study to investigate the changes and challenges brought upon in the familial interactions by the developed technology.

3.3.1.1 Exploratory Study

The scarcity of empirical studies about how people currently use and manage different ICTs during their family mealtimes and how it influences their interactions with and around it inspired me to design an exploratory study to investigate the same. Similar approach was taken by many researchers, for example, Leong et al. [2006] and Wyche et al. [2006] followed this approach to gather baseline data and develop a framework for future investigations. This study had two phases. The initial phase involved discussion in an online forum. The objective was to have basic understandings around peoples’ attitude towards technology usage during mealtimes. I then designed a qualitative study to probe deeper into the family practices associated with their technology usage during family mealtimes. Based on the understandings of this study, I held two design workshops to discuss different options for a technology probe to better understand the potential role of technologies to enhance familial interactions at the mealtimes. I came up with an idea, developed the prototype, ran pilot studies, and finally made a field deployment in the next study.

3.3.1.2 Technology Probe

Technology probes are simple, flexible, adaptable technology applications introduced into various settings (e.g., families’ homes) that serve multiple purposes - field-testing a technology prototype, collecting data about the use of the technology in a real-world setting, and inspiring users and designers to think about new technologies [Hutchinson et al. 2003]. It has its origin in the concept of culture probe [Gaver et al. 1999], which has been considered as a design-oriented approach for acquiring inspirational design insights from the targeted communities. However, one notable difference is that cultural probes tend to focus on the activity of the user and do not
stress on technology per se. Hence, culture probes are not designed to collect data about its own use, nor are they a tool to enable users participate in the development of new technological design ideas [Hutchinson et al. 2003]. On the other hand, technology probes are technically simple, flexible, and open ended technological artifacts designed to inspire new activities among the participants, often in creative ways that its designers have not even considered. Technology probes are expected to change the behavior and interactions of its intended users and enable collecting data in-situ from their intended real-world settings [Boehner et al. 2007].

Technology probes were used in many field studies to understand the use of new technologies and investigate the potential of experimental technologies in the family home [Ganglbauer et al. 2013; Grevet et al. 2012]. However, its adoption in many research projects have raised considerable concern and are sometimes criticized as poor substitutes for ethnographic and other methods for understanding of the practices of everyday life [Dourish 2006]. Another reason behind the criticism rises from the fact that technology probes are used for both data collection as well as inspiring new design aspects through deployment of carefully crafted technological intervention. So technology probes have clearly different aims from ethnography, yet many of the research used ethnographic methods and technology probes together or adapted technology probes for ethnographic ends [Hemmings et al. 2002]. Vetere et al. [2005] acknowledged these limitations in describing their own study “The probe data was naturally incomplete, unclear and biased. This inevitably led to subjective interpretations where the data was often discussed in terms of the researchers’ own experiences” (p. 474). However, rather than seeking to develop objectively validated understandings of their data, Vetere et al. [2005] argued about the indeterminacy and subjective nature of the data being a strength of technology probes as a research tool. In designing my second study as a technology probe, I agree to the same.

The first study demonstrated that there are both positive and negative aspects around technology usage impacting family togetherness during mealtimes and each family develops a set of norms to mitigate any concern. This study also highlighted the participation of every member in the family to make mealtimes enjoyable and the widespread presence and occasional usage of mobile devices in this space. So, next I focused on design ideas to investigate if these personal devices can be reconfigured as a shared resource. I quickly developed a technology probe TableTalk to test this
concept. *TableTalk* was designed as a tool to provoke ideas and interactions than a prototypical solution to address any particular problem family members face during their mealtimes. I focused more on the design concept than refining it through detailed user-requirement analysis for different functionalities that could be afforded in such a system. *TableTalk* worked both as a tool for provocation as well as a data collection tool about its users. The app recorded any user interaction with it along with the content shared within the family through this app. The second study is focused on evaluating the design aspects of the system and uncover the various ways it could influence the commensal experience in the family. The data from this study and subsequent analysis helped me to investigate the potential of these new technologies in enhancing the family mealtime experience.

### 3.3.1.3 Design Intervention

My findings from the second study supported the hypothesis that personal technologies have the potential to play a pivotal role in enriching the mealtime experiences in the family home. So, next I designed another study to examine which of these experiences are due to the introduced technology and what are the challenges for long time deployment. I modified the *TableTalk* prototype to address this research question and made a final deployment with 7 families in Australia and UK. This study is characterized as a design intervention rather than a technology probe due to several reasons. First, the system was refined through early stage deployment in the second study and I took detailed feedback from the families to incorporate the understandings from that study. Unlike the second study, this could not be done using a low-fidelity prototype, but required me to thoroughly design, develop, and test minute details of both the user interface and the functionalities in devices with different configurations. Second, my focus in this third study was to deploy the system in the context of everyday regular meals in the family. This could not be achieved in the short-deployment of study two, as novelty effects would preclude me from evaluating the impact of the system in regular settings. These two features made this third study a design intervention study [Hayes 2014].

### 3.3.2 Different Methods Used in This Research

I used various research methods to collect data in these studies. Table 3.1 summarizes the methods used in each study. Now I focus on these methods, justify their usage, and discuss their suitability in answering the research questions for each study.
3.3.2.1 Discussion in Online Forums

Terveen et al. [2014] discussed the methods and challenges associated with performing research based on online communities. As the number of people using these communities are often large, the scope for research broadens and interesting research questions can be investigated through the use of it. Researchers can enable themselves to reach potentially unlimited number of audience members from anywhere on the planet through online communities, a feat which is not practical or possible other ways. But motivating the users to contribute in online communities remains a great challenge, which depends on a number of factors, including but not limited to the community itself, the researchers’ relationship with the community, the project, and the level of activity required on user’s part. Liu and Jansen [2013] discussed the extrinsic factors that influence users to contribute in the context of social media question asking. In another work, Mamykina et al. [2011] discussed the success of Stack Overflow (www.stackoverflow.com) and the design features that encouraged this success, e.g., the reputation of the founders, user engagement, user ratings, moderation, etc.

At the initial stage of this research, I resorted to online forums for getting a general overview of the attitude and practice associated with technology usage during mealtimes from the Australian populace. I provoked the discussion in a popular Australian user community OzBargain (www.ozbargain.com.au) by opening a discussion thread with the question “Do you use phone, television, or any other device while you eat meals?” I further explained the purpose of this question and research objectives. According to web traffic analysis by Alexa (www.alexa.com), as of April 2017, OzBargain visitors are predominantly from Australia (91.7%,) and the 38th most visited website in Australia. I am long time member of this community (since 2009) and often find the community members as helpful, kind, and humorous in nature. I received a good number of responses ($n = 71$) and the topic remained among the top five discussion threads in the forum for about a week.

3.3.2.2 Technology Home Tours

Technology home tours are generally used by qualitative researchers, where the participants are asked to show the researchers around their home and are questioned about how particular technologies are used, their history of usage, by whom and how often [Blythe et al. 2002; Davis et al. 2010; Petersen and Baillie 2001], etc. For
example, Wyche and Grinter [2009] adopted this approach by focusing questions about religious and faith-related usage of ICTs and other household artifacts that potentially pertained to domestic religious practices. Odom et al. [2014] took a home tour in their participating families to discuss where their technology probe Photobox should be installed. Ganglbauer et al. [2013] used this opportunity to ask participants to show them where and how they store their food. All these examples show that if used properly, technology home tour can be a powerful tool to understand current practices of technology usage. Hence, I asked the participants for a home tour during study one, where I aimed to explore current practices in the families, and in study three, where I compared the usage of the developed technology with the regular practices in the families.

3.3.2.3 Video Recorded Observations
In many cases, it is not possible or convenient for researchers to physically monitor the participants in the field, for example, due to the inconvenience of both the researcher and the participants, privacy, bias introduced by the physical presence of the researcher, etc. Many HCI works resorted to self-recorded video observations to mitigate these concerns [O'Hara et al. 2012; Tran et al. 2005]. In all of the three field studies, I gave the participants video camera(s) to self-record their family mealtimes. This allowed them flexibility to record their meals on the most convenient days of the week and also ensured a more natural setting of their family life compared to the scenario where the researcher would be physically observing their mealtimes. This approach has limitations too, for example, the fixed location of cameras and temporally partial nature of video recordings can limit the understanding of the activities of the participants.

I tried to minimize the bias introduced due to the presence of the camera by asking the participants to place it a few meters away from their dining area. The first study focused on understanding the current activities and practices of technology usage during mealtimes, so I used two video cameras to record each meal from multiple viewpoints. The first camera was positioned so as to face the participants (close-up view using a zoom lens). The second camera was then directed at the dining space (using a wide-angle lens). Since the objective of the second and third study was to investigate the influence of the developed technology, I used only one camera to get an overview of the activities of the participating family members. The video
recordings and subsequent interview data showed that participants were not much concerned about the presence of the camera, but I acknowledge the potential bias it may have introduced.

3.3.2.4 Semi-structured Interviews
Qualitative interviews are a well-used technique for collecting user information and are often used to get data that cannot be observed, for example, explanation of real-life events from the perspective of the study participants [Weiss, 1995]. Many of the related works discussed in Chapter 2 used interviews to collect data from families [Ganglbauer et al. 2013; Hupfeld and Rodden 2012; Wyche and Grinter 2009]. Generally, these interviews are semi-structured and guided by a set of open-ended questions to provoke and encourage discussion among the researcher and interviewee. Interviews can involve only one interviewee or be performed as a focus-group discussion (e.g., family members interviewed together). Furthermore, qualitative interviews can also involve utilizing different technologies or available artifacts. For example, Kirk et al. [2006] interviewed participants in front of their personal computers so that they could go through their photo repository and discuss practices of organizing their photo albums.

In all three of the field-studies, I conducted two interviews with each family – one at the beginning of the study period, and one towards the end of it. Transcribing these interviews is also an important part of the analytical process, which helps researchers to engage deeply with the data and to generate analytic ideas [Hammersley and Atkinson 2007]. I transcribed all the interviews of these studies, but did not including nonverbal elements (e.g., gestures of the participants, emphasis, etc.).

3.3.2.4.1 First interview
The purpose of the first interview was to gather background information about the family, the technologies available to them, and their family routines. In particular, the family members discussed the typical organization of their everyday mealtimes and how the configuration of their technological practices might relate to the pragmatic demands and expectations of family life. I sought to understand the technologies typically present during their day-to-day activities (study one and three) and their mealtimes (all three studies) and an indication of the attitudes towards the presence and use of technologies during family mealtimes.
3.3.2.4.2 Second interview

I interviewed the families for the second time after collecting their video recorded meal times, app data, and analyzing all these data including the first interview. The purpose of this interview was to seek clarification of any particular segment of the collected data. During this interview, together with the family members, I reviewed the video clips (all studies) and the shared content from the app (study two and three) to examine the data and discussed specific episode of familial interactions from the corresponding recorded video clips.

3.3.3 Data Analysis

The adoption of qualitative approaches to data analysis is also based on established ways used in related works about technology usage in the family home. I followed an inductive thematic approach to analyze the interview data, video recordings, and app data, where the themes are developed in the process of examining the data [Miles and Huberman 1994]. Inductive analysis is an iterative process, where the researchers revisit previously categorized data and combines or divides codes to account for new findings and to resolve conflicts [Pfeil and Zaphiris 2007].

I also used the software NVivo and other media (MS Word, MS Excel, pen and paper, etc.) to organize, examine, and code the video and interview data and to add detailed notes of all technology-mediated activities. These notes were then refined through discussions between me and my supervisors. NVivo was particularly useful to organize the different kinds of data (e.g., field notes, online-forum data, contents shared through app, video recorded data, interview transcripts, etc.), to code them, and to check these again at the end of the analysis. I repeatedly listened to the interview recordings and watched the video recordings to familiarize myself with the study participant and their data. Furthermore, I did the initial coding on paper because it allowed me to get a quick overview of the data. I drew diagrams to organize analytic ideas and added personal notes before using NVivo.

3.4 Research Description

I describe the demographics of the participants, data collection, and data analysis process in detail in the respective study chapters in this section. I briefly introduce the three studies conducted in the course of this PhD research and provide sample of the
semi-structured interview questionnaire, plain language statement, consent form, etc. from this research in the appendix of this thesis. All the research studies conducted received approval from the University of Melbourne’s Human Research Ethics Committee and I followed established protocols for data analysis and preservation.

3.4.1 Study One
In this ethnographic study, I first engaged in an online discussion forum to get an overview of the problem space. Then I collected qualitative data from six families through two in-depth semi-structured interviews combined with home tours of the families and self-recorded videos of two family meals - one during the weekdays and one at weekends. As criteria for participation, families had to regularly engage in shared mealtimes and also have some form of technology present during these shared mealtimes (e.g., television, radio, mobile phone, etc.).

3.4.2 Study Two
I began this study with two focus-group discussions about potential intervention by designing novel technologies to support commensal experience in the families that led towards the development of TableTalk. Then I conducted a field-study to examine the ways through which TableTalk supports social interaction during family mealtimes. I deployed the prototype with nine families that were recruited through university mailing lists, notice boards, my 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 (with or without children). I collected data from two semi-structured interviews, two self-recorded video of family mealtimes while using TableTalk, and usage data from the app.

3.4.3 Study Three
Based on the second study, I redesigned the TableTalk app to develop Chorus and conducted a field study to explore its influence on conversation topic and to identify challenges and opportunities for long-term usability of such systems. I deployed the prototype with seven families from UK and Australia for three weeks. The criteria for participation was similar to study two. My collected data in this study included two interviews, self-recorded video of family mealtimes – two without Chorus usage and four with Chorus usage, shared content through the app, and log data of any user interaction with the app.
3.5 Summary

In this chapter, I have summarized the main research agenda, and the research methodology and methods I adopted for this thesis along with justifications for their selection. I followed the celebratory research agenda that recommends designing for positive experiences as a separate branch of research alongside of solving food related problems. Guided by this perspective and based on a review of methods used in related works, I have outlined my study design for this thesis consisting of three fieldwork studies. I shall discuss these studies in much more details in the following chapters.
Chapter 4: Understanding the Current Practices of Family Mealtimes (Study 1)

4.1 Introduction

Recent HCI research about ICT usage during mealtimes has been mostly concerned with developing technology rather than creating a deeper understanding of the context of family mealtimes and associated technological practices. In this chapter, I aim to address this gap and present a two-phase study discussing how the temporal, social, and food related features are intertwined with technology usage during family mealtimes. I examine familial interactions of the use of information and communication technologies around domestic mealtimes and explore how family members configure the dining space in response to the technologies placed within it. I identify and analyze typical situations ranging from the use of any available technology while eating solitary, to idiosyncratic family norms and practices associated with shared technologies. I seek to understand how technologies are used and negotiated amongst family members and the influence of the technologies on the content and context of their interactions. The findings demonstrate how technology can be used to complement the experience with food in both everyday meals and special occasions, and provide with a balanced account of the affordances and challenges of technology usage during family mealtimes. This study reveals certain circumstances in which background technologies come to the foreground, visible devices are hidden, unwanted distractions become desired, and ordinary technologies support celebratory occasions. Based on the analysis of the study data, I identify four patterns of arranging technologies and family members around the dinner table and discuss how technologies contribute to satiety and commensality. Finally, I present implications of the findings and directions for future technological advancements focusing on the social and celebratory nature of family mealtimes in everyday life and make recommendation about the need for HCI research to recognize the contextual nature of technology usage during family mealtimes and to adopt appropriate design strategies.
4.2 Background

While there has been a growing interest in the relationship between food and interaction design [Grimes and Harper 2008; Spence and Piqueras-Fiszman 2013; Wei et al. 2011], surprisingly little attention has been given to understanding the current practices of using interactive technologies at family mealtimes. Smartphones, tablets, laptops, and other mobile networked devices are widely available during mealtimes, but their usage and acceptance widely varies across the families. Hence it is becoming very important to understand the interplay between mealtime practices, family routines, and opportunities offered by these personal devices to provide new insight about the role of technologies at mealtimes.

Existing research have shown that the spatial and material arrangements of the dining setting influence the social construction of family relations and the organization of family mealtimes [Hupfeld and Rodden 2012; O’Hara et al. 2012]. Increasingly, the dining setting has become infiltrated by various technologies, which are likely to have a discernable impact on mealtime practices. These technologies may draw away or contribute towards the commensal experience in the family. In either case, it is important to understand the ways that families orient themselves to the perceived opportunities or threats brought upon by these technologies.

Among all these technologies, television has received particular attention among researchers for the way it has influenced the arrangement of many eating spaces [Hersey and Jordan 2007]. Most of this research focuses on the negative impact it has on commensality, i.e., television is often portrayed as a distraction and hindrance to shared conversation and from the sensory joys of eating together in the family. As I have discussed earlier (Section 2.4.1), research by Barkhuus and Brown [2009] challenged the assumptions bound up in these narratives around television watching in the family. While not focused on the mealtimes, their study demonstrated how the television is positioned as a backdrop to other everyday activities and practices in the home, thus offering a more nuanced perspective on how we might understand its influence on commensality in the family.

Modern mobile and networked communication technologies, for example, smartphones and tablet devices have been subjected to similar criticisms. For example, these technologies are often connected to Internet and cause distractions when users
remain engrossed into using it for various purposes including but not limited to checking emails, updating their social media status, playing games, etc. during their family mealtimes. Although most of this criticism is written about in opinion pieces rather than scholarly research, it nevertheless highlights a certain lack of balance in the critical discourse surrounding the position of these technologies in the family mealtime space. There is relatively little research exploring the roles, practices, and attitudes relating to the broader set of digital technologies (smartphones, tablets, laptops, etc.) which are now finding a place in our everyday mealtime routines [Spence and Piqueras-Fiszman 2013].

In this chapter, I seek to address this gap by presenting a contemporary account of the evolving role of digital communication technologies during family mealtimes and explore the influence of technologies on the content and the context of mealtime interactions. I aim to explain how particular characteristics of the technologies actively contribute to both a positive sense of commensality as well as the tensions that may emerge through their use or non-use. Furthermore, I look to the ways that these contributions and tensions are oriented to, managed, and normalized in the construction of family mealtime practices. This analysis provides valuable insights about how social concerns are enacted in relation to the characteristics of particular mealtime technologies.

In this chapter, I present the findings from an exploratory study focusing on the practices associated with technology usage during mealtimes in family homes. I frame food practices in the households as enacting of the complex relationship encompassing the meal itself, the participating members and their interrelationships, and surrounding elements. I explain how different factors impact the technology choice during mealtimes and how family members often make conscious (and unconscious) choices in this regard. The findings show how meals and technologies are often paired. My use of the word “pairing” is commensurate with the food connoisseurs who use it to match the taste of the food and taste of the wine, while I follow this usage to discuss the relationship between technology and meals. I examine current practices and seek to investigate how common beliefs, assumptions, and understandings underpin technology usage during everyday mealtimes in the family home.
4.3 Aim

The principle objective of this study is to answer my first set of research sub-questions (Section 2.7.3), that is: **Which information and communication technologies are generally used and shared during the family mealtime? How are they used and managed by the family members?** As I have explained before (Section 2.5 and Section 2.6), existing research either focused on negative aspects of technology usage during mealtimes, or developed technologies for novel interactions in this space. But there is a need to understand how families currently manage their technological practices during family mealtimes at homes. I aim to address this gap through a qualitative study described below.

4.4 Study: The Technological Practices of Families During Mealtimes

I used the work of Barkhuus and Brown [2009] and Hupfeld and Rodden [2012] as a springboard to understand the ways in which a broader set of everyday technologies become implicated in the social configuration of everyday commensal practices and family relations at mealtimes. Rather than making moral arguments with respect to the position of technology within mealtime behavior, I looked to the ways that such technologies contribute or detract from any idealized notions of family order (Section 1.4) in these settings. In this respect, I explicated the ways that families orient to the opportunities presented by particular technological arrangements and how they enacted a moral order of family life through their lived practices.

In order to develop this understanding, I conducted a two-phase qualitative study to investigate the role of information and communication technologies during shared family meals and how families manage interaction with these technologies and among themselves. I was also interested in exploring potential differences in ICT usage during mealtime due to time, place, and quality of the meal. The first phase was an open discussion about ICTs during mealtimes in an online discussion forum. The second phase was a field study with six families based on observations of their mealtimes and interviews to get a deeper understanding of the family norms and practices related to ICT usage during family mealtimes.
4.4.1 Phase 1: Online Discussion Forum
The first phase was an open discussion in an Australian user online discussion forum called OzBargain (www.ozbargain.com.au). OzBargain is a very popular and completely free community-driven website among Australian consumers for sharing product related information (especially price, quality, and experience) and engaging in discussions related to issues they face (question, problem, recommendation, opinion, etc.). The community overall is a very helpful one. I am a member of the community since 2009, so it appeared like a good starting point to get feedback about the problem space and build more specific queries for the next phase of the study.

I provoked the discussion by opening a discussion topic with the question “Do you use phone, television, or any other device while you eat meals?” I further explained the purpose of this question and research objectives. I received 71 comments from 50 unique user-IDs from the online discussion. For the rest of the chapter, I refer to them as P1-P50, sorted alphabetically according to the user ID. I analyzed the text from the online discussion forum using the software NVivo [Glaser and Strauss 2009]. This analysis identified the most commonly used technologies and indicated differences in technology usage depending on the context of the meals (e.g., different meals of the day, solitary vs. shared meals, etc.). This phase of my study showed that while most of the families are selective about what technologies are allowed to be used during their family mealtimes, there are some families that have a strong negative stance on the presence and usage of any ICTs during their family mealtimes. The findings from this phase helped me to design phase two of the study. Based in these initial understandings, I refined the semi-structured interview questions for phase two to investigate the nuances in the way families use and manage their interactions and ICT usage during family mealtimes.

4.4.2 Phase 2: Field Study in the Family Homes
I conducted an in-depth qualitative study in the homes of six families to examine the use of technologies during mealtimes in further depth. This involved two in-depth semi-structured interviews for each family combined with home tours and video recordings of two family meals.
4.4.2.1 Participants

This study was conducted in Australia with six families (hereafter referred as family 1- family 6 for the rest of this chapter). Family 1, 2, 5, and 6 have Anglo-Celtic family background (English and Australian). Family 3 and 4 have Asian origin (Bangladesh and India, respectively). Most of the participants had been well settled in Australia for many years. The exceptions are the female members in family 3 and 4, who moved in Australia about one year before participating in the study. The families were recruited through university mailing lists, notice boards, my extended social networks, and local community Facebook groups. Criteria for participation required that families had to be regularly engage in shared mealtimes and have some form of technology present during these mealtimes (e.g., television, radio, mobile phone, etc.). I purposefully chose families who already use technologies during mealtimes in order to understand how the devices are managed and negotiated within the family context. Each family received a 20 AUD iTunes gift voucher as an acknowledgement of their contribution.

These participants came from diverse family backgrounds and family structure. As summarized in Table 4.1, the families included those with and without children, couples as well as single-parent families. The families were also diverse in their education and economic capabilities. Among adults, the educational qualification varied from a high school degree to post-doctoral qualifications. The participants’ occupations included home duties, academic positions, self-employed business people, and private/government employees. In terms of income, the recruited families varied from 240 AUD to 720 AUD approx. per person per week (50,000 AUD to 1,50,000 AUD per family per year), after tax. The children’s’ age ranged from pre-school to 7th grade. Although a diversity of participant background was important, my aim was neither to focus on any particular segment of society nor to obtain a representative sample for generalizability. Instead I intentionally sought some diversity of family setting as a context for an in-depth examination of each family’s practices with technologies at their mealtimes. I present a brief summary of each family’s technological practices and mealtimes settings.

Family 1: This family has two televisions, the newest one is placed in the dining room while the other one is in the lounge. The television in the dining area keeps running when the meal is being prepared (generally by the adult female member of
the family), playing some television shows, but nothing in particular. During this time, the male member would generally watch some news or sports program in the television at the lounge. The children in this family would do their studies or engage in other personal activities before the meal begins – in their bedrooms or near the dining area. When the meal is ready, the female member would ask everyone to join there. During this time, everyone helps to clear up the dining area and remove any laptop or tablet device placed there. Parents keep their mobile phones nearby (in the pocket or on the table) but children had to leave all of their devices (including phones) in their own rooms. This family generally watches reality TV shows during their meals (*MasterChef* at the time of the study). While the whole family sits together and eats, the father sometimes keeps his favorite program (news or sports) running with muted volume in the lounge. The family would spend some time together watching the TV program even if they have finished their meals. Personal device usage is prohibited while they eat, but as I shall discuss later, this was not always adhered to. While eating, the family members would engage in casual conversations about the meal, the TV program, or other mundane topics related to their everyday life.

**Family 2:** In this family, both the male and female member would prepare their dinner then ask their child to join them when the meal is ready. The child would use her tablet device to watch some animation or play with some app while she eats. They generally do not have any explicit restriction on technology usage during their mealtimes, but generally would watch some television program or listen to the music streamed through their phones. They would also use their smartphones to do some quick search or share some interesting social media post with each other while they eat together. They often talk about the TV program, various news, or social media posts while they have their family meals.

**Family 3:** This family also keeps the television running while the female member prepares the dishes and the male member assists her. During the meal, they would generally watch some news program as a backdrop of their conversation. Sometimes they may watch something from their laptop or DVD player. While there is no explicit restriction on technology usage, it is uncommon for them to use personal devices unless there is a specific need to do so (e.g., taking a call). They rarely talk during the meal, but when they do, it is generally about something shown in the news program, the meal, or mundane chores of daily life.
<table>
<thead>
<tr>
<th>Family Members</th>
<th>Available and Commonly used Technologies</th>
<th>Technologies available but generally avoided except specific cases</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Family 1</strong></td>
<td>television, mobile phone (for music), tablet (for music), Apple TV</td>
<td>mobile phones (for call, text, or browsing), tablet, land phone, laptop</td>
</tr>
<tr>
<td>Female (private sector), Male (government job), Child 1 (10 yo) Child 2 (12 yo)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Family 2</strong></td>
<td>television, mobile phone (for browsing, or music), tablet (apps), set top box</td>
<td>mobile phone (for call or SMS), desktop computer, laptop computer, smart light, DVD player, sound system, tablet</td>
</tr>
<tr>
<td>Female (academic), Male (academic), Child 1 (4 yo)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Family 3</strong></td>
<td>television</td>
<td>mobile phone (for call, SMS, or browsing), DVD player, laptop, land phone, sound system</td>
</tr>
<tr>
<td>Female (home duties), Male (engineer)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Family 4</strong></td>
<td>laptop</td>
<td>mobile phone (for call, SMS, or browsing), land phone</td>
</tr>
<tr>
<td>Female (student), Male (student)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Family 5</strong></td>
<td>television, mobile phone (for social networking or SMS)</td>
<td>mobile phone (for call or browsing), tablet, DVD player, gaming console, laptop, desktop</td>
</tr>
<tr>
<td>Female (book-keeper), Child 1 (8 yo) Child 2 (12 yo) Child 3 (14 yo)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Family 6</strong></td>
<td>television, DVD player, sound system, set top box, Apple TV</td>
<td>mobile phone (call, SMS, or browsing), tablet, land phone, gaming console, laptop, desktop</td>
</tr>
<tr>
<td>Female (academic), Male (businessman), Child 1 (8 yo) Child 2 (11 yo) Child 3 (13 yo)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Family 4:** This family always watch some television serial from streaming services using their laptop during their meals. The male member configures the laptop and makes it ready to start watching while the female member brings the dishes from the kitchen to their dining area. Generally, they watch some TV series from the comedy
genre during this time. They prefer not to use personal devices during their meals, but there is no explicit restriction. During mealtimes, they do not prefer to engage in prolonged conversations, but have some small talk about the media they were watching, or about the food.

**Family 5:** In this family, the female member and her children would bring their meals from the kitchen to their lounge and watch television together during their meals. They would watch news or other local television channels. During this time, the mother generally leaves her mobile device for charging in a nearby place, but the children often use their device for social networking and other applications. This family does not put any restriction on their technology usage during mealtimes. Similar to family 4, they do not talk much during their mealtimes.

**Family 6:** This family with children generally watches television during their meals, unless there is any guest and then they only use the music system connecting it to their mobile devices. The children and the female member leave their mobile devices in the lounge before the meal begins. The male member keeps his mobile device but generally does not use it unless required specifically (e.g., during the study, they were expecting phone calls due to medical purposes, hence they would take a call). Occasionally, the parents turn the television off if they feel the children are not paying attention to their conversation. The parents would discuss their day with the children and also try to engage them in the conversation.

**4.4.2.2 Study Protocol**

The qualitative data was collected using three methods: (i) a technology tour of the home, (ii) in-depth semi-structured interviews (before and after recording the mealtimes), and (iii) video recordings of two family meals.

I visited each family in their respective homes. The initial visit began with an interview, aiming to gather background information about the family and its routines. In particular I discussed about the typical organization of mealtimes in the context of the normal day-to-day life and how the configuration of these practices might relate to the pragmatic demands and expectations of their family life. I sought to understand the kinds of technologies typically present during their mealtimes and an indication of the attitudes towards their presence and usage at mealtimes. I interviewed all the family members together (including children). While I did not observe any reluctance
with participants honestly expressing their opinions in the presence of others, I acknowledge this may be a methodological limitation. Each interview lasted between 45 minutes and 1-hour.

During the initial visit (week 1), participants took me on a tour of their homes to understand the spatial and material arrangements of the household, in particular the dining areas. Through the interviews and the tour, I developed a deeper sense of mealtime organization in relation to the dining room’s setting, furniture, seating arrangements, and the presence of any personal and shared devices that might have some bearing on the organization of family members during mealtime activities.

Each family was then provided with two video cameras. I tried to minimize the influence of the video observation by asking the participants to place the camera a few meters away from the dining table. Using two cameras for each meal enabled the meal to be recorded from multiple viewpoints. The first camera was positioned so as to face the participants (close-up view using a zoom lens). The second camera was then directed at the dining space (using a wide-angle lens). The video recordings of the family mealtimes were about 30 to 45 minutes long. Though I did not ask for this, all families recorded their evening meal, citing it as the most common (or only) meal they all have together.

Participants were asked to choose two shared mealtimes over the following week (week 2, one weekday meal and one weekend meal) and to self-record these with the video cameras provided. Capturing both a weekday and weekend meal allowed me to become aware of different daily routines and their impact on technology use. After approximately one week, I collected the video recordings and camera equipment from

<table>
<thead>
<tr>
<th>Timeline</th>
<th>Task Performed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Interview one, home tour, demonstrate and drop off video recording equipment</td>
</tr>
<tr>
<td>Week 2</td>
<td>Families video record their mealtime – one weekday and one weekend</td>
</tr>
<tr>
<td>Week 3</td>
<td>Collect video data, analyze video and interview data</td>
</tr>
<tr>
<td>Week 4</td>
<td>Interview two</td>
</tr>
</tbody>
</table>

Table 4.2: Timeline and sequence of study activities (study one).
the families (week 3). I analyzed the first interview and video recordings. Finally, in week 4, I returned back to that family to conduct a second interview. I used the video recordings of the two selected meals to direct my questions and to focus on any specific episodes during those meals that related to the socio-technical landscape of the mealtime. The second interview lasted approximately 30-45 minutes. Each interview was audio recorded, transcribed, and then analyzed.

While appropriate to the exploratory nature of this work, I acknowledge the limitations of my small participant set and study settings. Family mealtime practices and attitudes towards technology usage vary between different households, as well as across socio-economic and cultural contexts. Also, by interviewing all the family members together, I could have missed opportunities for parents and children to speak separately, which may have raised issues about the influence of parental authority and power imbalance between generations. However, these are important but separate research questions, and warrant their own independent studies to investigate and answer these questions. They do not particularly limit this investigation of how families currently manage their ICT usage during mealtimes.

4.4.2.3 Analysis

I used an inductive, qualitative analysis approach to discern the technologies used (and not used) during mealtimes, their position in the broader spatio-material configuration of the mealtimes, influence on commensal practices as well as family practices for special occasions, across different social groups, and at different times and places. I used NVivo to analyze the video and to add detailed notes of all technology-mediated activities. These notes were refined through discussions between the myself and my supervisors. Together, we identified recurring patterns in the video analysis and in the interviews. After conducting the study with four families, I noted several common themes. I then conducted the study with two more families. These data strengthened the evidence of my analysis, but did not generate additional themes. Nevertheless, I acknowledge the possibility that additional themes may have appeared if the sample size was larger.

Based on interviews and video data, I identified the technologies available in the families’ homes. I also created maps to illustrate how families, technologies, and other household items were spatially arranged on and around the dining table. I
conducted a thematic analysis to characterize the family norms and practices regarding mealtimes and technology use to understand how these shaped various aspects of commensality (e.g., sociality, satiety). This analysis was done iteratively to identify common themes across families as well as unique family practices.

4.5 Findings
In this section, I present findings from both Phase 1 and Phase 2 of the study together; the qualitative data referred as P1 - P50 and family 1 - family 6, respectively. I begin with an overview of the relevant mealtime technologies and associated family norms. My analysis clearly showed that the negative impacts of technologies threatening the very essence sought after in commensality are somewhat overstated, and there is potential for actively contributing to a positive sense of commensality. Next, I discuss various temporal, social, food related aspects that influence how technologies are used during mealtimes. Then I present the spatial arrangement of these technologies around the dining space. Finally, I focus the attention into how these technologies contributed to commensality in the family.

4.5.1 The Availability and Usage of Technologies during Mealtimes
All the participating families owned a range of information and communication technologies. However only a subset of them were used during mealtime. As shown in Table 4.1, five out of six families owned televisions, with families 1, 2, 5, and 6 owning multiple televisions. All family members (including most of the children) owned smartphones. Other devices such as tablet devices, set top boxes, laptops, desktops, DVD players, sound systems, gaming consoles, etc. were also common in or near the family dining space (Table 4.1), but many were not used during mealtimes, or used vary sparingly.

Amongst those technologies that were used during the meal, I could observe notable differences in how they were incorporated into the meal. I noticed that some technologies (often televisions) were incorporated seamlessly into the dining experience and the interaction among the family members around the dining table. I also noticed that some other technologies were equally available during the meal, but removed from the social interaction amongst the family members, either by removing it from the dining space or through implicit or explicit understandings between the
family members. When these technologies were incorporated into the meal, e.g., in response to a mobile phone ringing in a person’s pocket, then the technology drew attention to the fact that it was a separate entity that was brought to the shared space.

This distinction in how some technological practices are well incorporated into the mealtime experience while other usage is considered separate depends on the coupling between the technology and the human actions. Here I am concerned about the relationship between an individual and his/her technology usage in the context of the family meal. The distinction between the technologies that are well integrated into the family mealtime practices and those that are not, is not a feature of the technology per se, but emerged from the particular activity in question. The characterization (Table 4.1) shows that the same device could be both seamlessly integrated (e.g., mobile phone streaming background music during mealtime) and create disruption (e.g., mobile phone at easy reach in case someone sends a message). Now I provide more details about each.

4.5.1.1 Technologies that Integrates into Family Mealtime Practices

It is not surprising that television was the most common technology used during dinner for all of the participating families. Television viewing occurred on traditional television sets (family 1, 2, 3, 5, and 6) and on laptop for video streaming (family 4). Reality shows, news, movies, etc. were the most common programs watched during mealtimes. Some participants reported playing movies from their DVD player or connecting the laptop to their television, thus obtaining a bigger and shared view of the content in the large screen. Once configured, these devices along with the television became an (invisible) intermediary between the user and the content they were watching, and the television ran without requiring much interruption to its users.

Mobile devices were also popular during mealtimes, albeit with restrictions. None of the participants made any conscious effort to change their phones to silent mode before they came to attend the meal. It was generally accepted that family members would avoid making phone call/SMS during mealtimes. However, they would respond to a call during mealtimes, especially if they thought it might be urgent or expected (for example, family 6 had one relative in hospital, family 4 expected calls from overseas family members). Children often had stricter restrictions, for example, unlike their parents they were not allowed to have phones with them (family 1 and 6),
have no SIM in their phone (family 2, not specifically for mealtime though), or refrain from making or receiving calls (family 6). Here the technological opportunities of personal communication with others (not at the dining table) were seen largely as something that separates the individual from family togetherness. By contrast, I observed that the use of phones or tablet devices as a source of music played through the sound system or television was allowed (family 1, 2, and 6). These practices vary from family to family, but when these devices were used in accordance with each family’s established and accepted norms, such usage did not raise any concern or draw any attention, and subsequently, that device was considered as well integrated into their family mealtime experience.

Personal devices such as mobile phones or tablets were sometimes shared with other members of the family, provided that the owner of the device thought the content was compatible with other members’ interest. People remained cautious around this concern, along with the privacy issues (family 2 and 5).

“[If] something awesome happens on a [phone] screen, we will definitely alert the others and the others will show suitable interest and in that context we will share a screen. But in any other context, we won’t just sit there and watch someone else browse the Internet, for example.” (Female, family 2)

Thus, in general, personal devices can be often used if it serves a shared cause or interest, as I would show some examples in later sections, even sometimes against established family norms and restrictions, but without causing any commotion in the family. This capacity of engaging and serving everyone is what I claim made their usage integrated into the mealtime practices of the family.

4.5.1.2 Technology that Does Not Integrate with the Family Mealtimes

Each of the participating families had developed their own set of norms and practices for technology usage at mealtimes that evolved over the time, and everyone in the family accepted them. This was often something not very explicit, but evolved over the years of families living together and thus became a core practice of the family – which everyone followed willingly as no one noticed, unless it was interrupted. When these norms were violated by any family member, it could become instantly noticeable. For example, mobile phones and other personal technology usage during mealtimes in many families could be considered out of place.
Other technologies were available in the home, but for various reasons (e.g., spatial considerations, concerns that devices would be dirtied or damaged, or concerns that children would become distracted), they were not readily available or were not used at all. In this sense, their use would raise concerns in that particular family and so they were avoided. Game consoles, laptops, and desktop computers were nearby in the house, but were not used during mealtime. I observed laptops being used immediately before and after the meals, and not used during the meal itself. Sometimes laptops remained on the dining table while family members ate together (family 2, 3), but it was not used during mealtime. When the laptop was used (family 4, video recordings), family members configured the device before the meals and only performed very simple interactions during mealtime (for example, pause the video when someone leaves the table to fetch more dishes). In this sense, I consider these ICTs as not being integrated into the mealtime practices in these families. While Table 4.1 shows that each family develop their practice about which ICTs are integrated for use during their mealtimes, it nevertheless shows a symbolic gesture of good intention among the family members in adhering to their respective family norms.

4.5.2 Temporal Aspects in Technology Usage
The findings show that the time of the meal had implications for the ways in which technologies were used. Technology usage varied between weekdays and weekends. Weekend meals allowed more freedom both about technology use and meal consumption. Furthermore, there were differences according to the time of day, for example, personal technologies were often used for quickly checking work related information during breakfasts than during lunch or dinner.

4.5.2.1 Technology and Different Days of the Week
Family meals on weekends were usually longer and more relaxed than weekday meals, and accordingly often also more relaxed in terms of technologies allowed during a meal. For example, family 6 reported eating dinner in the lounge rather than using the dining table during weekends. Also, the meals were less structured, with meals consumed at the couch rather than at the dining table, different members finishing it at different times, and with increased use of technologies such as the TV, smartphones, or tablet devices.
“It is very different on a Friday night I suppose, because we are closer to the TV. On Friday, we often get takeaway, and we’ll sit around here [couches in the lounge, with TV on] and have it, it is just as something different” (Male, family 6)

“We generally eat at the dining table around 5 nights a week and in front of the TV the other two (generally Fri/Sat).” (P7)

While all the participating families (phase two) watched television (broadcast or streaming media) during weekday meals too, dinner times and associated media consumption in those days were generally more rushed and squeezed during the week as one needs to study, work, or do household chores. The technology usage also reflected the relaxed nature of weekends. In particular, parental rules that restrict technology use for children, i.e., for personal devices like phones and tablets during meals were often relaxed on the weekends. The data showed that in both family 1 and family 6, children could use personal devices (e.g., phones, tablets) during weekend meals, whereas both of these families had strict rules to avoid such devices during weekday meals.

“On weekends, the first things kids tend to do is to get up, [name of child], she will get up, she will get her iPad and she will play Minecraft. So, the television might not be on but she will play Minecraft and she will probably play that right up until she has a breakfast, umm..., and lunch.” (Female, family 1)

4.5.2.2 Technology and Different Meals of the Day

Breakfast in weekdays were often more rushed and less structured than other meals with a view of hurrying to start the day, as also noted by Hupfeld and Rodden [2012]. Many family members consumed breakfasts according to their personal schedules, with little time spent in eating with other members. Hence, people often used personal technologies in this time, partly because breakfast is often prepared alone. Technologies were sometimes used during breakfast as a tool to organize events and activities for the day.

“[During breakfast] I check work, personal, or business emails, stock market, etc.” (Male, family 6)
“I will check it [phone] in the morning, usually Facebook, Gmail, but she [wife] usually does not see it [Email] in the morning unless she has a meeting at 10 [am] so she just sees what the status is or if it’s still on time.” (Male, family 4)

Breakfast was often held in a different place to other meals. For example, family 4 had breakfast in the kitchen whereas lunch (during weekends) and dinner (everyday) were consumed in their lounge room. Family 5 reported having a quick breakfast in the kitchen bar table rather than at the dining table. It was convenient to prepare and consume the meal at the same place. Participants indicated that breakfasts should be efficient, not just about consuming food, but also about planning and coordinating activities.

On weekdays, all the participants reported having lunch either in office or school (for children). Contrary to breakfast and dinner, many reported technology non-use during lunch, thereby enabling a break from their technology-dominated lifestyle.

“Lunchtime I am the almost opposite, especially at work. I make a point of getting out of the Office.” (P33)

“During lunch at work, I like to try and get out of the office because too often I’m stuck working through lunch anyway.” (P29)

On the contrary, it was often a custom in the families that recommended all the members be present during the dinner time, and their technology practices were also adjusted accordingly. I discuss how families have developed their own set of rules and practices in this regard in the next subsection.

4.5.3 Technology Usage and Sociality
It was common to use technologies when meals were consumed alone. However, during meals shared with family members or guests, technology usage tended to be restricted, either completely or to the shared technologies like TV and music.

4.5.3.1 Solitary Meals
Almost all participants reported technology use while they eat alone. It was as if the technology served as a mealtime companion. In contrast to meals shared with others, I
could note an increased use of personal technologies (computer, smartphone) over shared ones (television, radio).

“When I’m alone I smash [use heavily] the technology, every lunch if I’m alone I’m on the iPad.” (P11)

“Any time I eat by myself I’ll be found using some form of technology; at home I will be in front of the computer or at work/out and about I’ll play games on my phone or just general browsing.” (P26)

Two notable aspects of technology could be noticed here. Firstly, Internet enabled and mobile devices let people connect with others through browsing or social networks. Secondly, technology use in such instances were often something that is not planned or serves any specific purpose, rather these practices are in situ, utilizing any available technology or content.

4.5.3.2 Meals Shared with Family Members
Technology usage changed when people shared meals with their family. Some families completely restricted technology use, as they saw technology interfering with the social rapport created by shared meals. Adults often justified the rejection of technologies based on family values. The values were typically instilled during childhood when they learned to socialize at mealtimes. These values persisted with their own families as adults.

“Growing up I was taught by my mum that eating in front of the TV was rude and as a result my sister and I were banned from doing so.” (P30)

“No disturbance when eating unless it is really important or the whole family thinks it’s worth being disturbed.” (P48)

Sometimes families only restricted personal uses of technologies such as checking messages on phones, but allowed communal or shared uses. Shared usage of technologies, e.g., TV and radio, tended to be allowed because it helped to create a shared experience that enhanced the sociality of the meal. Rather than hindering family communication alongside their dinner, technology was often seen as supporting communication by either enabling the members to pick topics of conversation (e.g., children in family 1 mocking each other referring to a TV
character in Section 4.5.6.1) or supporting conversation (e.g., mother in family 2 searching for information in her smartphone about a restaurant mentioned in the mealtime conversation, Section 4.5.6.). In some cases, the sharing even went so far that technology was only used when all family members were present.

“If someone walks away [from the meal] for something, we would pause it [video streaming], so that the other person can join.” (Female, family 4)

“Yes, definitely the TV [at mealtimes]. To make it work, you just watch it together, grows the bond between two people when you’re sitting on the couch being so accessible to each other :) Not sure how it would work with kids though as their cartoons would be too kiddy to watch.” (P23)

Again, such practices of using technologies to enhance the mealtime experience were shaped by values that adults had developed when they were socialized as children. Some parents acknowledged the change in the technologies available in the home compared to when they grew up, particularly the emergence of mobile phones.

“For us (parents and myself), I grew up with watching the news at dinner time. It helped to get me interested in what was going on around the world and it’s something that I still do now. Our family is perfectly functional, we all love and get along with each other, and I don’t regret it at all :-)” (P16)

“There is now a lot of technologies [compared to 10 years before], a lot more distractions.” (Male, family 6)

Notable here was that people did not change their meal pattern with the change in their preferred media. Mealtimes in most families are routine activities and families generally have their own timeframe for having meals. All of the participating families mentioned that they do not change their mealtime according to the change in their television program or when the season of their preferred TV show ends. For example, family 1 regularly watched MasterChef during their dinner, but on days when the program was not available, or when the show ended, they would watch other programs. Another participant reported a similar incident, which illustrates that technology choice is paired with the time of the meal, but not the other way around:
“We used to have 30 minutes news from 8 - 8.30 p.m. back home and that’s the time I eat even today with my own family in here. However, this is bit late for the dinner in here and I don’t think there’s any channel telecast news at this time.” (P37)

4.5.3.3 Meals Shared with Occasional Members and Guests
A different pattern emerges when guests or extended family members living elsewhere join the meal. In this case, families typically resort to technology non-use or ambient uses of technology, like running the TV in the background. The quotes below illustrate that such occasional members not only include friends, but also family members that do not regularly attend meals.

“On the rare occasions my Dad was home for work in time for ‘kid’s dinner’ at 6pm, my mum would insist we all sat at the dining table together with no TV on.” (P29)

“I always watch TV while eating either breakfast, lunch or dinner. If it’s family that frequently visit (like weekly/monthly) I’ll still have the TV on but normally can’t pay too much attention to it cause of the noise levels. If it’s family I rarely see, I normally have it off despite being bored.” (P49)

Often such orientations are adopted out of courtesy, paying more attention to the conversation with the guest or visitor. During special occasions, or when guests ate with the family, some participants would listen to music rather than television programs to entertain and create ambience to support the social gathering. All of the participating families (except family 2 and 5, who celebrate special occasions with guests in restaurants) said they selected music to create the right ambience to celebrate special occasions with their families and guests.

“When we have people over [here], we’ll have music in the background, either from the CD player, or we have the music channel in the TV; sometimes I may have my iPhone or iPad playing music, while other people are here.”
(Male, family 6)

Here then, technological resources were configured to contribute to mood and ambience through their assembly.
4.5.4 Technology and Quality of the Meal

I also identified a connection between the quality of the meal and the type of technology or media used during mealtime. In particular, it appeared from my analysis that the more effort participants invested in preparing a meal, the more restrictive families were about technology usage, unless they used technologies deliberately to celebrate a special occasion. These observations aligned and partially overlapped with observations about meals with guests and special meals on weekends. Beyond that, however, they also showed the value of the food itself, or the lack thereof, when junk food was consumed alongside with junk technologies.

4.5.4.1 Junk Technologies for Junk Food

Many participants associated the consumption of junk food, (i.e., quick meals, ready-made food, or snacks) with junk technology use. By junk technology I do not mean that the technology itself is of little value, but rather that the ways in which they are used are not very deliberate. For example, people switched between different channels rather than choosing a program to watch, or they browsed through content of their phone to pass time, without paying much interest to it.

“I have a bad habit of emotional eating on weekends. And I eat KFC/Charcoal chicken or some other junk food. And I have to be watching something, usually a TV show or YouTube. I think as I want to increase the pleasure I am getting from the food or to distract me from realizing I’m eating bad food and not feel guilt.” (P20)

Family norms and practices associated with technology usage during mealtimes were often relaxed for these quick meals or snacks, as reflected by P15 and the female member in family 1:

“We rarely eat in front of the TV unless, both of us can’t be bothered cooking or we have ‘fend for yourself’ nights, where we make our own quick dinner.” (P15)

“If it’s a mealtime I won’t let her play it [Minecraft] and eat. But if she is, I don’t know, having a pack of chips or something, yeah, she will, you know, play it.” (Female, family 1)
It appeared that technologies were used here to enliven the monotonous experience of everyday meals, i.e., through entertainment technologies like the TV and updates from social network sites. During weekdays, all six families in the study (phase 2) kept their television running in the background. The families often watched reality TV shows and sitcoms, because they did not require constant attention and thereby it also allowed them to engage in social interaction during the meal.

“We try to watch those serials or those movies which do not require much attention. Otherwise we keep watching it and forget to eat. Some comedy series are seen out of order too.” (Female, family 4)

“We have a dining table in our living area where the TV is. The TV is generally on but on some sort of pointless channel, which is more just background noise.” (P22)

4.5.4.2 Good Food Encourages Less Technology Use
Just as people tend to use junk technologies for their ordinary meals, I often noticed non-use of technology for meals that are specially prepared with care and attention:

“If the food isn’t good, we’re probably more likely to check our phones during the meal. But if it’s decent/awesome then we’d just eat and enjoy it along with each other’s company.” (P6)

When the family put a lot of effort into preparing a meal, then food was often considered a special treat and general usage of technologies were more likely to be avoided. An example of this could be seen in family 5 who had a weekly tradition of preparing a special lasagna for a weekend meal. In the context of the busy weekday routines, family mealtimes were pragmatic in the ways that they needed to be integrated into the weekday schedule. During these weekday meals, family 5 demonstrated less concern with the children using their mobile phones at mealtime (Figure 4.8). However, during the weekend Lasagna meal, the children did not use their mobile phones. Special status was accorded to this meal both in the preparation of the lasagna (which was different from weekday lasagna) and in terms of the expectations when eating it. It was a time when the family would devote attention inward to the family rather than outward to the world through their respective smartphones.
The father in family 2 stated, “There is no doubt; good food encourages conversation”. The assumption being made by the participants was that technology would dampen conversation and therefore undermine the experience of enjoying good food. Similar evidence came out from other participants too:

“Growing up with 2 younger siblings we ate together most nights with only the [TV] news in the background, which was normally turned off for special meals (if mum did a roast or we had my nan or grandparents over for dinner) not so much for politeness, but for us to focus on family time.” (P27)

4.5.4.3 Technologies for Special Occasions

A separate theme arose when the participants had special occasions in their home. As noted earlier (Section 4.5.3.3), these occasions often included sharing meals with guests. Just as mundane use of technologies was avoided for special meals, technologies were used in special ways (as with special foods) to enhance an exceptional occasion. For example, the husband in family 3 described how they carefully choose a suitable movie to accompany their meal to celebrate an anniversary.

“My, taking an initiative to watch a TV during my dinnertime, so that will be very infrequent. For example, last time we did, it was our anniversary, first anniversary. So, we put on the DVD and were watching it.” (Male, family 3)

Family 4 confirmed that when someone puts a lot of effort into cooking a good dish, there is an inherent expectation of less technological interaction which would (by implication) nurture more interaction amongst family members:

“[For special occasions] there will be a lot of variety food, there also will be a decoration.” (Male, family 4)

“I think because of the variety we are not much getting into technology because it would be very hard to focus on the phone [technology].” (Female, family 4)

“If its special occasion then it would be more like dialogue, so we will be speaking more on the topic.” (Male, family 4)

“Yeah, if it’s special, we would prefer to talk rather than to see something.” (Female, family 4)
Technology use (or rather non-use) then is bound up in the broader social context of the meal. At times, its usage becomes an accepted part of everyday living while at others, their practices become implicated in the social acts of family members. They often show respect and gratitude for the efforts made in preparing a meal or for the specialness of family interaction that is attached to that routine tradition.

Some families used technologies to create a distinctive ambience for a special meal. Family 2 had smart lights installed in their living room for which the intensity and color could be controlled via their smart phone. This family used these features for special dinners to create a party environment in their house. This was sometimes combined with other technologies to create the desired environment. For example, family 1 used a YouTube video with sound muted and played old music from another device to create a mix of “1920’s environment” for a birthday party. Here then, technologies were deliberately configured to contribute to mood and ambience and to convey significance and meaning in their assembly.

4.5.5 Spatial Arrangement of Technology during Mealtime

There is spatial relationship between how families arranged themselves and their technologies during mealtime. In particular, my analysis revealed four patterns of familial arrangement around the furniture and available technologies during mealtime. The patterns of spatial arrangements are:
1. Families arrange the **technologies** in the dining space so that they can enjoy it together.
2. Families orientate **themselves** so that they can have the best possible experience with the technology.
3. Some technologies are **hidden** during the meal, but remain there for usage if necessary.
4. Some technologies could be **displaced** intentionally from the dining space before the meal begins.

Each family showed multiple of these patterns in their spatial arrangements, as I discuss below.

**4.5.5.1 Technologies Orientate to Families**

Firstly, the families arranged some technologies to enable easy and convenient access. For example, families reported that the best television viewing took place when the television was situated near the dining place. Family 1, for example, mounted their most sophisticated (and favorite) television set on the wall closest to the dining space so that all family members would have an unimpeded view. Family 6 situated their largest television near the dining table. The rationale for this placement was that mealtimes are one of the few occasions that brought all family members together, and that often the television was a source of interactions for the family. The DVD player, sound system, set top boxes, and Apple TVs were also often used with the television. Families with land phones (always cordless), placed one handset in the kitchen for easy access. The other handsets were usually in the bedrooms. Some devices were heavy and could not be easily re-configured (e.g., televisions), while others are small (e.g., remote controls, land phones) and could be repositioned more easily. In both cases families carefully considered how and where to place these technologies so that they made sense with the social context of the mealtime. Such orientations then could influence the interactions both with the technologies and among the family members. For example, family members sat together in the couch to enjoy movie playing through the DVD player (Family 3), or the female in family 1 generally answered the land phone placed in the kitchen while preparing meals or dining, as its placement allowed only her to access it without moving away from the table (Figure 4.1).
Participants arranged themselves around the technology so that all family members could have the best possible access to it. For example, Figure 4.1 shows the spatial organization of family 1 during mealtimes. The mother sat on the inner side of the bench, giving her easy access to the kitchen utensils as well as a good view of the television while she cooked. The father and the two children sat on the other side. Notably, their sitting arrangement was fixed according to their heights so that

**Figure 4.2: Spatial arrangement of technologies and family members (family 2).**

**Figure 4.3: The sitting arrangement in family 3 sometimes makes it difficult to watch television by everyone.**

### 4.5.5.2 Families Orientate to Technology

Participants arranged themselves around the technology so that all family members could have the best possible access to it. For example, Figure 4.1 shows the spatial organization of family 1 during mealtimes. The mother sat on the inner side of the bench, giving her easy access to the kitchen utensils as well as a good view of the television while she cooked. The father and the two children sat on the other side. Notably, their sitting arrangement was fixed according to their heights so that
everyone can enjoy watching the television without obstructing others. Similar patterns were seen with family 2 (Figure 4.2) and family 6 (Figure 4.6). Family 4 used a temporary arrangement – they placed their laptop on top of a small bench and sat on their floor mat in front of it (Figure 4.4). Family 5 sat on a couch parallel to the television (Figure 4.5), so their seating arrangements was unproblematic regarding television watching.
This study also revealed certain interesting scenarios that showed the complex nature and nuances of family practices involving technology usage in the mealtime context. For example, family 1 would eat in the kitchen where they had a smart television on the wall. A second television was placed at the back of the lounge room, which could be seen only from the side where the father sat while dining (Figure 4.1). It was evident from the orientation of the room that he had located himself to watch this second television without interrupting the other members’ viewing experience of their preferred program. This sort of arrangement was not always possible, for example with family 3, where one member had to sit at a corner of the table that was not optimal for viewing the television (Figure 4.3). They sometimes took their dinner to the couch in front of the television or moved their body/chair to get a better view of it.

4.5.5.3 Hidden Technologies

Thirdly, I noticed that various technologies were hidden (i.e., deliberately positioned so that they are distanced from the food and associated tableware) but available if needed. Some of these devices are the same as the ones listed as “not integrated” in Table 4.1, but here they are categorized for their spatial orientation at the mealtime rather than their acceptability in usage. For example, mobile phones were kept either in pockets or on the dining table (family 1, 2, 5, and 6), or in a nearby place (family 3 and 4). Remote controllers for the Apple TV and television remained in the dining table (family 1, 2, and 5) or in a nearby table at the kitchen (family 3 and 6). Family 2
and 3 kept their laptops folded up but in reach in case it needed to be used. In this sense, these technologies were hidden from the available interaction space during the family mealtimes.

4.5.5.4 Displaced Technologies
Finally, several technologies were deliberately placed away from the dinner table so as not to interfere with mealtime interactions. This is done not only for practical concerns related to managing the dining space, but also to comply with family norms regarding technology usage. For example, family 1, 5, and 6 deliberately moved their laptops and tablets to other rooms and kept the dining table free from other technologies or artifacts that would not be required during mealtimes. Often some family members, particularly children, also leave their phones in a different table or room, either voluntarily or because they were asked to (mother and children in family 6, children in family 1).

“They [laptops, iPads] could be anywhere but they are not brought here, not in the kitchen.” (Male, family 1)

“Yeah, not really at the table. I try to make it more of an open space ...”
(Female, family 1)

“And if they were doing their homework with the computer here, we usually put down table mats and staff, like that so they need to clear the table off to get room ....” (Male, family 1)

4.5.6 Mutual Shaping of Technology and Commensality
So, despite the concern that technology diminishes social interactions between the family members at mealtimes, ICTs are widely available and used in this space. In this section, I discuss findings that focus on how the family norms and expectations guide the family members regarding their use of ICTs and how ICT usage influences the content and context of their interactions – thus forming their shared experience of eating together.

4.5.6.1 Technology and Mealtime Conversations: Enacting Family Relations through Technology
It was apparent in the video-based observations and the interview discussions that the technology and media content could provoke conversations among the family
members that reflected their relations. Rather than being a distraction, in these scenarios, the media content provided opportunities to enact social encounters with other family members and to express their sentiment. The relationship between technology and familial conversation at the mealtimes was twofold. Firstly, technologies served as a conversational resource – it was, in itself, a topic of conversation. Secondly, I could notice how technologies were used to support family coordination and conversation in practical ways. For example, certain media (such as television programs) would become the focus of conversation and contribute to a shared sense of conviviality. In a particular instance with family 1, I noted how interactions in television program provoked shared familial memories or shared family narratives. Therefore, family members may orientate to these media specifically because they represent, reflect, or celebrate particular shared narratives.

For example, in the interview, family one recounted from the video recordings about a shared memory invoked by interaction in a television program:

“Sometimes, [name of a child] gets off the car and runs behind it while we go down that slope in front of our house. We were laughing because a man in that TV was running after the car just like her.” (Female, family 1).

There is no inherent humor in the technology. Rather the significance is in the ways it is actively bound to socially significant elements of family narrative. In their shared laughter (“We are laughing”), they were demonstrating a shared affection for the behavior of their child and sibling. The television content then is significant in offering the family members an opportunity for, in this instance, this display of affection. More generally though the point is that such media content is actively oriented in the context of family relation rather than being just a distraction from family relations.

I saw this too in relation to various forms of mobile phone content. While such information may be personal communications, it is in the acts of opening them up to social scrutiny by others at the table and the acts of commentary that the media objects contribute to the social concerns of the mealtime. For example, the mother in family 2 describes the mealtime practice of using mobile phones in her family:

“It also does serve as a point of content for every now and then for us to comment on what each other is looking at. So, it’s not like we are devoid of
conversation, I think we can call it virtual co-presence; even though you are sort of separated from each other by being on this [phone], you are actually interacting and using that as a point of interaction.” (Female, family 2).

What is evident in this snippet is acknowledgement of the potential for these technologies to draw other members into the awareness about the exchange of personal communications. It is clear that even when such personal communication happens, the concern for togetherness in the family remain important. Rather than simply ceding to any individualizing tendencies apparent in these technologies, what I see in response is a deliberate orientation to these pieces of information and communication content as resources for enacting the social.

I also explored the ways that technological interactions were oriented in response to particular episodes in the family conversation. A common example was the use of mobile phones at the dinner table to perform Internet search queries pertaining to a particular conversational topic.

“Because often we need it [mobile device] as a point of reference too. Something comes up in a conversation, one likes to try and be historically correct or accurate, and so it’s a great way just to check facts. You know someone mentions like, you know, perhaps a new restaurant that has opened, for example this [name of a place] I am obsessed with, you have to start queuing up at 5 pm, what’s the other people say about it? As I am telling it in a dinner party conversation, so we need to quickly check a blog and then everyone will see what they can find about it...” (Female, family 2)

Here again, an acceptable orientation to technology interaction at the dining table is noteworthy – one in which the interaction is demonstrably aligned with particular values underpinning commensality.

4.5.6.2 Pragmatics of Family Coordination

One of the elements of family mealtimes is how the family creates opportunity for discussion about practical family matters, such as the coordination of schedules and upcoming activities. Networked information and communication technologies were used at the table to support information searching, coordination, and scheduling related to concerns involving the family coordination pragmatics. The acceptable use
of technologies during mealtimes for these activities was bound up in the ways that it contributes to shared concerns of the family. As an illustration, the adult female in family 1 used her mobile phone to send a text message during one of the recorded mealtimes, in spite of the established family rule of not using mobile phones during mealtimes. Just preceding the message, the family had been discussing their activities for the following day. The daughter (child 2) mentioned that her friend would pick her up for school. The mother, being unaware of this arrangement, felt she needed to confirm this with that friend’s mother, so sent a quick text to that effect. Importantly here, in spite of the general rule pertaining to mobile phone use at the dinner table, the actions of the mother were not called to account by other family members. The context of the actions was understood by all and so treated as unproblematic. Other families (family 4, 5, and 6) also reported similar events.

4.5.6.3 Attention towards Technology

While analyzing the video recorded observations, I was surprised about how a very large television screen with notably loud volume could blend into the background during the family mealtimes and remained apparently unobtrusive during the mealtime conversations. Television (or video streaming, family 4) continued running during family mealtimes of all the participants, yet they did not feel the need to constantly attend to it. They often talked amongst themselves about completely unrelated topics, ate their meals, made fun of each other, seemingly unaware of the very presence of the television in that context (as also observed by Barkhuus and Brown [2009])

“It is just the television tends to go on as people come home, but not necessarily sitting and watch it, just again have it in the background and be watching as you do something ...” (Male, family 1)

Participants watched television intermittently while doing other things or having conversations. During dinnertime, all family members talked amongst themselves, while eating and keeping an eye on the television. What is important here is that the family was able to eat their meal, and have a conversation while watching television. Thus, television did not demand the continuous and complete attention of the viewers. The television show could be more casually monitored for noteworthy events and commented upon or brought to the attention of the family as a whole.
Not all technologies could achieve this feat. When asked why family 1 had imposed restrictions on usage of smartphones by their children during mealtimes, their reply was,

“If someone is on a page of social media they are not participating in the family discussion and that’s why I would sort of go, no (you can’t use your mobile phone at dinnertime).” (Female, family 1)

“And those kids. You can talk to them and there is just no response because they are just concentrating on that thing, so...” (Male, family 1)

“They don’t hear.” (Female, family 1)

“You gotta yell, GIRLS.” (Male, family 1)

The imposition of restrictions on technology use was not related to an inherent property of a specific technology, rather it referred to the users perceived level of engagement with technology vis-à-vis family. Family 4 reported an instance with the male member’s watching cricket matches on television:

“If he [husband] watches something like cricket, he actually forgets everything.” (Female, family 4)

“So test cricket is good, like nothing much happens. But I was watching T20 matches. It’s like either you should watch, or you should eat.” (Male, family 4)

4.5.6.4 Balancing Togetherness and Technology Consumption
In certain instances, I saw various tensions arose in the context of technology use that were perhaps at odds with conceptions of commensality and family togetherness. These tensions arose from the choices of content accessible via the shared technologies and the discrepancies in content preferences across different family members. The issue here is not simply one in which disharmony among family members arises from disagreeing about the use of shared resources in the dining space. Rather, I see ways in which behavior is configured to enable a harmonious co-existence of preferences.

An example here was found in the video recordings of family 1 (Figure 4.7) where the father preferred to watch news or sport instead of the reality shows. His wife and
children would watch the reality TV shows on the kitchen television, while he would
watch his preferred program in the lounge before the meal begins. When the meal was
ready, everyone gathered in the kitchen, but he kept the television running in the
lounge room with low volume and would lean back in his chair to watch it behind the
backs of his children. Of significance here is the balancing of family needs and
personal needs with the father demonstrating a respectful orientation to the institution
of family mealtime by not removing himself entirely from the space being shared. A
number of interesting features are apparent here. First, the use of multiple devices
enables certain points of conflict around shared resources to be managed more
gracefully. But there is still work to be done here for togetherness and participation to
be enacted. While the respective video streams of the two televisions do not interfere
with each other, the audio aspects of the content would potentially be in conflict. Of
note, then, is that the father keeps the volume of the sport low on his television to
enable the more audio-dependent reality TV content to be heard by the children. Next
the discrete and intermittent leaning back to view the other television also shows a
certain ongoing commitment to the primary togetherness of the family during
mealtime.

I could also notice similar tensions in family 2. During one of their meals, the mother
and father were watching the television while their young daughter wanted to watch
an animated movie on her tablet device. The challenge here was again the sound of
both devices which have to compete for the same airspace. While the parents found
the sound of both devices annoying, it was interesting that the parents chose to

Figure 4.7: Father in family 1 having a discreet look at the other television (published
with permission).
tolerate this rather than ask the child to wear headphones. They explained that wearing headphones would create distance between them, they chose to tolerate the noise rather than jeopardize the opportunity to interact.

Parents also imposed restrictions on technology use arising from the situated and dynamic context of the family. For example, the father in family 6 described when technology use could cause familial conflict, and how they managed this.

“We (parents) are having a conversation, and the kids are paying attention to the TV, that’s fine. But if we are speaking (to them) and they are ignoring us, and the TV gets priority over people, that is not on. So that’s when we would stop the TV or reprimand the children, or both.” (Male, family 6)

Here the restriction on television watching was imposed in situ, contrary to the general and accepted practices of that particular family. This emphasizes the delicate balance that family members often have to maintain regarding technology use at their mealtimes.

### 4.5.6.5 Technology as Distractor

While the distracting role of technology has come under particular scrutiny in relation to family mealtimes, the predominant distraction narrative is one in which it draws away the attention and interactions (e.g., eye contact, conversation, etc.) among the family members. In this fieldwork, I noticed a number of alternate facets to the ways that distracting functions of technology played out in the lived experiences of everyday family mealtimes. For example, a key challenge faced at mealtime, in
particular for parents with younger children, concerns the social organization of satiety (e.g., Laurier and Wiggins [2011]). That is, there is a pragmatic concern for parents in ensuring that their children finish their meal to ensure they are suitably nourished. Such a concern was apparent in mealtimes of family 2. During the second interview, they discussed occasions in which they would try to get their young child to finish their meal. When the child’s attention is focused solely on the meal, then the parents experienced difficulties persuading the child to finish. The parents used technology as a way to distract the child from the food with a view to achieving meal completion and satiety. In one particular episode, the mother discussed the realization that technology could be distracting in a positive way when she showed her daughter some new iTunes application. The application distracted the daughter from the immediate sensory elements of the food so that she would be more inclined to eat and finish the meal.

“I never realized [name of her child] gets so engrossed in technology. I can shovel a whole plate of food into her and she doesn’t even realize it. Even Brussel sprouts.” (Female, family 2)

A further example of the ways in which distraction was more actively used in the management of the meal could be seen in the behaviors of family 5. Here, the children had been constantly arguing at mealtimes to the point where it was becoming problematic. In response to this the mother had been forced to sit in between the son (child 3) and the elder daughter (child 2) in order to mitigate the problems arising from bickering at the dinner table (Figure 4.5). She found that watching television during the mealtime distracted the children from their squabbling and from each other. Mealtimes had become much more relaxed as it avoided the likelihood of any conflict:

“If we actually sat there [kitchen] and ate together, it would always end up in [name of child] and [name of child] fighting. So we found it sort of more relaxing to watch television, because there is no fighting.” (Female, family 5)

I also observed technology increasing the consumption of food. Families often remained at the dinner table long after completing their main meal, waiting for a particular television program to finish. Sometimes they kept eating casually, picking small items from their plates (video recordings of family 1, 2, 4, 5, and 6). Their
interest appeared to be in watching the television rather than eating and the food complemented the technology. For these families, technologies such as television programs help to shape the duration of commensality by, for example, extending the amount of time the family sits together.

“If it is really good and like we eat a lot yogurt and ice cream sometimes as a dessert afterwards. So if we are eating and continuing the meal, we watch one more episode, and eat more.” (Male, family 4)

I do not necessarily argue that such distractions are required or should be encouraged. Nevertheless, I recognize this as an example of how the technologies during mealtimes are influencing the interaction between the people and with the food they consume.

4.6 Discussion

In this chapter, I have presented findings from my study investigating how technology is incorporated into the current practices of family mealtimes in the home. While previous works have often focused on the potential downsides of technology usage during mealtimes (i.e., a diminished social experience or health risks) or on developing cutting edge technologies to enhance and augment the interaction with and around food, this study suggests a richer story. Technologies such as television or radio have historically come under criticism for their potential to inhibit familial interactions; but this research suggests a more complex scenario around personal and mobile communication technologies is emerging. Clearly, the adoption of these new mobile communication technologies is having an impact on mealtime interactions and experience.

In exploring the everyday practices of technology usage during mealtimes, I have found that technology is often paired with the mealtime occasion. Whether and how technologies are used during a meal often depends on the time and day of the meal, the people that are present, the food that is served, and family values. I propose that viewing technology practices paired with food consumption helps to illuminate the complexity of such practices, the social and temporal contexts in which they occur, and the actions and interactions among people and technologies that make them work. I also recognize that the patterns of technology usage are adjusted dynamically based
on the context of everyday life. The act of coming together at mealtimes and the 
opportunities this presents for the enactment of family routines and expression of 
family values remains important. Indeed, this research highlights that the social norms 
associated with devices at mealtimes and the enactment of shared concerns in the 
family remain at the heart of technology integration. What is notable though is how 
such rules are at times not strictly adhered to but rather are considerations that are 
oriented to as necessary. There are exceptions for instance where such practices have 
the family and togetherness as a central concern in their organization. The findings 
make three essential contributions to our understanding of technology use during 
family mealtimes:

1. **The use of ICTs can have both positive and negative impacts on the social 
   interactions during family mealtimes.** Despite the concerns about possible 
detrimental effects, mobile and networked devices are increasingly available and 
being used during mealtimes. It is hence important to recognize this presence, 
understand the family practices around their usage, and consider the design of 
such devices (e.g., reconfigure personal devices as a collective resource, as 
discussed later) so that they enhance commensality. Adopting this new 
orientation to technology usage at mealtimes can lead to novel approaches to 
design for commensality.

2. **The spatial interplay between people, furniture, and technologies plays a 
   crucial role in understanding and negotiating the commensal experience.** I 
extend the contribution of Hupfeld et al. [2012], who discussed the spatiality and 
impact of dinner table artifacts in the family mealtime context, but didn’t 
consider mobile-networked devices in their analysis. Indeed, some technologies 
are fixed (e.g., television, land phone) and families arrange themselves and their 
technologies to create a satisfying experience. However mobile and networked 
devices are placed so as not to obstruct the mealtime utensils, but remain 
available when necessary. I recommend that future developments should 
recognize these arrangements and be designed accordingly to target one or more 
of the four orientations proposed here (Section 4.5.5).

3. **The transition of technologies between ambient and focal attention has 
   significant impact on its acceptability in the mealtime context.** In general,
Family members are not permanently focused on the technology but on the enjoyment of the meal. I believe this is an essential feature of any successful technology which aims to be used during mealtimes. Mealtime technologies should support a smooth transition between being ambient and being focal when necessary. Barkhuus and Brown [2009] discussed backgroundness in television watching practices in the family, but here I extend their findings to new mobile and networked devices.

Family mealtimes are often considered as a special space and time for social interaction. Hence any technology used during family mealtimes is typically regarded with concern about diminishing or even displacing that social interaction [Fulkerson et al. 2008; Stroebele and De Castro 2004]. This concern is particularly relevant for smartphones and other personal ICT devices, because they can isolate and exclude individuals from the shared experience of a meal [Bell and Kaye 2002]. Despite such concerns, mobile and networked devices are increasingly available and being used during mealtimes. Findings from this study offers evidence about how families manage their presence and usage, and what might this mean for HCI researchers and for future technological advancements. Now I discuss implications of these findings and explore how these can be 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.

4.6.1 Technology at Mealtimes and Situated Timeliness

Lucy Suchman explained that many of the everyday activities are not based on predefined rules but are situated, i.e., acted based on the current settings [Suchman 1986; Suchman 2007]. A central tenet of the theory of situated action is that “every course of action depends in essential ways on its material and social circumstances” [Suchman 2007] (p. 70). Comber et al. [2013] built upon her work but focused on everyday food practices to show that everyday food practices in the families are not much pre-planned either. Planning and purchasing food ingredients, recipe choice, cooking and eating food, cleaning or stocking up, having fun with others while eating – all these activities are dynamic, relational, and occasioned on the social and material settings at that instance. In this study, my analysis about the technology practices during family mealtimes hints the same. Families can prepare detailed and scrutinized plans for technology usage during special meals for a number of occasions (e.g.,
birthday parties in Section 4.5.4.3 or Christmas in [Petrelli and Light 2014]) throughout the year. But almost all regular everyday meals are underpinned by routine and taken-for-granted familial practices; and so is the use of the accompanying technologies. This is evident, for example in the ad-hoc nature of media watching practices of the participating families. Some families watch a regular TV show during mealtimes (e.g., family 1 watches *MasterChef*). However, the participants reported that they do not adjust their mealtime if the program changes or when the season ends for that particular program. Instead they find another program to watch in that time. It shows that technology usage is paired with the timing of the meal (but typically not the other way around).

This study also reveals other temporal patterns in pairing technology usage and mealtimes. Family norms are rather loosely structured and regularly adapted to adjust to the context of the meal under consideration. Informal meals during weekdays and the less structured food practices at weekends have implications for technology usage. Typically, these meals allow for increased usage of technology. Also, this study suggests technology is used as an organizational tool during breakfast, and has characteristics of relaxation and conviviality during family dinner. However, these observations do not prescribe which technologies are used, or how they are used every day. Each household pairs technology and meals in their own unique ways.

### 4.6.2 Technology to Support Familial Interactions

The pairing of technology usage during mealtimes is also evidently influenced by social factors emerging from those present at a meal. This is highlighted, for example, in people embracing technologies when they eat alone, people avoiding technology and preferring social bonds over personal technologies when they eat with their family, and people being very discerning about technology use for creating a particular ambience during meals with guests.

This study also shows that technology practices are significantly shaped by the social setting, and the social setting is equally shaped by such practices. Technology often acts as a companion for people eating alone, as is evident by the use of technologies to support remote sharing of mealtime experiences [Barden et al. 2012; Wei et al. 2011]. However, eating alone also offers opportunities to use and enjoy personal technologies that are otherwise avoided. Eating with other family members takes
precedence over technology usage, and this is often reflected in family norms and rules discussed in this study.

There is a common belief (as discussed in Section 2.3.3) that using technology during mealtimes prohibits family conversation or suppresses conviviality. While some of the participants seem to hold similar beliefs, others have pointed out that this is not necessarily the case, and that technology usage rather depends on the particular family attitude and their relationships. The findings show how technology has indeed enriched conviviality by provoking familial interactions during mealtimes (e.g., a news reader’s glitch caused family members to burst into spontaneous laughter in family 5 or members in family 1 were mimicking towards each other after a particular TV actor). In such contexts, technology does not detract from shared familial conversations and time, but rather provides an avenue for engaging and enjoying the presence of others.

4.6.3 Technology Usage and the Perception of Meals
The pairing of technology usage and mealtimes is also influenced by the meal itself. This is because families often perceive the entire process of mealtimes (from planning and preparing, to serving the meals) as a gift from the persons involved in different stages of the preparation of the meal to the rest of the family [Lupton 1996; Sidenvall et al. 2000]. For example, children in family 5 were not using technology while having their favorite Lasagna (Section 4.5.4.2), and family 4 enjoyed their meals without technology when they put more than the usual effort in preparing their food (Section 4.5.4.3). It is apparent from this study that technology non-use, or adopting the technology so as to enhance the social experience of being together according to the quality of the meal is common in many families.

This finding opens up new design opportunities for dealing with technology usage at mealtimes – for example, rather than restricting people from using their devices, one can encourage them to prepare special meals that make the use of technology seem inappropriate. Some recently developed technologies aim to impose control of children’s mobile phone use during meals (e.g., [DinnerTime 2014]) or shut down the Wi-Fi network at home as people start the meal (e.g., “Pepper Hacker” in [Hutchings 2015]). These approaches have considered food and technology as antithetical, whereas findings from this study suggest that the food itself, the effort that a person
may put into its preparation and serving, and the appreciation of a special meal by other family members may also be effective in reinforcing participants’ attention on the meal and on each other, thus limiting their isolated usage of communication technologies.

4.6.4 Personal and Shared Technologies vs. Personal and Shared Acts

At the heart of the practices of commensality lie a set of core social, cultural, and family values. These values and family relations are played out in many ways through engagement with the socio-material context of the mealtime setting, which is increasingly permeated by a range of technological offerings. While many of the technologies present at the mealtime do have a certain potential to distract family members from engaging with others and thereby threatening the very essence sought after in commensality, it is clear that such pernicious effects are somewhat overstated. What is apparent in the fieldwork is that technologies are also implicated with particular concerns for family relations. Television, for example, is a shared technology that can be viewed and listened to by all members of the family. While there may be points of conflict around television content, it ultimately provides a focal point through which social engagement among family members could be enacted. Important here is not just the status of this as a resource for the enactment of family relations. Rather it is that attitudes towards technological practice at mealtime become contingent upon the acts performed with them being aligned with the socially enacted values of commensality. This was particularly apparent when considering the use of personal devices at the dining table. When devices such as mobile phones drew the attention of the user away from the rest of the family, their use was typically frowned upon (Section 4.5.6.3). But when the same technologies were opened up for shared interest, scrutiny, and commentary, through which various facets of family relationship could be enacted (Section 4.5.6.2), then their use was less problematic.

Recent works have focused on such social use of personal devices. It has been noted that people naturally use technology in shared ways, even with devices designed for individual users [Rogers et al. 2009; Yuill et al. 2013]. Yuill et al. [2013] demonstrated the social interactions and associated enjoyment of drawing through sharing one tablet device among a group of children. How such combined displays
augment the social experience and commensality of family mealtimes remains a question for my next research study (Chapter 5 and Chapter 6).

4.6.5 Backgrounding of Technologies

Of interest is that certain forms of technologies could be backgrounded, allowing casual monitoring and viewing. Others have written about this in terms of technologies that become *unremarkable* [Crabtree et al. 2012; Tolmie et al. 2002], i.e., when technologies become part of a routine and hence blend into the domestic environment. Consistent with Barkhuus and Brown [2009], I also observed how some technologies (e.g., television, music, etc.) appeared to blend into the background and at other times were brought into the foreground (i.e., focus of interest). Interestingly, the mobile and networked device also achieved the same feat. In all the participating families, different sorts of mobile devices were readily available for usage if necessary, and in some cases, these were used (e.g., searching for some information, sending a quick text message, etc.). However, this usage did not draw any unwanted attention or surprise among the members; everyone understood the purpose and even participated in it or the user explained his/her purpose behind the usage to other members of the family. What was also significant were the ways that noteworthy happenings within the media (e.g., showing others about interesting social media posts or receiving a phone call midway through the meal, etc.) could also engage the family as a whole and hence can be considered important for the social construction of family relations and togetherness. So, these media offered resources for the enactment of family relations through shared humor, comment, or inscriptions with family relevance. Likewise, technology use such as web-based information seeking when done as a response to particular family conversation strands was seen as something that could augment the work of togetherness rather than detract from it. In this particular orientation, it was deemed an acceptable practice.

The observations also showed that such *unremarkableness* was not a static property of a particular technology but rather an emerging property of a particular mealtime context. The same technology and device (e.g., television) can be considered unobtrusive in one instance (with family 1 watching a reality show, Section 4.5.6.3), but can also become very *remarkable* or obtrusive in another (family 4 watching cricket, Section 4.5.6.3 or children in family 6 were too much into the TV watching,
Section 4.5.6.4). I argue that the ability to move in and out of focus is an important and desired capability of technologies used in the mealtime context. When I discuss about commensality in family meals, the shared experience of eating together becomes what matters most; both the meal and the technology are ingredients of this experience. This study shows that when technologies, even shared ones, hinder the experience of togetherness in the family, it is not generally accepted. Successful integration of television, music, mobile devices, or other media during family mealtimes highlighted their capacity of seamless transition between foreground and background in terms of attention towards it. I believe that this transferability is very critical to effective use of technology during mealtimes and hence an important guide for future technological advancements in this context.

**4.6.6 Technology for Special Occasions**

Certain technologies were used as a medium for setting scenes and creating ambience during mealtimes (Section 4.5.4.3). Such creative practices were a way of using technologies to augment special mealtime occasions. Hupfeld and Rodden [2012] discussed how families used special tableware to mark special and mundane family meals. The findings from this study show how the selection of technology could play a similar role. For example, watching a special movie with dinner to celebrate an anniversary (family 3), changing the colors of room lighting (family 2), and selecting music to accompany a meal for a birthday party (family 1), etc. (Section 4.5.4.3). The use of these technologies here reflects the significance of particular familial relationships and events, and thus contributes to commensality.

These observations suggest that novel designs for home environments need to consider how a technology can be reconfigured to support both everyday routine events as well as mark special occasions. Some household furniture (such as many familial dining table) allows users to extend or reconfigure artifacts to support additional members who may be present during special occasions. Personal and mobile devices should allow alternate configurations to support special familial or celebratory events such as intergenerational gatherings, birthdays, Christmas, etc. For example, researchers are exploring how to reconfigure regular surfaces like the dinner table into an interactive gaming surface [Wilson 2005]. Currently very few of the technologies people own in their homes are for use for special occasions only [Petrelli
et al. 2012; Petrelli and Light 2014]. This study also recognizes this is an opportunity for future ICT design targeted for family mealtimes.

4.6.7 Spatial Arrangements of People and Technology
Spatial arrangement and commensality has been of interest for quite some time. Fischler [2011] provided a historical account of how different spatial arrangements of people around the dining table marked hierarchy during commensal eating. Hupfeld and Rodden [2012] examined the spatial arrangement of dinner table artifacts and their implications for social interaction occurring at the table. In this chapter, I focused on technological artifacts and identified four spatial arrangements (Section 4.5.5) in the dining context: technology orienting towards people (e.g., having the best television in the kitchen), people orienting towards technology (e.g., seating arrangements at the table), hidden technologies (e.g., mobile phone in the pocket) and displaced technologies (e.g., laptops removed from the dining table before meal starts). These configurations arose from conscious choices of the family members to ensure the best possible experiences of media consumption for everyone and enjoying the meal together as a family. In doing so, I could notice how different aspects of the technology (e.g., stationary television or land-phone vs. mobility in smartphone or laptops) and people (e.g., heights of the members in family 1) influenced the spatial configuration of technology and people in the family mealtime space.

It is therefore important to recognize how particular technologies enable or constrain particular spatial configurations among family members during mealtimes. Televisions for example may demand a particular orientation of the family and may dominate other features of the dining space whereas mobile and other wireless devices (e.g., remote control) may offer greater latitude in terms of their spatial demands. In this way, technologies can have particular consequences for mealtime proxemics [Hall 1963], for socio-spatial orientations [Fogtmann et al. 2011], and how the moral order is manifested at mealtime. It opens up the opportunity to investigate how the newer technologies shifts socio-spatial relations, for example, by comparing the presence of screens in the middle of the table [O'Hara et al. 2012] vs. at the end of the table (e.g., television), or along with each dinner participant (e.g., ambient tablecloth for each diner [Wei et al. 2011] or using the mobile phone to remotely control music rather than getting up from the table, etc.). Understanding these
arrangements can provide opportunities for the design of personal devices. For example, designers can either target technologies that have a prominent place already around the dinner table, or for families to reorient their technology to allow shared access. Otherwise, apps designed for mobile phones may be hidden during a meal and only be accessible before or afterwards. DinnerTime [2014] is an example of such kind, which allows parents to control the smartphone usage of their children during different times of the day, specifically mealtime and bedtime.

4.6.8 Technology for Reminiscing and Distraction during Mealtime

These findings show how technology can support both reminiscing and distraction. Reminiscing was evident when families used technology to draw connections between past events and present media usage. For example, family 1 related an actual event of their daughter (child 1) running after their car, which was triggered by a scene from the television (Section 4.5.6.1), or when the female in family 4 found that a scene in a TV serial looked similar to a street in her neighborhood in India and shared that with her spouse. Other researchers have shown that mealtime technologies can support reminiscing during family mealtimes [O'Hara et al. 2012]. Also Grimes and Harper [2008] suggest that showing mealtime related photographs can support and evoke discussions. However, reminiscence need not be having a literal association to mealtime stimuli. Technology at mealtimes can extend reminiscence beyond the time and place of the mealtime. This study shows that mealtime conversations can be provoked and supported by technological content not related to the meal itself but can be drawn from diverse events of everyday life. While these memories (Section 4.5.6.1) provoked by the television are purely serendipitous, there is opportunity for design interventions to support reminiscence among the families through their available technologies, as I shall discuss in Chapter 6 and Chapter 7.

In this regard it might be useful to consider how technologies can support different sorts of memories [Sellen and Whittaker 2010], namely reminiscence, remembrance, recollection, retrieval, and reflection. One might aim to design to support one or more of these aspects with mealtime technologies. Also, a variety of digital items can be used to provoke and support such memories, including but not limited to photo, video, music, social media post, news headlines, etc.
Finally, it is worth noting that distraction was in itself not always at odds with the social conduct of the family mealtimes. Existing literature has explored how technology can be a distraction to encourage overeating and thus could lead to obesity [Bellisle and Dalix 2001; De Bourdeaudhuij and Van Oost 1998]. In contrast to these concerns around unhealthy eating, this study highlights how even technology responses such as distraction are not inherently and consistently problematic but rather are features that are oriented to with a view to familial concerns. Where appropriate, technology was used deliberately to distract, as I saw in the strategic efforts to encourage child satiety or maintain family harmony (Section 4.5.6.5).

4.7 Summary
This chapter has reported on the role of new technologies on familial commensality. I have taken a qualitative approach to closely examine and understand how a small number of families, who typically allow and utilize everyday technologies at mealtimes, negotiate and manage their use. I offer an analysis in terms of commensality and provide a rich picture of the family norms, interactions, limitations, and exceptions around it. I have explored current practices around the personal and shared devices and analyzed how they support familial conversation, provide relaxation, achieve satiety, and enable celebration, albeit not without occasional tension. The use of technology at family mealtime has traditionally been seen as working against the moral foundations of commensality. While aspects of these arguments remain apparent in my own observations, I also see important ways in which technologies can be meaningfully integrated into the social space of family mealtimes and thereby contribute to commensality.
Chapter 5: Designing Technology to Support Commensality

5.1 Introduction

The previous chapter showed that there are both positive and negative impacts of ICTs on familial interactions during mealtimes. The first study showed nuanced ways through which each family develops their own norms and practices to manage the existing technologies and the emerging ones. It also revealed certain scenarios in which the use of ICT actually encouraged and facilitated the interactions of and among family members, the tension of using personal devices in the shared social space of family mealtimes, and the various means through which families manage this tension. In the next study, I investigate ways to mitigate such concerns by transforming the personal devices into shared resource for the family. Based on the findings from this study I aim to develop a technology probe for examining the potential of technologies to enhance interactions during family mealtimes.

As shown in the first study and existing literature, mealtimes are cultural sites for the exchange of narrative accounts of personal and collective significance as well as past activities and future planning [Mintz and Du Bois 2002; Ochs and Shohet 2006]. For many families, mealtimes are the only time of the day when all members come together at the same place at the same time [Fischler 2011]. So their conversations and other interactions are very important to form a sense of identity and belongingness in that family [Larson et al. 2006]. Hence my main interest is not the family conversation itself, but the bonding nurtured through such means, and other practical (and sometimes intentional) opportunities [DeVault 1994; Fischler 2011; Ochs and Shohet 2006], i.e., family accountability, event planning, educating and socializing children, etc. So, I develop a technology probe TableTalk to investigate if we can facilitate interaction in the family and support these commensal features through the use of personal mobile devices and the content within. I start by asking if there is evidence of positive intention in the families to manage their mealtime interactions and technology usage, as per the Toyama [2015] framework.
5.2 Identifying the Positive Intensions in the Family about Their Current Technological Practices

As Toyama [2015] argued, the performance of any technology under consideration depends on underlying human intention and capacity. Technology amplifies human capacity in the direction of their intention; it does not (and cannot) amplify human forces that are not there. So, a technological intervention to enhance the family experience of togetherness can only work if positive intention to achieve such togetherness exists in their current practices.

The first study served as an exploration of the current practices of families related to their technology usage during mealtimes. Analyzing the data, I could identify the presence of features that Toyama [2015] ascribed as key qualities in any target social group. I sought if there is a good intention among the participating families about managing their technology usage during mealtimes. If there is a positive intention towards the issue, I can then build upon it; as technologies can be designed to magnify the good intention already there [Toyama 2015]. Fortunately, signs of the “good intentions” of the family members came out early in the analysis of study one. While each family have its own norms and practices of managing ICTs in the dining space, I could discern nuanced ways in which these norms allowed families to mitigate concerns associated with ICT usage during meals and rather facilitated familial interactions. I could identify good intentions among all the family members in numerous occasions; here are some examples:

- The adult male member in family 1 sacrificed watching his preferred TV program (news/games) to remain together with the family and watched reality shows (Section 4.5.6.4). Sometimes, he kept his preferred program running muted in another room and occasionally sneaked a look at it without causing interruption in the family interactions. Here he demonstrated the good intention through being concerned about remaining together with all the family members during mealtimes, and being careful that his preferred TV program does not interrupt the others by keeping it muted. While his slightly deviant behavior could be considered disingenuous, the fact that the rest of the family are aware of his act and takes it with a grain of humor in describing the event to the researcher again highlights the good intention from their part.
• The adult female member is family 5 identified that with TV running, her children could sit together without bickering with each other (Section 4.5.6.5). She also sits between her daughter (child 2) and her son (child 3) to cushion against any commotion. Again, it is noticeable here how she carefully considered the family concerns to come up with a practical solution that everyone finds working.

• The adult male member in family 4 knows what sorts of TV series his wife would like and suggests accordingly to watch during family mealtimes. Interesting here is that he may have already watched those programs, but would love to watch them again with the company of his family (Section 4.5.4.1). Alongside those programs (romantic, comedy, etc.) he enjoys other genre of media too (crime thrillers, fictions, etc.), but he would watch them separately. The principle purpose of this media viewing is not the media itself, but to enjoy something that they both find suitable to their taste and enjoy the company.

• Children in family 1 (study one) and their parents laughed over minutiae (apparently) unrelated incidents in the TV program or advertisement. They related these snippets to their own experiences in the family (Section 4.5.6.1). Similar incidents were there with other families, for example, family 2 discussed about clothing stores in their locality with relation to stores shown in the TV serial they were watching. These examples show that family members are not engrossed into the media, but concerns around their collective memory and togetherness are always present there.

• When the parents and the child in family 2 were watching different media (in television and tablet, respectively), it resulted in “tug of war” between the volume of competing devices (Section 4.5.6.4). Still they decided against using headphones, as they thought it would separate themselves from their child. Here a certain degree of family togetherness overtrumps the need of a perfect experience of media consumption.

• Family 1 has strict restriction on personal technology usage during mealtimes. Yet when the mother used her phone during the meal to send SMS to another guardian to organize her daughter’s travel to school for the next day, it was
understood by everyone else and not questioned. Notable here is that while using her phone, she explained the purpose briefly to everyone present there (Section 4.5.6.2). This (and other examples above) illustrates that social awareness of the personal device usage context is very important for the family.

- Family 6 generally watches television programs while eating. However, if the parents feel that their children are too much into watching television and ignoring the family conversation, they would reprimand the children and turn the television off (Section 4.5.6.4). Such scenarios are understood by everyone in the family, and everyone including the children accepts them.

I could identify a plethora of events in the observed meals where family members in their ICT usage had shown good intentions towards maintaining family harmony, facilitating interactions, and enjoying the event together. This could be seen as entirely unsurprising, since it is generally expected that families would be strongly motivated to have good intentions to each other. Each participating family has established some set of (often implicit) rules and norms to manage usage of technologies during their family mealtimes. While I acknowledge that there is a power gap among parents and children, but yet generally these rules are not imposed by force, but have gradually evolved over time and everyone understands and accepts its necessity.

This is important for my next step in this research. As Toyama [2015] has explained, a technology can only improve something, if there is some trace of its existence even without that technology. The performance of technology depends on underlying human intention and capacity. So, if there was no positive intention in the family members to make their mealtime peacefully enjoyable, probably no technology design could improve it. But as I have explained the existence of this good intention, next I ask how we can design technologies to support this positive intention and subsequently enhance the togetherness in families during their mealtimes.

5.3 Aim

The principle aim of developing TableTalk is to investigate ways through which the personal devices can contribute to support interactions among the family
members during family mealtimes. The first study hints that the overall negative attitude towards these personal devices might be overstated and there is potential to design applications of these devices that promote the togetherness found in typical commensal experience in the family home. This insight remains the core inspiration for the next study where I develop and field-deploy a technology probe TableTalk to leverage personal smart devices into a shared family resource during mealtimes for facilitating and provoking interactions between the family members. Existing studies [Blackwell et al. 2016; Hiniker et al. 2016; Moser et al. 2016] have shown that despite the tension, these devices are widely available and occasionally used during the family meals. I aim to resolve the tension around the presence and use of personal smart devices during family mealtimes by transforming them into a shared resource that contribute, rather than disrupt, family mealtimes. Also, these devices carry an unprecedented amount of user’s personal data (e.g., photos, music, social media, etc.); I aim to leverage this opportunity in order to engage the family as a whole and subsequently create new commensal experience that is not there otherwise. Hence, I develop a technology probe TableTalk to test the following hypothesis: Personal devices and contents can be used in the shared context of family mealtimes to support and enhance existing features of commensality.

5.4 TableTalk Design Process
The core design idea of TableTalk was conceived and created through a user-centered design entailing an initial online survey (phase one, study one), an in-depth observational study (phase two, study one), a pair of design workshops (study two), and field deployment (study two). As discussed in Section 4.4.1, I sought inspiration through provoking an open discussion in an online user forum by asking, “Do you use phone, television, or any other device while you eat meals?” My analysis of the responses showed the distinction in technology usage for different social groups, time settings, and the quality of the meal itself. Based on these initial understandings, I designed phase two of this study, conducting an in-depth observation (a home tour, two interviews, and two self-recorded videos of family meals) in six family homes on the existing uses of technology during mealtimes. This study highlighted that the attitudes towards technological practice at mealtime reflect the socially enacted values of commensality. It was particularly evident with the use of personal devices at the
dining table, which were generally avoided for individual and isolating activity (e.g., browsing social media, gaming, etc.). But when the same technologies were opened up for shared interest or activity (e.g., searching something to support the ongoing conversation, sending a quick text to ensure family’s wellbeing), through which various facets of the family relationship could be enacted, then their use was held less to account. This work suggested designing based on the in-situ construction of shared materials from the personal devices that people bring to the table. For example, this could be done by transforming personal devices (e.g., smartphones and tablet devices) and data (e.g., photos, music, social media posts) into shared resources that support commensality. Then it is possible to exploit our everyday dwelling with these devices and offer a design to bring them together to respond to the context of collocated interactions in shared environments. This led to the initial concept for TableTalk - to transform personal devices into shared resources by combining displays whose content and access is negotiated amongst the family (Figure 5.1). TableTalk exploits our everyday dwelling with these devices and offers a way to bring them together in the context of collocated interaction in shared environments.

With this goal in mind, I conducted two design workshops of about one hour each to generate ideas for various aspects of design of the TableTalk system. Eight
researchers joined each workshop, composed of research students, postdoctoral researchers, and faculty members. Since everyday mealtimes occurs in most (if not all) families, I believe each of the participants in the design workshops are potential end users. While I did not recruit them in the later studies due to potential bias introduced by the people who already know about the research, but that does not limit the activities of the design workshops. The workshops were video recorded and notes were taken about different ideas generated. In these workshops, we considered various design options to achieve the goal, which I describe next. I developed a prototype of TableTalk and refined it through pilot studies - both in lab settings and family homes, before deploying for the field study to evaluate its design and objectives (Chapter 6).

5.5 Design Choices
The TableTalk system was developed as a technology probe [Hutchinson et al. 2003] to investigate certain aspect of commensality at the family mealtimes. Technology probes are generally inexpensive and quickly developed prototypes to test the potential of some experimental technologies and hypothesis. TableTalk served as a high-fidelity prototype that was quickly developed using already available iOS devices and existing APIs. The objective here was not focused on refining the user interface of functionalities of the system but to investigate the design concept that personal technologies can be used as a tool to support commensal features during the family mealtimes – making it a technology probe than a fully-fledged design intervention. Throughout the process, I required to make several design decisions. In this section, I briefly outline the design objective, choices, and the decisions made. Then in the next chapter, I discuss how different aspects of the system impacted commensal experience in the family home.

5.5.1 Different Types of Content
An objective of the TableTalk system is to probe how different kinds of media impact the commensal experience. Media usage during the family mealtimes mainly focused on the Television, and more recently some experimental usage of photos. I considered several types of digital contents based on the understandings from the first study and existing literature - photos, different types of social media posts, music, calendar, local and national news websites, etc. being the most prominent of them. I explain the
rationale of my choice here and how different types of media provoked interest and interaction among the family members in this section and the next chapter.

**Sharing Photos:** Usage of photos as a conversational element amongst family and friend groups has been of interest for some time now, generally to stimulate conversation [Van House 2009] and more recently in the mealtime context [Bhömer et al. 2010; O'Hara et al. 2012]. In designing *TableTalk*, I leveraged the ubiquitous presence of personal smart devices and the entire photo library within rather than using a custom hardware.

**Sharing Music:** Music is often used for creating an ambience in the background of family mealtimes (Section 4.5.3.3). Study one revealed certain circumstances where families resort to music as a shared background medium, especially when there are guests in the home. Many people also store and listen to music through their smartphones, thus giving me the opportunity to include this as a resource.

**Sharing Personal Social Media Posts:** The use of smartphones to access and share social media posts in family-like groups can be interesting. During the workshop, I discussed with the participants about a variety of social network sites, and found Facebook and Twitter to be most commonly used by both generations - parents and children. Twitter posts are limited to 140 characters only (at the time of the study), making it suitable for reading during the mealtimes.

**Sharing News:** The first study (Chapter 4) also revealed that family members discuss recent events, for example, interesting news in their locality, events with their friends, etc. during family mealtimes. Sometimes parents raise these topics intentionally to educate their children (e.g., on safety issues or current affairs). The parents described the importance of such discussions to make the family meals both instructive as well as enjoyable. After considering different news sources, I enabled the use of tweets to support such discussion as many popular news agencies now have a Twitter presence and regularly tweet recent stories and breaking events. Further, many of them can be customized based on locality and included photos or links for details. The field study revealed that external tweets (from news channel and celebrity accounts) could engage the family as a whole and provoked much conversation.
Sharing Other Media: I considered other forms of media as well. Specially, as mealtimes are also a popular site for family coordination and planning, I considered including calendars of the family members in the TableTalk system. However, I learnt from study one that children often do not keep such calendar entries in the smartphone, and most of the event entries by the adult members were found to be work related. Only one of the participating families in that study (family 3) maintained a detailed and shared family calendar to co-ordinate among the members. Nevertheless, all families reported discussing and planning events while they had their family dinner. During the workshop, we also considered incorporating videos, but decided against it, as the first study indicated that video playback may require more attention on the screen than from each other or the meal.

5.5.2 Control Dynamics

First, I required to decide how to enable the family members control the TableTalk system. I found inspiration from existing literature about collocated photo sharing in social groups. One notable aspect here is the asymmetrical nature of interactional control among the group members. This control concerns the ownership of the content or the device [Lindley et al. 2009], and the conversational asymmetry arising in this context [Van House 2009].

There are three different approaches to these control dynamics. The first approach is distributed content, where digital material is pushed to the personal devices of all participants so that everyone views the content independently on their own device, as illustrated by Ah Kun and Marsden [2007]. This approach allows simultaneous viewing, but does not support point-and-tell interactions (since all individuals have separate devices) and takes attention away from a common focus and shared interaction (in this case, the mealtime experience).

A second approach involves using a shared resource, for example, a projector or a television screen to display content from all family members, thus utilizing the large screen real estate and an already available familiar technology. But not all families might have these available in the area where they eat, and this approach is often criticized for taking attention away from the shared interaction space (i.e., dining table) and from each other. One creative response is the 4Photos table centerpiece prototype by [Bhömer et al. 2010; O'Hara et al. 2012]. The prototype consists of a
custom-designed 4-faced photo display to fetch and show photos from the Facebook collections of the diners and supports equal control of the system to all diners around the table. The images gradually rotated across all four sides for equal viewing opportunities and a spinner at the top of the device allowed users to bring the next random item for display. But custom hardware requires extra effort to procure or manage and makes ad-hoc deployment very difficult.

The third approach is illustrated by Nielsen et al. [2014], who brought together **personal devices to create a shared display** for all users to see. Instead of introducing additional, custom-built technology as in 4Photos [O'Hara et al. 2012], a centerpiece can be created by bringing personal devices (phones and tablets) to the table and by connecting them through “pinching” (Figure 5.2) to a shared display [Ohta and Tanaka 2012]. Nielsen et al. [2014] used this approach to share photos in a lab setting without any particular usage context in mind. I extend this concept by introducing multiple digital formats and by taking it to the family dining room.

So, while deciding which configuration of devices best suit the goal of facilitating interaction among the family members during mealtimes, I considered all three options - using the already available common screens (e.g., television in the family kitchen), developing custom hardware (e.g., 4Photos system [O'Hara et al. 2012]), and creating ad-hoc display with personal smart devices. Personal and mobile devices have screens and are more portable than televisions. These devices (e.g., smartphones, tablets, etc.) already store user’s personal data (e.g., calendar, photos, music, social media, etc.) in a never-seen-before scale, and I wanted to use the opportunity to

![Figure 5.2: Adjacent device of different sizes can be joined using a pairwise pinch gesture (not drawn to scale).](image-url)
facilitate interaction among the family members and engage the whole family. As I shall discuss in the next chapter, by contributing these devices for shared usage, family members alleviated the tension around the use of personal devices (for personal purposes) in the shared space of family mealtimes.

5.5.3 Combined Screen vs. Individual Screen

The next design issue involved deciding on the how to organize the display of the shared content. During the workshops, we considered two options – using individual screens of the participants’ smart devices in such a way that each screen shares the same contents. But then each of them might get tied with the screen, thus obstructing the expected social interaction at the dining table. Combined Screen on the other hand could provide a larger screen space, so could be usable from a greater distance. Also, by taking the device from individual’s own possession and placing it in the shared table space, there is a sense of transformation of ownership to the group. The act of taking the device from the personal space (for example, pocket) and placing it in the table itself has a significance of giving away or contributing to the common self. It conforms to the notion of commensality – the shared experience becomes common for both eating together and using technology together, and highlights the togetherness in both dimensions.

5.5.4 Rotation of Screens to Allow Viewing from All Sides

The next design decision involved the ways to enable equal access in viewing and controlling the system to all members present during the meal. Commensal experience in the family is democratized nowadays, with generally no emphasis put on the sitting order except for pragmatic concerns (Section 4.5.5). I aimed to incorporate the same with TableTalk. Large screens like TV could provide equal access of the media to everyone, or custom hardware like 4Photos did the same through rotation of contents across all screens. The previous decision of using already available personal devices then left me with a design challenge – the orientation of the devices itself. Because, often family members sit across different sides of the dining table (Figure 4.1 – Figure 4.6, for example). How all the family members would experience the contents from different sides, especially reading textual contents (e.g., tweets) then became a challenge.
One possible solution was to rotate the screen contents automatically, for example 360-degree rotation in 4 steps of 90-degrees each to cover all sides of the table, but from the previous study, I noted that family members seating is not always symmetrical around the table. Another option was to prepare a custom enclosure to provide vertical support (same as 4Photos). But this goes against the ad-hoc nature of device usage and will also require different design for different families. Also, unlike O'Hara et al. [2012], the TableTalk system may have devices of different sizes, thus a custom enclosure was deemed as not practical.

Finally, I took a design decision to use a commonly found dinner table artifact named Lazy Susan, which is basically a rotating tray made of cheap materials like wood or plastic and a very simple assembly. Many families already have this, and it is also a cheap (13 AUD at Ikea) off-the-shelf available hardware. It also added the benefit of separating the electronic devices from the food items, providing some protection against food spilling on to the devices. I required to adjust for acceleration caused by the rotation of Lazy Susan and tuned the parameters by trial and error method to find a suitable, practical value that at one hand does not cause accidental disconnection of the device and also does not pose a challenge to intentional disconnection.

5.5.5 Amount and Distribution of Content to Share

I required to make some practical decisions about the amount and distribution of content from each participant. This required a balance between the time spent by each user at the moderation phase before the meals (to alleviate various ethical concerns as discussed in Section 6.5.1.4) and avoiding repetition of the shared content arising during mealtimes. Notable here is that existing literature recognized that there is no defined start and end time of family mealtimes [Cook and Dunifon 2012]. Phase two of study one indicated that family mealtimes are about 20-40 minutes of length, hence I assumed an approximate duration of 30 minutes. So, in playing each item for 30 seconds, I tried to choose 60 items of content from all members of the family. While some of these contents might be excluded during the moderation phase, I did not include any replacement, so as to reduce the workload on the participants.

While distributing the total number of contents to different media types, I decided to limit the number of music tracks. So, if participants chose to share music, one track was selected from the last week's playlist and another from the
rest of the collection. The remaining content was divided in half between photos and tweets, if both were enabled. Among the tweets, half of them were from a personal Twitter account, and the remaining half from external sources chosen by the participant. I fetched the last 50 tweets from each source and then chose randomly from those.

5.5.6 Moderation of Contents and Ethical Concerns
There were different ethical concerns about sharing contents through TableTalk. First of all, there might be content that the participants want to share within the family, but not the researchers. I asked to participants remove any such content. I was also concerned about news items that may contain violent or mature contents. To alleviate such concerns, I decided to disable sharing from news sources in the children’s version of the phone. I also reminded the families before data collection from the app that they can opt to remove any particular content from the system or delete the full dataset from the app – so I never get access to their shared contents. Though I did not face any such request, I shall discuss how families moderated the shared contents and different concerns of the family members in the next chapter.

5.5.7 Minimum vs. Maximum Bounding Rectangles for Display
When aggregating displays of different size, one pivotal challenge is deciding the resulting screen size. Two common approaches are minimum bounding rectangle and maximum bounded rectangle. Nielsen et al. [2014] followed the former while Ohta and Tanaka [2012] followed the later. It appeared from the development of TableTalk and pilot deployment that the second approach works better with images - giving a larger view of the images while possibly excluding some parts of it along the image boundary. This is because often the core and significant attractions of the images reside near the middle of the image, not the boundary. On the other hand, while displaying text, I find this approach unsuitable as any missing text can make the whole content meaningless. Hence, I recommended using the minimum bounding rectangle for displaying text in the combined display.

5.5.8 Interruption in Devices during Mealtimes
I did not want to force the families to exclude all other mobile phone functions for TableTalk usage, nor it was practical. Study one showed that though the family members generally refrain from using their personal devices during mealtimes, they
are fine to keep it nearby or take an incoming call or message. So, when such events happen, the TableTalk system would pause and allow the user to pick up a phone. Afterwards, s/he can open the app again and pinch to connect it with others, and then swipe right to resume the slide-show. One related design decision was whether to allow the system to continue with the remaining displays if one device is taken away mid-meal. I decided against it to keep solidarity with the concept of shared meal and previous perception that if a technology is used during mealtimes, it is for a shared cause. So, if one device is taken away (e.g., to receive a call or use any other app), the TableTalk app would pause in all the remaining devices. When the user finishes using the device, s/he can open the TableTalk app, put with the other devices, and pinch the screens to join it with other devices and resume the app.

5.5.9 Interaction with TableTalk and Chorus during Mealtimes

My observations of family mealtimes in study one indicated that while families use technologies (TV, video streaming in laptop, etc.), they set it up before the meal and do not change the settings often. So, I assumed that people will set up the TableTalk system before the meal begins and aimed to allow very simplistic and minimal kind of interaction with the system while the meal progresses. I designed the system like a slideshow to bring up new contents after an interval. However, the participants might still want to interact with the system – for example, go back to see the previous item, pause the system to discuss something that they find interesting in the current content, or skip an item to avoid conflict or embarrassment, etc. I considered different hands-free and gestural interactions and implemented voice control to interact with it using simple voice commands. To afford easier interaction with the TableTalk system, I implemented voice-based control using simple commands - “play”, “next”, “previous”, “pause”, and “resume”, preceded by the keyword “Susan” to avoid accidental triggering by using these words in regular conversation. However, the pilot testing showed that (even infrequent) false positives can cause negative experience among the users and finally I scrapped the voice command system to develop a simple touch-gesture based control system.

In the next section, I briefly present the TableTalk system that was deployed for a field study. I shall present and discuss the usage experience of TableTalk in Chapter 6.
Figure 5.3: Participants open up the app and choose content sources.

Figure 5.4 Participants moderate the contents before sharing.

Figure 5.5: Devices are placed together and pinched to join screens.

Figure 5.6: Families can rotate the Lazy Susan to have a better look.
5.6 The TableTalk System

Family members open the TableTalk app on their personal device before the meal begins, and make their choice of data sources for sharing, e.g., photographs, tweets, music, etc. (Figure 5.3). From each device, the TableTalk app randomly chooses 20-30 different items from their approved list of data sources, prioritizing more recent items. Participants then check or review each item to confirm that it is suitable for sharing (Figure 5.4). Those who prefer not to share any content are still able to participate - first for creating the sense of contribution through giving their device for the common cause and being physically present at the table, and second, for increasing the total display space. Family members place their individual devices on a Lazy Susan (or rotating tray) on the dining table so that they are touching each other (Figure 5.2). This act symbolizes a willingness to be part of the commensal experience and to engage in conversation.

When family members place their personal device on the dinner table, the devices calculate their relative position using the pinch gestures [Ohta and Tanaka 2012]. It enables the devices to calculate which portion of the image or tweet they would show in their own screens – and thus form a large single display (Figure 5.5). Items from the individual devices are randomly presented on this enlarged single display. Photos and tweets are displayed for 30 seconds, while music is played for 30 seconds and then faded out; unless family members interacted with the system to change it. The duration was carefully chosen after some trials and pilot studies to give family members enough time for focusing on a content or the system can automatically load the next content when no one is particularly interested about the current one. 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 on inappropriate, or swiping right allows families to return to an earlier item for reference. The rotating Lazy Susan facilitates easy viewing from any seating position around the table (Figure 5.6).

TableTalk utilizes iOS’s Bonjour zero-configuration network protocol [SDK 2016] using available Bluetooth or Wi-Fi networking. I used the Pinch framework [Ohta and
Tanaka 2012] to join displays of multiple devices and extended it to support tweets and music too.

5.7 Summary
In this chapter, I introduced the core concept behind the design of a technology probe *TableTalk*. I described the design process and then discussed various design issues that I required to decide while developing the system along, their alternatives, and the rationale behind my choice. Based on this design concept, next I discuss the findings from field deployment of this technology probe.
Chapter 6: *TableTalk* and Commensality (Study 2)

### 6.1 Introduction

Study one (Chapter 4) clearly showed that while technologies, especially television and personal devices are often criticized for disrupting the social aspects of mealtimes, they are widely available and commonly used nevertheless. In this chapter, I explore this tension and present a novel system *TableTalk*, which transforms personal devices into a communal shared display on the table to enrich mealtime interactions and experience. I report on various design aspects of *TableTalk* and the findings of a field deployment study with nine families. The findings show that *TableTalk* does not undermine togetherness, but supports familial expectations and experiences by engaging everyone in the family through stimulating conversation, reminiscing, bonding, education, and socializing. I discuss how technology that is sensitive to the needs of family interactions can augment the commensal experience and reflect on design choices and opportunities that contribute, rather than disrupt, family mealtimes.

### 6.2 Background

In this thesis I explore the relationship between technology and everyday *commensality*, typically defined as “the practice of sharing food and eating together in a social group such as a family” [Ochs and Shohet 2006] (p. 37). While HCI has begun to attend to the act of eating together, commensality also alludes to the shared dependency, accountability, storytelling, everyday planning, socializing children, reciprocal commitment, and other social, political, material, and cultural aspects [Fischler 2011]. In this chapter, I extend recent research about commensality by exploring the potential scope for digital interventions in its social and material configuration opened up through the ubiquitous presence of smart devices and the data within. I am concerned both with how understandings of commensality inform the design of new technologies and further, how such technologies might reconfigure the practices of shared mealtimes.
To this end, I present and evaluate a system called TableTalk, an application that integrates the personal devices (such as smartphones and tablets) of mealtime guests into a singular and shared display (Figure 5.1). The aim here is to enable the sharing of personal content (e.g., photos, music, social media posts, etc.) in the collaborative construction of the mealtime experience. TableTalk both embodies elements of commensality in its design (e.g., conversation, accountability, etc.), and also intends to support commensal experiences through its design (e.g., togetherness, shared reminiscence, etc.). Noteworthy towards this goal, I do not expect that TableTalk will be incorporated seamlessly for every meal or for all families (as individual families have different levels of acceptance of technology, power dynamics, etc.), but I hope that this work might lead to a more balanced exploration of technology usage during family mealtimes.

Further to presenting the system in this chapter, I aim to understand how different design aspects impacted commensal experience and the evolving behaviors around this device ecology by contributing an empirical investigation of TableTalk in practice. From this field deployment study, I derive practical insights regarding how digital technology can be designed as a part of commensal experience to support and configure shared space, data, narratives, and subsequently interactions. Specifically, I consider the practical implications of the design on commensality in the (1) physical setup of the system and concerns around shared contents, (2) different types of interaction around the TableTalk system, and (3) different commensal activities supported through these interactions. Finally, I discuss how TableTalk served as a technology to amplify the good intention among the family members during their commensal experience.

6.3 Aim

The principle aim of this study was investigating the second set of research sub-questions of this thesis (Section 2.7.3) - How personal devices can be transformed into a shared resource to support interactions and enhance the shared experience of eating together? What is the impact of the developed technology on various aspects of commensality in the family home? I developed the TableTalk app in response to this, and through its field deployment, I tested the following hypothesis: Personal devices and contents can be used in the shared context of family mealtimes
to support and enhance existing features of commensality. I investigated how *TableTalk* supports various commensal features through using personal devices in a shared way. I evaluated the design in real-life settings of the participating families and analyzed their response to various design features of the system (e.g., visibility and easy access to everyone, physical presence of the system among the food items and dishes, etc.). Finally, I investigated how different types of content provoke or support interactions among the family members.

### 6.4 Field Deployment

I conducted a field study to examine the ways through which *TableTalk* influences social interactions during family mealtimes. I was particularly interested in the influence of the following aspects: (1) configuring the personal devices for shared physical and social space, (2) familial interactions with and around *TableTalk*, and (3) influence on different aspects of commensality. I used a qualitative approach based on interviews, observations of interactions with *TableTalk* during household family mealtimes, and collected app data.

#### 6.4.1 Participants

I deployed the prototype with nine families. The families were recruited through university mailing lists, notice boards, my 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 (with/out children).
As summarized in Table 6.1, similar to study one, I recruited families from different socio-economic backgrounds, with and without children, aiming for diversity in terms of family dynamics and experiences rather than generalizability.

Table 6.1: Description of participants, list of the devices and data sources used by them during the study two.¹

<table>
<thead>
<tr>
<th>Family</th>
<th>Family Members</th>
<th>Devices Used</th>
<th>Data Sources and Number of Items Shared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family 1</td>
<td>Female (student), Male (part-time job), Child (1 yo)</td>
<td>iPhone 6, iPhone 5*</td>
<td>Photos (28), External Tweet (17), Music (2)</td>
</tr>
<tr>
<td>Family 2</td>
<td>Female (student), Male (student)</td>
<td>iPhone 5*, iPad Mini 2*</td>
<td>Photos (50), External Tweet (20)</td>
</tr>
<tr>
<td>Family 3</td>
<td>Female (student), Male (professional), Child 1 (12 yo) Child 2 (17 yo)</td>
<td>iPhone 5S, iPad Mini 2, iPad 2</td>
<td>Photo (53), Music (4), External Tweet (9), Personal Tweet (4)</td>
</tr>
<tr>
<td>Family 4</td>
<td>Male (student), Female (home duties)</td>
<td>iPhone 5S, iPhone 5*</td>
<td>Photo (66), Music (2), External Tweet (14)</td>
</tr>
<tr>
<td>Family 5</td>
<td>Female (academic), Male (academic), Child 1 (12, yo) Child 2 (16 yo) Child 3 (18 yo, non-participant)</td>
<td>iPhone 5, iPhone 6 plus, iPad Mini, iPhone 5, iPhone 5</td>
<td>Photo (56), Music (5)</td>
</tr>
<tr>
<td>Family 6</td>
<td>Male (full-time job) Female (full-time job), Child 1 (14 yo) Child 2 (16 yo)</td>
<td>iPhone 6S, iPhone 4S, iPhone 5</td>
<td>Photos (44), External Tweet (3), Personal Tweet (4), Music (2)</td>
</tr>
<tr>
<td>Family 7</td>
<td>Male (part-time job), Female (full-time job)</td>
<td>iPhone 6 plus, iPad mini 2*</td>
<td>Photos (44), Music (8)</td>
</tr>
<tr>
<td>Family 8</td>
<td>Male (full-time job) Female (full-time job)</td>
<td>iPhone 6, iPad Air 2</td>
<td>Photos (34), External Tweet (24), Music (8)</td>
</tr>
<tr>
<td>Family 9</td>
<td>Male (full-time job), Female (academic), Child 1 (10 yo), Child 2 (14 yo), Child 3 (16 yo)</td>
<td>iPhone 6S, iPhone 6, iPhone 4, iPad mini, iPad mini 2</td>
<td>Photos (70), Music (10)</td>
</tr>
</tbody>
</table>

¹ ** Denotes devices given to the participants (existing data from their own device was migrated to the given device).
6.4.2 Study Protocol

I 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 *TableTalk* app in their own personal iOS device. Otherwise, I offered them iOS devices to use during the study period and assisted them to migrate their data from their smartphone. The aim of this first visit was to introduce the technology and collect background information about the family. In particular, I discussed 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. I gave each family one video camera to self-record two of their family mealtimes - one during a weekday and one at weekends. I tried to minimize video observation induced bias by asking the participants to place the camera so that it could obtain a complete view of the table and surroundings. The video recordings of the family mealtimes were about 30 to 45 minutes long. Unprompted, most of the families recorded their evening meals, citing it as the most common (or only) meal they all have together.

After one week, I collected the video recordings and log data of user interactions using the app and the shared content. I analyzed the first interview along with video and app data, and returned to the family to conduct a second interview. I used this data to generate discussion and focused on any specific episodes that related to their commensal experience. Both the interviews were about 45-60 minutes long. Each family received a $30 iTunes gift voucher as an acknowledgement of their contribution.

<table>
<thead>
<tr>
<th>Timeline</th>
<th>Task Performed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Interview one, home tour, install and demonstrate <em>TableTalk</em> app on mobile devices, instruct and drop off video recording equipment</td>
</tr>
<tr>
<td>Week 2</td>
<td>Families use the <em>TableTalk</em> app and video record their mealtimes – one weekday and one weekend</td>
</tr>
<tr>
<td>Week 3</td>
<td>Collect video and app data, analyze all data</td>
</tr>
<tr>
<td>Week 4</td>
<td>Interview two</td>
</tr>
</tbody>
</table>

Table 6.2: Timeline and sequence of study activities (study two).
6.4.3 Data Analysis
I used an inductive, qualitative analysis approach to the data [Miles and Huberman 1994]. In particular, I focused on who used TableTalk, how it was used, and how it might support different aspects of commensality. Further I was interested in any relationship between individual interaction and the group dynamic, for example, whether parents facilitated turn-taking, whether they encouraged children to speak, etc. I also noted the spatial arrangements of the devices and other artifacts on the table during these meals. I analyzed the interview transcripts, video recordings, and app data to add detailed notes of all interactions with TableTalk and among the family members. These notes were refined through discussions between me and my supervisors. This analysis was done iteratively to identify common themes across families as well as unique family practices.

6.5 Findings
In this section, I focus on evaluating the specific design objectives of the TableTalk system, related design decision, and field study observations of how that aspect impacted commensal experience in the family home. I start by discussing how families set up the TableTalk system and its contents to create a shared space that fostered interaction. Then I discuss how TableTalk provided input to conversations and how these conversations contributed to commensal activities like family bonding and socializing children.

6.5.1 Setting Up the Physical Space and the Social Space
One of the objectives of TableTalk system was to emphasize shared experience and togetherness through using participants’ already available smartphones or tablet devices and the contents within. Commensality is considered to have its most salient expression in the common everyday nature of it [Fischler 2011], hence it was deemed appropriate to use participants’ already available smartphones and tablet devices instead of using any custom hardware. To the best of my knowledge, collaborative and social use of personal smart-devices during mealtimes has not been investigated before, so I was concerned about how such an arrangement might work in practice. TableTalk required work before the mealtime in order to set up phones and tablets on the dinner table and to moderate contents pre-selected by the system, however, this was not so onerous that participants found it to be time-consuming. As I discuss
below, families engaged in these tasks to set up a space that fostered interaction between family members, including those that did not have a personal device to share.

6.5.1.1 Physical Arrangement of Devices during Mealtimes
An initial concern was the physical setup of TableTalk at the dinner table, i.e., how families would place their phones and tablets to ensure they are accessible and readable, and how these devices would blend in with other artifacts on the dining table. Overall, I found that the system sat comfortably among other mealtime artifacts in the dining table. Participants generally placed the system in the center of the table and reported that it did not interfere with their regular mealtime artifacts, e.g., plates, glasses, etc. From this arrangement, I could note that the TableTalk system was allocated a privileged place on the table. Combining the screens of multiple devices provided them with a larger screen space and I observed that the system was within view and arm’s reach of all members, allowing them to interact with its contents. Sometimes, families had to wait (1-2 minutes maximum) for the all the devices to sync and to begin the display, but family members generally used this time to banter around what might have been shared by others and started their meal.

As discussed in Section 5.5.4, another concern with TableTalk was the orientation of the devices, especially for reading tweets. I aimed to ensure equal access to all the family members sitting across different sides of the table (Figure 4.1, for example). I decided to use a Lazy Susan, which is basically a rotating tray (Figure 5.6). Many families already have this, and it also adds the benefit of providing some protection against food spilling on to the devices. I found that families with only 2 or 3 members (family 1, 2, 4, 7, and 8) did not use the rotating tray because the family members could sit close to each other and see the TableTalk data without rotating it. On the other hand, larger families with 4 or more members relied on the rotating tray to re-orient the devices to read tweets and view photos. At the start of the meal they oriented the devices to face the majority of family members, and then occasionally rotated the tray to read and interact with TableTalk.

6.5.1.2 User Interaction with TableTalk during Mealtime
Despite the initial concerns that the touch-based controls might be unsuitable for family mealtime settings, it was later found to work surprisingly well. This is because in the family mealtime space, dining tables are not very large and all the family
members were within arm’s reach of the system. I also found that family members rarely interacted with the system to pause or go back, but used it to swipe through the remaining contents at the final stage of the meal or when they stayed at the table afterwards. Another unexpected finding was that while discussing specific content, people generally did not refer or point back to it, but kept the discussion flowing naturally. Only when they felt it necessary to point at something, or required explicit information, did they look at the content. The eye-contact remained mostly between the family members and not on the TableTalk system.

6.5.1.3 Collective Significance in Technology Usage
The decision to use personal devices for TableTalk system caused some setbacks too. While I aimed to include personal devices of all family members, it was not always possible to incorporate every person’s device due to incompatibility issues (family 3, 6), technical issues with older devices (family 3, 6, 7), absence of family members (family 5), or simply unwillingness to use a smartphone (family 3). However, I found that family members overlapped in their device usage and often collaborated or complemented each other in sharing devices and personal contents. For example, tablets were often shared and thus contained data from multiple family members (family 2, 3, 5, and 9). Even devices that were used exclusively by one user contained photos as well as music of other members. Hence no family member was excluded from the content shared via TableTalk. This in effect demonstrates the multiplexed nature of data among family members and distinguishes family as a social group.

I noticed this complementary and collaborative engagement with TableTalk content also in the dinnertime conversations. As one might expect, many of the photos represented events that involved multiple family members. So, when one family member had forgotten something about the event, the others could remind him/her and made the story more complete and rich. For example, the following excerpt shows how family 5 collaboratively reconstructed the details of a family holiday:

Female: “Where is this? I think it was in [place] last year. Is that possible?”

Male: [rotates the Lazy Susan] “Yeah, I think so.”

Child 2: “It was when me, you, [name of two children] went out for lunch.”
[rotates the Lazy Susan back]
Child 1: “And we went surfing.”

Female: “hmm... Oh, speaking of which ...” (continues)

Such collectiveness is also visible in the physicality of sharing devices as well. The act of taking the device from an individual’s own possession (e.g., from pocket) and placing it in the shared table space, has a sense of transformation of (temporary) ownership to the group and has a significance of giving away or contributing to the common self. It conforms to the notion of commensality - the shared experience becomes common for both eating together and using technology together - thus highlighting the togetherness on both dimensions. This was evident in family 3, for example. The adult female member in family 3 generally discusses about their plans for the next week and uses her phone calendar during mealtimes on regular days. But while using TableTalk, she tried to recall from memory, though she could have used her phone (TableTalk would pause and resume later). It was evident in other families too, that no one used their phone for personal use during their meal, though they mentioned that they might otherwise do so. This indicates a commitment to both the research and the shared usage of technologies during commensal experience.

6.5.1.4 Moderation of Content and Ethical Concerns

Another concern was how families would curate contents for the TableTalk system to support interactions around the dinner table, i.e., what contents they would share and what content they would remove while doing the moderation. To minimize the efforts of participants in setting up, TableTalk would chose content from the approved sources and then allow the participants to remove items that they do not feel comfortable sharing with the family members or the researchers. For most of the study, this worked well. I expected that participants would carefully moderate personal content before sharing. But the study revealed that content moderation was only critical for families with children that actively engaged with TableTalk. Families without children sometimes did not moderate the content (family 2, 7), or they left the moderation to one member of the family (family 1 and 2 during one meal). However, during family meals with children, both the parents and the children usually moderated carefully to share content that would be appropriate for the meal.

Adults were mainly concerned about what content would generate interest among the rest of the family. They removed contents that were considered irrelevant for the rest
of the family - snapshots of their daily chores, for example, photos of class-notes, shopping lists, etc. They also removed content that they personally found interesting but that they thought others would not find engaging. Parents also carefully considered the balance of the content they shared, and were concerned that children might feel left out or less represented if there was no content about them. The adult female member in family 5 illustrated this:

“I tried to get a balance because a lot of my photos were gymnastics and I thought it is important to represent all of the children fairly, so I tried to make sure I just have one of [youngest child’s] gymnastics, then one of something that [middle child] and [father] have been - Tennis, and one of that [oldest child] have been in, because it’s not fair if I have like 10 of gymnastics and nothing for the other kids.”

Although children could share as much personal data as adults, teenage children sometimes were more restrictive in what they shared than adults to protect their privacy. For example, the son (child 2) in family 5 only shared one photo in each meal. Their parents commented that this was similar to how much their child shared daily life experiences in general.


Female: “He is secretive. He is a teenager. [laugh]”

Interviewer: “Do you share photos with your friends?”

Child 2: “Yeah [everyone laughs].”

On the contrary, children in Family 6 carefully constructed their shared content, while children in family 9 did not moderate at all. TableTalk, therefore, supported individuals’ decision-making regarding how much, as well as which data they chose to share with the family group.

Another ethical concern was that news items might contain violent or mature content. To alleviate this, external tweets were disabled in the app version loaded in the children’s devices. Though I have not experienced significant challenges regarding this in the course of this study, I paid special attention to how the families would manage if there were conflicts arising from TableTalk usage, especially among the
children. I noted some minor incidents (family 3, 5) where the adults interrupted promptly and resolved the issue (discussed later in Section 6.5.3.4).

6.5.1.5 Choice of Media for Sharing
Another objective of the TableTalk system was to probe how different kinds of media impact the commensal experience. As summarized in Table 6.1, most often the participants shared photos and tweets from external sources with the expectation that these would engage the family as a whole.

**Sharing Photos:** In the field study, I found photos to be the most useful content to successfully generate interest in all the families. Participants often captured interesting and spontaneous moments of the day in their smartphone and shared them with others during family mealtime. Older photos also provoked shared reminiscence among the family, particularly if some member forgot about the event or was missing there, as I discuss later.

**Sharing Music:** During the field study with TableTalk, I found that selecting appropriate music content was particularly difficult, as taste in music differed between partners and between parents and children. Hence when the adult male member in family 5 chose some of his favorite music to share with the family, the other family members teased him about this, and he had to account for his choice and his taste in music. Some families enjoyed listening to the music together (family 7 and 9) while in some other families (family 1, 3, 4, and 6), it provoked friendly banter, but no one showed complete interest in listening to the music and instead continued to converse.

**Sharing Personal Social Media Posts:** During the field study, I found that personal tweets were shared rarely, either because family members did not tweet frequently (family 1, 2, 4, 7, and 9), or they followed each other’s social network and already saw their posts (family 3, 5, and 8). As one special case with family 3, the adult male member does not use a smartphone; hence the adult female member used his twitter account while configuring TableTalk in her phone so as not to exclude him from contributing.

**Sharing News:** The participants often shared news tweets from external sources, popular topics included recent movies, local events, safety and security, etc.
Sometimes, one person read it aloud, and then others responded to it. Occasionally, someone will rotate the Lazy Susan to have a better look and read the tweet.

6.5.1.6 Amount and Distribution of Content to Share
I required to make some decisions about the amount and distribution of content from each participant’s device (Section 5.5.5). I observed implications of these decisions for commensality during the field study. Firstly, none of the family members left the table after finishing the meal, but stayed at the table to scroll through all the remaining content. The families explained such behavior in terms of their interest in watching what other members have shared with them. While the phase two (study one) demonstrated that family members sometimes stay after the meal to discuss different affairs that interests the family, here technology has played a role in lengthening the duration of family togetherness. Second, TableTalk generated photos and music that provoked distant memories for shared reminiscence, which the participants recognize as uncommon and very much different from their regular mealtime experience. Another impact of randomly displaying content was that some family members had to wait patiently so that a particular item shared by them was displayed. This design on one hand reflected the socialization process of commensality, but also sometimes resulted in frustration among the children and anticipation among other members of the family about what that item might be.

6.5.1.7 Duration of Content Play and Conversation
While deciding about the length of the display time for each item before bringing up the next, I considered keeping it as long as the families were talking (about anything) and change it after detecting a period of silence. However, then families could be talking about unrelated things (with or without reference to TableTalk) and may welcome a change to provoke a new discussion topic. So, I decided on a fixed interval and considered several factors for its duration. First, the time should not be so small as to change the content too much and thus draw too much attention. On the other hand, family members should be allowed time to talk about the topic while not wasting too much time on one item and missing the rest. After pilot testing, I set the display time at 30 seconds.

What was interesting in many occurrences during deployment was that the conversation progressed naturally and was not bound in any way by the technology
itself. Often the discussion was initiated with the content of the device (e.g., photo or tweet), but then it evolved into the personal experience and other aspects of the family life. In almost every occurrence, participants looked at the devices for only a few seconds and started a conversation, which then moved onto related topics and participants did not pay attention to the next data displayed after 30 seconds. They did not bother to use the pause feature of the TableTalk system while talking. In that way, some content received little or no attention.

6.5.1.8 Interruption in TableTalk Usage
One related design decision was whether to allow the system to continue with the remaining devices if one device is taken away mid-meal. I decided against this, to keep solidarity with the concept of commensal experience and with the previous findings that if technology is used during mealtimes, it is for a shared cause. During the field study, I did not experience any such occurrence though. Only the mother in family 3 reported that once she wanted to take her phone from the table to see the family calendar, but then she refrained from doing so, as other members were still engaged with the TableTalk system.

6.5.2 TableTalk and the Family Mealtime Interactions
TableTalk often provoked conversation between the family members, but more importantly, it provided content largely without interrupting ongoing interactions.

6.5.2.1 Provoking Conversation
Unsurprisingly, contents from the TableTalk system provoked interest and conversation among the family members. Family members discussed the photos and tweets, and enjoyed or expressed disapproval of the music choice of others. For example, here is an excerpt from family 3 that illustrates how a simple photo (Figure 6.2: A simple photo like this one could provoke interesting conversation and reminiscence in the family.):
6.2) of an empty railway station engaged the whole family and how they related the station’s name (Hartford) with a dialog from a play (Pygmalion by Bernard Shaw, plot of the movie My Fair Lady) they have all read years before:

Female and Child 2 together: [looking at screens] “Hartford! In Hertford, Hereford, and Hampshire, hurricanes hardly ever happen. [laughs together]”

Child 2: “Have you seen that movie, [name of sister]?”

Child 1: [signals negative]

Female: “Why did you go to Hartford, [name of child]?”

Child 2: “Um...I did not share anything.”

Female: “Oh, that’s Hartford, that’s where I met [name], when I was in Boston. That’s actually Hartford in US.”

Child 2: “I didn’t go near...”

Female: “So yeah, hurricanes might happen there quite (emphasize) frequently.” [contrary to Hertford in UK]

Male: “She was in the East Coast, wasn’t she?”

Child 2: “I have not seen the movie, but I studied the play.”

Notable here is that while the daughter (child 2) and the mother were particularly interested in the photo, eventually all the family members participated in some capacity. What was also interesting here and in many other occurrences was that the conversation progressed naturally and was not bound in any way by the technology itself. Often the discussion initiated with the contents of the device (e.g., photo or tweet), but then it evolved into the personal experience and other aspects of the family life. The participants generally looked into the devices for only a few seconds and started saying something about it. Sometimes, one person read the tweet aloud, and then others responded to it. But then the discussion moves onto related (or sometimes very distantly related) topics; participants were engaged in conversation and did not pay attention to the next data displayed after 30 seconds. Only when participants
referred back to the item to point at something, or re-read something written did they go back to the previous item. Otherwise the conversation progressed naturally.

6.5.2.2 Accountability for Shared Content

In each participating family, I could identify instances where one or more family members questioned why someone had selected a particular content item for the TableTalk system. The interesting thing here is not that people try to figure out why this content is there or blame someone else for its presence, but rather how family members accounted for their choices and/or how they anticipate what their family would find interesting while they curate content. In one instance with family 3:

Female: “Why on earth do we have a really weird and crappy photo of traffic? [laughs]”

Male: “Who would have taken that?”

Female: “Me? Or [name of child]?”

Child 2: “Me. You made me take photos of things. So that was probably an accidental photo while I was taking photos of other stuffs.”

Selecting appropriate content was particularly difficult for music, because taste in music differed between partners and between parents and children. Furthermore, while visual content could run on TableTalk without evoking attention, music tended to focus attention to the TableTalk system. Hence when the adult male member in family 5 chose some of his favorite music to share with the family, he found himself in a (friendly) situation where he had to account for his choice and taste in music. The following example from family 5 illustrates banter around this:

Child 1: “Your music, Oh Jesus [laughing].”

Male: “I don’t know why I chose this. Sounds funny [laugh].”

Child 1: “It sounds like an 80’s song.”

Male: “It is an 80’s song.”

Female: “Poor [name of father] with his music.”

Male: “Your music was not much better.”
Female: “Yeah, it was weird.”

6.5.2.3 Looking up Information and Coordinating Family Activities

TableTalk did not restrict other ways of using technology at the dinner table, i.e., searching for information instrumental to family activities, or sending a quick text if necessary. However, this did not happen during the study observations. For example, the mother of family 3 generally talks about their plan for the next week and uses her phone calendar during mealtimes on regular days. But while using TableTalk, she tried to recall rather than use her phone, though she could do so (TableTalk would pause and resume later). It was evident in other families too, that no one used their phone during their meal, though they might otherwise do so.

Some families used their phones to look up additional information: for example, family 4 planned a vacation and searched for airfares and hotels. These activities were conducted when other family members had finished (or almost finished) their meals but remained at the dining area to find information and coordinate activities. For example, in family 1 TableTalk showed a tweet (Figure 6.3) about a planned strike of public transport personnel. Hence, they searched to see if the strike would affect their travels to work, but waited till they finish their meal:

Male: “We did not know about the tram strike, so very surprised to see the news [in the tweet].”
Female: “I had meeting in the next morning. So, we required making sure about this.”

Male: “I searched for the full story after the meal.”

6.5.2.4 Ambient Engagement

It is important to highlight that TableTalk was not a constant source of conversation or interruption, but quite often a rather ambient technology that remained in the background for large parts of a meal. While the content of TableTalk changed every 30 seconds, it was up to the family members, if they wanted to, to engage with its contents and to bring TableTalk to the fore. This type of ambient engagement worked well with visual content (photos, tweets), which could be updated without taking the attention away from the dining table and of course, from the social interaction of the family time.

The only exception to ambient engagement was provided by music played through TableTalk. When music started playing, it immediately made TableTalk the locus of attention, causing surprise and delight sometimes (family 7, 9), but also irritation among some family members. Unlike photos or tweets where change in content did not draw much attention than only minor change in the ambient light from the system, music could interrupt the conversation. In family 3, one child complained about such interruption during the first meal: “I was saying, before the phone rudely cut us out was I am going to need some money”. As a result, during their second meal, the father suggested his wife turn off the music while configuring the app. In other families (family 1, 4, 5), it provoked friendly banter; no one showed complete interest in listening to the music, but the conversation continued.

6.5.3 Commensal Activities

While it is important that TableTalk supported familial conversations, one of my main interests is in understanding how these conversations contributed to commensality through, for example, shared reminiscing, fostering equality & bonding, and stress different roles and responsibilities, i.e., educating and socializing children.

6.5.3.1 Reminiscing and Bonding

The TableTalk system provoked shared reminiscence among the family members. Such reminiscing also extended to people not present at the table, as in family 5:
Male: [Looking intensely and then pointing to an old family photo “Who is that? Is that [name]?”]

Female: “I know who that is. I took that photo with [name], my brother. And there was this kid, a merry kid jumping into the water and shouted, “Take a photo! Take a photo of me!” So, I took a photo of him.”

Child 1: “Oh yeah, that kid was doing this [mimics].”

Female: “yeah [laugh]. Then [name] was saying you got a photo of a random kid on your phone.”

In many ways, the discussion around the pictures, music, or tweets displayed in the TableTalk system was more than the information within; it emphasized the care and affection family members held for each other and supported bonding. For example, during one of the meals, the mother in family 1 exclaimed, “How beautiful this picture of the smile of [name of child]. Here, the one-year old child could not possibly comprehend what his mother was talking about, but I take it as an expression about reinforcing her affection of her baby. This warmth and tenderness remain at the core of family reminiscence, regardless of whether it was generated by the technology. For example, another fragment from the conversation in family 2 referring to an old photograph shows evidence of both reminiscing and bonding:

Female: “I was thinner [both laugh], I looked good.”

Male: “You still look good. You did not change much. It just looks so because you were wearing Indian ethnic dresses, now you wear all western clothes.”

Female: “My wristwatch was also working, I had my wristwatch there.”

6.5.3.2 Conscious Contribution to Dinner Talk

The family members contributions to interaction during the dinnertime, which were mediated via TableTalk, were somewhat analogous to the consideration of food as a gift to the family [Lupton 1996]. The family members contributed to the dinner through TableTalk in multiple ways. First, (temporarily) lending their personal devices could be considered as a gesture of willingness to contribute towards the mealtime experience. Second, they contributed through sharing their data. For example, some participants took photos of their daily life specially in order to share
through *TableTalk* with other family members. While they also had taken such photos prior to using *TableTalk*, the system reminded them of this opportunity. These family members mentioned how they kept the other members of the family in mind while taking these photos. For example, the adult female member in family 3 reported that as she knew *TableTalk* displays recent pictures more often, she sometime made “conscious choice” to take photos that her children will find interesting. In another instance, the adult male member in family 2 used *TableTalk* to share a photo of a uniquely shaped architectural model from his work and I noted his excitement in anticipation of this contribution.

*Male: “Do you know what happened today?”*

*Female: “What happened?”*

*Male: “Wait, you will see.” (Sometime later, when that picture shown up)*

*Male: “See! One lab mate of mine made this interesting design! It’s more of a unique kind of shape.” (continued…)*

In these contexts, participants took photos throughout the day and brought them to discussion during the mealtimes as kind of endowment to other members.

### 6.5.3.3 Educational Opportunities

*TableTalk* provided opportunities for education through discussion around the shared content. Some parents deliberately chose content from local news sources that they thought their children would find interesting as well as instructive. As illustrated below from family 5, some parents sought to channel the conversation to raise interest among their children.

*Child 1: [looking at a picture] “Flamingoes!”*

*Female: “I know where that was.”*

*Female and Child 3 together: “San Diego zoo!”*

*Female: “Do you know why they are pink?”*

*Child 1: “I don’t know. I thought pink ones are the boy.”*

*Female: “They are pink because they eat crustaceans.”*
Child 1: “What’s crustacean?”

Male: “Prawns and stuffs.”

Female: “Shrimps, prawns, and lots of seafood, that makes them pink.”

Child 1: “Shrimps and prawns are the same thing.”

Female: “No, they are not.” (continues...)

Dinnertime conversation also included discussion about how to behave and take responsibilities for one’s actions. For example, it was a matter of both amusement and instruction in family 4 when the adult male member included the photograph (Figure 6.4) of a recent handwritten note placed on the windshield of his friend’s car, who had unwittingly parked his car blocking the neighbor’s driveway. The husband later explained that he brought up the issue to discuss parking rules with his wife (a learner driver) in a cheerful and humorous way without being patronizing.

6.5.3.4 Manners and Socialization

Similar to the observations regarding education, TableTalk created opportunities to instruct children about manners and socialization at the dinner table. Firstly, the socialization of children was vividly illustrated through conflicts that emerged during the meal. For example, the adult female member of family 5 wanted to celebrate a photograph of her son (child 2) winning tennis trophy; her son, out of shyness, did not. This incident led to a tug-of-war between both of them using the swipe feature to

Figure 6.4: Family 4 used this photo to bring the issue of parking rules and regulations in a humorous way.
change the image backward and forward, until the she asked the child to stop interrupting. Similarly, in family 3, a conflict emerged between the two children about who had captured a particular photo displayed in the system. After a while, their mother interrupted by swapping to the next content and in an authoritarian manner asked them to “move on”.

Secondly, TableTalk helped to socialize children by encouraging them to wait and to take turns. For example, family 3 mentioned that their younger daughter (child 1) wanted to share a particular photo (describing two characters from the Harry Potter movie) with her family, but she had to wait (with disappointment) as the system was showing contents randomly and did not show that photo while they ate. Hence, she waited until the end of the meal and skipped to that photo.

Finally, TableTalk shaped table manners by encouraging family members to wait for the meal to finish. While meals are often concluded when all members have finished their meals, I observed how the members in family 1, 2, 3, 4, 7, and 9 stayed at the dining area even when their meals were finished to go through the remaining items in the TableTalk system. For these families, the TableTalk system could have a positive effect on commensality by extending the amount of time the family sits together. During the interview, they explained that they did not want to miss any item that other members have chosen to share. Incidentally, engagement with TableTalk here can also be seen as reinforcing such behavior.

### 6.6 Discussion

Family mealtime is typically considered an almost venerated time and space for interaction among the family members. Hence the presence and usage of personal communication technologies (smartphones, tablets, etc.) in this space are of particular concern, because they have the potential to isolate and exclude individuals from the shared experience of a meal [Bell and Kaye 2002; Moser et al. 2016]. So it is unsurprising that Hupfeld and Rodden [2012] concluded their fieldwork in the following way: “While our homes, including our kitchens, are generally accepting of new technologies, the table, and spaces of food consumption more generally, seem to continue to resist augmentation.” (p. 127)
In this research, I do not intend to diminish social interaction during mealtime nor do I aim to replace conversation and other naturally occurring interaction with technology-mediated interactions or see technologies as a solution to disruption (e.g., children squabbling with each other in Section 4.5.6.5) that may happen in some families. What I have set out in this research, however, is to explore how technologies can support and mediate shared concerns and interests in the family, and subsequently, contribute to commensality by enriching familial experiences of shared mealtime. This study contributes in several ways to understand how ubiquitous computing devices can be used in shared domestic settings, which I discuss in this section.

6.6.1 A Novel Design for Sharing Personal Technologies at the Family Dinner Table

TableTalk is a novel system to support the sharing of personal devices, content, and experiences during family meals. TableTalk extends previous work that focused on the technical feasibility of creating a shared display using personal devices and related work on interaction techniques [Nielsen et al. 2014; Ohta and Tanaka 2012] by designing a system that allows family members to contribute and curate personal content (photos, tweets and songs) and subsequent interactions. I do not necessarily aim to bring new commensal experience (although this would be interesting), nor do I claim generalizability (e.g., that TableTalk would make sense to all families or for every meal). Rather, in this study, I use the system as a technology probe to investigate the relationship between technology and the family mealtime experience. In this regard, I consider TableTalk distinctly different from existing technologies in several ways. (1) It uses personal devices rather than a custom-made device. The implications of this can be seen in the findings - for example, discussing events of the day via photos captured on personal devices or expressing a sense of devices having collective significance, bringing usage in line with core values of commensality (extension of [O'Hara et al. 2012] in the family mealtime context). (2) TableTalk supports the curation of content by family members. The implications of this can be seen in anticipation of what others have shared (and why), careful inclusion of content to represent everyone at the table, or accountability for shared content. And (3), by incorporating a variety of media formats (e.g., music and tweets) I extend prior work to investigate how such elements contribute or detract from any idealized notions of commensality in the home. Thus, TableTalk is able to provide insights into
the effects of different media on the commensal experience, such as the effect of interruption and humor caused by music or the interest and need for further information created by local news tweets.

6.6.2 Significance of Sharing Personal Devices

The transformation from personal to social can have significance for the ways family members perceive the ownership of their devices and content. Firstly, by bringing the physical device from the personal space (e.g., taking it out from the pocket) to the shared space (e.g., dining table), it loses its personal quality and become a part of a larger system of multiple-devices, discouraging participants from taking it away before the meal finishes. Secondly, by discussing personal data in a family group, participants contribute towards shared understanding, memory, and the ongoing constitution of the family itself. The implications of curation of content by family members can be seen in anticipation of what others have shared (and why), careful inclusion of content to represent everyone at the table, or accountability for shared content. Noteworthy here is that, TableTalk allowed users to move seamlessly between these states - by having a device as personal when necessary or shared when appropriate.

6.6.3 Understanding the Potential Role of Technologies for Familial Commensality

The field deployment study contributes towards understandings of how technology can support and sometimes even enrich commensal experiences. This responds to concerns about possible detrimental effects of technology usage at the dinner table [Fulkerson et al. 2008; Stroebele and De Castro 2004] and a widespread resistance against personal technologies in this context [Hiniker et al. 2016; Hupfeld and Rodden 2012; Moser et al. 2016]. This study has shown how technologies like TableTalk can enrich familial experiences of the shared mealtimes by allowing all family members to contribute content and share personal experiences or concerns that are relevant for the family as a unit. TableTalk has provided all members including children with a voice in choosing content to share and in responding to content from others. These contents often provoked and sometimes supported ongoing conversations between the family members, which appeared to flow naturally, and new content provided an invitation to engage in conversation or interaction. But what
is more important here is that a range of commensal activities through these conversations brought the whole family together.

Finally, what emerged through the design and deployment of TableTalk is a focus on togetherness during the commensal experience. Such togetherness remained at the core of TableTalk usage, evident in both curation and conversation facilitated by TableTalk. In contrast to related work that focuses on the mealtime experiences of individuals connected through technologies [Nawahdah and Inoue 2013; Tsujita et al. 2010; Wei et al. 2011], this study was designed to investigate the shared practices that emerged when TableTalk was used during collocated family meals.

TableTalk thus finds its success in the nuanced and subtle ways it contributes to the family mealtime experience. It acts as a mechanism to consolidate personal devices and attention, rather than to isolate family members by keeping their focus on their own devices. It also allows everyone to contribute to the group synergy (both through interaction with the devices and conversation around content). Thus, TableTalk supports important characteristics of familial interaction (banter, teasing, educating, and even conflict) around mealtimes. Simply, TableTalk encourages families to talk - providing a platform of shared content as a conduit for exchanging their stories. Families responded to this positively and encouraged everyone to participate without awkwardly drawing attention to any particular member. It is notable that no family member turned off TableTalk, or left the table prematurely, but nearly every family extended their stay at the dining table beyond the completion of their meal. So, rather than criticizing technologies for diminishing commensality or trying to stop such usage forcefully [DinnerTime 2014; Hutchings 2015], this research then highlights the need to design for togetherness and utilize the technological affordances as an opportunity to positively augment family mealtime experiences.

6.6.4 New Challenges Introduced by TableTalk
As for any intervention, TableTalk changed the regular practices of the participating families. Here I discuss how these changes pose new challenges for the families, and open design challenges for TableTalk (or other similar technologies) for the family mealtime space.
6.6.4.1 Opportunity Cost of Not Using Personal Devices and Other Technologies
Most of the participants regularly watch Television or other streaming media during mealtimes and occasionally use their phones (e.g., sending a quick text, searching for some information, etc.). They refrained from watching TV for the purpose of the study and contributed their mobile devices to form the TableTalk system. Understanding how one configuration of technologies restricted them from using other possibilities or other ways they could enjoy the meals remain an open question. In the next study, I shed some light on this issue by comparing family interaction during their regular meals and another prototype based on TableTalk design.

6.6.4.2 Setup Time and Content Synchronization Time for the Families
Mealtimes are regular spontaneous event of everyday life. So, generally people do not prepare themselves about the things they would discuss during the dinnertime. With TableTalk, they have to do some work at the setup phase before using the system at their mealtimes, for example, moderate the contents to share and then setting up the configuration of multiple devices. This can have impact on commensal experience at the dining table. In the next study, I remove the moderation phase that happened immediately before the meal, but participants can choose or save content anytime throughout the day.

Another significant impact is on the way conversation takes place during the family meals. Usually, in spontaneous conversations, a topic or memory might pop up in someone’s mind and they s/he brings about the topic to the family’s attention, thus lacking any kind of preparation or planning. With TableTalk, one may consider the process is being reversed – during the moderation phase, the contents are shown to the individual family members (the content owner). Then s/he gets an opportunity to ponder about the content, think, and decide whether s/he wants to share it with the family. It gives him/her some opportunity to prepare his/her story related to the content first and then discuss (with others) during mealtimes when that content pops up in the joint screen. I would investigate such planning and its impact in my next study (Chapter 7).

Another challenge is reducing the setup time. TableTalk system requires some time at the beginning to synchronize contents across all the devices. This time increases with the number of devices and the number of contents shared. Though I requested to set
up the system before the meal begins, in practice families almost always started the system at the beginning of the meal. As a result, I have noticed that in some cases, family members started eating before the app begins display and then looked at the screen to check the progress in syncing from time to time. Future technologies (TableTalk or others) should try to minimize such setup time as much as possible.

6.6.4.3 Devices Sharing the Space with Mealtime Artifacts

TableTalk (like 4Photos) became a centerpiece at the dining table. This resembles the findings in study 1 that the placement of television was decided such that all the family members could enjoy it best. Some families (Family 3 for example) required shifting some of their dishes to the kitchen bench than the dining table, to accommodate the TableTalk setup. During meals, the mother then served the food in plates of the father and child. One might question if technology is then getting higher priority than the food and personal connection itself.

6.7 Identifying the “Discernment” in the Design of Technologies for Family Mealtimes

As I have discussed the study findings and insights from TableTalk deployment, now I focus the attention on the second element of Toyama [2015] framework, i.e., discernment or mind. As Toyama [2015] have explained in proposing this framework, a successful technological intervention needs to amplify the human intentions in its application context. Based on study one and study two, I ask if the ICTs commonly found and used in the participating families, particularly TV and smart mobile devices, amplify the positive intentions among the family members. I also ask if the content from these devices could engage the family as a whole and support togetherness. Then I analyze the findings from study two and discuss if TableTalk could enhance any aspect of their mealtime experience and how.

From study one, I received a mixed feedback about the use of television and mobile devices during mealtimes. Typically, only shared devices were allowed to be used during family mealtimes. TV or music was often considered acceptable in the participating families, but I also observed occasions to the contrary when its usage created tension and was stopped (see Section 4.5.6.4 for example). Overall, ICT use is allowed when everyone is in the same figurative space, that is, everyone is aware of
the presence of others and the interactions happening around them. If someone is too engrossed on the TV or using personal devices so that s/he is ignoring others, the usage is generally not accepted. On the other hand, when personal devices are used for some shared purpose which is apparent to others, technology use is considered as an accepted practice (e.g., sending SMS for a family purpose, searching about a restaurant under discussion, etc.).

Now, I argue that neither the television nor the mobile devices are designed to be used during family meals. Television, for example, while being a shared device, takes the attention away from the dining space (i.e., the table) and the food. Also, even though everyone is looking at the same television screen, they get distracted from their interaction among themselves, for example, not looking at each other while having a conversation. On the other hand, personal smart devices are personal by definition, thus sharing them is challenging. People can “pass the phone”, but there are a lot of practical issues that remain with this arrangement – privacy, portability, etc. among them, and while using these devices, the attention remains on the screen rather than on each other.

In terms of digital media contents shared through television, TV programs are made for a generic group of audiences and are not customized for any particular family. So, while families can choose a program to watch from a pool of available programs at that time, it may not reflect any particular event or interest of that family. When families find something interesting and correlating with their own life in the TV program, I attribute it more as a serendipitous experience and good intention for the family rather than the design of the technology itself. Personal device, on the other hand, contains an unprecedented amount of content (photo, music, calendar, social media posts, etc.) that relates to the family. But these are difficult to share during mealtimes. There are appropriate content and good intention (as discussed in Section 5.2) to amplify the interactions among the family members, but existing technologies often fail to do so.

I also ask, if I as a researcher have the same forces. Do I (as researchers) have the right “heart, mind, and will” to bring about a positive change in the family mealtime space? I have the positive intention (heart) and the relevant expertise in ICTs and technical skills (mind) to develop interventions. Also, I have a specific application
context in mind and am not merely disseminating the proposed technological system to work in every setting or for every family or meals that matter (will).

With this in mind, I developed TableTalk, an app that enable family members to share their personal device and data during family mealtimes. With TableTalk, Family members bring their devices (e.g., smartphone and tablets) together to create a single display thereby symbolizing the communal aspects of commensality. The aim here is to enable the sharing of personal content (e.g., photos, music, social media posts) for the collaborative construction of a mealtime experience. TableTalk both embodies elements of commensality in its design (e.g., conversation, accountability, etc.), and also supports commensal experiences through its design (e.g., togetherness, shared reminiscence, etc.).

From the field deployment of TableTalk, I could see the same positive intention (heart) that allowed the families to have meaningful interactions while they eat in their regular everyday settings (study one), but potentially in greater magnitude. (magnification, as Toyama [2015] has put it). Some examples include:

- I could clearly notice that the amount of conversation, facial expression, and eye contacts increased. Even though I did not undertake quantitative analysis of these features, I observed these increases informally in my analysis. With TableTalk, family members’ interaction and attention were not generally diverted away from the dining table and from each other. Families did not persistently look at the screen on the table, but looked at each other when they had conversation about any content in the screen. Often family members engaged in deep conversation about some topic and ignored the new contents of the systems brought after 30 seconds. While these conversations were provoked by a content from TableTalk, they naturally progressed into shared family concerns and experience (see Section 6.5.2.1 for an example).

- Even the contents that they did not enjoyed together, particularly music, provoked humor rather than criticism in the family (Section 6.5.2.2).

- Study one showed that families have concerns about each other while choosing a media content to watch (Section 4.5.4.1). I could identify many more occurrences of this good intention when families moderated the contents for sharing through TableTalk. In each of the TableTalk deployment sessions,
there was something for every member, even if s/he did not contribute with a device. For example, parents included something for every child, and remained careful not to show any bias for a particular child (Section 6.5.1.4).

• Families took the opportunity to educate their children about different things (e.g., discussion around Flamingoes in Section 6.5.3.3) and used the TableTalk contents to engage them in interesting ways (e.g. conversation about Hartford in Section 6.5.2.1). They also tried to instruct their children about appropriate table manners in using the TableTalk system – for example parents quickly interrupted to stop bickering among the children or asked to stop skipping a content before everyone sees it (Section 6.5.3.4).

• When some family member remained silent during meals, parents or other siblings tried to bring them into conversation in a natural way. For example, the mother in Family 5 tried to engage her son (child 2) in the conversation by sharing a photo of him, as he was shy to share contents from his own device (Section 6.5.3.4) or the eldest daughter in Family 3 asked her sister a question to engage her in the conversation (Section 6.5.2.1).

These observations provide evidence that TableTalk did magnify the positive intention family members have in order to make the shared family mealtimes an amiable place, reinforce family bonds, and nurture togetherness. I believe various design features of the TableTalk system led towards this, for example:

• Since family mealtimes are considered as a site for the exchange of narrative accounts of personal and collective significance, data from their personal devices can provide a cue for natural conversation that interests the whole family. I have noticed family members discussing about their day-to-day life and related concerns (e.g., shopping, travel arrangements of children, etc.) during study one. With TableTalk, they (including children) did bring these topics, often with much more enthusiasm. By discussing personal data in a family group, participants contribute towards shared understanding, memory, and the ongoing constitution of the family itself.

• Study one revealed the tension around the presence and usage of personal devices during the family mealtimes, to which families responded by imposing (sometimes implicitly) different rules and norms. My design response to this
was bringing the physical device from the personal space (e.g., taking it out from the pocket) to the shared space (e.g., dining table). The devices then lose its personal quality and become a part of a larger system of multiple-devices, thus emphasizes the communal aspects of commensality and resolves the tension around having personal devices in shared family space. I could notice this, for example, as none of the family members (in study two) took their device away during the meal and waited till everyone finishes to take the device away, though I advised them that they could do so.

So, I conclude that TableTalk displays an appropriate design and was able to enhance the good intentions of the family. This inspired me to design the next study of this thesis to explore what are the special features of family mealtimes that is relevant to the design and compare the mealtime interactions in families with and without TableTalk. For doing so, I took into account some design implications from the deployment of TableTalk and make some changes to the developed system.

### 6.8 Design Implications for Future Research

So as now I have investigated how different aspects of TableTalk impacted the mealtime configuration in families, what might this mean for HCI researchers and for future technological advancements? In this section, I discuss ideas of how TableTalk can be further utilized to sensitize researchers and practitioners to the challenges and opportunities involved in designing new technologies for supporting commensality in the family home. Some of these features has been incorporated into the design of a system named Chorus that I present in chapter 7, and I leave the rest of this discussion as future works.

#### 6.8.1 Implications for Curation of Content

Participants in this study appreciated the random selection of content (while prioritizing recent items), as it decreased their workload. However, I noted how sometimes they took photos of events for sharing later, or considered news worth sharing in the course of their everyday life. This highlights the need to afford both the serendipitous experience from randomly presented content as well as opportunities for planned curation.
One design response is therefore to allow automated assistance in the collection and curation of contents to be shared with the family. Throughout the day, smart devices might enable or ask participants to select current media (e.g., photos, music, social media posts, news articles, etc.) for later sharing, thus assist people to curate and plan for the storytelling of everyday life during commensal meals. The recording of the daily sharing of content within TableTalk could also act as an archive in itself - acting as a highlighted reel of a particular day. It would be interesting to see how this process could be supported, perhaps by replaying TableTalk sessions from an earlier dinnertime. I investigate these features in the next study (Chapter 7).

6.8.2 Implications for Supporting Depth in Conversation

TableTalk was designed to provoke and manage conversation among family members while providing equal opportunities for everyone. While recent photos, music, and tweets enabled and encouraged conversation about personal and local events, TableTalk did also provoke discussion and shared remembrance by displaying older content that may otherwise be forgotten. Overall, it provoked conversation about past memories (e.g., old photos), ongoing affairs (e.g., recent news), and future events (e.g., discussion provoked by photos of similar events in the past). One interesting observation was that participants needed to balance the breadth (change topic from uninteresting or confronting topic) and depth (continue discussion in further details) of a conversation topic. However, it is challenging to determine whether and how to present content that can extend an ongoing conversation, or to change the topic through new content.

One design idea is then to avoid switching conversation topics or abruptly starting music - for example, by detecting if the family members are discussing the displayed item, TableTalk could stay on that item until they have finished the discussion. A solution might be to detect periods of silence in conversation and change the displayed content in those gaps or switching to music for background ambience. Another improvement might be supporting the depth of conversation, for example, by enabling the system to fetch more data based on the current item (e.g., more photos of that time/place from participants’ devices, more music from the same album/artist, related news or social media posts). Such designs will need to adapt to individual
family’s desires concerning topic exploration or changes. I explore this approach in the next chapter.

6.8.3 Implications for Complementary Role of Family Members

TableTalk usage was also confluent with the inclusion and exclusion of members in the commensal meals [Fischler 2011]. TableTalk gave everybody a voice including the children, who otherwise might feel disconnected from adults’ conversations. I noted how families carefully included all of the core members, even if they were not present during the meal (e.g., by including photos of the child in family 1 and 5) or when some member did not use a smartphone (e.g., by including tweets of the male member in family 3). On the other hand, extended family members and friends were included in turn (in all participating families). One future extension of this research might be to enable extended family members and friends to contribute their content from their own TableTalk system and vice versa, that is, exploring the remote dining experience [Barden et al. 2012] through TableTalk system.

TableTalk serves to scaffold family interactions in positive ways; the process of curation reflects this. Care is taken to include data that are relevant, interesting, and not too confronting to individual family members, particularly children. Curatorial practices also seek to include all family members, e.g., by ensuring there is balance in the content. These curatorial practices separate family from other social groups. As family members have shared experience throughout their life, data from their personal devices convey information that relates to other members of the family. Also, their knowledge about each other enables them to relate the content (photo, music, etc.) with their past experiences in ways that might not make sense to outsiders. Then, they can play a complementary role in discussing shared memories; one can remind others of the event if they have forgotten specific details.

Thus, another design opportunity for future exploration is the complementary role of family members in collecting data about shared memories. It is possible that multiple members’ devices have data (e.g., photos, social media posts, etc.) about a particular event or memory (e.g., a birthday party, a family tour, etc.). So, one extension of TableTalk can be to search and combine such data from family members’ devices and bring them to the fore when they show interest in it. I implemented this feature and discuss it in detail in the next chapter.
6.9 Limitations of the Study

While appropriate to the exploratory nature of this work, the limited number of participating families precluded me from examining the possible influence of socio-economic status or cultural factors. Also, the novelty of TableTalk may have influenced the experience of the participants due to the short duration of the study. However, as discussed above in this study, I have used TableTalk as a technology probe to provoke discussion about the concept and understands participants usage and interactions with it through field-deployment. In this study, I am not investigating the adoption of TableTalk for every family or for every meal, nor am I interested in the differences between meals with and without it. All of these factors warrant further investigation to develop understandings of how families with diverse backgrounds might adopt new devices into their everyday domestic mealtime settings. The significance of this study is that personal devices were brought together at dinnertime to support social interaction at the dinner table. I observed conversations, reminiscing, and socialization of children and in many cases novelty effects may or may not have played a role. However, this is not as significant as the fact that the TableTalk system mediated personal technology, reconfiguring it as shared technology to successfully and seamlessly support mealtime commensality. These are important and novel findings. In the next chapter, I extended the study to evaluate this technology for longer periods of time and compare its usage with regular mealtimes in the family.

6.10 Summary

I have presented the design and deployment of TableTalk and explored the ways in which it reconfigured personal data and devices to a shared display, thereby supporting and enriching the commensal experience in the family home. In doing so, I note how the TableTalk system enables the family members to shift their attention from individual to collective significance and the nuanced ways in which technology usage can correspond to different aspects of commensality, e.g., reminiscing, educating, socializing, bonding, etc. in the family. While I recognize concerns about ICT usage during family mealtimes, the outcomes of this research are important for researchers and designers working on systems for shared domestic settings. I show how careful consideration of various design issues such as the type and amount of content to include, selection and moderation of content by familial members, and
interaction with the system help to generate and sensitively support familial interaction during mealtimes. Overall, this study demonstrates that through sensitive design, deployment, and recognition of familial norms, expectations, and responsibilities, technology designers can positively support and enhance interaction during family mealtimes.
Chapter 7: Celebratory Technology for Familial Commensality (Study 3)

7.1 Introduction

I have investigated the role of existing ICTs (study one) and the potential for new ICTs to support commensal activities through reconfiguration of personal smart devices during family mealtimes (study two). In this chapter, I focus on how these technologies can be meaningfully integrated into the family mealtime practices through a bespoke prototype. While the idea of celebratory technologies [Grimes and Harper 2008] during family mealtimes to support positive interactions at the dinner table is promising, there are few studies that investigate and compare the usage and experience of these interventions with regular mealtime practices in the family. Similar to TableTalk discussed in previous chapter, I build upon the use of existing and widely available personal smart-devices to explore and compare the changes and challenges brought about by such interventions on familial practices at mealtimes at home. I present the design and 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. The objective here is to investigate which aspects of the family interactions are novel due to the introduction of Chorus, and what are the implications of using the system for extended duration. A three-week long 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 family members to broach sensitive topics into familial conversation, and encourages participation from all members in the family. I discuss implications of this research and reflect on design choices and opportunities that can further contribute to enhance the family mealtime experience.
7.2 Motivation and Research Objective
Grimes and Harper [2008] recast the role of technologies at mealtimes by proposing that they be considered celebratory and called upon researchers to create applications that enhance the social experience associated with food and eating practices. A few have responded to this call. O’Hara et al. [2012] demonstrated the potential of a custom 4-faced photo display to facilitate interactions and engage everyone in the table. In my previous study (Chapter 6), I presented TableTalk, a smartphone app to transform individual devices into a shared resource for displaying random photo or tweets, and playing music during family mealtimes. While these studies demonstrate the potential for technologies specifically designed for family mealtimes, 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. The field deployment of TableTalk, while for brief duration, demonstrates the potential for technologies specifically designed for family meals as an interaction space. But a detailed understanding of how such celebratory technologies have changed existing familial interactions is missing here. It poses with interesting questions to further extend the research field and the challenges to successfully adopt celebratory technologies in the collocated interaction space of family mealtimes. In this final study of the thesis, I aimed to explore these research gaps:

1. What are the implications for the use and design of celebratory mealtime technologies beyond the novelty effect?
2. How do these technologies affect the conversation in the family, and how is the experience of mealtimes including the use of the developed technology different from the regular experiences of family mealtimes?

All these questions guided me towards the design and deployment of Chorus. The Chorus system has significant overlap with TableTalk in terms of technological concept. However, the objective of the study with Chorus is very much different. In terms of functionalities, Chorus has three major changes. (1) It requires participants to select the content to share (TableTalk selected random contents from the device). The objective here is to investigate the motivation behind choosing any particular content, and how these contents channeled the family interaction during mealtimes. (2) When family members find interest in any photo or music, they can then ask the
system to search similar contents from all the members’ devices. Motivated by the prolonged conversation on relevant topics among the family members (Section 6.8.2), the objective here is to combine similar resource from all members and leverage the overlap in data from the family. (3) Chorus enables the family members to revisit previously shared contents – either from individual devices or together by joining screens. All these functionalities are guided by the field deployment study of TableTalk, as I discussed the implications in Section 6.6 and Section 6.8.

I aim to investigate how such digital repositories can act as a tool to capture family experience of togetherness during mealtimes. I am interested in understanding how and why family members share particular content, and whether such system could work as a repository for the family history of togetherness. I explore how Chorus is integrated into everyday actions and the evolving behaviors around this device ecology by contributing an empirical investigation of Chorus in practice. From the field deployment study with seven families for three weeks each, I 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 chapter, I: (1) present the findings of this 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 could be used to enhance togetherness through familial commensalsity; and (4) identify the family dynamics and features that made such interactions meaningful. Through this, I offer new opportunities for design and novel understandings of the potential role of technology for enhancing togetherness through shared mealtimes in the family home.

7.3 Design and Development of Chorus
The field deployment of TableTalk (Chapter 6) revealed important aspects of families’ use of personal devices in a shared way during mealtimes and demonstrated the potential for technologies specifically designed for family meals. However, the study findings pose interesting questions about the potential role and the challenges to successfully adopt celebratory technologies in the family mealtimes. A detailed
understanding of how such mealtime technologies have changed existing familial interactions in missing here. 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 mealtime technologies beyond the novelty effect? All these questions guided me towards the design and deployment of Chorus discussed in this chapter. The Chorus system has significant overlap with TableTalk in terms of technological concept. However, they are independent projects, and the objective of the study with Chorus is very different. The second study (TableTalk) was designed as a technology probe (Section 3.3.1.2), whereas the third study (Chorus) is designed as a design intervention (Section 3.3.1.3). With regard to research objective, Chorus takes the understandings from the field deployment of TableTalk and extends it further. Where TableTalk aims to investigate if technology can support family togetherness during family mealtimes, Chorus investigates which of these findings are unique to the introduced technology, what are the challenges of long-term usage and adoption (of Chorus, and potentially of other celebratory technologies). I am interested in how and why family members share particular content, and whether such tools work as a repository for the family history of togetherness. To do so, I focus on the curation process before sharing during the mealtime and support further exploration of data dynamically during the mealtime. Now I briefly discuss various distinguishing features of the Chorus system and this study.

7.3.1 Curation of Contents before Sharing with Others
Previously in Chapter 6, I noticed how family members (especially parents) often curated the contents carefully to include everyone in their shared contents and removed any item that they thought others will not be interested in. In this study, I take this further to actively support family bonding through the curation process. Family mealtimes often serve as a venue for storytelling of the day, encouraging everyone to speak about their present day as well as plan for the day after. Often such storytelling is spontaneously done on the spur of the moment. Chorus would than change this dynamic and assist them to think ahead about what others might find interesting and create anticipation among family members about what others might have shared.
7.3.2 Supporting Depth of Conversation

Another insight from the previous study was that even if the family conversation is provoked by the technology, it then progresses naturally and moves on to related memories and experiences. To support this further, I designed Chorus to fetch more contents related to the present item on screen and investigated how that supports the family togetherness and reminiscence. I am interested to investigate the multiplicity of contents and memories among the family members here. As they share a lot of experiences together, this is reflected in their device data too - for example, multiple family members can have photos of the same event. Chorus then can help to explore this connection.

7.3.3 Compare Meal with and Without Chorus Over Long-Term Deployment

The deployment of TableTalk showed that technology could facilitate family members’ interaction. But now I am interested to see what happens when the novelty wears off. So, in this study, I aim to capture data with and without Chorus in the same families, which then enables me to compare the changes introduced by Chorus. I also collect video data from the first and last week of the three-week deployment (and app data for all the usage in these three weeks). That enables me to understand what happens after continuous usage in the families and comment on the changes and challenges for long-term usage of such technologies in the families.

7.4 The Chorus System

The aim of Chorus is to explore how technologies can enhance family togetherness through their collective interactions during family mealtimes. Family members can use the Chorus app on their personal device at any time before the meal to curate and save their contents (e.g., photographs, tweets, or music) for sharing later (Figure 7.1). They can select any photo from their existing media library in the phone, take new photos, or save a screenshot from any other application (Figure 7.2). They can also save tweets from their personal Twitter account or add any tweet handle to save available tweets (according to privacy settings of that Twitter account) in the app. The app can also access the entire music library from the device and allow users to select any music for sharing later. During this preparatory stage, the contents selected by the users are not shared with anyone else, but only saved inside the app. The user can also
review these items and remove contents from the app any time before mealt ime (Figure 7.3). When a member saves something in the app, all members of the family receive a small notification on the home screen of their app indicating the total number of contents shared by the rest of his/her family (as shown by the number 7 in Figure 7.1). They can also send an auto-generated text message to other members indicating the number of contents s/he has shared with them using the notify button. Those who prefer not to share any data are still able to participate by simply opening the app during mealtimes 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 on any orientation (Figure 7.6). 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 (Figure 7.4). Thus, the personal devices come together to form a new integrated shared display (Figure 7.6).

*Figure 7.1: Participants open the app. Figure 7.2: Participants can save contents anytime during the day.*
Figure 7.3: Participants moderate the contents before sharing.

Figure 7.4: They place devices together and pinch to join screens.

Figure 7.5: Participants can revisit their shared items anytime later.

Figure 7.6: Items are displayed randomly. Families can rotate the Lazy Suzan.
Chorus app in these devices then communicate with each other via available Wi-Fi or Bluetooth. All devices need to be connected in the same Wi-Fi network, have Wi-Fi on but not connected to any network, or have Bluetooth on. Similar to TableTalk, Chorus utilizes the Apple Bonjour Protocol [2016] for these inter-device communications. All devices in the same family shares a unique “family name” which is set up when the app is installed and used for the first time. The Bonjour protocol uses this name to identify and connect the available devices when pinched (Figure 7.4). The devices exchange a list of items that is saved in its app in that day and then share the contents (photo and tweets, but not music) with all connected devices. Each device then has a local copy of all the shared items (except music) in its own version of the Chorus app directory. The content exchange, slideshow, and user interactions for Chorus is very similar to that of TableTalk (Section 5.6), except that the Chorus plays any shared song in full instead of the 30 second by TableTalk.

During mealtimes, if family members 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. If it is a photo, the Chorus app looks for similar photos based on location (within 10 km radius) and timestamp (in the same day) in the entire photo library of all the devices present in the system (unless any particular user disabled this capacity in the app settings, in that case Chorus skips that particular user’s device). For music, the Chorus app searches for music from the same album or artist in all the devices (unless any user restricted it, as before). If found, it adds these items in the list of items for slideshow immediately after the current item on display; otherwise it does nothing. It will then bring the next item in the queue for display or playing. I name this feature SIMPLE (Similar Items from Multiple Persons to Lengthen Expression). In doing so, I aim to utilize family members’ overlap in their data. Since families have a long time of shared history, it can often be found that their devices captured data of the same event too – for example, photos from a vacation that the family enjoyed together. As noted previously for collecting health information of family members [Grimes et al. 2009], their knowledge and familiarity of each other and their data overlap can be utilized for better interactions. Using Chorus, I try the same to facilitate interactions at the dinner table.
Participants can always revisit their already shared contents from previous meals in their own devices (Figure 7.5), except music shared from others’ devices. They can also join the device screens of multiple members’ devices together and enjoy the content in shared settings. I investigate if such repositories can support family reminiscence about previous mealtimes.

7.5 Field Deployment
I conducted a field study to examine the ways through which Chorus influences and changes social interaction during family mealtimes. I was particularly interested in the following aspects: (1) preparation, i.e., choice and moderation of contents for the meal, (2) the intent and purpose of different media shared through Chorus, (3) influence on conversation topic, and (4) challenges and opportunities for long-term usability for such systems.

7.5.1 Participants
I deployed the system with seven families from United Kingdom and Australia (referred to hereafter as families 1-7). The families were recruited through university mailing lists, notice boards, my 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 (with or without children). These participants came from diverse family backgrounds and family structure. As summarized in Table 7.1, I 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 families were also diverse in their education and economic capabilities. Among adults, the educational qualification varied from a diploma degree to post-doctoral qualifications. The participant occupations include academic positions, self-employed business people, and private sector/government employees. In terms of income, the recruited families varied from approximately 240 to 720 AUD (after tax) per person per week. Although a diversity of participant background was important, my aim was neither to focus on any particular segment of society nor to obtain a representative sample for generalizability. Instead I sought some diversity of family setting as a context for an in-depth examination of the familial practices with technologies at mealtimes.
Table 7.1: Description of participating families, their commonly used technologies at mealtimes, contents shared by the families during the study three

<table>
<thead>
<tr>
<th>Family Members</th>
<th>Commonly Used Technologies</th>
<th>Data Sources and Number of Items Shared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family 1</td>
<td>Female (private job), Male (academic)</td>
<td>TV (news, reality shows, sports, etc.)</td>
</tr>
<tr>
<td>Family 2</td>
<td>Female (private job), Male (private job)</td>
<td>TV (movies, series)</td>
</tr>
<tr>
<td>Family 3</td>
<td>Female (academic), Male (academic), Child 1 (13 yo), Child 2 (16 yo), Child 3 (18 yo)</td>
<td>No technology</td>
</tr>
<tr>
<td>Family 4</td>
<td>Female (student), Male (part-time job)</td>
<td>Laptop or TV (movies, series)</td>
</tr>
<tr>
<td>Family 5</td>
<td>Female (private job), Male (public job), Child 1 (1 yo), Child 2 (2 yo), Child 3 (12 yo), Child 4 (17 yo)</td>
<td>TV (reality shows)</td>
</tr>
<tr>
<td>Family 6</td>
<td>Female (academic), Male (business), Child 1 (12 yo), Child 2 (16 yo), Child 3 (18 yo)</td>
<td>TV (any program)</td>
</tr>
<tr>
<td>Family 7</td>
<td>Female (student), Male (student)</td>
<td>Smartphone (Facebook), TV /Laptop (movie, series)</td>
</tr>
</tbody>
</table>

7.5.2 Study Protocol

I began the study with visits to the participants’ home. This consisted of interviews with all family members including children (aged over 5 years). When available, family members (including children) installed the Chorus app in their own personal iOS device. When iOS device was not available, I offered participants iOS devices to use during the study period and migrated data from their smartphones. The aim of this first visit was to introduce the Chorus and to gain an understanding of their mealtime routines and how these practices might relate to the pragmatic demands of their family life.

I gave the families a video camera to self-record their mealtimes. Each family was asked to record two of their regular meals without Chorus. They were then asked to use the Chorus for three weeks. Families were requested to use the app at least three
times per week. Families were asked to video record four of these nine mealtimes – two at the first week and two at the last week of Chorus usage. This enabled me to collect longitudinal data about the impact of the Chorus system as well as compare familial interactions with and without the app. The video recordings of the mealtimes were about 20 to 30 minutes long. Additionally, I collected log data of user interactions with the app and the shared contents for all meals with app usage.

Once all three weeks of Chorus usage was complete, I returned to the home for collecting the video recordings and data from the app. I met with them one last time in the next week for the final interview. The questions for the final interview were informed by analysis of the first interview, video recordings, and app data. During this interview, I reviewed the shared content from the app to examine the intention for choosing particular items and discussed specific episode of familial interactions from the recorded videos. Each family received a 30 AUD iTunes gift card as an expression of gratitude. Table 7.2 summarizes that sequence and activities for this study.

I acknowledge the limitations of the study protocol, particularly since the families used the Chorus app for three weeks only. It precluded me from examining the long-term effects of the technology - when the Chorus app is fully integrated into the family practices of mealtime and they no longer use it for study purpose but out of their own interest (or do not use it at all). While it was not possible due to time

<table>
<thead>
<tr>
<th>Timeline</th>
<th>Task Performed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Interview one, home tour, install and demonstrate Chorus app in participants’ devices, demonstrate and drop off video recording equipment</td>
</tr>
<tr>
<td>Week 2</td>
<td>Families video record two regular (without using Chorus) mealtimes</td>
</tr>
<tr>
<td>Week 3</td>
<td>Families use the Chorus app at least three times during their meals and video record two of these mealtimes</td>
</tr>
<tr>
<td>Week 4</td>
<td>Families use the Chorus app at least three times during their meals but did video record them</td>
</tr>
<tr>
<td>Week 5</td>
<td>Families use the Chorus app at least three times during their meals and video record two of these mealtimes</td>
</tr>
<tr>
<td>Week 6</td>
<td>Collect video and app data, analyze all data</td>
</tr>
<tr>
<td>Week 7</td>
<td>Interview two</td>
</tr>
</tbody>
</table>
constraints and practical limitations, this is important but separate research question, and warrant its own independent study to investigate and answer this question. They do not particularly limit this study.

### 7.5.3 Data Analysis

I used an inductive, qualitative analysis approach [Miles and Huberman 1994]. In particular, I focused on how *Chorus* channeled mealtime conversations, how it changed the mealtime dynamics and interactions, and how the families used *Chorus* in the final week compared with the first week of the study. Further I was interested in any relationship between individual interaction and the group dynamic. I analyzed the interview transcripts, video recordings, and app data to add detailed notes of all interactions with *Chorus* and the family members. These notes were refined through discussions between me and my supervisors. This analysis was done iteratively to identify common themes across families as well as unique family practices.

### 7.6 Findings

I begin this section with brief description of each family and their technological practices during everyday meals and how the family members used *Chorus* in general. The introduction of *Chorus* changed the nature of familial interactions during mealtimes. I provide details of this change by examining the preparation phase before the meals, the motives for choosing particular content, the quality of family conversations, and the challenges that emerged after repeated use of *Chorus*.

#### 7.6.1 Current Practices and Chorus Usage in Participating Families

In this section, I present the everyday mealtime practices of the participating families as well as the ways in which the family members used *Chorus* during the study period. All the participating families completed the tasks, sometimes with occasional issues in their usage, which I elaborate in this section.

**7.6.1.1 Family 1: Adult Couple Working in Nearby Office**

This family consists of an adult couple who work in nearby offices and travel together to/from their home every working day. They occasionally send photos or shares interesting social media posts with each other during the day. They share many details of their everyday life and notable happenings of the day while they take the journey back home or prepare their meals. During their shared meals (dinner mostly), they do
not talk much but generally watch television without any particular preference – reality TV show, games, news, etc. Either of them could choose something to watch. During mealtimes, this family have little conversation around how the meal is, affairs of the everyday life, planning for various chores, about the TV program, etc. From the video-recorded observations, I noted that there was little or no eye contact during these conversations and these were very brief exchange of words – usually a couple of words or incomplete sentences, as they were more focused into the television watching. For example, in one of the recorded observations, I noticed how the wife finished her quick remarks and stopped to wait for 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.

The number of content shared through Chorus by this family was uniform during the three-week study (on average 6.7 content per use, standard deviation 2.1), though they mentioned that they found it difficult to find “interesting” content to share (discussed in detail later). So, in the later part of the study, they shared more content referring to their earlier memories than from their current life. This family completed all the study tasks, and both the male and female participant shared similar number of contents.

7.6.1.2 Family 2: Newly Married Working Couple

The female participant prepares the meal, while the male participant helps her with other household staffs, organizes the table, and chooses the television program to watch. This family generally watches television programs during their shared mealtimes. They keep their mobile devices nearby, but do not use them unless there is a call or they need to search something at that time. Among the participating families and based on my observations, this family have their meals very quickly (both regular meals and with experiencing Chorus).

This family completed all the study tasks, but they shared the least no of content among the participating families, and also showed least interest in the content. Both of them took photos to share with the other member – the main motivation being to update each other about notable happenings of the day. Photos included everyday chores (bills paid, items purchased, etc.), recent celebratory events (e.g., birthday cake), interesting and funny quotes (from social media), shopping (dress that the female member is interested to buy in future, etc.). Similar to the male member’s
choosing TV program to watch during regular meals, in a couple of the recordings with Chorus deployment, I could notice the male member choosing contents from both of their devices. The wife was very much okay with this, and explained that “he knows what I like” and did not have any privacy concerns. On an average, they shared 4.1 content per use, with standard deviation of 0.8.

7.6.1.3 Family 3: Family with Young and Adolescent Children
This family prefers to avoid technology use during their regular meals. While parents sometimes keep their mobile phones nearby and take a call, the children are instructed to leave their devices away from the dining space. During regular days, either the adult female, the adult male, or the eldest child would prepare the meals and the rest of the family would help them setting up the table or with other related tasks. All through their mealtimes, this family engaged in conversation with each other both during the regular meals and meals with Chorus. The everyday discussion focuses on various topics related to their workplaces and schools, daily chores, local news, family and friends, etc. The parents try to engage the children by asking how their day was, but some of their children (child 2) is very shy about sharing anything. The parents take this sportingly and understands the adolescent’s behavior.

With Chorus, the family members sometimes saved contents in the app during the day, but most often they took photos with the intention of sharing later, and the actual selection through the app happened immediately before they began their meals. During the study period, the adult female member and the youngest daughter shared many contents consistently throughout the study period; the eldest child was not present during the dinner in all but one time (as he worked during that time). The adult male member sometimes shared few or no content, when he was busy and could not think of anything to share. In other times, he shared various tweets related to his research area that he hoped the children would find instructive as well as enjoyable – particularly some tweets about his recent conference trip where he delivered a keynote speech. When he could manage the time, he also shared some recent and old photos, and some music of his personal choice. During the deployment, a notable change could be noticed in the ways the second child shared his device and content. While at the beginning, he did not share any content and was shy about photographs of him shared by others, he gradually opened up to the discussion and at later weeks of the study shared few contents of personal significance with the family. The family
rejoiced this change, and I discuss this in a later section. On an average, this family shared 12 contents on every use, with standard deviation of 1.6.

7.6.1.4 Family 4: Young Married Couple
This family either watches streamed video of some TV series in their laptop or some program in the television during their everyday shared meals. The husband joins at the later stage of preparation for the meal while the wife prepares the dishes. Similar to family 2, the husband organizes the dining space and configures the media to watch during the meal. Often, he chooses some serial or movie that he has watched before and thinks that his wife would like that. This family rarely talks during their regular meals, and when they do, it is generally some small talk about the food or about something they are currently watching.

With Chorus, both the male and female participant selected their own items to share during the day, but also added more contents before the meal. Often, they took a photo from their workplace or took a screenshot of something from the social media and news. My observations indicated that they talked much more during their meals with Chorus, but they rarely engaged in prolonged conversations about anything and changed the topic as the content in Chorus changed. Interestingly, this family reported that they preferred not to have conversation during meals and recommended to include video sharing through Chorus. As the deployment time progressed, this family gradually used Chorus in a way that reflected their regular mealtime (without Chorus) habits. Initially they shared more photos of personal significance, but later, they resorted to movie related news, tweets, and photos. I could notice a slight increase in the number of their shared contents from first week to the last. Notable here, the female member in this family only shared personal photos or screenshots, whereas her spouse shared all the tweets and music along with some photos. Overall, the adult male member shared much more content than his spouse (9.1 vs. 5.5). On an average, this family shared 14.6 content per use, with 2.8 standard deviation.

7.6.1.5 Family 5: Family with Very Young and Adolescent Children
This family generally watches reality TV shows during their meals. Parents keep their mobile phones nearby (in the pocket or on the table) but children had to leave their devices in their own rooms. During mealtimes, they occasionally focus on the TV program or talk about it among themselves. But most of the time the television
remains in the background and they discuss various topics related to the family’s practical affairs, for example, school activities of the children, planning for vacation, parent’s work activities, the food, etc.

This family experienced some setback with their Chorus usage. After the first use, they experienced some technical issues with connecting the iOS device used by the adult male and child 3 with the other devices. I had to visit this family next week and reinstalled the app in their devices. While it did not cause any loss in their data collected through the app, it delayed the data collection and they ended up in using the system for 4 weeks (9 uses in total) as per my request. I noticed some overlap in device usage in this family. In a couple of occasions, one of the children wanted to share some photo, but that content was located in the phone of their parents. While asked, they explained that in those cases they used their parents phone to take that photo as it had a better camera configuration. In general, the parents shared photos related to the family including the two youngest children, but the adolescents shared photos more related to their own activities. They shared 9.0 content per use on average, with standard deviation of 1.3.

7.6.1.6 Family 6: Family with Adolescent Children
This family with children generally watches television during their meals, unless there are guests and then they only use the music system connecting it to their mobile devices. The children and the adult female leave their mobile devices in the lounge before the meal begins, but the adult male member generally keeps his device in his pocket. Occasionally the parents turn the television off if they feel the children are not paying attention to them. The parents intentionally emphasize on family conversation during their meals, for example, the adult male member often brings topics of his business so that the children get some idea about his work.

During the deployment period of Chorus, the children enthusiastically shared many more content of their preference than their parents. The eldest child shared many Internet memes of her favorite anime character, she also shared some of these repeatedly during multiple family dinners at the first week, which other members did not find much interest in. So, after the first week they excluded her phone from using Chorus. The youngest children had an older iPhone, where the Chorus app could not be installed. So, she shared content from her mother’s device and brought this topic
into the mealtime conversation as an opportunity to ask for a new phone. While the adult female member found it challenging to share new content during every use, the children said the opposite. On an average, this family shared 18.3 content per day of Chorus use with standard deviation of 4.6.

### 7.6.1.7 Family 7: Young Married Student Couple

This is a young student couple who regularly watch television programs, movies, or share social media posts through mobile devices during their family mealtimes. They either use the dining table or couch during regular meals. Mobile devices are kept nearby even if not used during shared meals. During regular meals, they would watch “anything” without giving much thought on it; they prefer media from the comedy or drama genre. Though this family does not have any explicit restriction on technology usage at shared mealtimes, they sometimes consciously avoid technology usage that are not shared. Interestingly, being shared could have somewhat different meaning than generally agreed – the interaction does not require to be shared, but the awareness of the interaction needs to be (more details in Section 7.6.2.2). During their regular meals, the most common topics of conversation is about the food or about the media they are watching at that time. They also occasionally show interesting social media posts to each other while they eat together.

In this family, both the male and female members saved interesting content to share in the Chorus app all throughout the day. Their app usage remained unchanged over the time with average of 10.9 content per day and 2.7 standard deviation. They did not find it challenging to select suitable content for sharing through Chorus.

### 7.6.2 Changes in Preparation for Family Mealtimes

I noticed several changes in the way families prepared for their mealtimes. While mealtimes have associated activities that span throughout the day (e.g. deciding what to eat, shopping for ingredients, etc.), individual family members generally do not prepare a narrative for the mealtime. Chorus specifically encourages participants to prepare for meals by considering what digital content they wish to share and discuss at the dinner table. In this section, I report on how participants prepared for the meal, with and without Chorus.
7.6.2.1 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 TV content 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. Or, I would, for example, [know] a Persian website for movies, and if I knew a new movie was uploaded, okay let’s watch this new movie.” (Female, family 7)

There are two aspects notable here. First, the entire family had to watch something that was agreeable to all, sometimes sacrificing individual preferences. For example, the father in family one watched reality TV shows despite his preference of sports or news programs. Second, these television programs were developed for generic audiences and thus not tailored for individual audience and their life experience.

Chorus changed this by allowing everyone to select their own content 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. On several occasions, I observed the excitement of children when their shared content appeared into the display. 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. Hupfeld and Rodden (2012) showed that families often leave the regular chair where a member generally seats empty when s/he is absent. Hollows (2008) on the other hand showed that during special occasions, families sometimes mark the presence of physically absent family members using photographs. Here the families tried to achieve the same using Chorus.

I expected families to prepare anecdotes and stories throughout their day for sharing at mealtimes. However, in practice, all families (except family 7 and occasionally, family 3) 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 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.”
(Male, family 1)

All 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 participants or at least did not disrupt them noticeably.

7.6.2.2 Choice and Moderation of Media for Mealtimes
During the regular meals (without Chorus), families generally watch or stream television programs, such as reality TV show, games, movies, news, etc. (Table 7.1). 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.” (Male, family 7)

Families without children generally do not place explicit restrictions on technology usage at shared mealtimes. However, they sometimes consciously avoid technology use that is not shared. Interestingly in the mealtime context, sharing is not limited to interactions that the family members enjoyed together, 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.” (Male, family 7)

“Maybe I am more concerned specially if it is work related things, for example, if he is checking his university [email] 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.” (Female, family 7)

With Chorus, most 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 I discuss next.

7.6.3 Intentions for Sharing Content through Chorus

Participants often reported that there was no specific reason for choosing an item. Nevertheless, several themes, concerning motivation, emerged from my discussion with them and subsequent analysis. I loosely structure the findings according to the classification by Sellen and Whittaker [2010], who identify different ways people use
digital artifact to support personal memories, namely reminiscence, remembrance, recollection, retrieval, and reflection.

7.6.3.1 Updating Family Members and Retrieving Facts

One of the features in Chorus application was to update family members about notable (or sometimes mundane) events of the day during the family mealtimes. Photos served as a very good cue to trigger discussion about an event. This was evident when the husband in family 1 described why he shared a banal photo (Figure 7.7) 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.” (Male, family 1)

I have found many more occurrences of the same. In many cases, families took multiple photos around one topic and used the SIMPLE feature (Section 7.4) to show more photos related to the current one. Also, 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].”

Another purpose of sharing contents was informational, serving the purpose of retrieving factual events to discuss at meals. One example concerned the youngest daughter (child 1) in family 3, who was a gymnast of her school team and was interested in the ongoing Olympic games. She was particularly proud to share an instance when Australia was on top of the medal-list for gymnasts, and selected this screenshot to bring this matter to others’ interest. 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 as a reference to bring the topic into their mealtime conversation. While I found families updating each other and sometimes discussing notable news events (particularly by parents) during their regular meals as well, Chorus made it easier to explain their day with visual cues.
7.6.3.2 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 to buy it next time, based on their previous experience of drinking 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.” (Male, family 1)

I also observed acts of reminiscing. Family members shared old photos or music to remind others about a past experience, hoping to relive an emotion or sentiment. This study revealed many occurrences of reminiscing, which was the main motivation for sharing old photos or music. For example, the wife in family 4 shared a photo of her husband’s Master’s degree project to remind him one of their common memories. In another instance, the husband in family 1 shared a photo of a house cat from their previous locality, which they were very fond of:

“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.” (Male, family 1)

In another instance, the wife in family 4 shared a photo from her office with her husband to reminisce her own childhood experience:

“I remember one photo in particular, in the office with [name] and [name], with the (portable) heater. It looked like my home in India. My mother and grandmother used to make such portable heaters – the homemade heater; we call it ‘Angithi’. In the nights of winter, we used to have it in the room” (Female, family 4)

I did not observe any act of recollection during regular meals (without Chorus) in the participating families. 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.
7.6.3.3 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 photo of food] this is called chutneys. If you even been to [name of city], you must go there – curries, chutney, and puri!” (Male, 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:

“I wanted to discuss about planning for a friend’s birthday. So, I just took a screenshot of her Facebook home page as a cue for me to raise the topic. And later I shared the photos of the event to show him, as [name of husband] was not there.” (Female, family 7)

In another example, the adult male member in family 4 shared photo of a movie poster because he had partially watched it before and wanted to remind himself 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 adult male member 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.”

I believe it is of particular importance to note that not one instance of reflecting or of reminding were observed during regular meals without Chorus usage. I will discuss about the relevance of it later in this chapter.

7.6.3.4 Entertainment

The final motivation for sharing content 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.
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.

7.6.4 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. From the analysis of study data, I could notice significant changes in the conversation topic, duration, and participation from all members in the family.

7.6.4.1 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 themes was a change in orientation away from TV towards other family members. All the participating families (except family 3) watched television or other streaming media during regular meals (Table 7.1). 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. One of the participants explained:

“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.”
(Female, family 7)

“Last night we were watching a movie, and so we rarely had conversation, because we usually do not talk while watching movies or we will miss a scene or something. Even if we do, it will be a very short comment, because we do not want to, especially if it is a movie, interrupt each other or miss a scene.”
(Female, family 7)

Also, 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 words or an incomplete sentence, as they were more focused into the television watching. For example, in one of the video observations, I notice how the female member in family 1 finished her quick remarks and stopped to wait her husband’s response. However, her spouse missed the cue and did not respond until she stared at him for a few
seconds and he noticed the irregularity. In another instance with this family, I note this conversation snippet:

“*Heating okay?*” (Male, family 1)

“*[Looking at the TV] It will be alright. [After 15 second, 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]” (Female, 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.” (Male, family 6)

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

### 7.6.4.2 Focus on Intimate Exchanges

One interesting use of *Chorus* involved how the families used it to bring sensitive personal topics into the conversation. For example, family 1 discussed about a photo showing a 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.” (Female, 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 - an anniversary that went a couple of days ago. The whole family was engaged to discuss the photo and remember him.
Adolescent children in the families were more difficult to engage during both regular mealtimes as well as with *Chorus* usage – “They are secretive”, as the adult female member in family 3 explained. So, it brought delight to the family during one meal with *Chorus* when the youngest son (child 2) 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 generally does not share or discuss personal matters with the family.

The parents in family 3 chose to share some music of their personal preference, some of which had other significance with their life experiences. 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 adult female member explained how the singer David Bowie and his songs inspired their generation on many aspects of fashion and lifestyle.

7.6.4.3 Orientations towards Food

One interesting difference was that the *Chorus* app brought the attention back to their food. During the study, I noted how the families discussed 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 adult male in family 7 is the food itself:

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

7.6.4.4 Engaging Everyone in the Family Including Children

Most notably, *Chorus* served as an intermediary to engage everyone in the family into a conversation. When asked about the changes in their mealtime interactions brought upon by *Chorus*, the adult male member in family 5 responded:

“I suppose [there is difference], because we were deliberately trying to show the photos and stuff like that, and make sure that everyone is involved in it. But it was also engaging. We can sit here and people will eat and talk generally, but this was talking about certain subjects rather than, you know,
like, because if no one has anything to say in a normal dinner, we will eat like not much is going on. Especially when you have little kids, there will always be talk with them, but between the older ones, they would at least try and make the effort to talk about what we were showing on the phones on the app. Staff on my phone probably would not normally get shared, the girls would tend to do.”

In that way, Chorus enabled everyone an opportunity to share content of their choice to the rest of their family. 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 (child 3) 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 with Chorus, they decided to exclude her phone.

During a meal with Chorus, this family also became engaged in a small game provoked by an Internet meme shared by the youngest daughter (child 1). It involved word transformation to find one’s “Dragon Name” from his/her real name (Figure 7.8: Family 6 used Chorus to discuss the game “Dragon Name” and played the game after the meal.)
7.8). 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 adult male member once shared a few photos related to 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 finally the parents took her and her friend to that place during the next weekend. In both cases, Chorus worked as a tool to provoke interaction, it was by no means intended to work as a platform for all interactions, but enable participants to highlight their interests and promote interaction in subtle ways.

Children also intentionally brought sensitive topics of their interest, often in a humorous way. For example, the youngest daughter (child 1) in family 6 wished she could live near to her best friend’s home. So, when she saw an advert of a nearby house being up for sale, she took a photo and during the meal posed like a “real-estate agent” trying to convince her parents to buy that house. The second daughter (child 2) 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).

7.6.5 Challenges for Long-Time Deployment

Even though Chorus facilitated families to engage with each other in interesting ways, its usage was not always just positive. In this section, I present the challenges that emerged over the three-week deployment of Chorus.

7.6.5.1 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” (Female, family 4)

The chore of creating content became notable as families used the system over the three weeks. They noted how it became increasingly difficult to find significant happenings in their everyday life. Many resorted to sharing old photos and funny quotes instead. This was particularly evident with small families, where there were fewer people contributing to the family experience. One participant explained:
“Maybe someone else in the family could chose photos for us, so it will be both related and serendipitous. While I did not know about [husband’s name] photo [from his day], half of the things I already knew.” (Female, family 4)

Another participant described why they found it hard to bring interesting topics to discussion too:

“I think we found that hard actually, to come up with content that would be interesting enough to have conversation around, because, we spend so much time with each other anyway.” [Male, family 1]

An 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:

“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, [Child 3’s name] 5, mom 10 in the first, and then smaller, smaller …” (Child 1, family 6)

“My one became bigger.” (Child 3, family 6)

“Until we stopped using your device.” (Female, family 6)

Over time, 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.” (Male, 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 one in a week (family 1, 2, 4, 6), when notable events happen (family 3, 5) or in one family (family 7), regularly. The adult male member 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”

7.6.5.2 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 mealt ime. For example, 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 now 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.” (Male, family 1)

This challenge rises as a change from spontaneous discourse during mealtimes to a pre-planned and curated media provoked discourse among the family members.

7.6.5.3 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 1, 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 including 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.” (Female, family 4)
It might not be that these families do not want to have conversation during mealtimes, but rather that they have exhausted conversation (as indicated by the quote) or that they prefer moments of peace and quiet, or to focus on the experience of eating (as also have been seen with family 3, 4, or 5 in study one). These examples then challenge the assumption that it is always desirable to have family members interact with each other during mealtimes. Hence, I do not expect Chorus (or any other technology for that matter) to be incorporated seamlessly for all families or for every meal. Different families have different levels of acceptance of technology, power dynamics, etc., which would make Chorus usage idiosyncratic to particular family structures and routines.

7.7 Discussion

This chapter investigates the potential role and associated challenges of technology usage in augmenting the togetherness achieved through the experience of family mealtimes. While I acknowledge the criticism of technology (both television and mobile devices) usage in this space [Bellisle and Dalix 2001; Hiniker et al. 2016; Stroebele and De Castro 2004], this 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, I present Chorus – a celebratory technology specifically developed for mealtime usage that transforms personal devices and data into a shared resource. The field study with Chorus deployment shows interesting ways in which its usage contrasted with the regular experiences of family meals.

First of all, as I have found in study 1, TV watching practices during family mealtimes serves as form of relaxation and a distraction from the meal itself. In contrast, content from Chorus 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, I found the 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. I 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 to individual family members and also onto the food itself. From analysis of video recorded observation, I could notice better eye contact and interest towards what other members have shared during the meal (while I do not quantify this). I also note how children were more enthusiastic and pro-active with sharing contents of their choice, their voice typically unheard during regular meals. Another interesting observation included how technologies could help the families broach sensitive topics in a smooth, sensible, and humorous way. For example, when the mother in family 3 shared a photo of her long-deceased father whose death anniversary happened to be couple of days ago, all the family members actively participated in talking about their own experience with him and toasted to his memory. While the discussion is reinforced by place (e.g. dining settings), members (people who knew him), shared experience (spending time with him), technology (*Chorus*) did provide a way to bring this into the discussion in a discerning 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 brought about 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. For these families, they find relaxation in quietly watching various media (e.g., TV programs and other streamed media), as they have already shared their daily experience while travelling back to home together, or while cooking. This study thus sheds light on the popular belief that having family interaction at mealtimes is *desired*, and highlights other opinions too.
Now I discuss the design insights I obtained from this study and how it (along earlier studies of this thesis) informs about the use of technologies during family mealtimes as per the Toyama [2015] framework.

7.7.1 Design Implications

Having investigated how different aspects of Chorus impacted the mealtime configurations, what might this mean for HCI researchers and for future advancements in mealtime technologies? Now I discuss how the findings can be used by interaction designers and other technologists to address the challenges and opportunities involved in designing new technologies to support commensality at family mealtimes.

7.7.1.1 Implications for Media Selection at Mealtimes

While the participating families liked the capability of handpicking media, they also recommended unexpected content by automatic or random presentation of items. The display of random content or presenting system-generated related content without moderation raises privacy concerns and concerns about the suitability of such content for young children. Another concern was the setup time for the system, partially because participants selected items immediately before the meal and because the devices were required to sync with each other to exchange shared contents. During this period, the families generally started their meal, with an eye on the progress bar of the system and waited for the display to start.

7.7.1.2 Implications for Device Ecology in Home and Workplace

The participants often used multiple devices throughout the day - e.g., laptop, desktop, smartphone, tablet devices, etc., but they typically used their mobile devices for Chorus. When they identified something to share from another device (e.g., a photo on a laptop), they sometimes took a photo of the screen with their mobile device. It would be preferable to have the ability to transfer content between devices and platforms. 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 7, work related call in family 3 and family 5, work related text message in family 6) can impede on the social enjoyment of togetherness at mealtimes. While this is an interruption to both the meal and the experience around Chorus, families could not avoid such interactions.
7.7.1.3 Implications for Storytelling in the Family

*Chorus* played an important role in encouraging storytelling. Photos have long been used in domestic settings to share stories that engender family values and roles [Chalfen 1987]. Lindley et al. [2009] explored how stories shared and told through photos can support reflection and remembrance, self-expression, and connections with partners, family members and other significant contacts. *Chorus* offers different ways of engaging with the photo for storytelling during family mealtimes. On the one hand, I observed storytelling that is fragmented where each piece of content tells its own story, for example in family 1 sharing the photo of a wine bottle to remind themselves to buy this wine again. On the other hand, *Chorus* also supported connected storytelling where all the content tells one story. This was illustrated when family members chose multiple photos to describe how his/her day was.

Furthermore, 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 provides a “ticket-to-talk” [Sacks 1992] – a legitimate circumstance for conversation, which can be the hardest part of the story. There is also a sense from some families that they have a prepared *story* and they then struggle not to *break* it in the course of other activities.

7.7.1.4 Implications for Adoption of Celebratory Technology at Family Mealtimes

This study shows that the celebratory nature of mealtimes is found not in the shared content itself, which is banal in many cases – but the expression of caring for each other, which is carried by the intention of sharing. In many cases families struggled to identify interesting contents among their surrounding life and turned to sharing old photos and Internet memes. This demonstrates that *Chorus* is able to support sharing across multiple aspects of familial life. The design of celebratory technology needs to carefully consider the balance between recent and older content, and ensure the technology remains in the background without impeding the expressions of caring.

7.7.2 Identifying the Self-Control over Media Usage at Mealtimes

Toyama [2015] advocated for *self-control* or *will* as the final element of his proposed framework, i.e., avoiding indiscriminate dissemination of technologies that works in one context to another context assuming it will work there too. He explained that the
contextual factors of each social problem, even for the same problem in different geographic locations and societies, can vary a lot. Hence, it is really important to avoid any indiscriminant application of technologies without carefully considering the first two factors (intention and discernment). I recognize the very lack of this “self-control” in the current ICT usage in the family mealtime space. As discussed in earlier chapters, families are adopting technologies (television, mobile devices, etc.) in the social space of family meals – technologies that are not designed for this space. So as Toyama [2015] explained, these technologies in their current form fails to utilize the good intention properly and rather occasionally magnifies the problems associated with ICT usage.

My first study demonstrated that families do have the good intention towards making the family mealtime an enjoyable occasion for everyone. The second study focused on amplifying the positive intentions of the families through discernment in designing technologies for the family mealtime space. This study focused on the changes brought upon the commensal experience by the technology. In this study, I developed Chorus and analyzed various aspects of commensality with its usage in the families for three weeks. I investigated into how everyday happenings becomes mealtime conversation topic, formed a storyline in that way, and revisited notable happenings of the event. Thus, the third study completes a story that investigates the potential role of technologies during family mealtimes.

Both TableTalk and Chorus embraces the design for family’s commensal experience at its core, and hence may not be the right design for other social settings. Some of the participants detected the benefits of such systems in other application contexts, for example, when friends reunite after some time, playing games with amalgamated screens, etc. However, each of these application areas will require careful readjustment of the system and that is not the focus in this PhD research. In this section, I discuss how TableTalk and Chorus supported and influenced various aspects of family mealtime – the shared experience of eating together, moral concerns around the interaction of family members, the mundane nature of everyday family meals, intergenerational interactions, etc. These aspects may not be at the core of other collocated social contexts (e.g., outside the family or other contexts than mealtimes), hence indiscriminate application of the same technology (TableTalk or
Chorus) may not be appropriate in those scenarios. Now I discuss each of these aspects in details.

7.7.2.1 Shared Practices of Eating and Using Technologies

Commensal experience demands the sharing of food together. Fischler [2011] discussed the social, political, and other aspects of communal eating practices. He explained that eating alone were historically associated with treacherous activities (e.g., poisoning, black magic, etc.) and being antisocial due to the suspicion of undue eating (without sharing with others). In that sense, food consumption seems to be perceived as a zero-sum game; not taking part in the process may be equated with secretly taking an undue part of the whole.

I believe the same applies for technology consumption as well. When someone is using their own personal smart-device while eating together, it not only creates a personal sphere of attention for that individual, it is considered by the rest of the family as if s/he is too much into his/her own activities (be it casual browsing, social media, or work-related things). It is then sometimes considered customary to share or at least describe what s/he is doing on that personal screen (e.g., the mother explaining the purpose of her sending SMS in Section 4.5.6.2, or the husband reading aloud nutritional information to the wife while they eat in Section 7.6.4.3).

Both TableTalk and Chorus embodies this philosophy in its design, that is everyone needs to be in the same place near to their technology usage during mealtimes. Once the system starts running, it requires all the devices to be a part of it. Family members could take away a device (e.g., to take a call, or do some searching), but it will cause the whole system to pause and wait till that device joins back. Notably, not one of the families in study 2 took their device away while using TableTalk. But in study 3 the adult male member in family 3 once used this feature to take a call, but promptly returned the device to join the rest and resumed Chorus.

Such concerns around shared usage of technologies may or may not apply to personal technology usage in other social settings, for example, in office environment with colleagues or friends’ get-together in a pub [Porcheron et al. 2016]. The context and subsequent practices around personal technology usage could be very different from the commensal experience that I investigated in the family. Hence, I do not conclude that this design concept for sharing personal contents by creating an ad-hoc display of
the personal smart devices will work in other social settings too. I confine this research solely into the family mealtime settings, and avoid indiscriminate application of the developed system.

7.7.2.2 Moral Concerns and Accountability Regarding Conversation and Shared Contents

Family mealtimes, especially in families with children, are often sites for recounting narratives that convey moral messages through exchanging accounts of personal or collective significance [Ochs and Shohet 2006]. Children often play a prominent role here, for both discussing and updating parents about notable happenings of the day, or storytelling that is aimed towards guiding them in a morally preferred way of thinking, feeling, and acting in the world [Blum-Kulka 2012; Ochs and Shohet 2006].

I have seen such moral concerns and accountability reflected in both study two and three. Family members sometime enquired or expressed their disapproval (in a humorous way) about shared contents, for example music (Section 6.5.2.2) or too many contents that others’ do not find very interesting (Section 7.6.4.4). While such usage reflects the core aspects of commensality in the family home, it could be quite different in other social settings. Other social groups might show a completely different attitude to contents they find not up to their taste (music, for example), or there could be implications for accountability in sharing contents (e.g., inappropriate contents) that is quite different from the family. Another notable issue is that the participating families rarely had any concerns around privacy of the contents in their phone when other family members accessed it. This was evident, for example, when families did not moderate the randomly selected contents (study two) or asked others to do it for them (Section 6.5.1.4). I can safely assume that concerns around privacy will be a much more prevailing issue for other social groups than families. So carefully considering the group dynamics and privacy concerns would be required before designing similar technologies for them.

7.7.2.3 Mundane Nature of Commensality

Fischler [2011] explained the relevance of everyday commensality in the family: “Commensality is not necessarily associated with ceremonial occasions; it actually is an essential dimension of the common meal and it could even be said that it finds its most salient expression in that particular, daily social occurrence. Above all, it
counteracts the essential, basic, biological, ‘exclusive selfishness of eating’ and turns it into, at the very least, a collective, social experience.” (p. 531)

I have noticed such mundaneness in shared contents through TableTalk and Chorus. In both study two and study three, family members intentionally took many photos or shared tweets to discuss and share ordinary things around them (e.g., a shared walkway through the park, supermarket grocery, etc.). In many such occasions, these contents carried more meaning to the family members than to any other social settings. For example, one motivation was just sharing what happened throughout the day while they were not together (Section 7.6.3.1), or when a railway station name reminded about a previous novel that the mother and her children read together (Section 6.5.2.1). Those contents mean something to that particular family because of their shared experience together, and probably would not make much sense to an outsider.

So, one may safely assume that the usage of TableTalk, Chorus, or any other similar technology could be quite different when other groups of people than the nuclear family meets in social settings. For example, the ways spouse updates each other about mundane happenings of the day (both through TableTalk and without it) may not be of particular interest in other social groups (e.g., friends or co-workers); as an example, they might be interested in more noteworthy happenings that happened since this group meet last. There could be multitudes of different other requirements, and technological advancements requires to focus on that unique requirements of the application context.

7.7.2.4 Opportunities for Bringing Educational, Sensitive, and Emotional Topics into Conversation

Family mealtimes are often considered as events to support the intimate bonding and nurturing strong ties among the family members. So, it is unsurprising that the study two and study three revealed how family members expressed contents that bear symbols of sensitive and emotional topics for that particular family. Technology here played the role of a medium that allowed bringing the topic into the discussion in a subtle way – be it a photo of a deceased family member to commemorate his death anniversary (Section 7.6.4.2) or sharing a photo of a cat from old neighborhood that everyone in the family loved (Section 7.6.3.2). Parents also intentionally used the
system to bring several topics of educational interest to their children (Section 6.5.3.3). All these are important aspects of commensality in the family home that TableTalk and Chorus supported, but they might not be that relevant in other social contexts outside the family. So again, I need to show restraint in using TableTalk and Chorus in other social contexts than family mealtimes.

7.7.2.5 Manners and Etiquette around Meals and Technology

It is generally expected as good manners during shared meals both in families and other social setting to practice restraint in consumption of food - each person is expected to not reveal eagerness or take more than a modest share so as not to deprive others of it. My studies showed that the same etiquette might be expected of shared technology usage in that space as well.

During study two with TableTalk, each family members was restricted to share at most 30 items from their device, but they could share less. I removed this restriction in the third study – but generally the amount of shared contents by different family members were not very disproportionate. When exception to this happened, for example the younger son (child 2) in family 3 (Study three) were shy to share much contents – it drew attention from the family, but they explained it is common in the family as they know him being adolescent and shy about sharing personal contents with the family (Section 6.5.1.4). However, in another instance, the eldest daughter in family 6 (study 3) shared too many contents, many of those were repetitions of her favorite anime characters, the family at one point decided to exclude her device from the Chorus system.

Both TableTalk and Chorus displayed the shared contents in random order. While this ensured lack of any bias towards any family member, it caused dissatisfaction in some cases too (though very rarely). In one instance the youngest daughter in family 3 (study two) was quite unsatisfied as her shared content did not come to display by the time their meal was concluded (Section 6.5.3.4). While commensal experience in the family recommends for such democratic arrangement, they may not be suitable for other formal settings.
7.8 Summary
In this chapter, I aimed to bring the attention to the sense of togetherness achieved through regular family mealtimes. My goal was not to develop a generalizable solution. Instead I focused on how a system designed to support family interactions could augment the enjoyment of the meal, and I compared the experience with regular meals to understand the contrast and impact on familial interactions. In doing so, I note the ways through technologies can support memories and experiences shared between family members. *Chorus* encouraged participation of every member in the family, helped to introduce sensitive topics into discussion, and brought the attention back to the family and food. Finally, I discuss the challenges associated in using such systems over three weeks and discuss implications for future refinements. Overall, this study demonstrates that through sensitive design and deployment celebratory technologies can positively enhance the family interaction at mealtimes.
Chapter 8: Discussion and Concluding Remarks

8.1 Introduction
I began this research with an exploratory study to understand the technological landscape and associated family practices during mealtimes (study 1). This study highlighted both the positive and negative aspects of technology usage in this regard and revealed the nuanced ways families manage interactions with technologies and among themselves. This study inspired me to design TableTalk – a technology probe to investigate if the personal devices (e.g., smartphones, tablet devices) can be repurposed as a shared resource and if that aligns with or supports the core values and expectations of commensality. The field study demonstrated that TableTalk supported familial experiences of togetherness by stimulating conversation, encouraging participation, bonding, education, and socializing. This study highlighted the possible roles and opportunities of mobile-networked devices to enhance the family mealtime experience. In the third and final study, I developed Chorus and focused on the novel opportunities offered up by the affordance of smart mobile devices during everyday life, investigated how the families could utilize them in constructing new experience for the shared family mealtime space, and identified the challenges for adoption of such celebratory technologies by the families.

In discussing the contribution of this thesis, I reflect on the implications of the findings from all of these studies. In this chapter, I begin with a reflection on the main research question I addressed in this thesis: “How can the use of information and communication technologies contribute to familial commensality in the home?” I adopted a framework proposed by Toyama [2015] alongside analyzing each of the three study findings of this thesis in their respective chapters to explain family members’ attitude towards technology usage at mealtimes, and my understandings from the ways each family manages their technological practices. I explain the study findings using this framework to discuss how families have managed their technology usage, how these can be used as opportunities to enhance family mealtime experience, and finally, what it means for future technological advancements. In this concluding
chapter, I begin with a brief discussion on the key understandings from using this Toyama [2015] framework in the family mealtime context. From there, I discuss how ICTs can contribute to commensality in the family home and summarize the contributions of this thesis. The field deployment of TableTalk and Chorus showed both success and limitations of technologies at mealtimes, and revealed new challenges brought upon by ICTs. I conclude this thesis by elaborating on these new challenges for celebratory technologies at family mealtimes and for the collocated interaction space in general.

8.2 The Role of Technologies during Family Mealtimes

Despite the vast amount of experimental and cutting-edge technologies developed for either solving kitchen issues or facilitating the familial interaction at mealtimes, the dining space have resisted widespread adoption of these technologies [Hupfeld and Rodden 2012]. The most commonly available and used device in this space is still the television. Personal and mobile devices are widely available nowadays (as they remain with the user almost all through the day) and occasionally used during mealtimes. There has been strong criticism about technology usage during mealtimes - both in sociological research [Hersey and Jordan 2007; Mintz and Du Bois 2002] and common cultures [Blackwell et al. 2016; Hiniker et al. 2016; Moser et al. 2016]. Technologies used in the context of family mealtimes, be it a smartphone or television, are often regarded with concern because they can diminish or even displace social interaction [Fulkerson et al. 2008; Hiniker et al. 2016; Stroebele and De Castro 2004]. Despite these criticisms, the use of technologies while eating is very widespread, and often without creating notable disruptions in the familial interactions. It appears as if families are not much concerned with the possible detrimental impacts on their social interactions or unhealthier eating practices, or the potential for entertainment outweighs the negative concerns.

I acknowledge these concerns (Section 2.3.3) and recognize some evidence of these concerns in my study findings (Section 4.5.6.3, for example). My studies showed the nuanced ways each family manages the usage of these devices – from arbitrary use to non-use or use of some specific applications for specific purposes – each family have consciously or unconsciously developed a set of norms and practices that works for that particular family. I do not make moral arguments with respect to the usage of
technology during family mealtimes, or problematize the use of technologies during mealtimes in general, but I look to the ways that such technologies contribute or detract from the experience of togetherness by the family members in these settings. In this respect, I unfold the ways that families utilize the opportunities presented by particular technological arrangements and how they enact a moral order of family life through their practices related to technology usage.

The body of this research aimed to understand ways to improve the social experience of eating together through utilizing personal devices as a shared resource. This might seem counterintuitive, and one might even ask whether it is necessary at all. The studies showed that families are in fact managing their technological practices (which vary widely across different families) quite harmoniously, while there is no universal way of managing interactions with and the presence of these devices during family mealtimes. But importantly, I wish to venture beyond this answer to find why despite the criticism of technology usage (particularly television and smartphones) at mealtimes in existing literature, these are widely accepted and used in many families and generally remain there without noticeable hiccups.

In this research, I considered a technological intervention to support and enhance the experience of shared family mealtimes. While technology design in this space traditionally aims at solving food related problems, I believe there is potential and a need to address the celebratory nature of meals and support them. I argue that family bonding, concerns about each other, and family members’ effort to make the mealtimes a successful place for nurturing family ties is behind the apparent successful (or unproblematic) management of the current technological practices of family mealtimes. In this thesis, I identified and discussed based on the study data about how families demonstrated the good intention (Section 5.2), and hence, as per the Toyama [2015] framework, there is potential to design ICTs to enhance the experience of family togetherness during their mealtimes.

Study two and study three of this research demonstrates that there are many opportunities to positively enhance the family mealtime experiences through careful design of technologies, despite the widespread criticisms around these. In fact, the availability of television and other newer devices have shown that it is not possible to restrict technology usage; family members are using them anyways during their
mealtimes. So, I recommend more research and development to harness the positive intentions in the family, and develop technologies to enhance this intention into promoting more enjoyable experience of family togetherness during their mealtimes. With this in mind, I conducted study two and three to examine how the design of TableTalk and Chorus supported the existing positive intentions of the family members, and how the findings could be generalized (or not) for future endeavors – discernment and self-control respectively, as per the Toyama [2015] framework. Both TableTalk and Chorus aimed to support and enhance togetherness in the family through their commonly available smart devices. However, I do not say that there is a lack of togetherness in the family without these interventions, but highlight how several design features of the system could amplify it in different ways than from meals without TableTalk and Chorus. And finally, this discussion led me to consider the changes and challenges for future technological interventions in this context.

The experience with TableTalk and Chorus was not all positive, nor it was similar for all families. For example, family 4 (study three) complained that while the system encouraged them to talk, they preferred not to do so during the meal. They would rather prefer video sharing feature (in Chorus or a similar system), so they can watch it passively. This is understandable, as this particular family rarely talks during their regular everyday meals and normally watches a show in their laptop. They are habituated to this practice, and expected the same from Chorus. This is also confluent with the explanation Toyama [2015] provided in proposing the framework, i.e., technology cannot amplify if the underlying human intention does not exist. This is something I noticed on several occasions. TableTalk and Chorus provoked more conversation and interactions in families that generally talks more during their regular mealtimes (without these interventions) than those that often silently eats their meals in front of the television. My observations also indicated that TableTalk and Chorus usage experience was more enjoyable in families that generally do not use technologies at mealtimes. This might be because these families already have more conversation than those who watches television during mealtimes. TableTalk then provides more nudges for these families to discuss, and more pointers for generating interest. TableTalk could only support family’s intention to interact and share personal stories, it cannot force them, at least not in a meaningful way to support togetherness. It is a non-trivial task to encourage family members who do not engage
in conversation to do so with *TableTalk*, it will take time and effort, technology alone would be insufficient to do so. Technology cannot bootstrap an ethical or behavioral change on its own; people need to demand it.

So, my adoption of the Toyama [2015] framework informs us that the current criticisms of ICTs hampering the commensal experience in the family could be somewhat overstated and these technologies are not designed to support commensality in the family home. However, there are positive intention among the family members to make their mealtimes enjoyable to all, and hence, there is potential for ICTs to support and enhance this positive intention. Study two and three demonstrated a design concept to engage family members through sharing various content of personal and familial significance. So, I recommend more research and development to harness the positive intentions in the family, and develop technologies to enhance the positive intention of the family members into promoting more enjoyable experience of family togetherness during their mealtimes.

### 8.3 How can ICTs Contribute to Familial Commensality in the Home?

In view of my adoption of Toyama [2015] framework to explain the motivation, findings, and implications of this thesis, I now discuss how it answers the main research question (Section 2.7.3) - how can the use of information and communication technologies contribute to familial commensality in the home? While I acknowledge and agree with the criticism that technology can hamper the togetherness and familial interaction around mealtimes, I attribute that to the lack of designing technologies with specific concerns around domestic mealtimes at its core. I encourage designing using already available devices that could be reconfigured to adjust to the family requirements of mealtime context. To demonstrate this, I designed the *TableTalk* and *Chorus* systems to leverage the opportunity of using both the smart devices and their data within to provoke interactions during the family mealtimes. In doing so, I could identify a few ways through with technologies can actually promote interactions in the family during mealtimes.

#### 8.3.1 Promote and Provoke Conversation in the Families

Family mealtimes are often 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 a sense of anticipation. Content from Chorus, though mundane to an outsider, carries significance for the family through the stories underpinning the content. Often, I found the participants had specific intentions for sharing content, which generally could not be achieved during their regular mealtimes. With Chorus, one member specifically shared something purposefully to remind others about a memory (e.g., the mother in family 3 shared photo of her deceased father) of personal or familial significance. I noted how families used Chorus intentionally to provoke different kinds of memory aspects—retrieving, reminding, recollecting, and updating each other—many of which are generally not achieved (at least intentionally) with traditional media (television, for example).

So, these findings appear to contradict the traditional understandings that technologies hamper familial interactions during mealtimes. I show that mealtime technologies do not necessarily take the attention away from the social experience of commensality. I have demonstrated that families have positive intentions to make their mealtimes a place for interaction and enjoyment, but technologies in their current form (television, mobile devices, etc.) are not designed to support this intention. The study two and three has proven that it is possible to use the already available devices and their data within to promote and provoke conversations in an interesting way so that their natural conversation could be supported and remain enjoyable.

8.3.2 Enable Sharing Sensitive Topics in the Families

Another interesting observation included how technologies could help the families broach sensitive topics in a smooth, sensible, and humorous way. For example, when the adult female member in family 3 (study 3) shared a photo of her long-deceased father whose death anniversary happened to be couple of days ago, all the family members actively participated in talking about their own experience with him and toasted to his memory. While the discussion is reinforced by place (e.g., dining settings), members (people who knew), shared experience (spending time with him), technology (Chorus) provided a way to bring this into the discussion in a discerning way.
Here again, it is evident that technologies can allow people to plan and prepare for the topics they want to bring into the family discussion in a subtle way. Since family members generally have positive attitude about each other and provides mental support to one another, the role of the technology here is being a mediator. It can create a middle layer between the source of the content and the audience and create the abstraction that family members can find comfort in while sharing any content of sentimental value.

8.3.3 Encourage Everyone to Participate in Conversation

Another contribution that technologies can bring to the family dining table is that it can encourage everyone in the family to participate in the conversation. It is worth clarifying at this point that my objective here is not to ensure that every family engage in intimate conversation during their mealtimes. As the studies have shown, this is not something that all families want at all times. Some families may just want to watch something silently, and I do not take a stance that there is lack of togetherness in doing so. However, I noted during both the second and third study that children were more enthusiastic and pro-active with sharing contents of their choice, thereby giving them a voice, which is often unheard during the regular meals. While during regular meals, parents enquire about their children’s daily life and subtly try to bring various matters of interest into the conversation (education, safety, etc.), here I could see children’s perspective too. They could share topics of their own interests (e.g., Internet memes, anime characters, favorite sports, etc.). Spontaneous and equal participation is what made the experience with TableTalk and Chorus enjoyable to everyone in the family. Also, other members in the family can subtly invite or encourage a family member to join the conversation through pointing about some media (see Section 7.6.4.2 for an example). This might be particularly relevant for adolescent children, who are often shy to share their personal content with their family. But I have noticed that over the time, the usage of Chorus could bring down the barrier and eventually they also might start sharing content of their choice.

8.4 Contributions of the Thesis

This thesis has shown that commensal technologies are complex and evolving. The television, while being one of the few commonly used mealtime technologies, takes 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.). Also, mobile devices are designed around the individual, and so they are not ideal for supporting shared commensal experiences. The first study demonstrated that the presence of these mobile ICT devices is causing changes in the dynamics of family interactions. I explored the different ways families manage and interact with their technologies during mealtimes and have sought to better understand the evolving challenges and opportunities for interaction designer and researchers in this space. The second and third studies showed that there are untapped potentials for mobile technologies to enhance the family experience of mealtimes. The originality of this thesis is embedded in challenging the traditional viewpoint that technology usage hinders commensal experiences at the dinner table. I proposed a design concept, developed, tested, and deployed it with families over extended period. The results arising from this deployment demonstrate that personal mobile technologies can be reconfigured to shared devices at mealtimes. TableTalk and Chorus have shown that technology can positively impact on commensality by support reminiscence, family bonding, accountability, education, manners, etc. TableTalk and Chorus therefore provide an exemplar of ways in which the thoughtful design of technology can ultimately serve to engage each and every family member both present and absent, thereby enhancing the experience of togetherness through sharing content of personal and familial significance during family mealtimes.

8.4.1 Understanding the Role of ICTs during Family Mealtimes
To the best of my knowledge, study one is the first field study among HCI works that provides a detailed understanding of how families currently use and manage their available ICTs during family mealtimes. This research highlights that the impact of ICTs on the social interactions during family mealtimes cannot be simply characterized as good or bad. Family members have nuanced ways of managing their usage and the outcomes are context dependent. For example, TV watching practices during family mealtimes often serves both as a form of relaxation and a distraction from the meal itself. Mobile communication technologies cause occasional tension among the family members, but it also provokes conversation through sharing its content and supported the conversation through information searching over the Internet. Study one also identified various spatial arrangements of technology and family members and I discussed with examples of how technologies are dynamically
brought in and out from foreground to background of the family conversation throughout the meal. Overall, this study highlighted the positive motivation of the family members in managing their technology usage and encouraged me to design technologies for this space.

8.4.2 Potential of Personal Smart-Devices to Enhance Commensal Experience in the Family

The second study focused on designing and field testing a technology probe _TableTalk_ to investigate the hypothesis that personal smart-devices (phone, tablet, etc.) and content can support various commensal features and enhance the togetherness in the family during their mealtimes. This study showed that with minimal effort, family members could configure and utilize the _TableTalk_ system during their mealtimes. Content from the system generated much interest and conversation among the family members, through which I could observe its influence on various aspects of commensality, for example, family bonding, coordination, education, manners, etc. Again, to the best of my knowledge, _TableTalk_ was the first attempt to leverage the use of already available devices in the family to enhance their interaction during family mealtimes – so my contribution was both in proposing a new design and field testing it in the families. The success of this technology probe encouraged me to focus on the changes in familial interaction brought upon by the technology and the challenges in long-term usage and adoption of such technologies during family mealtimes, which I discuss next.

8.4.3 Changes and Challenges in Designing for Family Mealtimes

The contribution in the third study involved investigating the changes in the family interaction due to its usage and discuss the challenges for adoption of celebratory technologies designed for the family mealtimes. To the best of my knowledge, this is the first study in the domain of family mealtimes that investigates the use of novel technologies for extended durations and compares them with regular family mealtimes. This study showed how everyday happenings became mealtime conversation topics, formed a storyline in that way, and allowed families to revisit notable happenings of the day. _Chorus_ provided more autonomy and option to the users by allowing them to select content they wanted to share anytime during the day, and they could probe deeper into any conversational topic by bringing out similar contents from multiple devices. Notable here was how different types of conversation
could be supported through the usage of the personal smart-devices, many of which generally did not come to the family conversation during their regular mealtimes. Also, I noted how their knowledge of each other and their family history enabled them to make interesting conversation topics out of mundane digital contents. Through this deployment of *Chorus*, I noticed how the system was integrated into the routine of everyday life and the existing practice of the family meals, and the challenges in the ongoing process. Now I discuss some of these challenges and some future research directions related to technology usage during family mealtimes.

### 8.5 Challenges and Future Direction for Celebratory Technology at Family Mealtimes

Designing an effective technology that does not interrupt the enjoyable experience of family meals is by no means a trivial task. While most of the families enjoyed the enhanced conversation brought about by *TableTalk* and *Chorus*, some also felt the burden of curating media for sharing, setting up the system, and especially, engaging in conversation at mealtimes. Grimes and Harper [2008] identified three challenges towards development of celebratory technology for mealtimes – judicious application of technologies and refraining from indiscriminate use of technologies driven by capacity, identifying the appropriate research project, and evaluation of experience-focused research endeavors as opposed to more task-oriented ones. I acknowledge these concerns in this research, but in addition to these, this research has highlighted some new challenges and future opportunities. I discuss them next.

#### 8.5.1 Designing for Different Age-Groups

One challenge is designing for intergenerational family members present during the family mealtimes. My studies showed that young children loved to express themselves, adolescents were mostly hesitant in sharing personal content, and parents carefully maintained a balance in their shared content to represent and attract everyone (including immediate family members who were absent). Most of the existing research on family mealtimes either targeted the adults [Grevet et al. 2012] or the children [Ganesh et al. 2014]. There is very little work that investigates technologies for intergenerational interactions during mealtimes. There are significant challenges associated with designing for this mixed generation of family members.
First of all, the interest, motivation, and expectations vary among different age-groups. For example, the children might be excited to share content that the adult members do not find engaging, particularly if there are many such content (Section 7.6.4.4). They could also become a bit frustrated while waiting for their item to come to display (Section 6.5.3.4). Adults on the other hand are more thoughtful about selecting their content, but they sometimes lack the time or effort to go through their available content and select the right ones. So, in general, it is important to recognize and support intended interactions of all of these age-groups.

8.5.2 Designing for Individual Families’ Preferences
The interaction with technology is unique to the individual family and the mealtime context. For example, while TableTalk and Chorus resulted in provoking and stimulating conversation in all of the participating families, not all of them enjoyed end up in similar experience. While most of the participating families welcomed the opportunity of having interactions prompted by contents from TableTalk and Chorus, some families (e.g., family 4 in study 3) preferred less interaction during mealtimes and wanted to relax by watching television. Hence I do not expect Chorus or any other technology to be incorporated seamlessly for all families or for every meal, since each family may have their own level of acceptance of technology, power dynamics, family norms and restrictions, etc. It is important to recognize this difference and provide freedom for families to make individual choices about their mealtime experiences.

8.5.3 Curating Relevant Content for the Family
My analysis of the contents shared through the Chorus system showed that like mundane meals, the content can also be considered mundane (at least to an outsider), especially when the novelty of the system wears off. These contents are sometime prosaic descriptions of everyday happenings (e.g., husband in family 1 shared a banal photo (Figure 7.7) of a pathway through the park to express how his day was, wife in family 7 took a screenshot of her friend’s Facebook profile just as a reminder to discuss planning for that friend’s birthday). Thus, even though the contents shared through the Chorus itself may not be compelling to the outsider, it is the family members’ history of interactions and their reinterpretation of those interactions during the course of the meal that gave these contents the significance and makes them
interesting. It makes any effort to automatically curate contents to meet the family’s interest particularly difficult. The deployment of Chorus showed that at one hand, it is important for individuals to have the authority for selecting any particular content of their interest, but it might also beneficial to have a system that curates their content, for example, when they are rushed or to bring something serendipitous into the family conversation. Any such system would need to learn and adapt to particular family’s history, individual member’s preferences, and their ongoing life. Hence designing a system that automatic curates interesting memory cues for the family members will be a big challenge.

8.5.4 Reconfiguration of the Dining Space for Technology Adoption

I have seen family dining in three different spaces – the kitchen, lounge, and a dedicated dining space (among the participating families, there could be other configurations too). The presence and usage of technologies have spatial concerns, as I have discussed in Section 4.5.5. Families are required to orientate the technologies, their own sitting arrangements, and remove or hide some technologies during their mealtimes. These practices have evolved over time and each member of the family understands and accepts these arrangements. Introducing any new technology (or new usage of existing ones) may require the already established spatial arrangement to change. As the studies demonstrated, these arrangements may have social consequences too (e.g., the mother in family 5 of study one needed to sit between her children to stop them bickering). Also, some families in study two had to remove some dishes from the dining table to the kitchen for accommodating their smart devices on the table. So understanding how the spacial arrangements of new technologies impact the targeted families is one challenge.

8.5.5 Reconfiguration of the Dining Place for Technology Adoption

Harrison and Dourish [Dourish 2006; Harrison and Dourish 1996] explain how the cultural and social understandings form a place out of the physical space. Place emerges from physical space and is a cultural phenomenon rather than a spatial one. The same physical space (for example, an office) when used for different purposes (for example work or office party) recommend different norms and represent different value set. For family mealtimes, this results in the emergence of norms and practices (that could be different for each families) that has evolved over time and have become
a practice for that particular family. So along with Harrison and Dourish, I argue that
the family culture has made these spaces into a particular place for family
togetherness. And I could see this in all three studies – both for the arrangement in
physical space (and subsequent place) and the virtual place (study two and three).

Place is dynamically formed and adapted with changes in the perception and practice
of its users [Harrison and Dourish 1996]. The family dining-space when equipped
with television and associated family norms form a distinct dining-place. When that
same space is endowed with mobile and networked communication devices, their
availability and adoption challenges existing mealtim
changing, with a different set of rules, expectations, and outcomes. This was
evident, for example, regarding the tension around mealtime technologies. The wife
in family 7 (study 3), while feels comfortable with the husband’s social media use in
mobile phone during mealtime (as she knows most of his friends in Facebook and he
informs her of interesting updates from it), gets irritated when the same device is used
for work purposes (e.g., checking email), as she then feels he is disconnected from
family communication. In another example, family 6 (study 1) is generally fine with
the children watching TV, but the parents take away this privilege if they consider
their children to be acting rudely by paying no attention to the family conversation.

Shared contents created an augmented place, where each family member is
represented by the content s/he has shared, and the contents that represent him/her and
shared by the rest of the family. Family norms play a role in there too. The contents of
TableTalk and Chorus reflected the identity of the person who shared those, and in
some way, the family itself. The mobile phone was bound to its owner and not to the
domestic space. For example, when someone’s content does not arrive in a timely
manner s/he got frustrated; or when someone shared too many content, or shared
content that are not interesting enough for others, they could be criticized, avoided,
quickly passed through, or even excluded from further sharing.

This transformation raises interesting challenges, particularly around how family
norms arising from new technologies convert the corporeal dining space into a social
place for family cohesiveness, relaxation, practicality, and overall enjoyment. By
developing these practices, they essentially turn this dining space into family dinner
place. When these norms are violated by any family member, it could become
instantly noticeable. For example, smartphones and other personal technology usage during mealtimes in families that restrict (sometimes implicitly) their usage, could be considered *out of place*. It is often neither the technologies nor the space that is relevant to the family experience and expectations; it is the in situ interaction with technologies amongst family members that informs this experience and subsequent actions. So, designing the physical space for dining is not the only concern, but more challenging is designing appropriate technologies for this social place.

### 8.6 Conclusion

In this thesis, I have taken a qualitative approach to closely examine and understand how families negotiate and manage ICT usage during mealtimes. I have provided a rich picture of the family norms, interactions, limitations, and exceptions around this use. While I acknowledge the criticism and concerns related to ICT usage at mealtimes and recognize the moral foundations of commensality, I also see important ways in which technologies can be actively integrated into this social space. To this end, I have presented the design and deployment of *TableTalk* and explored the ways in which it reconfigured personal data and devices into a shared display, and consequently supported the commensal experience in the family home. I modified this prototype and developed *Chorus* to further investigate the changes and challenges brought upon by the intervention. This study showed the enthusiastic participation of everyone in the family, followed by difficulty about the chore of creating or finding interesting content, and different social concerns surrounding the deployment. The deployment of *Chorus* clearly showed how family members had focused on sharing content that signifies collective interest over personal ones and how the technology usage corresponded to various aspects of commensality, for example, family bonding, shared reminiscence, education, socialization, planning, manners, etc. in the family. Overall, my research demonstrates that through sensitive design, deployment, and recognition of familial expectations, responsibilities, norms, and practices, personal smart-devices can be reconfigured to positively support and enhance the experience of togetherness during family mealtimes.
Appendix A: Sample Semi-Structured Interview Questionnaire (Study 3)

These are sample questions for our semi-structured interviews that will be refined further throughout the project. Selection criteria for participants will be having at least two adults living together in the family and who use communication technology (for example - television, radio, etc.) during family mealtimes.

**Objective for interview one:** Identifying the dining space of the participants, placement of technology in that space, technology usage, demographic information, meal patterns, etc.

**Questions related to family and mealtimes:**

1. Describe your family members that live together and share meals regularly?
2. Which meals do you share together each day?
3. Where do you have your shared meals? Why do you have it there?
4. Do extended family members have meals together with you? When and how often? With whom? Do you have it at the same place as mentioned before?

**Questions related to technology usage during mealtimes:**

5. What technology you have at home? Who uses which? Which of them are for personal use only? (we may need to probe for additional ones)
6. Which of the communication devices you use are shared by multiple members (together/turn-taking)?
7. Do you have any implicit or explicit restriction/guideline/preference for using technology during family mealtimes? Who set these rules and why?
8. During mealtimes, where do you keep personal devices (like mobile phones)? Do you use them under any circumstances during mealtime? Can you please give an example of such usage, if any?
9. Where do you place shared devices during mealtime? More discussion around this to follow. For example, if they have a land phone, who picks up the phone if there is a call while you eat together, or the sitting arrangement with reference to the television in the dining place, etc.
10. Then we discuss with reference to the devices that are shared together (for example, television) during mealtimes. What do you watch? Who chooses what to watch? When do you start watching it? What do you do with it after your meal finishes? If everyone is not interested in it, do you change it, or keep it going, etc.
11. Has there been any change over the past years regarding the use of communication technology during mealtimes at your family? What was the scenario when you grew up?

**Questions related to conversation around mealtimes:**

12. Do you frequently talk during family meals? What are the main conversation points around your mealtimes? Do you share what happened during the day? Can you think of an example from recent time?
13. Do you discuss any local news or event in the family during mealtimes? Example?
14. Which sort of events you share (and not share) with others during mealtimes and why? Can you please give an example of a recent discussion?
15. Do you ask others about their days? What are you interested to know? What are you interested to tell?
16. Do you discuss your future events or plan for such during mealtimes? For example, do you tell others about your plans for the next day, or discuss the plan for next holidays?
17. Does the existing technology (e.g., television, mobile phones) usage provokes conversation during your mealtimes? For example, conversation about the program you are watching on your television or discuss about a local news. If yes, can you please elaborate?
18. If you need additional information arising from the mealtime conversation, what do you do for that?
19. How does your meal finish normally? Do you generally stay at the table to discuss practical issues or other things after you have finished your meals?
20. Do you take any photos or note/think about any local news around the day to share with your family members later?

Questions related to mobile technology usage:

21. Can you please tell about the mobile communication technologies you use and for what purposes? Please describe how often you use them and where do you keep these devices through the day.
22. What social networks you use in your mobile device? What are your general activities in these networks?
23. What photos you capture through your device? How often? How do you moderate and use these photos? Do you share these photos with others?
24. Do you keep your daily schedule in your phone?
25. Can you please describe if you listen music through your device? Do you share these songs with others in your family?

Objective for interview two: Understanding participants’ usage of the app, refining the patterns identified from qualitative analysis of interview one, video recordings, and app data.

We will probe into specific instances of the data. Here are some sample questions for this semi-structured interview.

Questions related to app usage experience:

1. Discuss the general experience of the participant of using the app. What did they like (and dislike) about the app?
2. Which aspects worked the best e.g., location, photos, social media, etc. in terms of encouraging family conversation or conviviality?
3. Could everyone access the app with ease during mealtimes? Any suggestions about the location, orientation, or placement of mobile devices while using the app? Could you read the tweets, or found it difficult?
4. How do you think the app influenced familial interaction at the table (e.g., we explore in terms of who talks and leads conversation, in terms of the topic of conversation, in terms of eating their meal)?
5. How was the placement of app amongst other tableware? Did it create problems with other table artifacts?
6. How did it work with devices of different sizes (iPhone and iPads, etc.)?
7. Did using the app resulted in discussing more details of everyday life than while using TV?
Questions related to shared contents through the app:

(These questions will refer to app usage data obtained before interview two)

8. Why did you choose to share this content? Was it because you want to show it, or thought others will find it interesting? – what motivated you most?
9. Did it happen that you wanted to share a particular content, but it was not there? What sort of content? How did you experience the auto-generation of contents? Did you prefer the other way?
10. Did you think about what others might have shared, before you saw it? Could you guess which content came from whose device?
11. What did you thought while moderating the contents? Did you think about any particular story/narrative to tell while showing a particular content?
12. What sort of contents do you think better to avoid during mealtimes? Why?
13. Did you want to access more information about any content displayed in the app? What did you do in such cases?
14. Did you use the “Fetch More” feature of the app?
15. Why did you choose to skip this content? How this could be avoided/improved?
16. Did you wanted to show a particular item during the meal? Did it come in due time? Did you waited for it to show? How did you feel when it was shown or if NOT shown?

Questions related to privacy and suitability associated with app usage:

17. Did you avoid any particular type of contents from this app? Any suggestion about how we can improve this?
18. Question about how the exclusion of other devices (TV, laptop, mobile) impacted their mealt ime experience. How it was different than their regular and everyday meals. Did they talk on too many topics? Transition between topics? Influence of displayed media?
19. Why did you choose those tweet sources?
20. Discuss about exclusion of some people from contributing? How influential was that?
21. Moderation by children, why they were so secretive
22. Question F and M separately about sensitive issues.

Questions related to conversation around Chorus

23. What sort of conversation/memory did Chorus provoke that would not happen normally otherwise? Can you think of such an occurrence? [ask it at the end part of the interview]
24. What do you think about the quality of the conversation around Chorus? Was it natural? Was it different than your regular conversation? If so, how?
25. Did you extended your stay at the table after you have finished your meals? Was it different that your regular times? If so, how?
26. While using Chorus, did you require to use your phone during mealtime? If so, what did you do and why?
Appendix B: Sample Plain Language Statement (Study 2)

Research Project Description (Plain Language Statement)


Investigators: Hasan Shahid Ferdous, A/Prof. Frank Vetere, Dr. Bernd Ploderer, Dr. Hilary Davis

Study Level: Ph.D.

What is the purpose of the project?

The purpose of this study is to trial an app for personal communication devices (smart phones, tablets, etc.) to share personal events during family mealtimes. We aim to study how this app can facilitate mealtime conversations around daily events such as photos taken, music listened to, locations travelled, etc. with other family members. You will be asked to try out the app on your phones or tablets during two family mealtimes, record these meals, and comment on your experiences through interviews.

Why and how was I selected?

We invite you to participate in the research project because you share meals with your family and/or use communication technology during mealtimes.

What will I be asked to do?

You will be asked to install an app on your phone or tablets and try it out during two family meals. You will be asked to video-record these mealtimes and we will conduct interviews before and afterwards:

- Interview 1: We will meet at your home for an interview at your convenient time where you will be asked questions about your family meals and the use of communication technology during your family mealtime. You can show us suitable locations to place two video cameras to capture your family meals. We will provide you with two video cameras and instructions regarding how to operate and place them. We will help you install an app on your iOS devices and show you how to use that app. We may take photographs, record audio, and take notes of what we talk about. We expect the interview and app installation will require about 75 minutes.

- Try out app during two family meals: The app we installed in your phone or tablet device will be able to access your social network data, photos, videos, music, location data, and calendar information. You can restrict access to any of these anytime using the app settings menu. You will try out this app during two of your family mealtimes over a one-week period, prior to the second interview. One of these mealtimes will be held during a weekday while the other needs to be done during the weekend. Before the meal begins, you will open the app. It will then display about 20 pieces of content from different categories that you have allowed access to it. You can review this contents and approve/disprove any of them. Then you will place your phone/tablet in the table with other similar devices from other family members. All the devices will form a larger display together. The contents you have approved may appear on this screen and other members of your family will be able to see these. You can interact with the system using simple voice commands. The app will store only the content you have approved and your interaction with it, which we will collect later. It may take about 10 minutes to moderate the content before each of these two meals.
- **Create video recordings of two family mealtimes**: We will ask you to take video recordings of the two family mealtimes where you used the app. You will be asked to start the video recording 5 minutes prior to the start of the mealtime and stop recording 5 minutes after everyone has finished his or her meals. You may do this recording during either lunch or dinner, as you prefer.

- **Meet the researchers to share the video recordings and app data**: After the video recordings are done, we will collect the app data and camera equipment from you at a time to suit you.

- **Interview 2**: We will analyze the video recordings and app data, and then we will meet for another interview. The aim of this meeting is to understand the relevance of these two video recordings and app usage with your everyday family mealtime and the alternate scenarios that you might expect in those settings. We may take photographs, record audio, and take notes of what we talk about. The interview will be carried out at a time and place of your choice and may last for about 45 minutes. We will delete the app along with its recorded data from your device after this interview.

**Why should I participate?**

Participants will receive a $30 iTunes gift voucher per family as a gesture of thanks for your support. We know that your time is limited and valuable and that we can offer you very little in return for your help, but your support will make a great contribution to the work of a Ph.D. student.

**How will the data be used?**

This study will form part of Mr. Ferdous’s Ph.D thesis. The results may also be written up in the form of reports to be presented at conferences and published in academic journals. You can indicate on the consent form if you wish to receive a brief summary of the research findings and copies of any papers arising from this research via email.

**How will my confidentiality be protected?**

We intend to protect your anonymity and the confidentiality of your responses to the fullest possible extent, within the limits of the law. Due to the small number of participants there is a possibility that people could be identified by contextual information. To preserve your anonymity, we will use code names for participants in all written work. No individual person will be identifiable in written reports or audio-visual material without the expressed agreement of the individuals concerned. Video recordings, app data, and photographs will only be used by the researchers for analysis purposes, unless you indicate on the consent form that you are happy for us to use them for research presentations and reports. In all such cases, the data will be de-identified, (e.g., faces or names blocked out, photographs on walls or car number plates that are visible will be removed, etc.).

Our app may collect data from your device, including photos, music, social media usage, and location information. You can restrict access to any data through the app settings at any time during the study. We will only collect the data that were displayed to you by our app during two of your family mealtimes. The app will store data on your devices only and you will delete the app along with the stored data from your devices after you finish your participation in the study. You can also ask us to delete any data we obtained through the app.

As required by the University, data gathered as a result of this project will be held in locked cabinets in the Department of Computing and Information Systems, and destroyed using confidential waste disposal techniques five years after the date of last publication of results arising from this research.

**Dependent relationships with research team members**

If any participant has any dependant relationship with the research team members, we want to assure that participation is completely voluntary, and that your decision to participate or not to participate, or the nature of your participation will have no bearing on any assessment or treatment your work or study.

**Are there any risks of participating?**

The project does not involve any recognisable risks to participants. To eliminate the risk of showing personal content to your family members, you will need to review and approve the content to be
displayed each time before you share your device with others. Children will participate in this project only if their parents provide consent and in the presence of at least one adult member of the family. The researcher conducting the interviews has a working with children check. Please be advised that your participation in this study is completely voluntary. Should you wish to withdraw at any stage, or to withdraw any unprocessed data you have supplied, you are free to do so without prejudice.

In case you experience conflict between family members at any stage of your participation, we advise you to contact free family counselling services (e.g., kidsline, Relationships Australia). You can also let us withdraw yourself from the study if you wish to. The researchers will report any indications of child abuse or neglect to the responsible researcher and the University human research ethics representative to discuss appropriate action.

Where can I get further information?

Should you require any further information, or have any concerns, please do not hesitate to contact the responsible researcher A/Prof. Dr. Frank Vetere on f vetere@unimelb.edu.au or +61383441496. Should you have any concerns about the conduct of the project, you are welcome to contact the Executive Officer, Human Research Ethics, The University of Melbourne, on ph: +61 3 8344 2073, or fax: +61 3 9347 6739.

How do I agree to participate?

If you would like to participate, please indicate in the email reply to hferdous@student.unimelb.edu.au that you have read and understood this information and agree to the accompanying consent form. The researchers will then contact you to arrange a mutually convenient time for a first meeting.

Thank you for your support.

The University of Melbourne’s Human Research Ethics Committee has approved this research project HREC Reference #1544380.1. Should you have any concerns about the conduct of this research project, please contact the Executive Officer, Human Research Ethics, at the University of Melbourne, VIC 3010, AUSTRALIA on: +61 3 8344-2073 (Tel) or +61 3 9347-6739 (Fax).
Appendix C: Sample Consent Form (Study 1)

Project title: Use of communication technologies during family mealtimes

Investigators: Hasan Shahid Ferdous, A/Prof. Frank Vetere, Dr. Bernd Ploderer

1. I consent to participate in this project, the details of which have been explained to me, and I have been provided with a written plain language statement to keep.
2. I understand that after I sign and return this consent form it will be retained by the researcher.
3. I understand that my participation will involve two interviews and that I will be asked to take two video recordings of our family mealtime and I agree that the researcher may use the results as described in the plain language statement.
4. A $20 iTunes/Coles voucher will be reimbursed per family as a token of reward for the service after the completion of all tasks.
5. I acknowledge that:
   (a) The possible effects of participating in the interview and video recordings have been explained to my satisfaction;
   (b) I have been informed that I am free to withdraw from the project at any time without explanation or prejudice and to withdraw any unprocessed data I have provided;
   (c) The project is for the purpose of research;
   (d) I have been informed that the confidentiality of the information I provide will be safeguarded subject to any legal requirements;
   (e) I have been informed that with my consent the interview will be audio-taped and I understand that audio-tapes and other data obtained will be stored at the University of Melbourne for five years after publication and destroyed afterwards.
   (f) My name will be referred to by a pseudonym in any publications arising from the research;
   (g) I have been informed that a copy of the research findings will be forwarded to me, should I agree to this.

I consent to this interview being audio-taped □ yes □ no
I wish to receive a copy of the summary project report on research findings □ yes □ no

If you ticked ‘yes’, please provide your email address: ________________________________

Name of participant (please print): __________________ Signature: __________ Date: ______

Name of participant (please print): __________________ Signature: __________ Date: ______

Name of participant (please print): __________________ Signature: __________ Date: ______

Name of participant (please print): __________________ Signature: __________ Date: ______

Name of participant (please print): __________________ Signature: __________ Date: ______
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