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Supporting Intentional Media Use in Families

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Abstract

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Designers of interactive technologies have long prioritized user engagement, and today's popular end-user products are irresistibly engaging. Modern technology offers enormous value and convenience, but it has also led to widespread feelings of dissatisfaction, and users report wishing they had a different relationship with the technologies they use. Though families are avid technology users, this eager adoption has come with concerns about the impact of technology on family life and child development, and limit-setting is a salient topic in family contexts. This conversation is complicated by social narratives that pressure families to limit exposure to technology.

My dissertation examines how families choose to integrate technology into daily life, how they wish they integrated technology into daily life, and what designers can do to help close the gap between the two. By building tools that families find easy to dynamically use and *not* use, as it suits their shifting needs, designers can support them in both making technology a meaningful part of daily life and also keeping it within bounds they feel good about.

Here, I report first on a series of formative studies to understand families' practices and values related to using technology. Across three investigations, I report on observational, interview, diary, and survey data from both parents and children. These studies show, for example, that many parents feel guilty when using personal devices in front of their children (even when they use them for only brief periods of time), children have a harder time complying with rules that ban technology in certain contexts (e.g., no phones at the dinner table) than rules that ban certain types of technology altogether (e.g., no social networking), and young children find it easier to transition away from screen media when the technology itself encourages them to do so than when parents encourage them to do so without the support of technology.

Based on this background work, I next examine how designers might create systems that promote intentional usage behaviors. I present the design, development, and evaluation of two such systems: "MyTime," created for adults, and "Plan & Play," created for children. MyTime is a system-level persuasive technology for intentional smartphone use, and my deployment results indicate that it is effective in changing users' habits in the short-term. Plan & Play translates evidence-based techniques for teaching self-regulation to preschoolers into a digital setting, and a lab study with parent-child pairs suggests that it supports children in engaging with tablets with intention.

Across these studies, I examine how motivation, autonomy, family dynamics, and situated activities shape the ways in which families engage with and push back against technology. I argue that today's parental controls, the primary design mechanism for limit-setting in family contexts, undermine children's likelihood of self-regulating their own technology use and do not attempt to support families in mentoring children in becoming thoughtful consumers of technology. In a world where technology is available at every moment, managing one's own media consumption has become an essential life skill. I hope that this work will shed new light on how designers can support users in engaging with technology with intention and leave them feeling more satisfied with their own behaviors.

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Chapter 1. Introduction

Designers of consumer-facing digital experiences have long prioritized “user engagement,” and many of today’s end-user products are irresistibly engaging. Designing for engagement has led to many delightful experiences that captivate users, but it has also led to widespread feelings of dissatisfaction, as many people report struggling to unplug and wishing they had a different relationship with the technologies they use (Ames, 2013; Baumer et al., 2013; Portwood-Stacer, 2013; Schoenebeck, 2014). My research explores people’s experiences working to find and maintain a dynamic balance of technology use they feel good about.

Setting limits on technology use is a particularly salient concern for families, and this dissertation investigates this topic in the context of family life. Many children and their parents are avid technology users, but concerns about families’ use of media and its impact on attention, well-being, togetherness, and interpersonal relationships abound (Christakis, Zimmerman, DiGiuseppe, & McCarty, 2004; “Parents on social media: Likes and dislikes of sharenting,” 2015; Steiner-Adair & Barker, 2013; Turkle, 2012). Decades of research has investigated the risks associated with children’s use of technology (Calvert & Wilson, 2009; Dietz & Gortmaker, 1985; Hinkley et al., 2014; Olsen, Shults, & Eaton, 2013; Sigman, 2012; Zimmerman & Christakis, 2007) and also documented the approaches parents take to supervising their children’s media exposure (Austin, Knaus, & Meneguelli, 1997; Dorr, Kovaric, & Doubleday, 1989; Livingstone & Helsper, 2008; Valkenburg, Krccmar, Peeters, & Marseille, 1999a; Vaterlaus, Beckert, Tulane, & Bird, 2014).

Comparatively little work has investigated the way in which design choices influence media habits or the ways in which technology itself can support families in setting boundaries they feel good about. Even less work has investigated design decisions for boundary setting as they relate to parents’ use of technology. In this dissertation, I examine what designers and developers can do to create technologies that respect families’ desired patterns of engagement and support them in living within these self-defined limits.

1.1 BACKGROUND AND MOTIVATION

Parents and children have long struggled to integrate new technologies into daily life. The introduction of radios, televisions, and video games into households brought with them new discussions—and sometimes panics—about the impact those technologies would have on the family (Bryant, 2001; Schooler, Kim, & Sorsoli, 2006; Valentine & Holloway, 2001). The child development research community has validated some of these fears, and average screen media consumption among American children today is associated with

increased risk of aggressive behavior (Bandura, Ross, & Ross, 1961; Friedrich & Stein, 1973; Johnson, Cohen, Smailes, Kasen, & Brook, 2002), disordered sleep (Falbe et al., 2015; Garrison, Liekweg, & Christakis, 2011), anxiety (Wilson, 2008), attention problems (Christakis et al., 2004), cognitive impairments (Zimmerman & Christakis, 2005), and even motor vehicle fatalities (Olsen et al., 2013). As a result, the American Academy of Pediatrics recommends that parents curate and limit children's media experiences (J. S. Radesky & Christakis, 2016).

Despite these risks, children's use of screen media is also associated with many positive outcomes, including academic success and healthy development (Romer, Bagdasarov, & More, 2013). It has been shown to provide valuable and enjoyable experiences for children of all ages, including increased appreciation for racial and cultural diversity among preschoolers (Strasburger, 2010), increased creativity and collaboration in family groups (Yuill, Rogers, & Rick, 2013), language acquisition (Rice, Huston, Truglio, & Wright, 1990), and increased prosocial behavior (Coates, Pusser, & Goodman, 1976). Adolescents who use the Internet for information-seeking purposes have better grades and higher levels of social confidence than peers who are prohibited from using the Internet at all (Romer et al., 2013). Thus, modern parents must support children in the complex task of defining and maintaining a healthy balance of technology use, rather than the comparatively simpler options of banning or permitting all activities.

As technology has become pervasive in children's lives ("Zero to eight: Children's media use in America 2013," 2013), defining and enforcing such a balance has become increasingly complex (Livingstone & Helsper, 2008; Mendoza, 2009; Mesch, 2009; Yardi & Bruckman, 2011). American children spend more time using technology than engaged in any other activity besides sleeping (Livingstone & Bovill, 2013), and newer technologies like smartphones and tablets make it possible to plug in at nearly any moment. Parents say that they wish they had greater familiarity with the technologies their children use, had more knowledge of what their children do with technology, and feel unprepared to raise children in a media-rich world (Yardi & Bruckman, 2011).

The challenges of defining parameters for children's use of technology may be exacerbated by the fact that parents struggle to set and abide by limits themselves (Ammari, Kumar, Lampe, & Schoenebeck, 2015; Hiniker et al., 2015a; Kumar & Schoenebeck, 2015). Adults with and without children report feeling pressure to maintain constant connectivity (Ames, 2013; M. Mazmanian, 2012) and frustration with their own heavy use of technology (Ko, Yang, Lee, Heizmann, & Jeong, 2015; S. Morrison & Gomez, 2014; Schoenebeck, 2014), suggesting that limit-setting is a challenge for family members of all ages. Mobile devices provide users

with the opportunity to leverage the power of technology in nearly every context; this potential to engage with technology at any time comes with a cost, and adults report feeling the need to check in even when it poses a risk to their safety (Bayer & Campbell, 2012), well-being (Przybylski, Murayama, DeHaan, & Gladwell, 2013), or that of those they care about (McDaniel & Coyne, 2014). Overly simplistic cultural narratives pass judgment on both “distracted addicts” and “out-of-touch luddites” (Harmon & Mazmanian, 2013), leaving individuals with reason to worry they engage with their phones both too much and too little.

As part of navigating this complexity, many adults report taking deliberate breaks from technology or setting explicit boundaries on their own use. Prior work describes users giving up Twitter for Lent (Schoenebeck, 2014), committing ‘Facebook suicide’ by deleting their accounts (Portwood-Stacer, 2013), and refraining from smartphone ownership in favor of traditional feature phones (U. Lee, Yang, Ko, & Lee, 2014). Yet despite finding support in these make-shift solutions, adults report that creating and adhering to self-defined boundaries is not always easy. Some say that they want to self-limit but believe it would be impossible, some say that they do self-limit but are not always successful, while others say they successfully self-limit but in the process sacrifice aspects of technology use that they value (Baumer et al., 2013; Ko, Chung, et al., 2015).

Thus, the pull to engage with technology and the struggle to enact personal policies is a salient topic for family members of all ages. As technology becomes increasingly sophisticated and occupies a growing portion of families’ time and attention, it becomes more and more useful to understand the predictive relationships between what developers create and how families feel about their own behaviors and policies. My dissertation explores this phenomenon both by working to understanding families’ practices and by evaluating how design might support users’ self-regulation.

1.2 THESIS STATEMENTS AND RESEARCH QUESTIONS

The claims of this dissertation can be summarized in the following thesis statements:

T1. Understanding the ways in which families manage their use of technology and their feelings about these behaviors is necessary for identifying opportunities to support them in achieving their desired patterns of use through design.

T2. Interface design can predictively increase families’ ability to self-regulate their technology use.

By identifying: 1) systematic patterns in families’ current practices and goals, and 2) predictive relationships between interface design and people’s satisfaction with their own behaviors, I claim that we can define design principles for building technologies that are more conducive to self-efficacy, self-regulation, and user

satisfaction. Though the term “technology” can mean many things, in this work I use it to refer to user-facing digital experiences with mass penetration, like smartphones, tablets, computers, and television.

To examine these thesis statements, I have investigated how families engage with technology today, how families wish they engaged with technology, and what designers can do to close the gap between current habits and desired behaviors. In Table 1, I outline the research questions that fall under each of these umbrellas and the projects that investigate each of these cross-cutting questions.

To support **T1**, I examine research questions RQ1-RQ6, which all explore people’s current technology practices, their feelings about their behaviors and habits, and the ways in which they want to integrate technology into daily life. Though some of these investigations examine these practices as they relate to the individual, I primarily take a family-centric view and examine habits, preferences, and expectations in the context of family life. To support **T2**, I also investigate research questions RQ7 and RQ8, in which I design, build, and evaluate two new systems intended to bring users closer to the technology-usage habits they want to establish.

1.3 THESIS OVERVIEW

In this dissertation, I report on findings from five different investigations that examine families’ current practices around technology use (T1, RQ1-RQ6) and evaluate design solutions to support them in enacting behaviors they feel good about (T2, RQ7-RQ8). I first build up an empirical base of knowledge about how adults and children currently integrate—and aspire to integrate—technology into daily life. Through mixed-methods, I explore adults’ use of smartphones in parenting contexts, the ways in which families mediate young children’s use technology, and the expectations and policies that children and their parents have for each other’s use of technology.

I then present two different design solutions to support intentional technology use, one targeting adults and one targeting young children. I present my user-centered design process for creating each of these system-level tools, as well as results from empirical evaluations with users. Below is a short summary of each of these five investigations and how each of these chapters connects to the thesis statements above. Finally, I discuss the themes that cut across these studies (Chapter 8), including the importance of self-determination, the new challenge of context-specific limits, and how designers can support families in moving away from an “all-or-nothing” approach to technology use in which the only effective boundaries are extreme ones.

Table 1: Research Questions

	Playground Study	Transitions Study	Rules Study	MyTime	Plan and Play
What families do today					
RQ1. What are adults' smartphone usage habits?	X		X	X	
RQ2. What are children's technology usage habits?		X	X		X
RQ3. How do parents mediate children's use of technology?		X	X		X
What families want to do					
RQ4. What smartphone usage habits do adults want to have?	X		X	X	
RQ5. What expectations do children and parents have for each other's use of technology?		X	X		X
RQ6. What mediation practices do parents want to engage in?		X	X		X
Closing the gap through design					
RQ7. How can designers support parents and other adults in self-regulating their smartphone use?				X	
RQ8. How can designers support children in self-regulating their use of entertainment media?					X

1.3.1 Chapter 2: Review of Prior Literature

In this section, I describe the prior work I leveraged in conducting these investigations. I report on work describing families' practices using technology, setting limits on use, and mediating children's use of technology. I also describe prior work on non-use and boundary-setting in adults. I describe work on designing to enable boundary setting (e.g., technologies like parental controls or commitment devices for adults) and work on designing to inhibit boundary setting by creating habit-forming experiences. I also describe existing work on human motivation and self-regulation to contextualize users' ability to regulate their use of technology in our broader understanding of the way individuals control their behaviors.

1.3.2 Chapter 3: How Adults Use Mobile Phones at the Playground

In this project, I explored whether adults feel pressure to limit their phone use when caring for children and, if so, whether they choose to do so. By exploring adults' behaviors and their feelings about their behaviors in this context, I sought to better understand what, if any, gap exists between their current and desired habits (RQ1 and RQ4).

Through mixed methods, I worked with a team of collaborators to collect data from 466 adult caregivers at playgrounds. We found that phone use was a small part of playground time, yet a notable source of guilt. Adults engaged in systematic and specific phone-use and phone-non-use behaviors in order to prioritize their children above themselves. Our results also showed that caregiver values and self-control together predict behavior and can be used to model phone use in this context. Users' mixed success with engaging in intentional periods of non-use suggest that a design agenda which prioritizes cycles of engagement, disengagement, and re-engagement may be of value to this group.

They also demonstrate the complex ways in which social norms (such as culturally constructed ideas of what it means to be a "good" parent) and self-defined ideals (such as personal goals for technology use) are entangled. In addition to helping to answer RQ1 and RQ4, these results provided a foundation for the designs I present in Chapter 6.

1.3.3 Chapter 4: Toddlers' and Preschoolers Transitions To and From Screen Media

In this project, I worked with a team of collaborators to investigate young children's (age 1-5) transitions to and from screen-based activities. I chose to examine transition points in particular, because they offer insight into the boundaries families have set for children and their experiences living with these self-defined limits. To examine these transitions, our team conducted interviews with 27 parents and a diary study with a separate 28 families. Results showed that these families turn on screens primarily to facilitate parents' independent activities.

Parents feel this is appropriate but self-audit and express hesitation, as they feel they are benefiting from an activity that can be detrimental to their child's well-being. We found that families turn off screens when parents are ready to give their child their full attention, and technology presents a natural stopping point. Transitioning away from screens is often painful for children and parents, and predictive factors determine the pain of a transition. Technology-mediated transitions were significantly more successful than parent-mediated transitions, suggesting that the design community has the power to make this experience better for parents and children by creating technologies that facilitate boundary-setting and respect families' self-defined limits. These findings support T1 by helping to address both RQ2 and RQ3, and they provided design guidance for the intervention I describe in Chapter 7.

1.3.4 Chapter 5: Family Technology Rules

In this study, I worked with a team of collaborators to investigate the perspectives of both parents and children on technology in family life. The rules or expectations that family members have for each other's use of technology offer an explicit articulation of the behaviors they believe are appropriate, thus we conducted a survey with 249 parent-child pairs distributed across 40 U.S. states to understand the expectations they have for each other.

My data robustly show that children (age 10-17) are more likely to adhere to policies that constrain technology activities (e.g., no Snapchat) than policies that constrain technology use in certain contexts (e.g., no phone at the dinner table). Children find these "context constraints" harder to live up to, parents find them harder to enforce, and parents' most common challenge when trying to enforce such policies is that children "can't put it down." This is consistent with the idea that banning certain technologies is currently easier than setting more nuanced boundaries. Parents and children agree that parents should also unplug when spending time with family, while children alone express frustration with the common parent practice of posting about children online.

Two findings emerged from this work that align with findings from the other formative studies I describe in this dissertation. First, along with the results presented in Chapter 4 about younger children's screen-time transitions, the data I collected in this study suggest that supporting children's autonomy and involving them in the process of setting policies improves their ability to self-regulate their technology use. Second, along with results presented in Chapters 3 and 4 about both young children's and parents' behaviors, these results suggest that older children also find it difficult to adhere to policies that support balance and easier to adhere to extremes, regardless of whether these policies are more lenient or more strict.

1.3.5 Chapter 6: MyTime: Persuasive Technology for Intentional Smartphone Use

Building on the formative work described above, I worked with a team of collaborators to explore how the technologies adults use might move them closer to the usage habits they would like to establish (RQ7). I conducted a design exercise and online survey to map the design space of interventions for smartphone non-use, and I distilled these into a small taxonomy of intervention categories. Using these findings, I implemented "MyTime," an intervention to support people in achieving goals related to smartphone non-use.

I conducted a deployment study of this system with 23 participants over two weeks. I found that participants reduced their time with the apps they feel are a poor use of time by 21% while their use of the apps they feel

are a good use of time remained unchanged. I found that a small taxonomy describes users' diverse set of desired behavior changes relating to smartphone non-use, and that these desired changes predict: 1) the hypothetical features they are interested in trying, 2) the extent to which they engage with these features in practice, and 3) their changes in behavior in response to the intervention. My findings demonstrate links between users' desired behaviors and the categories of my design taxonomy, providing a foundation for a theoretical model of designing for smartphone non-use. Together with the work presented in Chapter 7, these findings address T2 by demonstrating that designers can influence individuals' ability to self-regulate their use of technology.

1.3.6 Chapter 7: Plan & Play: Supporting Intentional Media Use in Early Childhood

Finally, I worked with a team of collaborators to examine how design can support children in developing healthy media habits (RQ8). Building on the formative work described in Chapters 4 and 5, I took elements from evidence-based preschool curricula that teach self-regulation and translated them to the digital space by creating a tool for preschoolers and parents to plan their device-based playtime. In an observational lab study with 11 parent-child dyads and follow-up interviews with 14 parents, I found that children demonstrated intentionality and made goal-directed choices as they planned, the mediating factor in developing self-regulation. I observed that parents prompted their child to be intentional and solicited children's input. When children played through their plan, they transitioned to the next activity without intervention 92% of the time. My results suggest that evidence-based practices for teaching self-regulation in a non-digital context can be applied productively to children's use of technology.

These findings provide support for T2, as we found predictive ways in which the system we designed facilitated self-regulation. By examining this design space specifically for children (RQ8), I hope to, first, shift the way in which the industry thinks about and designs parental controls, and second, shift conversations about limiting children's use of technology to conversations about mentoring them in learning to self-regulate their own behaviors.

1.4 CONTRIBUTIONS

This dissertation presents three types of contributions: artifacts, empirical findings, and theory. Specifically, my work has generated:

1. Empirical findings: Through diary methods, observations, and automated logging, I have collected several data sets on how families use technology and what content they engage with. This in itself is a contribution, as the majority of work in this space relies on self-report and recollection alone to document usage. In addressing T1, I also use interviews and surveys to generate new knowledge about how parents feel about their children's use of technology, how family members manage their own usage behaviors, how family members feel about and exert control over one another's usage behaviors, and how families want to change to their current practices. In addressing T2, I present empirical findings about both adults' and children's responses to persuasive technologies designed to promote intentional technology use.
2. Artifact contributions: In order to investigate T2, I conceived, designed, implemented, and evaluated two novel systems to support intentional technology use. Each of these is a system-level intervention that monitors all device activity, enabling me to examine how system designers might broadly design for intentionality (in contrast to design choices that might be built into individual applications which lack the reach and influence of system designs). One contribution of this work is to provide examples of designs that support families in moving closer to engaging in technology usage habits they feel good about.
3. Theoretical contributions: Finally, many of these projects have laid the ground work for building new theory in this space. For example, in Chapter 3, I document categories of parents' beliefs about using technology in the presence of their children, and I demonstrate the predictive utility of these categories in modeling parents' behaviors. In Chapter 5, I identify "activity constraints" and "context constraints"—new constructs that describe the technology-usage policies that families set—and the systematic ways in which these categories predict a policy's success. In Chapter 6, I describe a taxonomy that categorizes design approaches to creating persuasive technologies to support intentional technology use. In each investigation in this dissertation, I use empirical data to begin to model the phenomena of interest, and in Chapter 8, I discuss how these emergent theories work together to describe the relationship between digital media and self-efficacy in modern family life.

Chapter 2. Background and Related Work

2.1 TECHNOLOGY USE AND FAMILY LIFE

Technology is pervasive among American families, and children and parents alike are regular users of both traditional technologies like television and newer ones like smartphones and tablets (Rideout M.A., Foehr Ph.D., & Roberts Ph.D., 2010; “Zero to Eight: Children’s Media Use in America,” 2011). In 2012, 23% of children age 12-17 owned a smartphone (Lenhart, 2012), but by 2015, prevalence among adolescents had grown to 73%, with 24% of adolescents saying that they go online “almost constantly” (Lenhart, 2015). Younger children are also active technology users, and on average begin watching television regularly by four months of age. Children under eight watch an average of two hours of video content each day (“Zero to eight: Children’s media use in America 2013,” 2013), while 75% of children under four own their own dedicated mobile device (Kabali et al., 2015). Similarly, parents are active technology users, and 91% own a cell phone while two-thirds use social media (*Teens’ parents and their technology profile*, 2011).

In this section, I describe existing work that examines the ways in which families integrate these experiences into daily life and the ways in which technology use relates to long-term outcomes. A large body of research has considered families’ use of technology—and particularly that of children—with respect to developmental risk. Here, I review some of those concerns, as well as prior work documenting the ways in which families set limits on their use of technology to guard against these risks. This risk-averse perspective is consistent with cultural narratives that frame digital experiences as, at best, inferior to non-digital ones and, at worst, quite dangerous for children. To contextualize this evidence documenting the risks of technology, I also describe prior research documenting the cultural conversation that surrounds these practices.

2.1.1 Technology and Child Development

Decades of research has examined the many ways in which technology can influence children’s development, both positively and negatively. A large body of work has studied the relationship between media use and sedentary behaviors (e.g., Boone et al., 2007; Fitzgibbon et al., 2011; Robinson, 1999; Sleddens, Gerards, Thijs, de Vries, & Kremers, 2011), showing that increased time with digital technology can displace physical

activity and increase children's risk of obesity, diabetes, and other adverse health conditions (S. E. Anderson, Economos, & Must, 2008). The content children engage with plays an important role in determining the extent of this effect, and, for example, one longitudinal study demonstrated that fast-food advertisements in television programming increase the rate of childhood obesity by 22% (Chou, Rashad, & Grossman, 2008). Other work has shown that exergames and fitness technologies can lead to increases in physical activity and self-efficacy (Staiano, Beyer, Hsia, Katzmarzyk, & Newton, 2017; Toscos, Faber, An, & Gandhi, 2006), suggesting mechanisms by which technology can support children in adopting healthy habits.

A separate body of work has documented that children emulate the behaviors they see on screen, and that screen media is effective in teaching both prosocial and aggressive actions and attitudes (Bandura, 1986; Bandura et al., 1961). More than 2,000 prior studies have documented the negative effects of violent television programming on children's level of aggression and perceptions of aggression in others (Strasburger, 2010; Wilson, 2008), while other work has shown that digital media is an effective platform for teaching empathy and increasing altruistic behaviors (Coates et al., 1976; Friedrich & Stein, 1973; Rasmussen et al., 2016). *Super-peer theory* explains that mass media influences children's and adolescents' beliefs about normative behavior and carries more weight than actual peers ("Super-Peer Theory," 2006).

Other work has examined the relationship between digital media and a variety of other aspects of children's development, including learning, social bonds, mental health, and more. A robust investigation of thousands of children and adolescents concluded that increases in media multi-tasking predict increases in negative long-term emotional outcomes (Pea et al., 2012). Others have reported that children find parents' phone use during after-school pick-up and school performances disappointing (Turkle, 2012), while family members show resentment of one another's solitary use of technology (M. Morrison & Krugman, 2001). Yet, other work has shown that educational programming can foster language development (Rice et al., 1990), video games can promote collaboration and community-building among youth (McGonigal, 2011), and moderate use of the Internet for information-seeking purposes predicts healthy development and academic success in adolescents relative to peers who are prohibited from using the Internet (Romer et al., 2013). Social media use has also been shown to provide a number of benefits, such as social capital, wellbeing, and job opportunities (Burke & Kraut, 2013; Burke, Marlow, & Lento, 2010; Steinfield, Ellison, & Lampe, 2008), and families report that they find the net impact of technology on daily life and well-being to be positive (Barna Group, 2011).

Thus, despite the well-documented associations between specific patterns of media use and risks to children's health and well-being, today's vast array of digital offerings can influence children's growth, learning, behavior, and relationships in a variety of ways. Parents raising children in a world with so many options are faced with the daunting task of navigating this landscape together with their child. Supporting a child in learning to regulate and curate media consumption demands more thought and nuance than one might employ when helping children learn to regulate other practices (like smoking cigarettes or consuming junk food), where the healthiest choice is total abstention. As a result, there is a need for a scientific understanding of how parents can support children in finding this balance, and one goal of this dissertation is to contribute to the ongoing research effort to do so.

2.1.2 Parental Mediation

Parental mediation is the practice of overseeing a child's exposure to and use of technology and mass media. Prior work has documented that three types of parental mediation are common across a variety of technologies: 1) *active mediation*, where parents and children discuss and reflect on content and usage; 2) *restrictive mediation*, where parents set limits on permitted activities; and 3) *co-engagement*, where parents and children consume content together (Livingstone & Helsper, 2008; Valkenburg, Krmar, Peeters, & Marseille, 1999b). The American Academy of Pediatrics, Common Sense Media, and the Surgeon General, among others, all recommend that parents mediate the amount and type of digital content children engage with, and they provide parents with age-specific guidelines for children (American Academy of Pediatrics, 2014; Common Sense Media, 2014; Office of the Surgeon General (US), 2010).

Prior work has shown that parental mediation can be highly effective in promoting positive experiences with technology and reducing negative ones. Increases in parental mediation are associated with reductions in total screen time (Hoyos Cillero & Jago, 2010; Schmidt et al., 2012; Van den Bulck & Van den Bergh, 2000), selection of higher-quality content (Wilson, 2008), and greater learning gains from digital experiences (Rasmussen et al., 2016). Other work has shown that parental mediation reduces the risk of digital media impeding academic performance or healthy sleep habits (Gentile, Reimer, Nathanson, Walsh, & Eisenmann, 2014), and active mediation is associated with long-term reductions in aggression and fear of victimization (Desmond, Singer, Singer, Calam, & Colimore, 1985; Rosenkoetter, Rosenkoetter, Ozretich, & Acock, 2004). The benefits of mediation have been shown to apply to both young children (Vandewater, 2005) and teens (Ramirez et al., 2011a) and to translate across a variety of platforms (Livingstone & Helsper, 2008; Warren, 2003). Adolescents with family-defined boundaries and expectations around media use have higher

self-esteem (Schooler et al., 2006), while preteens whose parents actively mediate advertising content demonstrate less materialism (Robinson, Saphir, Kraemer, Varady, & Haydel, 2001) and experience less conflict with parents (Ramirez et al., 2011a).

Despite the variety of prior work showcasing the benefits of parental mediation, this construct is broad and the relationship between the many ways in which parents can practice mediation and the many outcome measures related to children's well-being remains complex. For example, some common mediation strategies are less effective than others (e.g., discussing content with children has more protective effects than passively viewing it with them (Livingstone & Helsper, 2008)), and the effectiveness of mediation practices likely varies with parent and child demographics (Lin & Atkin, 1989) and individual differences in child behavior (Vaterlaus et al., 2014). Further, even when parents engage in mediation routinely, children continue to encounter risky and unpleasant situations when using technology (Mesch, 2009; P. J. Wisniewski, Xu, Rosson, & Carroll, 2014). An ethnographic exploration of families' technology practices revealed that families think about their usage habits and expectations flexibly, and they mediate by dynamically establishing parameters for specific usage instances rather than rigidly adhering to or breaking hard-and-fast "rules" (Mazmanian & Lanette, 2017).

Thus, while mediation is well-established as a recommended and effective means of promoting long-term positive outcomes, defining personal mediation practices is far from straightforward. A simplistic conception of parents as gate-keepers tasked with restricting media use misses the many nuanced ways in which families can mentor children in using technology, such as supporting them in developing resilience in the face of negative experiences, or guiding them toward positive digital experiences, such as online civic participation or acts of digital creation and construction. While a central goal of this dissertation is to innovate technical supports to promote parental mediation, I aim to do so in a way that recognizes the inherent complexity and variability of parental mediation and supports a wide range of practices and values.

2.1.3 Parents' Use of Technology

A limited amount of prior work examines adults' use of technology when caring for children, describing adults' phone use as detrimental to the children in their care. Radesky and colleagues collected observational data from 55 families eating together at fast food restaurants. They documented the ramifications of adults' constant connectivity, uncovering thematic distractibility, irritability, and inability to be interrupted among those using phones (J. S. Radesky et al., 2014). Other work has reported that adults respond inappropriately

to children when they are distracted by devices (Turkle, 2012), that children experience adults' phone distraction as alienating and emotionally dissatisfying (Steiner-Adair & Barker, 2013), and that parents provide children with less encouragement and less interaction when using devices (J. Radesky et al., 2015).

Researchers have expressed concern that adults' phone use while caring for children is displacing play-based adult-child interactions (Steiner-Adair & Barker, 2013). As play and face-to-face interactions are the bedrock of young children's social learning and language acquisition (Christakis, 2009; Ginsburg, 2007), adults' phone-use practices are potentially disruptive to critical elements of children's early learning environments. Despite these early investigations, work in this area is still in its infancy (J. S. Radesky et al., 2014), and many of these concerns remain speculative.

Other research has examined the ways in which technology provides support to parents. Parents are active social media users, and prior work has shown that various social networks support parents seeking information, building community, and finding other families with similar parenting challenges (Ammari & Schoenebeck, 2015a, 2015b; Ammari, Schoenebeck, & Morris, 2014; Schoenebeck, 2013). Work in joint media engagement has shown that when parents use technology together with a child, they can promote learning and sense-making and strengthen their bond with their child (Stevens & Penuel, 2010; Takeuchi, Stevens, & others, 2011). Thus, despite the ways in which parents' use of technology might introduce disruptions or distractions into family life, there are many reasons why parents might choose to integrate digital experiences into daily life, above and beyond the many reasons that adults in general adopt consumer-facing technologies.

2.1.4 Social Constructions of Family Technology Use

Families' technology practices—and researchers' explorations of them—do not occur in a vacuum. Cultural narratives about parenting, childhood, technology, and family life all shape the ways in which people think about and choose to engage with technology. In this section, I describe existing scholarship on several social constructions related to technology and family life in order to situate the participant experiences I later describe in my own studies.

The modern conception of childhood portrays children as passive dependents who are vulnerable to ever-present dangers that demand the constant vigil of parents (Jackson & Scott, 1999). Without the protective shield of “good” parents, the thinking goes, children are at risk of both incurring and causing great harm. This risk-averse perspective not only defines childhood as a state of vulnerability, it also holds parents responsible

for any harm that befalls or is caused by the child, blaming virtually all broader social problems on poor parenting (Y.-K. Lee, Chang, Lin, & Cheng, 2014). Prior work has shown that across western culture, adults miscalculate the risks children face, cast moral judgments on parents when a child is perceived to face risk of any kind (Thomas, Stanford, & Sarnecka, 2016), and underestimate children's ability to mitigate and guard against risk themselves (Christensen & Mikkelsen, 2008; Staksrud & Livingstone, 2009). This has led to moral panics on a range of topics related to childhood and parenting.

The introduction of new technologies is often accompanied by parental and societal fears about technology's impact on children and family life. Parents have worried, for example, that television content is too violent (Kutner & Olson, 2008), oversexualized (Schooler et al., 2006), and advertising-heavy (Oates, Newman, & Tziortzi, 2014), and that Internet-use will expose children to predators (Lwin, Stanaland, & Miyazaki, 2008), bullying (Mesch, 2009), and inappropriate sexual content (Turow & Kavanaugh, 2003). These fears are not unfounded; as described above, research on child development and technology use has documented a variety of mechanisms by which technology can expose children to risky situations, and the large amount of time children spend with technology by itself calls for examinations of ways in which technology use influences children's long-term health and well-being (Sigman, 2012). However, such examinations demand consideration of the fact that these questions are being asked within a cultural frame of reference that foregrounds risk, and in doing so, often overlooks opportunity costs and creates new burdens for families.

Social constructions of family life also influence perceptions of parents' use of technology. In western culture, the dominant modern parenting ideology, known as "intensive parenting," emphasizes the responsibility of parents and other caregivers to craft an environment for children that is rich with stimulating, caregiver-facilitated activities and interactions, intentionally designed to promote ideal development (Hays, 1996). Beginning in the middle of the last century and intensifying in the 1990s, this school of thought posits that the agentic and self-reliant caregiver has the capacity to directly shape the cognitive development of the child in care (Wall, 2010). Parents who are not oriented toward such goals are seen as needing education and improved parenting skills (Romagnoli & Wall, 2012).

Critics of intensive parenting have documented that parents experience its standards as unattainable, overly idealized, and disempowering (Romagnoli & Wall, 2012; Wall, 2010). Past research has suggested that there is little support for the idea that such "concerted cultivation," above a baseline of what children in middle-class, western society might experience in daily life, improves children's long-term outcomes or increases intellectual ability (Brussoni, Olsen, Pike, & Sleet, 2012; Wall, 2010). On the contrary, prior work shows

that intensive parenting limits children's necessary opportunities for free-play, developmentally appropriate risk-taking, and self-entertainment (Brussoni et al., 2012; Lareau, 2002, 2010).

As prior work has positioned adult phone use as potentially detrimental to children, it is a natural candidate for intensive parenting debate. Given that conversations influenced by intensive parenting standards, such as debates about breastfeeding (E. J. Lee, 2008) or mothers working outside the home (Christopher, 2012), have led to guilt, confusion, and lack of self-efficacy in parents (Tummala-Narra, 2009), it is plausible that adults experience negative emotions when reflecting on phone use or non-use in care-giving contexts. In Chapters 3 and 5, I explore parents' perspectives on their own use of technology in relation to family life.

Families' desired technology practices and notions of what they "should" be doing are inevitably influenced by broader social ideals. Such ideals may be rooted in empirical evidence, just as social perceptions about the harm caused by child abuse or the benefits of breastfeeding align with important research findings (Binns, Lee, & Low, 2016; Pain, 2006). But as with other parenting topics, it is important to examine not only the evidence of risks and benefits to children when thinking about families' use of technology, but also to consider the broader discourse in which these risk/benefit assessments are made.

2.2 BOUNDARIES BY DESIGN

In this dissertation, I examine the ways in which families want to integrate technology use into daily life, which, by definition, includes the ways in which they want to limit their use of technology. In this section, I report on prior work that looks at limit-setting from multiple perspectives. I first examine existing research on individuals' decisions *not* to use technology. I then describe research on tools that support goal-oriented behaviors and limit-setting, both within and beyond the context of managing technology use.

2.2.1 Technology Non-Use

A recent movement in the HCI community advocates the study of not just the use of technology, but also its non-use (Baumer et al., 2013; Satchell & Dourish, 2009). Initial investigations have looked at why people abstain, take breaks from, or quit certain types of technologies, such as Facebook (Baumer et al., 2013), Twitter (Schoenebeck, 2014), or other social networking sites (Sleeper et al., 2015). Though non-use comes in many forms—ranging from lagging adoption (Satchell & Dourish, 2009) to death (Brubaker, Hayes, & Dourish, 2013)—in this dissertation, I specifically explore non-use decisions by active users as they balance time spent with technology with time spent without it.

A substantial body of recent work outside of family contexts demonstrates that users often feel conflicted about the time they spend with technology and that these mixed feelings are a contributing factor to technology non-use (Ames, 2013; Foot, 2014; Portwood-Stacer, 2013; Rainie, Smith, & Duggan, 2013; Sleeper et al., 2015). Ames reports that college students experience guilt and anxiety in response to expectations to be continually present with both those they are with physically and those they are connected to through devices (Ames, 2013). Other work has documented that media use can disrupt interpersonal family relationships, with romantic partners reporting that cell phone use undermines their communication and relationship satisfaction (Lapierre & Lewis, 2016; McDaniel & Coyne, 2014). Satchell and Dourish explore the design implications of resistance to technology and call on the CHI community to consider “the non-user” with the same rigor given to consideration of “the user” (Satchell & Dourish, 2009).

However, not all users with misgivings about their own behavior take action, and many report an interest in non-use that they fail to actualize (Ko, Yang, et al., 2015). To describe this gap, Baumer and colleagues coin the term *lagging resistance*, which they define as “a sense of wanting to quit but not doing so just yet” (Baumer et al., 2013). The opposite of lagging adoption, lagging resistance requires both the desire to change one’s own usage behaviors coupled with barriers to making such a change. My work builds on this construct by designing to support users in translating lagging resistance into action.

There has been little exploration of parents’ non-use practices, though some research suggests that parents reflect on this topic and consider their technology use through the lens of its potential impact on children and child behaviors (Ammari et al., 2015). Adults also consider the impact of their technology use on other family members, for example, negotiating technology use in the context of its impact on relationship quality with a romantic partner (Coyne et al., 2012; McDaniel & Coyne, 2014). Thus, a growing body of literature demonstrates that many adults feel dissatisfied with their current usage habits, leaving open questions as to how designers contribute to this sense of dissatisfaction, and what designers can do to address it.

2.2.2 Persuasive Technology

In designing to support non-use, my work builds on a large body of work in human-computer interaction to persuade users to adopt or adhere to specific lifestyle choices through technical solutions. Researchers have created tools to support behavior change in areas as diverse as physical activity (Consolvo et al., 2008; Denning et al., 2009), sleep (Eun Kyoung Choe, Lee, Kay, Pratt, & Kientz, 2015; Kay et al., 2012), nutrition (Cordeiro et al., 2015), stress reduction (Lu et al., 2012), and using sustainable transportation

(Froehlich et al., 2009). The HCI research community has formalized design frameworks for creating persuasive technologies (e.g., (Klasnja & Pratt, 2012)), and they have created or appropriated a variety of others based on existing theories of behavior change. Michie et al. provide a framework of behavior change techniques across 16 different clusters (Michie et al., 2013), while other researchers have developed interventions based on theories of goal setting (e.g., (Consolvo, Klasnja, McDonald, & Landay, 2009; Munson & Consolvo, 2012)), self-monitoring (e.g., (Choe et al., 2015; Maitland & Chalmers, 2010)), self-efficacy (e.g., (Guo, Chang, & Lin, 2014)), and mindfulness (e.g., (Chittaro & Vianello, 2014)). My research focuses on interventions for technology non-use using strategies that involve promoting goals and planning, providing feedback, and enabling self-monitoring.

A small body of recent work explores the design of persuasive technologies for non-use scenarios. One such study demonstrated that a novel tool to reduce smartphone use in social groups successfully supported peer groups of college students in collectively cutting back on the time they spent with their phones (Ko, Yang, et al., 2015). A second research effort provided a large pool of anonymous smartphone users with a tool to set rules restricting their use of specific apps (Löchtefeld, Böhmer, & Ganev, 2013). The seventy thousand rules set by the app's users suggest smartphone owners may be interested in such tools, and the research team found themes in the types of apps users wished to restrict.

In addition to these early investigations into designing for non-use, many commercial products exist to promote productivity, reduce distractions, self-monitor screen time or restrict access to certain applications or features. One prior study examined the effectiveness of the commercially available tool "RescueTime" designed for tracking personal screen media use (Collins, Cox, Bird, & Cornish-Tresstail, 2014). The research team found that users' lack of engagement due to the tool's limited salience, credibility, contextual information, and action advice rendered it ineffective. Though many other tools (e.g., "Procrastination," "Moment," "Chrome Nanny," and "Kill News Feed") have been developed for this space, little work has evaluated the effectiveness of such supports empirically.

2.2.3 Parental Controls

Though digital tools to self-monitor technology use are a relatively new development, parental controls that enable parents to restrict children's use of technology have existed for decades. Since 1997, the Children's Television Act and the Telecommunications Act have mandated content ratings for television programming to help parents make informed choices for and with their children about technology exposure. The "V-chip,"

an early technology that allowed parents to filter television content based on these ratings, was one of the first design attempts to support setting boundaries on media use. However, the V-chip was poorly received and had limited uptake due to usability and discoverability barriers (Hendershot, 2002; Kunkel et al., 2002), and prior work suggests that in general parents have limited awareness of content ratings and their meanings (Funk, Brouwer, Curtiss, & McBroom, 2009a). As parental controls have evolved, parents have continued to report that they are difficult to discover, difficult to understand, and require planning and proactivity (Funk, Brouwer, Curtiss, & McBroom, 2009b; Mitchell, Finkelhor, & Wolak, 2005).

Today, many commercially available technologies include features that allow parents to set limits on their children's media use. Some prior work has shown that these continue to be broadly unpopular and rarely used (M. Anderson, 2016; Hashish, Bunt, & Young, 2014; Mitchell et al., 2005), although other work has shown that when they are used, parental controls can be effective in guiding children toward healthier behaviors (Mitchell et al., 2005). A recent review of this design space reports that the tools that are available today are designed to control and limit children through filters and restrictions and strive to prevent children from encountering risky situations (such as using digital media for an extended period of time, making in-app purchases, or viewing adult content) (Zaman & Nouwen, 2016). Existing tools do not yet strive to support children in developing resilience to such situations when they do occur, despite the fact that internalized resilience has more protective effects than external restrictions (P. Wisniewski et al., 2015).

However, the child-computer interaction research community is beginning to explore more nuanced solutions. Hashish and colleagues developed a system called "Kid-in-the-Loop" that provides children and parents with tools to collaboratively set content filters on a device (Hashish et al., 2014), and Hartikainen and colleagues call for tools that work to build trust between parents and children (Hartikainen, Iivari, & Kinnula, 2016). A value-sensitive design exploration to understand parents' values with respect to parental controls found that parents value being involved and exercising control with respect to their children's use of technology, but they also value children's independence and the development of an internal moral compass that children can use to guide their own decisions (Nouwen, Van Mechelen, & Zaman, 2015). In this dissertation, I contribute to this space by exploring the design of supports for children that emphasize children's autonomy, intrinsic motivation, and self-regulation.

2.2.4 Eroding Boundaries by Design

Finally, in considering the ways in which we can design for boundary-setting and intentional technology use, it is worth noting that many commercial products do just the opposite, designing for habitual experiences that capture and hold users' attention as often as possible for as long as possible. "User engagement" is a guiding principle in software design and a common metric for evaluating products (Lehmann, Lalmas, Yom-Tov, & Dupret, 2012). As many products benefit from users' continued engagement (e.g., pay-to-play games and services, websites and apps that profit from ad impressions or click-through rates), designers are often incentivized to work against the boundaries users might otherwise set for themselves. Prior work has documented a variety of *dark patterns* in existing commercial technologies, that is, design approaches that serve the product and the company at the expense of the user (Brignull, n.d.).

Research in HCI has documented that dark patterns and malicious design are a pervasive problem (Conti & Sobiesk, 2010), and some of these patterns seek to erode users' ability to self-regulate their use of a system or application. For example, prior research has identified systematic dark patterns in video games that intentionally erode players' self-efficacy, leading them to invest more time and labor into gameplay than they enjoy or would choose to engage in without coercive design elements (Zagal, Björk, & Lewis, 2013). Lagging resistance and users' reports that they habitually engage in patterns of technology use that they later regret or feel are a waste of their time (Ames, 2013; Baumer et al., 2013; Foot, 2014; Ko, Yang, et al., 2015; S. Morrison & Gomez, 2014; Rainie et al., 2013) are consistent with the idea that manipulative design practices at times seek to break down boundaries and intentionality. Many commercially available books for practitioners offer advice and act as how-to guides for building addictive products that users find hard to put down (e.g., (Eyal, 2014; Lewis, 2014)).

2.3 SELF-REGULATION

Supporting self-regulation is central to many investigations of behavior change, and all the studies described here touch on users' ability to self-regulate their use of technology. In this section, I describe, first, underlying theories of human motivation and self-regulation, second, evidence-based non-digital tools to foster self-regulation, and finally, work in human-computer interaction to support self-regulation.

2.3.1 Self-Determination Theory

Self-determination theory (SDT) is a well-developed model of the role of internal and external motivation in supporting learning, well-being, and participation (Ryan & Deci, 2000). Work in SDT has repeatedly shown that individuals who feel agency and self-direction with respect to a particular activity will be more likely to both: 1) self-regulate their behavior in a way that enables them to perform the activity successfully, and 2) internalize these regulatory processes such that they are intrinsically motivated to enact them (Grolnick, Deci, & Ryan, 1997). As a result, environmental factors that foster a sense of self-determination improve individuals' intrinsic motivation and self-regulation. For example, adults who are given freedom of choice are more likely to persist in tedious tasks than adults who are told that they are required to complete these exercises (Deci, Eghrari, Patrick, & Leone, 1994).

Though the majority of studies on SDT have been conducted with adults, prior work shows that this model is also applicable to children (Deci, Driver, Hotchkiss, Robbins, & Wilson, 1993; Deci, Nezlek, & Sheinman, 1981; Frodi, Bridges, & Grolnick, 1985). Sheehan and colleagues report that children's sense of self-determination predicts their intrinsic motivation to exercise (Sheehan et al., 2013), and a series of studies have shown that parenting approaches that are more supportive and less controlling are more effective at facilitating long-term compliance (Grolnick et al., 1997). A field study of first- and second-grade children showed that rules for a painting activity accompanied by controlling language undermined children's creativity and motivation relative to the same rules accompanied by neutral language (Koestner, Ryan, Bernieri, & Holt, 1984). Other work has shown that preschoolers with disabilities benefit from support structures that foster self-determination (Palmer et al., 2013).

My dissertation builds on this work by framing children's ability to self-regulate their use of entertainment media in the context of SDT. It is well-understood that children need autonomy to regulate their behaviors and develop the intrinsic motivation to comply with social norms. It is also well-documented that self-regulating stimulating media experiences is a challenge, even for adults (Ames, 2013; Hiniker et al., 2015b; Ko, Chung, et al., 2015). Combining this prior knowledge with the fact that existing parental controls emphasize controlling children rather than mentoring them, I set out to investigate how technology might go beyond the lock-out mechanisms that are available today and explicitly foster the autonomy and self-determination children need to self-regulate their screen media use.

2.3.2 Pedagogy for Teaching Self-Regulation in Early Childhood

By the time children are three years old, they are capable of making thoughtful, self-regulated decisions, a skill they refine between the ages of three and six (Epstein, 2003). High-quality, evidence-based preschool curricula provide explicit mechanisms for supporting this development, and one of the most effective mechanisms for doing so is providing opportunities for planning (Epstein, 2003). When children are regularly prompted to thoughtfully plan out their actions in advance, their behavior becomes more intentional and they become more capable of learning across domains (Lockhart, 2010). By supporting preschoolers in making plans, parents and teachers help them identify and internalize norms and become more intentional, self-regulated learners (Epstein, 2003; Grolnick & Ryan, 1989).

Tools of the Mind (TotM) is an evidence-based curriculum for three-to-six-year-old children that provides opportunities for making, executing, and reflecting on plans (Bodrova & Leong, 2007). A randomized controlled trial of TotM with more than 200 3- and 4-year-old children showed that preschoolers exposed to the curriculum demonstrated improved executive function (the capacity for being goal-oriented) and greater learning gains relative to those who were not (Barnett et al., 2008). A core component of TotM is making “Play Plans,” child-created plans describing how the child intends to play.

The *High/Scope* preschool curriculum also emphasizes the importance of planning and includes a “Plan-Do-Review” sequence for children to engage in activities of their choosing in an intentional way (Schweinhart & Weikart, 1988). A longitudinal, randomized controlled trial of the High/Scope curriculum demonstrated that children who experienced this curriculum as preschoolers were higher earners, more likely to have graduated from high school, and dramatically less likely to have an arrest record as adults than peers in traditional preschool classrooms (Schweinhart et al., 2005). Researchers attribute these differences in community and social behaviors to High/Scope’s emphasis on planning and child initiative.

This prior work demonstrates that providing opportunities to plan is both effective for improving self-regulation and a developmentally appropriate tool for preschoolers. I build on this work in early childhood education by translating the planning steps developed by these curricula to a digital context and explicitly adopt components of these curricula in the design of the system described in Chapter 7.

2.3.3 Self-Regulation and Mindfulness in HCI

In addition to exploring children’s self-regulation, this dissertation also explores adults’ and parents’ experiences regulating their use of technology and engaging with intention. One recent trend in behavior

change is encouraging what is known as “mindfulness.” Brown & Ryan (Brown & Ryan, 2003) provide a theoretical and empirical examination of the role of mindfulness as a state of consciousness that promotes well-being. Aspects of mindfulness include “open, undivided observation of what is occurring both internally and externally” (Brown & Ryan, 2003; Langer, 2014) and it is related to other constructs such as self-monitoring, self-awareness, and emotional intelligence (Brown & Ryan, 2003). Research has linked achieving mindfulness with having a greater sense of wellbeing.

Within the HCI literature, there have been a number of research projects that have aimed to use mobile technology to promote mindfulness and awareness. The use of peripheral displays on phone screens has been used to promote awareness about exercise behaviors (Consolvo et al., 2008), sleep (Bauer et al., 2012), impact on the environment (Froehlich et al., 2009), and general mindful behavior and meditation (Chittaro & Vianello, 2014; Vidyarthi, Riecke, & Gromala, 2012). In Chapter 6, I discuss mobile interventions to promote mindfulness about smartphone use through self-monitoring and reflection.

Chapter 3. How Adults Use Phones When Caring for Children¹

As part of investigating T1, I examined the ways in which adults use their phones when they have children in their care and their perspectives on the appropriateness of phone use in this context. As described in Chapter 2, a limited amount of child development research suggests that caregiver phone use may be detrimental to children (J. S. Radesky et al., 2014; Steiner-Adair & Barker, 2013; Turkle, 2012), and the mainstream media has used this as fuel for an emotionally charged debate (Manjoo, 2014; Park, 2014; Worthen, 2012). Given these potential sources of pressure, I investigated caregivers' perspectives and values about their own phone use in caregiving contexts and how such values translate into emotions and behaviors.

I chose to conduct this investigation at playgrounds, a space where adults and children play together, children play independently, children encounter modestly risky situations (Morrongiello & Dawber, 2000), and adults enjoy time to themselves—thus providing a variety of social contexts for phone use and non-use. The playground's informal public atmosphere also gave me the opportunity to unobtrusively collect rich, naturalistic data on caregivers' behaviors and phone-use practices. In pursuing this investigation, I asked the following research question: How and why do adult caregivers use their phones when caring for children at the playground? This allowed me to collect data relevant to RQ1 (how adults use smartphones today) and RQ4 (how adults wished they used smartphones).

This work provides necessary empirical data for value-sensitive design (Friedman, Kahn, & Borning, 2009) for a user group that must integrate personal needs with constraints and desires driven by their role as caregivers. The contribution of this work is foremost to sensitize designers to the unique needs of children's caregivers by documenting common habits, beliefs, and concerns related to device-use in caregiving contexts. This data also reveals distinct subgroups of caregivers and suggests several avenues for creating differentiated technical supports for each. Finally, these results reveal predictive relationships among beliefs about the appropriateness of phone use, patterns of use, reported self-control, and feelings of guilt, all of which help to address T1 and provide a foundation for investigating T2. These stable relationships across this large sample

¹ Hiniker, A., Sobel, K., Suh, H., Sung, Y. C., Lee, C. P., & Kientz, J. A. (2015, April). Texting while parenting: How adults use mobile phones while caring for children at the playground. In *Proceedings of the 33rd annual ACM conference on human factors in computing systems* (pp. 727-736). ACM.

offer to inform predictive models of user behavior and provide formative work for building new sociotechnical theory.

3.1 METHODS

I recruited a team of six collaborators to conduct this work. To understand how adult caregivers use their mobile phones at the playground, we conducted: 1) covert non-participant observations, 2) semi-structured interviews, and 3) an online survey, all targeting adults who supervise children at playgrounds in north Seattle. We collected data from 466 adult participants during the spring and summer of 2014.

3.1.1 Study Sites and Participants

We performed observations and interviews at seven different playgrounds in the north Seattle area. Although we collected data from a diverse set of neighborhoods, this sampling was not intended to be representative of the general population. We included only caregivers who were supervising at least one child who appeared to be less than 10 years old. There were no exclusion criteria based on caregiver characteristics, and we observed a variety of adult caregivers, including parents, grandparents, and nannies.

We took notes on 171 adult caregivers during our qualitative observations (69% female). We timed the phone use of a separate 111 adults (68% female). We were unable to judge other demographic information about these individuals with certainty. We interviewed 25 adults (84% female). Of interviewees, 18 (69%) were parents, 5 (19%) were nannies, and 3 (12%) were other family members. Demographic information for survey participants is shown in Table 2.

3.1.2 Observations of Caregiver Behavior

Over three months, my collaborators and I individually visited seven playgrounds in north Seattle. Site visits were spread over all days of the week between 8 a.m. and 7 p.m. Across 22 visits, we collected a total of 33 hours of observational data. Because we could not always observe all individuals simultaneously, researchers chose a subset of caregivers to observe based on their location within the playground and their arrival time. Once the researcher began observing a caregiver, she continued observing him or her until the caregiver left the playground. We documented field data in jottings which were later used to develop ethnographic field notes (Emerson, Fretz, & Shaw, 1995).

Table 2. Playground Study: Demographic information for survey participants

Total Respondents = 154	
Gender	Female (79%), Male (21%)
Relationsh	Parent (93%), Nanny (6%), Other (1%)
Income	<\$50K (6%), \$50K-\$75K (8%), \$75K-\$100K (14%), >\$100K (60%), No Response (12%)
Race/ Ethnicity	Non-Hispanic white (87%), Hispanic (6%), Asian (3%), Mixed (1%), No response (3%)

During an independent set of visits to the same field sites, we observed an additional 111 participants without taking jottings. Instead we timed participants' phone usage precisely (in seconds) in order to quantify the frequency and duration of phone usage at the playground. Again, we assigned field sites to random days of the week and times of day, and we selected a subset of caregivers based on their locations and arrival times. Together across both types of observations, we observed 41.4 hours of playground time and recorded data on 282 caregivers.

3.1.3 Interviews with Caregivers

As adult caregivers' perspectives and experiences related to phone use at the playground were not accessible through observation alone, we conducted semi-structured interviews with an additional 25 participants. We approached and recruited participants at the same playground field sites using the same inclusion criteria as our observations. Given that caregivers were supervising children when we solicited interviews, our interview was intended to last no more than 15 minutes. We gave interviewees freedom to attend to their children and supported interruptions during the interview. Some participants generously spent 40 minutes or more elaborating on their responses.

Our interview protocol was shaped by early findings from our observations and was designed to elicit caregivers' self-reports describing their phone-use behaviors, motivations for phone use, and values and beliefs about phone use at the playground more broadly. Example questions included: *"How have you used your phone while you've been at the playground today?"* and *"Do you have any particular strategies for keeping an eye on your child when you're using your phone?"*

After completing the interview, participants were given a \$10 gift card as a thank-you for their participation. The total combined length of all interviews was 247 minutes (mean = 9.88, SD = 7.17). All interviews were audio recorded and transcribed by the research team.

3.1.4 Survey of Caregivers

Based on findings from our interviews, we developed a survey protocol to determine whether interview themes would be corroborated by a larger sample of the same community. In order to draw from the same population, we advertised to online groups and mailing lists that: 1) restricted membership to either parents or to nannies, and 2) had residency requirements limiting membership to those living in the areas surrounding our field sites. We asked caregivers to report on their mobile phone use at the playground, desired mobile phone use at the playground, motivations for choosing to use or avoid using mobile phones at the playground, strategies for integrating phone use into playground experiences, and beliefs about appropriate phone use, among other topics. As a thank-you for their participation, respondents had the opportunity to enter a raffle for \$15 gift cards (with 1 in 10 odds of winning). We received complete responses from 154 caregivers who routinely visit playgrounds in north Seattle. Of the 47 survey questions, 9 were open-ended. Two researchers coded open-ended questions for 14 codes spread evenly across 6 categories. Average agreement (Cohen's κ) on a random 10% of the data was .873 with all values of $\kappa > .71$. Disagreements on codes were discussed until consensus was reached.

3.1.5 Qualitative Analysis

Using a grounded theory approach (Charmaz, 2006), we iteratively reviewed and coded field notes, interview transcripts, and open-ended survey questions for themes. Data collection and analysis were interwoven, such that themes from early observations were used to develop our interview protocol, and themes that emerged from interviews formed the basis of our survey development. Data analysis was continual throughout our data-collection process. Each researcher reviewed her own data independently and the team collaboratively created a codebook capturing salient themes. Fieldnote codes from observations covered nine areas: child-caregiver interaction, children's attempts to interrupt adults, caregiver position, supervision style, phone activities, non-phone activities, balancing phone use with child needs, behavior just before and after phone use, and children's activity during phone use. Code categories drawn from interview data included: beliefs about the purpose of the playground, parenting style, concerns about phone use while caring for children, and benefits of phone use. After finalizing the codebook, each researcher independently coded the same randomly selected field note. Codings were reviewed as a group to ensure consensus. Using data from fieldnotes, we drafted analytical memos to develop themes. The memoing process was repeated for data collected from interviews and open-ended survey questions.

3.2 RESULTS AND ANALYSIS

3.2.1 Description of Phone Use

For the majority of these participants, phone use was a non-dominant part of their time at the park. This was consistent across all behavioral observations and corroborated by quantitative observations. Nearly two-thirds of participants spent less than 5% of their time at the park using a phone, including 41% who did not use a phone at all (see Figure 1, top). When adults were using a phone it was often for a short period of time. Nearly 30% of all uses were less than 10 seconds long and more than half were less than one minute (see Figure 1, bottom). Phone use via voice calls was far less common than phone use via touch interaction and comprised roughly 5% of all instances of use. There was no significant effect of gender on the percentage of playground time spent on the phone, average duration of an instance of phone use, percentage of phone time spent making voice calls, or total number of instances of phone use.

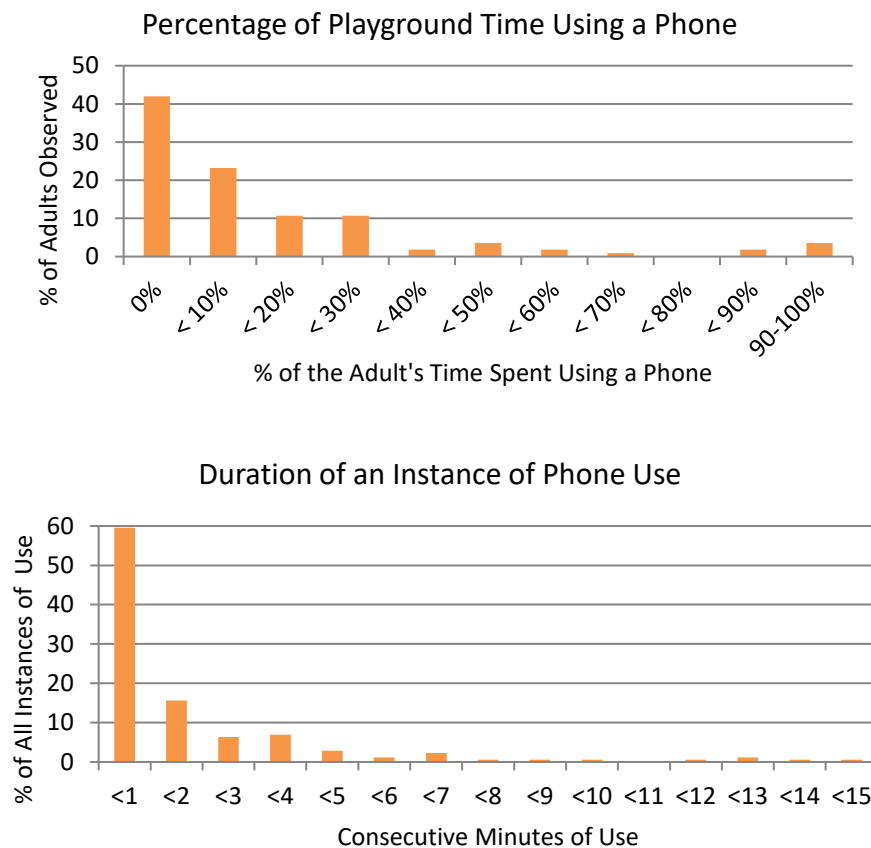


Figure 1. Playground Study: Top – Amount of time spent on the phone. Bottom – Duration of an instance of phone use.

Interviewees reported using their phones for texting (48%) and calling (48%), followed by email (38%), picture-taking (38%), and Facebook (20%). A small minority of interviewees mentioned other online activities and checking the time, and one interviewee reported playing casual games on her phone. These reports were consistent with survey data, though survey respondents reported each of these uses with higher frequency. This may be reflective of the fixed set of options provided to those surveyed, in contrast to the interview protocol, which asked participants for a free recall of the ways they use their phones. Table 3 (left) reports the frequency with which survey respondents use these and other technologies at the playground. The end-goals behind this technology use were varied (see Table 3, right). Tasks potentially related to childcare, such as checking the time, coordinating with others, and taking pictures, were reported more than twice as often as parent-centric tasks such as socializing, doing work, or viewing entertaining content.

In addition to describing the purpose of their phone use, my collaborators and I asked survey participants to report the type of situations that lead them to use the phone at the playground. The most frequently cited trigger for phone use was boredom, reported by 40% of those surveyed. We also asked participants to report situations that cause them put down the phone. A majority reported at times choosing not to use their phone because they felt it would compromise child safety (57%), make it hard to be responsive to their child (65%), or model behavior that they do not want their child to emulate (52%).

3.2.2 Absorption when Using Phones

As prior work has tied adult phone use to a lack of responsiveness to children (J. S. Radesky et al., 2014; Steiner-Adair & Barker, 2013; Turkle, 2012), I compared participants' responsiveness when they were and

Table 3. Playground study: what survey respondents do on phones and why

Technology	%	Purpose	%
Texting	85	Picture-Taking	88
Camera	85	Coordination	79
Email	64	Check the Time	75
Voice calls	57	Available: Emergency	71
Clock	49	Available: Family	71
Social media	48	Sharing Pictures	47
Browser	28	Information	41
Games	5	Available: Work	41
Reading app	3	Socialization	30
Video calls	1	Do Work	28
None	2	Entertainment	21

were not using phones. My collaborators and I observed 32 instances in which a child attempted to interrupt or gain the attention of an adult using a phone. In 18 cases (56%), the adult did not respond to the child at all (did not speak and did not look away from the phone).

By comparison, we observed 70 instances in which a child attempted to interrupt or gain the attention of an adult who was *not* using a phone. In these cases—when the adult was tending to the needs of another child, engaged in conversation with another adult, or simply removed from the play area and staring into space—children’s bids for attention were usually met with a prompt reply. There were 8 instances (11%) in which an adult without a phone did not respond in any way to a child’s request. Thus we saw a notable difference in adults’ ability to be interrupted when they were and were not using phones. Interrupted adults did not always provide responses that satisfied children and did not always agree to give children their undivided attention. For example, in one interaction: *“The boy says, ‘Mom, look!’ ‘Mom, look!’ And asks if she will play with him. She says, ‘I have to stay with the dog...there are other people you could play with’”* (Field Observation). But it was rare for an adult to remain silent in response to a bid unless he or she was using a phone.

However, children’s bids to adults occupied a small fraction of families’ time at the playground. To contextualize this absorption, my collaborators and I observed these 102 total interruptions across 33 hours of observation, always observing multiple children at once. That is, across several child-adult groups we saw one interruption roughly every 20 minutes. The majority of playground time was dominated by adults sitting and watching as children played independently and by adult-child interaction.

My collaborators and I investigated adults’ awareness of and feelings about the absorption we observed in phone users. The majority of interview participants (22 of 25) spontaneously mentioned that either they or phone users generally pay less attention to their physical surroundings when using phones. However, interviewees also expressed confidence that when they use phones, they consistently monitor for children’s requests. We asked interviewees who had used a phone at the playground that day to report what their child had been doing during phone use. In response, we received a variety of vague and sometimes defensive answers, such as:

- *“Yeah, so either climbing on some structure or playing. I kind of try to watch obviously.”* (P23)
- *“I did those things very quickly. They just kept doing whatever they were doing”* (P20)
- *“Um, pretty much what he’s doing now?”* (P11)

Collectively, interviewees reported that they believe phone use dilutes their attention to the physical world, but also that their children's requests draw them back to the present moment on demand, an opinion that was at odds with the behavior my collaborators and I observed.

Survey participants agreed with interviewees; more than 80% of respondents reported that it is more difficult for them to pay attention to their children when using a phone. Like interviewees, survey participants were less likely to agree that phone use makes it harder to respond to child requests. Participants reported feeling significantly more confident that their child can get their attention when requested than confident that they are proactively paying attention to their child ($t = -8.96, p < .001$). Thus, while adults generally believe that they are absorbed when using phones, many still believe that their absorption does not hinder their ability to be available upon request.

3.2.3 Values and Beliefs about Using the Phone

Through qualitative analysis, I found that both interviewees and survey respondents fell into three distinct categories based on self-reported values regarding phone use: 1) caregivers who believe it is appropriate for adults to use their phones whenever their children are safe and occupied, 2) caregivers who believe phone use should be minimized but that they are unable to live up to this ideal, and 3) caregivers who believe phone use should be minimized and that they successfully achieve this ideal minimization. These were not categories that the research team had preconceived, and my collaborators and I did not describe or prompt participants to identify with any of these profiles.

Profile 1: Confident Users. A sizeable minority of interviewees (28%) expressed the belief that within certain bounds—typically, when children are safe and occupied—phone use of any kind is appropriate. These interviewees unapologetically described instances where they were, “just, like, sitting there on Facebook or texting somebody,” (P16), “online checking grades,” (P15), or “checking Facebook or work email, basically. Sometimes I read the *New York Times* on my phone” (P23). As one father explained, “As long as I can see him, I’m comfortable [using the phone]” (P4). These users expressed no reservations about using their phones at the playground and no desire to regulate their phone use in any way, provided that their child was safely and independently occupied.

Like interviewees, a non-trivial minority (18%) of survey respondents expressed beliefs consistent with this profile. These individuals reported feeling comfortable using their phones without any self-imposed restrictions, though again adding the disclaimer that their child must be safe and happy. As one survey

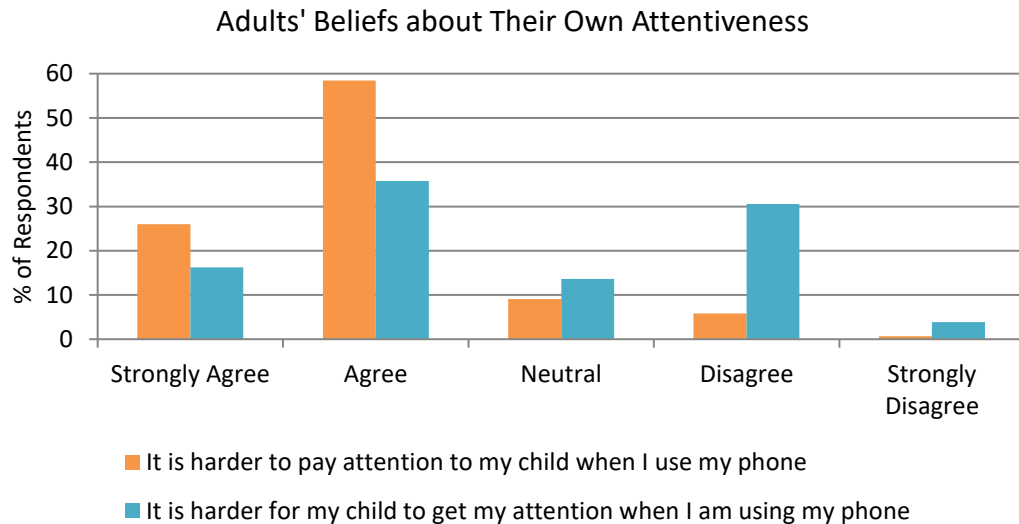


Figure 2. Playground Study: Adults believe they are absorbed by phone use but many feel they remain as available to their children as when they are not using phones

participant explained: *“If my child is playing independently and is in a safe situation, I see no reason not to do my own thing.”*

Profile 2: Users Who Would Like to Increase Non-Use. Nearly half of all interviewees (44%) reported both that they believe phone use should either be completely minimized or restricted to specific playground-appropriate tasks (such as taking pictures of children, checking the time, or managing essential coordination) and also that they struggle to live up to this self-imposed standard. These participants used the word “try” when describing their efforts to avoid phone use, such as: *“I try very hard not to check email or do Facebook,”* (P1) *“I try not to be on it if I don’t have to,”* (P19), or *“I tried to leave it [at home]”* (P10). Despite their reported attempts to disengage, these participants described struggling to resist the desire to use the phone. While many felt they were doing a good job of working toward this goal, all reported that they would like to use the phone even less.

Similarly, 40% of survey participants reported simultaneously that they believe phone use should be limited and that they would like to make further progress toward this ideal. As participants explained:

- *“At the park, I want to use my phone less... The more I keep my own promises regarding my phone use, the better I feel.”*
- *“I don't want to be addicted to my phone... The less she sees me holding it, the better... I use my phone more than I would like.”*

- *“I want to use it less, but bad habits are hard to break!”*

These caregivers described themselves when using the phone in front of their child as: *“not as attentive,” “not as responsive,” “ignoring,” “not a good role model,” “a slave to my phone,” “absorbed in the device,”* or *“set[ting] a bad example.”*

Profile 3: Confident Non-Users. A third group of participants expressed the belief that phone use in this context should be minimal, and they have successfully achieved this goal. These participants made strong statements about consistently living up to the standards they hold for themselves around phone use. 24% of interviewees fell into this category and described their phone use with statements such as: *“Everybody who knows me knows that I don’t answer the phone [when caring for children]”* (P5).

This category emerged naturally among the larger sample of survey participants as well. Of those surveyed, 36% felt that phone use should be kept to a minimum and that they successfully achieve this standard. One participant described her own behavior saying: *“I typically don't have trouble leaving my phone in my pocket for an hour, and I regularly can go for a whole playground visit without pulling it out. This is about the way I want it to be.”*

Caregiver profile was a significant predictor of feelings of guilt. A Kruskal-Wallis H test showed that the effect of caregiver-type on the extent to which participants agreed with the statement *“I feel guilty when I use my phone at the playground”* was significant ($X^2(2, 137) = 25.29, p < .001$). Post hoc analysis using the Tukey HSD test indicated that: 1) caregivers who believe they have successfully minimized their use feel significantly less guilt than phone users who would like to further reduce their use ($p < .05$) and 2) that caregivers who believe phone use is appropriate whenever children are safe feel less guilt than caregivers who believe all phone use should be minimized ($p < .05$).

Surprisingly, it also showed that confident non-users feel significantly more guilt than caregivers who believe phone use is appropriate whenever children are safe ($p < .05$). One might expect that users who feel fully satisfied with the way they use their phones would feel no more guilt than those who believe all phone use is appropriate. But for participants, valuing minimal phone use was associated with increased feelings of guilt regardless of how effectively users’ felt they controlled their behavior.

3.2.4 Perceptions and Judgments of Self versus Others

This investigation was motivated in part by social commentary on using phones while caring for children, and in our survey and interviews, my collaborators and I explored the extent to which caregivers feel judged for their phone use and the extent to which they judge others. Only two of 25 interviewees were primarily

critical of other caregivers' phone use at the playground. Nearly all interviewees were primarily agnostic toward other adults' use, with a subset going further and making statements of support, explaining that what they see from others *"feels good,"* (P22), that they are *"impressed"* by other caregivers (P19), and that *"people are pretty attentive to their kids"* (P23).

While some interviewees explained that they *"worry"* about other adults not giving children high quality attention (P8) or feel that others should *"temper [their use] a little bit"* (P12), in these instances, interviewees explained that they are equally concerned about their own behaviors. Further, interviewees who held themselves to a standard of minimal or no phone use while caring for children held more relaxed standards for other caregivers. Many interviewees expressed discomfort with the idea of judging others, explaining *"I'm one of those connected people so obviously I can't judge,"* (P23) or *"it's easy to judge...but I try not to"* (P22).

Among survey participants, 27% reported feeling judged for their phone-use behaviors, suggesting that feelings of judgment are a consistent but minor theme. Despite participants' reluctance to judge others, there were significant differences between adults' perceptions of their own behaviors and their perceptions of the behaviors of others. A paired-samples *t*-test revealed that participants were more likely to agree with the statement *"the way I use my phone at the playground is appropriate"* (mean = 2.21, sd = 0.75) than the statement *"the way other adults use their phones at the playground is appropriate"* (mean = 3.14, sd = 0.70, $t = 4.10$, $p < .001$). Response options ranged from *"1: Strongly Agree"* to *"5: Strongly Disagree."* Participants were also significantly more likely to agree that others should reduce their phone use (mean = 2.55, sd = 0.86) than that they should do so themselves (mean = 2.87, sd = 0.96, $t = -11.95$, $p < .001$).

Thus, despite commentary reflecting reservations about passing judgment, participants feel that their behavior is both more restrained and more appropriate than that of their peers. These results are consistent with the gap between perceptions of self and others observed in other domains, such as the classic example of 90% of drivers believing they are more cautious than the average driver (Codol, 1975; Svenson, 1981).

3.2.5 Adults' Interest in Technology Support

Given that 40% of interviewees and 44% of those surveyed reported a desire to change their current phone use habits (either by reducing the total time they spend with the phone or by cutting down on particular behaviors), is consistent with T2, and suggests that there may be a design opportunity in this space to support adults in achieving their desired phone use. However, when my collaborators and I asked survey participants whether they would be interested in a tool to *"help monitor [their] phone use and achieve [their] desired phone use,"*

the response was negative. 74% of all participants and 60% of those who wanted to change their behavior were firmly against the idea of using such a tool, while only 16% of all users and 26% of those looking to change expressed enthusiastic interest. Negative responses reflected thematic resistance based on: satisfaction with their current behavior (41%), valuing self-monitoring without support (21%), the oxymoron of using technology to reduce technology use (17%), and general technology fatigue (9%).

Two of these themes, valuing self-monitoring and the belief that technology to manage technology use is problematic, may pose unique barriers to designing to support this goal. Many respondents who expressed a desire to reduce phone use were resistant to the idea of leaning on supports and felt they should be able to change their behaviors themselves. They explained: *“I really should just limit my own usage and not be so addicted that I need an app,”* and *“Apps like these are for weak-minded people with no self-control... I will strive harder next time.”* This category of comments suggests that designing to support adults who wish to reign in their phone use at the playground will require consideration of their potentially competing desire for self-sufficiency.

A second design barrier may be the fact that so many of the participants in this study viewed technology as an inherently unproductive vehicle for delivering solutions to support intentional technology use. As one respondent explained: *“An app to cut down on apps? It feels like it feeds in[to] cell phone dependency.”* Though many respondents who expressed this opinion wanted to adjust their usage, they felt that technological supports were as concerning as the technologies they want to avoid. This category of comments suggests that designing to support adults in achieving this goal will require consideration of the fact that new technologies may be rejected and solutions may need to be invisibly embedded in adults’ current experiences on the phone in order to be accepted. This value and thus this design barrier may extend to other groups of users trying to resist technology and to other non-use contexts.

Respondents who were unequivocally interested in trying out such a tool (16%) hoped that it would help them *“see perception vs. reality”* in the amount of time they spend on the phone. Respondents most frequently reported that reminders to put down the phone or data documenting their actual use would be most helpful.

3.2.6 Practices for Integrating Phone Use at the Playground

In absence of tools to support caregivers in achieving their ideal phone use, my collaborators and I observed that participants engaged in five thematic practices when using their phones at the playground, which appeared to serve as attempts to mitigate the impact of phone use on children. We probed this topic with interviewees and learned that some of these are conscious strategies intended to mitigate phone absorption.

1. *Using the Phone in Short Bursts.* Adults commonly used their phones at the playground for very short periods of time: taking out the phone, looking at the screen momentarily, putting it away, and then returning to attending to their children. Although some caregivers used their phones for extended periods of time, most instances of adult phone use were very brief. This was corroborated by my quantitative observations of phone use in which 40% of phone uses were 30 seconds or less. 36% of survey participants reported that they intentionally practice this strategy of short-burst phone use. Interviewees described using this strategy as well; as one explained: “*When I use it, it’s usually **quick things** like messaging or I don’t really have time to read long article or like that. So that’s my strategy – **short quick things**” (P11).*
2. *Glancing Back and Forth between Phone and Child.* My collaborators and I also observed that adult phone users frequently glance back and forth between their phone and their child, often shifting their gaze as frequently as every few seconds. 37% of survey participants reported that they do this regularly and several interviewees spontaneously described glancing between phone and child. When asked how she used her phone, one interviewee said she would “*look at it and then... fiddle around with something, like email or texts, and then glance up and then go back*” (P16).
3. *Waiting until the Child is Safe and Occupied.* Adults systematically used their phones when their children were safe and occupied, for example, waiting until children were playing in a contained area like a sandbox or using the phone when children were playing cooperatively with others. The majority of interviewees reported that they tactically use phones once children are in “*safe*” situations, as did 58% of survey participants.

An exemplar of this strategy is phone use while young children are in swings. My collaborators and I frequently observed adults using their phones while their children were in bucket swings with leg holes and a safety belt intended to keep young children in the seat. Toddler swings restrain and protect the youngest children at the playground in a way that no other playground equipment does. Adults concurrently attended to their phones and their children by pushing them on the swings with one hand and holding, scrolling, tapping, and looking at their phone in the other hand. This was corroborated by interviewees as a conscious strategy.

4. *Post-Phone Adult-Initiated Engagement.* My collaborators and I observed adults initiating enthusiastic interactions with their children immediately after phone use. Though no interviewees commented on this explicitly, in behavioral observations, there was an ebb and flow of adult engagement with

children such that during phone use adults typically did not engage with their children but proactively initiated interaction immediately after putting the phone away.

For example, one participant used his phone for about fifteen minutes. After putting his phone back in his pocket, he walked up to two boys playing in the sandbox, “*hold[ing] up his hands and curl[ing] his fingers to make monster claws and growl[ing]*” (Field Observation). In these instances, adults’ engagement with children 1) followed a period of focused phone engagement, and 2) was adult-initiated rather than in response to a child request or interruption.

5. *Avoiding Phone Use.* To mitigate potential effects of phone use on children, interviewees reported deliberately making their phones inaccessible as a means of avoiding phone use altogether at the playground. One interviewee (P10) explained that she was not tempted to use her phone that day because she intentionally did not bring it to the playground. Three other interviewees (P12, P14, and P5) reported leaving their phones in their bags, so that phones were available but more easily ignored. Survey respondents also reported an inaccessibility-as-avoidance strategy and described leaving their phones in the car or using flip phones instead of smartphones to minimize features and potential distractions.

3.3 DISCUSSION

These results provide extensive empirical data on phone-use and non-use decisions among parents and other caregivers. These findings indicate that, for the majority of the participants observed here, phone use occupies a small fraction of their time with their children and that this limited use is intentional. A small set of common, child-centric concerns—the need to 1) supervise, 2) be responsive, and 3) act as a role model—drive this intentional non-use. Though no formal, expert guidance suggests they do so, the majority of participants (68% of interviewees, 76% of survey respondents) attempt to minimize their phone use when spending time with their child and report negative emotional experiences of engaging with technology while children are in their care. Further work remains to tease apart the extent to which these negative feelings arise from their personal experiences with phone use and the extent to which they arise from a social climate that is critical of phone use by caregivers.

Relatedly, participants found their phone use to be more acceptable when it either involved the child (taking pictures) or directly related to the child’s needs (coordination with others, setting a timer). Even participants who believe phone use should be minimal usually felt comfortable engaging with the phone for child-related

purposes. These results suggest that for many caregivers, playground time centers on child needs and phone use is appropriate only in service of these needs. Desired patterns of use and non-use for these caregivers arises from their perceptions of what is best for their children rather than what is best for themselves.

For a large subgroup (nearly half of participants), a gap exists between desired and actual patterns of use and non-use, and this delta is a source of guilt. These participants report wanting to change their behavior and feeling unable to do so. Given the success of self-monitoring tools in a variety of other domains, this space appears to be a promising target for data-tracking and goal-setting applications. As participants both underestimated the extent of their unresponsiveness and felt notable guilt even when their overall phone use was minimal, providing these individuals with accurate behavioral data may be valuable. Capturing and reporting such data could potentially support caregivers in better achieving their expressed values (e.g., improving responsiveness) and assuage unnecessary guilt (e.g., by showing that their usage is minimal).

However, participants' resistance to new technologies also suggests that the experience of collecting and viewing such data would only be acceptable if embedded seamlessly into their current digital experiences. This data also suggests that altering existing applications to provide natural stopping points and to be more respectful of non-use desires would also be of value.

These findings further reveal that while this device-resistance is prevalent, it is not universal. A distinct subgroup of caregivers expressed that unlimited adult phone use is appropriate and that they have no desire or intention to limit their time with the phone. Thus, the larger user-group of those caring for children is not monolithic; use and non-use intentions and behaviors are better predicted by caregiver profile than by general status as a caregiver. Supporting and designing for caregivers who value unlimited use will likely look very different from supporting and designing for caregivers who value minimal use. These results suggest that to best understand this user group, value-sensitive design for caregivers should probe whether or not an individual values minimal use in caregiving contexts, as well as the individual's perceptions of his or her own behavioral control.

Finally, the subgroups of caregivers that emerged from this data and their associations with specific emotional experiences related to phone use suggests that these categories offer predictive utility. Concerns about supervision, responsiveness, and modeling appear to predict feelings about phone use. Feelings about phone use, purpose of phone use, and perceptions of behavioral control in turn appear to predict phone-use behavior in this context. Participants reported that their values about phone use at the playground are similar to their values about phone use when caring for children in other contexts, thus the relationships documented here

may be useful for modeling caregivers' desires and behaviors across a variety of contexts and technologies. Further work remains to develop and assess this theoretical model.

Nearly every interviewee and survey respondent reported having thoughts about phone use in caregiving contexts. Caregivers' consistent ability to articulate their desired phone use suggests this is a salient topic for these users. Within this community, the majority of caregivers appear to think about this, value minimal use, and translate this belief into behavior. These include common patterns of use (e.g., using a phone only after securing a child in a swing) and common patterns of non-use (e.g., locking the phone in the car). While these use and non-use behaviors are superficially different, they are enacted to achieve the same end-goal of enabling caregivers to put child needs first.

My findings show that the need to prioritize child-centered concerns is fundamental across diverse members of this user group and should not be ignored. Today's technologies support this need with mixed success. Mobile phones give "confident users" the freedom to first provide their child with outdoor free-play and then engage with technology. Caregivers of all types appreciate the phone's ability to take pictures of children and facilitate real-time coordination while they are at the playground. But "users who would like to increase non-use" report frustration with their phone-engagement. These reported positive and negative experiences are both consistent with a world in which designers focus on engagement with minimal consideration of disengagement. My results suggest that designing to support user-driven disengagement and re-engagement would be of value to this group. In absence of this, caregivers who feel their phone use inhibits their ability to prioritize child needs express a significant guilt burden, take measures to restrain their own behaviors, and in some cases abandon their devices altogether.

This sample, and the Seattle metropolitan area, is less racially diverse, has a higher educational attainment, and higher household income than the American average. Patterns of phone use, technology access, caregiving attitudes, and family resources are likely to differ between the communities my collaborators and I studied and other areas. Future work remains to understand the extent to which these findings generalize to other populations. While participants reported that their values and behaviors at the playground are consistent with their values and behaviors in other caregiving situations (and thus may generalize beyond the playground), this sample was restricted to adults who bring their children to the playground in the first place. Future work is needed to understand whether these patterns hold among caregivers who are less likely to provide playground opportunities.

Parenting is a challenge in many ways, and the HCI research community has long investigated opportunities to support parents through technology. This data provides new insights into the needs of parents and other caregivers and offers to inform new models of caregiver behaviors in sociotechnical contexts. Such an understanding opens many new design possibilities including extracting design principles from the values documented here; designing for cycles of engagement, disengagement, and re-engagement; and examining caregiver guilt as a design target.

3.4 SUMMARY OF CONTRIBUTIONS

This work provides empirical data to evaluate T1 by examining the questions of how adults use mobile phones when caring for children and how they feel about these practices. By identifying that: 1) many caregivers perceive a gap between their desired and actual behaviors, 2) some caregivers mitigate this gap by restricting their own access to their phones, and 3) caregivers value engaging in some digital activities in this context (e.g., picture-taking) but not others, I document a design opportunity to support these users in shifting their habits to allow for certain patterns of engagement while limiting others. I build on these findings directly by studying and designing persuasive tools for adults for self-monitoring phone use (see Chapter 6).

This work also contributes to our theoretical understanding of this space by demonstrating that caregivers are not a monolithic design target, and different groups of parents have distinct and contradictory values and goals. By documenting these caregiver profiles and their predictive utility, this work contributes to our ability to model technology use and non-use in family contexts.

Chapter 4. Toddlers' and Preschoolers' Transitions to and from Screen Media²

A growing body of digital media targets very young children (ages 1 to 5), and more educational apps are created for children under 5 than for any other age group (Shuler, Levine, & Ree, 2012). As a means of documenting the limits families establish for children at this stage of development and their experiences with these limits, I conducted a mixed-methods investigation with several collaborators to study how children in this age group transition to and from screen media experiences. In this project, I explored the following research questions:

- Under what circumstances do very young children transition to and from screen media experiences?
- To what extent are these transitions painful, and what factors predict transition pain?

Exploring these scoped questions provided me with empirical data that is relevant to the broader questions of RQ2 (how do children use screen media today?) and RQ3 (how do parents mediate these experiences?) And it allowed me to evaluate T1 by determining whether an exploration of families' practices could inform the design of limit-setting technologies. I chose to focus on this age group both because child development researcher reports that stringent limits are most conducive to healthy development at this age, making limit-setting an important part of screen media use (American Academy of Pediatrics, 2014; Strasburger, 2010), and because children this age lack the self-regulation, language, and negotiation skills of older children, making boundary-setting a more onerous process for parents (Carlson & Wang, 2007).

4.1 METHODS

4.1.1 Interview Methods

Along with two collaborators, I conducted semi-structured interviews with 27 parents (5 fathers) of one or more children between the ages of 1 and 5 (inclusive). The majority of interviews (25) were conducted in

² Hiniker, A., Suh, H., Cao, S., & Kientz, J. A. (2016, May). Screen time tantrums: how families manage screen media experiences for toddlers and preschoolers. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (pp. 648-660). ACM.

person, but I accommodated requests for phone interviews as needed. I designed the interview protocol to take 30–45 minutes, and the average length of interview was 38 minutes ($sd = 16$). Altogether, we collected 16 hours and 55 minutes of interview data over the spring and summer of 2015. At the conclusion of each interview, the participant received a \$15 gift card to Amazon as a token of our appreciation.

I defined the initial interview protocol to probe parents' experiences managing their child's time with screen media. The initial protocol asked parents when, where, and what type of screen media their children consumed and what parents did during children's screen time. We asked parents about the limits they set on their children's screen time, asking questions such as, "*Do you generally limit your child's screen time? Why or why not?*" and "*In your opinion, what would be 'ideal' screen time look like for your child?*" We then asked parents questions about how their child's screen time experiences usually end, e.g., "*How does your child usually respond when screen time is over?*" and "*How often does your child choose to end screen time on his/her own?*" Finally, we asked about challenges they experience transitioning to and from screen time, strategies they use to overcome these challenges, and advice or strategies they use to manage children's screen time that they believe might be effective for other parents as well. I intentionally did not bring preconceived hypotheses to this investigation.

As we conducted interviews, my collaborators and I iteratively analyzed our data using an open-coding approach. I iteratively revised our protocol to accommodate emerging themes, and the final protocol included all of the topics described above as well as: questions probing the extent to which families have developed routine around screen time, the ways in which features of the technologies they use smooth transitions to and from screen time or make them more difficult, and the extent to which children's transitions to and from screen time resemble transitions to and from other activities.

All interviews were transcribed by the research team or by a professional transcription service and verified by myself or one of my collaborators for accuracy. I iteratively coded all transcripts and developed a code book with categories and example quotations. Final code categories included: type of technology, type of content, discussion of autoplay, boundaries established by technology itself, warnings in advance of a transition, screen-time routine, screen-time friction, transition triggers, and ideal screen usage. My collaborators and I discussed codes together using example quotations. One of my collaborators coded a randomly selected transcript to verify reliability; Cohen's κ was .843. Codes were used as the basis to develop analytical memos about themes.

4.1.2 Diary Methods

Using the themes uncovered in our interviews, I distilled a set of beliefs about screen time transitions that were common across participants and used these to generate hypotheses about the factors that predict smoother or rockier transitions. I then developed a diary protocol to evaluate these hypotheses. I asked a second set of participants to complete this protocol every time their child used screen media in their presence over a period of two weeks. I deliberately did not specify strict definitions for “screen time” or “screen media” and instead asked participants to define what screen time means for their family. I asked participants to complete the protocol after the child transitioned away from a screen media experience so that the participant could document how it ended.

In each diary entry, the participant first filled in the blanks in the following sentence:

My child stopped: [*screen time activity, e.g., “watching Sesame Street”*] **on a(n):** [*technology, e.g., “iPad”*] **because:** [*trigger, e.g., “he wanted to play outside”*] **while I was:** [*parent activity, e.g., “washing dishes”*].

Next, the participant reported how the child felt about this transition on a five-point Likert scale ranging from “1: My child was very happy about this transition” to “5: My child was very upset about this transition.” The participant then reported how unusual the child’s reaction was and then checked all applicable items from a list of possible attributes of this particular event, such as: “I gave my child a warning that screen time would be ending,” “My child and I were watching or playing with the screen together,” and “Having screen time in this context is part of my child’s routine.” The participant then had an opportunity to provide comments further describing or contextualizing this particular instance of screen time.

I recruited a new set of participants, distinct from interviewees. Diary participants included volunteers for the interview study who were not interviewed because I reached data saturation before they could be included. They also included families recruited through an institutional participant pool established by screening all birth records in the Seattle metropolitan area. Altogether, 28 families participated in the diary study and generated a combined 380 diary entries.

Each participant logged exactly one child’s screen time transitions, documenting a total of 28 children (14 boys). Children’s ages ranged from 14 to 66 months (see Table 4). Though I recruited from a participant pool that reflects the demographic composition of the entire region, respondents were all married or partnered mothers and over-representative of white families (85%) relative to regional demographics (71% (“United

Table 4. Transition study: Diary participant demographics

Child gender	M=14, F=14
Child age (months)	Mean=38, sd=16, range=14–66
Parent gender	M=0, F=28
Parent race	White (86%), Asian (7%), mixed race (7%)
Household income	>\$100K (54%), \$75-100K (18%), \$50-75K (18%), \$25-50K (7%), No response (4%)
Marital status	Married or partnered (100%)

States Census Bureau,” 2013)). Respondents’ household incomes were higher than the regional median of \$73,441 (“United States Census Bureau,” 2013). Each parent was instructed to record each instance of the child’s screen time for a period of two weeks. The parent was given a link to an online survey with the diary protocol. The participant then submitted this survey after each screen time instance. If they did not record any screen time instances on a given day, the participant received a reminder email in the early evening asking them to record any screen time they had forgotten to document. Participants were instructed to record each instance as soon as possible after it ended and no more than 24 hours later. Participants who participated in all 14 days of the diary study (even if their child did not have screen time each day) received \$53 in compensation as a token of appreciation. Participants received the same compensation regardless of the number of diary entries in order to incentivize honest documentation.

I used the code categories and the hypotheses generated from interviews as the basis of my analysis of diary entries. I performed a directed content analysis (Hsieh & Shannon, 2005) of screen time descriptions using the code categories from our interview study. I coded: the types of media content children consumed, types of form factors, types of transition triggers, and types of parent activities. I performed a quantitative analysis of diary results to evaluate the hypotheses drawn from our interview data.

4.2 RESULTS

4.2.1 Interview Results: Perspectives on Screens

Parents in the interview study reported that their children use screen media primarily to view video content and that they do this on traditional television sets, personal computers, tablets, and smartphones. Videos range from brief YouTube clips, to 22-minute cartoon episodes, to long-form movies. In general, older children consumed longer content. Ten parents said that they own at least one interactive app or game that their child has played at least once, but only two families reported that game-playing was a routine occurrence.

Many parents reported that their children use computers, tablets, and phones to view family photos or videos or to video chat with other family members, but they focused on professionally produced video content (and not interactive apps, games, family photos or video chat) when discussing their child's screen time.

The most dominant theme across interviews was a general negative impression among parents of screen media for young children. The majority of parents (25 out of 27) explained that, for children, screen media is often enjoyable, and perhaps innocuous in small doses, but needs to be: 1) limited to short durations, 2) dominated by non-screen activities, and 3) carefully monitored by parents. Much like parents might restrict children to a single serving of dessert per day or per week, nearly all participants felt that screen time should be doled out on occasion in small quantities. For example, parents told us that:

- *“Kids have too much access to technology and too much screen time is not very good for them... [my husband thinks] they should have zero access to screens, but I think that's cruel and unusual punishment.” (P12)*
- *“I don't think that screen time is the most appropriate thing at that age. I think some of it is fine. I don't believe that it's bad for them, but I think excessiveness is bad...for her development, if we played with her versus her watching something, it would be better.” (P17)*
- *“We try to limit her as much as possible, because we know that it's not very good for her...usually what I say is as little as possible.” (P24)*

Of these 25 parents, some believe that technology's influence on young children is inherently negative, explaining that it: *“encourages ADD,” “makes kids kind of crazy,” “feeds them what [they] should be interested in,”* and *“lead[s] to kids having poor attention spans and always wanting to be entertained.”* Others reported a perception that technology is not inherently bad, and in fact can even contribute to learning new concepts or creative play, but displaces other activities of higher quality. This second group of parents said things like: *“There's nothing wrong with watching Doc McStuffins. It's a positive, happy, wonderful show, and that's not the point. The point is, what else could you be doing with that time?”* Both groups of parents (those who feel screen media for children is inherently problematic and those who feel screen media is only problematic because it displaces more important activities) reported that, in an ideal world, their child would only use screen media occasionally for short periods. Three reported they would prefer their child have no exposure to screen media at all.

4.2.2 Interview Results: Transitioning To Screens

Despite these reservations, all of our participants reported that they do permit their young child to use screen media at least occasionally (an inclusion criterion for participation, and a common practice in the overwhelming majority of American households with children in this age range (“Zero to eight: Children’s media use in America 2013,” 2013). Given parents’ concerns and their desire to limit screen exposure, we explored the circumstances in which they *do* allow their children to use screen media. We found that 23 participants (85%) permit screen time primarily or exclusively when they need to occupy their child so that the parent is freed to engage in activities without interruption. Parents explained that it is challenging to do essential household chores, shower, or tend to younger siblings when a child is present. They further explained that screen media provide an effective tool for enabling these necessary tasks. Because of their general impression that screen exposure is undesirable, the parents we interviewed withhold screen media and strategically allow access primarily when the parent is unable to give the child his or her attention. For example, parents described their children’s screen time by saying:

“I started [giving her screen time] because I wanted to cook dinner. I would say ‘Let’s watch a movie,’ ...because she could really focus on that and that gives me the time that I need to make dinner.” (P5)

“When we give him the phone it serves...the purpose of keeping him distracted so that we can do X, Y, Z.” (P2)

“A lot of times it’s about giving us space to get something else done without having to manage her...I would say the majority is we’re getting some other task done around the house or with our infant son.” (P27)

“I choose a video that I want to be the correct amount of time. If I need him to be occupied for a half hour, then I’ll choose something that’s 30 minutes. If I need an hour, I’ll choose a movie that’s an hour.” (P23)

Parents reported that they also strategically wait to give their children access to screens until they as parents feel overwhelmed or drained from the demands of attending to their children, though they said that this is less common than using screen-based distraction to facilitate chores. For example, parents told us that they turn on a screen-based experience for their child: “when I’ve run out of steam,” “when my wife needs a break, cause it’s hard to spend a whole day with a three-year-old,” “when we are really, really tired and she’s really hard to deal with,” or when “I just need two minutes to decompress.” In these and many other examples, parents reported that they make themselves fully available to their children as often as possible and for as long as possible but use screen media as a replacement for parent-child interaction when their stamina for parenting has run dry. They report that they use brief periods of screen time to enable breaks from parenting and then turn off the screen when

they are rejuvenated and ready to resume. As one parent explained, *“It’s not like we come home on a random day and we’re a little tired and that’s when we do it, we do it when we REALLY need a break.”* Though some of these parents also told us that screen media use is contingent on good behavior or other child-driven factors, they reported that children’s screen media access is fundamentally scheduled around times when parents feel incapable of providing their child with what they perceive to be the superior alternative of screen-free adult attention.

The parents we interviewed view the relative freedom they derive from their child’s screen time with scrutiny and, given their belief that extended screen exposure is suboptimal for young children, view this as a potential conflict of interest. Though they feel that using screens to facilitate their own productivity or emotional well-being is an appropriate choice, they explain that it nevertheless induces feelings of guilt and ambivalence:

“She’ll use [screen media] while we’re getting ready to feed her and get her clothes and everything before getting her to daycare. We don’t really like doing that, but it’s really this balance of trying to meet her developmental needs by not having her watch a lot of stuff and also kind of meeting the family needs, we need to get her out the door to daycare by a certain time.” (P4)

“Sometimes we’ll ask, ‘Do you want to watch a cartoon?’ if we need to get something done and she’s being a little clingy or she wants us to play with her. Those are not our proudest parenting moments but sometimes for everyone’s sanity it makes sense.” (P17)

“[Letting them use screen media] just kind of feels like a negative thing to do. If [my husband and I] were better parents we would always have energy to play with them, we wouldn’t need a screen to kind of like, take a break from our children. Which seems like a sad thing to me to do, you know, in my fantasy imagination of me as a parent.” (P11)

Although many of these parents believe that it is perfectly reasonable to permit their child to indulge in occasional screen media experiences, just as it might be perfectly reasonable to permit that same child to eat an occasional bowl of ice cream, the fact that screen media use, unlike ice cream, comes with side benefits for the parent leaves parents questioning their choices and self-auditing. As one mother explained, *“We’ve decided that a little bit is okay, but I still wonder every single time I let him watch if I’m letting him watch for the right reasons for him, or if I’m letting him watch because I need space and I need to have him distracted. So that’s very guilt-inducing.”* Parents described their decision to strategically allow screen media when they need parenting support by saying: *“I hate to admit that I do this,”* *“no one ever feels great about doing it,”* *“I feel guilty if I go past 30 minutes,”* *“I definitely feel self-conscious that we’ve given him any screen time,”* and *“I don’t really know: is this good? Is*

this bad?” Though parents’ strategic use of screen media to occupy their children was pervasive, reservations about this practice were equally common.

Finally, many parents reported that they make exceptions and allow unrestricted screen time to ease infrequent situations that are especially challenging, tedious, or frightening for their children. Parents reported that they allow screen media on airplane rides, while cutting their children’s fingernails, during medical procedures such as sonograms and echocardiograms, during discussions with pediatricians about their child’s health, as a reward for taking unpleasant medication, during haircuts, and during home medical treatments, such as nebulizer administrations to control asthma. Parents expressed none of the guilt or internal conflict that they feel over routine screen media use at home, saying things like *“it’s just so useful and relieving and such a short period of time that it’s completely fine”* or unequivocally explaining that *“the iPad is fabulous”* for its ability to help a child stay calm and happy through a stressful procedure.

4.2.3 Interview Results: Transitioning from Screens

Parents reported that they are typically the ones who end their child’s screen time. Though 23 parents told us that they could recall at least once instance in which their child turned off or walked away from a screen unprompted, most described this as *“rare, really rare.”* Some parents said their child never ends screen time voluntarily, saying things like *“I don’t think he would close it [on his own]...I would have to say something pretty fabulous like, ‘We’re gonna go horseback riding!’ or ‘You’re gonna go fly a plane!’ I don’t think so.”* A minority of parents said that their child does not have the attention span for extended screen time and will sometimes wander off, particularly if the content is intended for an older audience. Parents of eight children said that, though their child rarely or never ends screen time voluntarily, he or she will close the screen independently when asked to do so.

Parents reported varying degrees of pain when transitioning away from screens. Nearly all parents (93%) reported that their child throws a tantrum, whines, or resists ending screen time at least occasionally, while 37% reported that screen time almost always ends with a fight. Even if it is infrequent, the transitions that lead to conflict are difficult to manage, and this transition pain shapes parents’ view of the entire screen time experience. As one parent told us, *“the biggest concern I have now is that he fights like hell when it’s time to turn it off...there are days when I feel like either I should rip the TV off the wall and throw it away...or I should just give in and say, as much as you want. Cause I’m just so tired of fighting the fight about the end.”* Similarly, another parent

explained: *“It’s a bit of a deal with the devil; it buys us 30 minutes of peace, but often for the cost of a tantrum afterwards. Which is awful.”*

We probed the strategies parents use to reduce the frequency of painful transitions and mitigate the pain when they occur. Parents surfaced a recurring set of strategies for fostering a smooth end to screen time, each of which is described below.

Strategy 1: Routine. Eleven parents said that they feel that establishing routine around screen time improves transitions. Several parents explained that their child can easily disengage from routine periods of screen time that occur at predictable times but will resist ending ad hoc periods of screen time. For example, one father explained: *“[Routine morning screen time] is such a regular thing that she knows basically. When it’s on the weekend and she’s watching something, it’s looser...those are the times where we end up battling her more. The morning routine is pretty good, the other time it’s totally hit or miss.”* Other parents explained that avoiding arguments is *“all about the routine and consistency,”* or credited routine as something that has *“been set up for a very, very long time [and] created a situation where we have very little friction when time’s up.”*

However, a few parents were reluctant to set up an established routine around screen time, explaining they felt it would give screen media too much prominence in daily life or increase the total amount of time children spent with screens. As one parent explained: *“Because it [the schedule] changes so much, it does make it less predictable, and maybe that does breed this fight that we have at the end. I don’t know. But at the same time, I have a hard time coming to terms with the idea that I would just say, ‘Yeah, you get to watch TV every morning.’”* These parents predict that the benefits of routine will come at the cost of increased total screen time and, as a result, have resisted establishing a routine with their child.

Strategy 2: Warnings. Many parents (21 of 27) also regularly use an advance warning to attempt to improve transitions. In these cases, parents tell their child things like: *“only two more minutes,”* or *“just one more video”* as a way of setting expectations on the fly and preparing their child for an upcoming transition. Five participants expressed confidence that this practice improves transitions. However, far more participants were unsure of its effectiveness. Interviewees reported regularly warning their child in advance of a transition, but admitted that *“the warning doesn’t always register,”* *“I don’t know how much he even understands the ‘time is up’ yet,”* *“it doesn’t always help,”* *“he knows it, but that doesn’t mean he’s happy,”* *“he doesn’t necessarily hear or comprehend,”* and even *“I don’t think she particularly likes us just leaning over her shoulder and saying there’s X amount of time left. She gets annoyed with that.”* Yet despite parents’ uncertainty over whether this approach is beneficial, they still report using this widespread practice consistently.

Strategy 3: Support from Technology. Finally, the majority of parents (20 out of 27) brought up technology itself as an influential factor that predicts whether a transition will be smooth or painful. Parents reported that when technology provides natural transition points, the experience of putting down screens is smoother for their child. Some parents explained that this can happen unintentionally (such as a battery dying or loss of an internet connection) or predictably (such as the end of a movie, video playlist, or television episode). Parents reported that in both cases, children are more amenable to ending screen time than they are when the transition is mandated by the parent alone without corroboration from technology. Parents said that they sometimes intentionally use technology as a scape goat, telling their children that a toy no longer works when the batteries have died or pretending that certain online content is unavailable.

Parents most frequently mentioned episode boundaries and autoplay features as ways in which technology facilitates or impedes transitions. Parents find episode, playlist, and movie end points to be easy boundaries to enforce, and children experience these as natural stopping points. Ending a video that is already in progress, even just a few seconds after it has begun, is much harder. As one parent described: *“I definitely need to be there [for] the last 10 to 15 seconds to kind of get in there [to turn it off]. If the new one starts, then he’s usually very upset.”* Another parent told us: *“Netflix automatically starts the next episode... [unlike] XBOX video. There [on XBOX video], you have to make a conscious choice, you have to do something with the remote to get to the next episode...I much prefer that, because it gives a natural stopping point and the continuity is broken.”* Eleven parents mentioned autoplay on Netflix or on YouTube, saying that they have to actively work against this feature and keep precise tabs on their child’s viewing so they can jump in and interrupt at the exact moment when one video ends, allowing the child to view the entire experience but not allowing the next to begin. Parents report they are not always able to execute on this timing perfectly, which makes transitions harder. As one parent explained, *“Sometimes it does [automatically start the next episode before the parent can stop it], and that’s with Netflix. And it’s very challenging. She’ll usually throw a fit.”*

Some parents told us that they view this feature as a deliberate design choice intended to undermine families’ ability to transition away from screens. These parents said: *“Things like Netflix try to fight that [ending screen time] because they want to enable binge watching, where you just go through and through and through.”* Other parents told us that they believe this tactic is effective and does delay transitions. They also told us that believe autoplay would prevent their children from ever self-limiting or self-monitoring: *“I would say that if we were to put on Netflix autoplay of a cartoon they would sit in front of that for as long as it autoplays...I think it’s really hard for them to put it away, even if they’re no longer having fun and they’re bored.”* Across interviewees, autoplay came up

frequently and was universally described as a feature parents fight against in order to create the bounded experience they value.

Parents reported that they value transition messaging from technology that aligns with the messaging they give to their children themselves. Some parents determine their own message based on the message that comes from technology, telling us that they set their child's daily limit at 30 minutes "*because it [is] the easiest way to stop,*" or that they stop at "*that natural breaking point, when the movie ends...so when it ends, it ends.*" Others parents define their own limits, but wish that technology would follow their lead and create natural breaking points that align with the limits they have set. These parents said things like, "*I would love something that auto-shut off...I feel like I shut enough things down*" and "*If you could be like 'Ope! Computer turned off! Sorry, I can't help you!' it would be nice.*"

In addition to the widespread strategies of establishing routine, using a "two more minutes" warning and relying on support from technology, parents also mentioned other factors that predict transition success, though these minor themes came up less often. Some parents reported that the child's mood, level of hunger, tiredness, and level of engagement with the specific screen experience all influence the success of transitions. Other parents told us that transitions are more successful when the parent creates a diversion or has a new activity prepared in advance. A few parents mentioned that transitions are smoother for their child when parent and child negotiate in advance and agree on a fixed quantity of screen time with a well-defined end point.

4.2.4 Diary Study: Description of Transitions

Based on our interview results, I hypothesized that: 1) established screen time routine, 2) use of a "two more minutes" warning, and 3) support from technology would all be associated with smoother transitions. I used diary results first to describe specific instances of children's screen time transitions and second to evaluate these three hypotheses.

The 28 children in the diary study used screen media a combined 380 times over two weeks. On average, children used screen media 0.97 times per day ($sd = 0.47$) for an average of 33 minutes each time ($sd = 36$). Across all children, the number of instances of screen time over two weeks ranged from 3 to 34, and the duration of an individual instance of screen time ranged from 30 seconds to 4 hours. In response to the prompt asking how the child reacted when the period of screen time ended, parents most frequently reported that their child's reaction was neutral (59% of transitions). Another 20% of transitions evoked a positive reaction,

and 22% evoked a negative reaction. This was consistent with our interviewees' reports that painful transitions are a non-dominant but routine occurrence.

I coded each diary entry for the technology the child used, the type of activity he or she engaged in, and the type of trigger which lead to the transition away from screen time. I found that the form factor was more varied than the activity: 50% of diary entries reported that a child viewed content on a traditional TV, but more than 70% reported that the child consumed traditional passive video content. Other form factors included tablets (22%), smartphones (18%), and personal computers (7%), while other activities included playing games (17%), browsing photos (3%), and video chatting (3%). This was consistent with interviewees' descriptions of the ways in which children use screen media.

I found that a small set of categories described the triggers that initiated transitions away from screens. The most common transition trigger was a situational change which made screen time impossible or incompatible with family activities (39%). For example, participants reported that their child stopped watching a DVD in the car when they arrived at their destination, turned off the TV because dinner was ready, stopped what they were doing because a friend arrived, or had to relocate and abandon the activity when a younger sibling peed on the couch. The second-most common trigger was the child's own whim; 25% of the time, screen time ended because the child lost interest, became distracted, or chose to pursue another activity. The regular occurrence of child-initiated transitions was at odds with interviewees' reports that this is quite rare.

The third-most common transition trigger was spontaneous interjection by the parent (15%). In these cases, parents told us that, "*I decided that was enough TV,*" "*I told her she was done with screen time for now,*" or "*I put the laptop away.*" These instances were distinct from standing rules or negotiated contracts and instead represented cases where the parent reported making an ad hoc decision that it was time for the child to disengage from screen media. The full set of transition triggers is shown in Table 5.

I also coded diary entries for the activity the parent was engaged in while the child was using screen media. I found that the most common parent activity during children's screen time was chores (45% of all diary entries), including caring for other children in the family (particularly infants). Occasionally, these chores included child care for the child using screen media (such as cutting a child's hair, cutting a child's finger nails, or brushing a child's teeth). The second-most common parent activity was to engage with screen media together with their child (35% of diary entries), an occurrence that was not prevalent among interviewees descriptions of their child's screen time. The third-most common parent activity was self-care activities, such as exercising, showering, eating, or getting dressed. The complete set of categories is shown in Figure 3.

4.2.5 Diary Results: Transitions and Routine

Based on interviewees' claim that established routine around screen media improves children's ability to disengage, we hypothesized that transitions following routine periods of screen time would go more smoothly than transitions following ad hoc periods of screen time. Parents reported that 61% of transitions marked the end of a period of spontaneous screen time, while 39% marked the end of a routine period of screen time that was a predictable part of the child's day. We compared ad hoc versus routine transitions using the extent to which a child was upset about the transition as our dependent measure. To account for the fact that our 380 samples were not independent, we used a block ANOVA to compare these two groups. We found a highly significant main effect of the presence of routine on the extent to which children were upset, with children transitioning away from screens more easily when it was a routine part of the day (mean = 2.84, sd = 0.71, 95% CI [2.72, 2.96]) compared to when it was ad hoc (mean = 3.10, sd = 0.85, 95% CI [3.00, 3.21], $F(1, 331) = 16.751, p < .001, \eta^2 = .048$).

Because some interviewees reported that they expect that having a routine would ease transitions but choose not to establish one because they fear it will increase total screen time, I compared the duration of ad hoc periods of screen time to the duration of routine periods of screen time. Using a block ANOVA, I found that ad hoc screen time lasted an average of 29.5 minutes (sd = 27.1, 95% CI [26.1, 33.0]), while routine screen lasted significantly longer (mean = 40.0 mins, sd = 47.2, 95% CI [32.0, 47.9], $F(1, 331) = 7.113, p = .008, \eta^2 = .021$). Together, these results provide strong suggestion that routine is associated with smoother transitions back to the physical world and slight suggestion that it may be associated with longer periods of screen time.

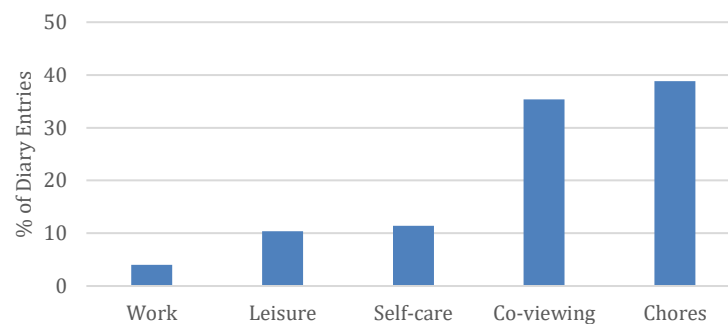


Figure 3. Transition Study: What parents did during children's screen time

4.2.6 Diary Results: Transitions and Warnings

Based on the pervasive use of warnings among interviewees to help children transition away from screens, I also hypothesized that warning children of an upcoming transition would be associated with more successful transitions. Unexpectedly, but consistent with interviewees' uncertainty around this practice, a block ANOVA showed that children were significantly more upset about transitions when they were warned by parents that screen time would be ending (mean = 3.35, sd = .71, 95% CI [3.22, 3.49]) than when they were not warned (mean = 3.03, sd = 0.81, 95% CI [2.78, 2.97], $F(1, 331) = 20.34, p < .001, \eta^2 = .058$).

I re-ran this analysis excluding all transitions in which children ended the interaction themselves ($N = 93$), as children were generally happy about the transitions they initiated and these were not transitions where it would make sense for parents provide warnings. In order to avoid a misleading result that confounded the child's sense of agency with the presence of a warning, I compared transitions with and without warnings only if the parent, technology, or other external factor dictated the transition. However, even after accounting for this potential confound, this phenomenon persisted, and transitions with warnings were still more painful (mean = 3.36, sd = .71, 95% CI [3.22, 3.49]) than those without warnings (mean = 3.06, sd = .81, 95% CI [2.94, 3.18], $F(1, 238) = 10.21, p = .002, \eta^2 = .041$).

To try and understand this counterintuitive finding, I examined parents' open-ended descriptions of transitions with and without warnings to identify themes that might account for the relationship between warnings and unhappy transitions. I looked to see if transitions with warnings were associated with shifts to less-preferred activities (such as bedtime or bath), shifts to preferred activities (such as outdoor play), more

Table 5. Transition Study: Reasons for ending screen time

Reason: %	Description: Example
Context: 39%	The situation changed in such a way that created a natural end point for screen time: <i>"His haircut was done"</i> or <i>"It was time to leave for summer camp."</i>
Child: 25%	The child proactively chose to end screen time without any prompting or situational change: <i>"She wanted to eat a snack and put the phone down."</i>
Parent: 15%	The parent decided that it was time for the child to end the experience: <i>"Watching YouTube videos for longer than that will rot your brain so I made him stop."</i>
Technology: 11%	The physical technology or the content it was showing led the child to a natural stopping point: <i>"The game was over."</i>
Rule: 9%	Screen time ended in accordance with either a standing household rule or a one-time contract that the parent and child established before the experience started: <i>"We only let her watch one show at a time"</i>
Fell Asleep: 2%	The child fell asleep using screen media

or less routine, or less companionship. I was unable to identify any significant differences that might account for children's negative response to warnings.

4.2.7 Diary Results: Transitions Triggered by Parents vs. Technology

Finally, I analyzed diary data in light of interviewees' claim that support from technology is useful for smoothing transitions. I hypothesized that transitions triggered by parents ($N = 55$), for example, "*I decided he needed to play outside*" or "*I told him it was time to put the camera away*" would be associated with more friction than transitions triggered by the technology itself ($N = 43$), for example, "*The DVD ended*" or "*The iPad battery ran out.*" Diary data confirmed interviewees' prediction: children were less upset when the technology turned itself off (mean = 2.98, $sd = .74$, 95% CI [2.66, 3.23]) than when the parent turned it off (mean = 3.47, $sd = .79$, 95% CI [3.28, 3.71] $F(1, 69) = 8.104$, $p = .006$, $\eta^2 = .105$), suggesting that technology may be an effective third-party mediator for easing transition pain.

I also examined this effect using duration of screen time as a covariate. After controlling for screen-time duration, a small but significant effect persisted such that children remained more upset about transitions triggered by parents than about transitions triggered by technology ($F(1, 68) = 6.780$, $p = .011$, $\eta^2 = .091$).

4.3 DISCUSSION

These results show, first, that facilitating transitions to and from screen media is important to parents, who largely believe that prolonged screen media exposure is detrimental to children and that their 1-5-year-olds will not self-limit. Parents view screen media as a treat (even using "*dessert*," "*sugar*," and "*candy*" as analogies for screen time) and are comfortable with screen media for their children as long as they are able to bound it to treat-like portions and smoothly transition their children back to screen-free experiences.

Parents also report a conflict of interest that concerns them: they strategically use their child's screen time as an opportunity to accomplish necessary chores, take care of themselves, and even take breaks from the demands of parenting. The majority of participants schedule children's screen time specifically to facilitate these opportunities for themselves. While parents are glad to have this option and feel that it is the best way to meet the needs of the entire family, they are uncomfortable with the fact that they are incentivized to provide their child with screen time, an activity they view as unhealthy in large doses. Even though most participants reported that they are comfortable with some screen media exposure for their child, and some parents say that a small amount of screen time is better than none at all, they worry about the possibility that

they benefit from this activity at their child's expense, saying both that they believe they are doing the right thing, but also that they worry they are not. This ambivalence, coupled with parents' view of screen time as a risk to children's well-being, fuels their desire to set limits on screen media exposure and transition their child away from screens on schedule.

4.3.1 Screen Time and Routine

Parents reported that several factors influence the ease with which their child transitions away from screens. They report that establishing a routine around screen time, such that children engage in screen-based experiences in well-defined contexts with established end-points, makes transitions much smoother. My diary study results were consistent with these reports, showing that routine periods of screen time are associated with smoother transitions and fewer battles between parent and child.

However, some parents reported that they are hesitant to establish a routine because they worry this will cement screen time into their family schedule and increase the amount of time their child spends with screens. Diary study results did show a significant increase in duration during routine periods of screen time relative to ad hoc ones. However, it remains unclear whether this increase is driven by the fact that screen time is predictable, by the fact that these families are comfortable enough with screen time to routinize it, or by some other factor. Future work remains to understand the implications of establishing routine screen time and the positive and negative effects this has on a family life.

4.3.2 Screen Time and Warnings

I found that nearly all parents who limit screen time use warnings and countdowns to set their children's expectations about upcoming transitions. Despite the prevalence of this practice, parents expressed some uncertainty about whether or not it is effective. Results from the diary study showed that, not only were warnings *not* predictive of smoother transitions, they were in fact associated with rockier transitions with greater parent-child conflict. After removing transitions from my analysis where the child dictated the end point and combing the qualitative description of each transition type for themes that might suggest differences, I was unable to find any evidence that transitions with and without warnings are contextually different in a systematic way. However, it remains possible that the difference stems from the fact that parents are more likely to warn their children about transitions that they anticipate will be challenging.

Given the power struggles between parents and children that characterize this stage of development (Kuczynski & Kochanska, 1990), it is plausible that transition warnings do effectively set expectations but also serve as an unwelcome reminder of parent authority. Other approaches to expectation-setting that do not come with this constraint may be more effective, consistent with my finding that routine and third-party mediation are more useful. Other techniques, such as associating situational cues with the end of screen time, or asking a child how many more minutes he or she would like to continue using a screen, may effectively set expectations without threatening children's sense of autonomy.

4.3.3 Technology as a Transition Mediator

Finally, I found that there is clear role for the technology children use to support their transitions. Parents said that they set limits based on the boundaries that technology makes easy to enforce, they use technology as a scape goat to foster smoother transitions, and they wish they could look to technology for third-party mediation. They said that transitions are smoother when technology is on their side, and rockier when they are working against technology. These instincts appear to be well-founded: diary study results corroborated that children are significantly less upset when technology itself limits screen time than when parents do.

Some technologies already offer such support, such as YouTube Kids and Amazon Kindle. Other technologies do just the opposite, making boundaries flexible and harder to enforce with autoplay and suggested-video features. Parents experience these features as frustrating, misaligned with their values, and even reported believing that these design choices were deliberately made to undermine parents' efforts to set limits. My results suggest that families who adopt technologies that respect the limits they set will experience less screen-related friction, and technologies that intentionally build in support for self-defined limits will best meet the needs of their users.

Many possible design solutions could foster rather than impede limits, and I explore one such system in Chapter 7. In addition to removing autoplay and suggested video features, screen media experiences could prompt families to set goals or ask at natural stopping points if they would like to continue or take a break. Screen media experiences could adopt some of the transition practices that parents report using, such as offering suggested next activities or asking the child how many more minutes he or she would like to watch. It would also be valuable to investigate whether the two-more-minutes warnings that children resist from parents are better received when they come from technology.

4.3.4 Limitations and Future Work

These results are drawn from a small sample living in a single, U.S. urban area and are over-representative of married mothers and families of high socioeconomic status. Prior work has documented disparities in screen time practices between families of different races, ethnicities, and income levels (“Zero to eight: Children’s media use in America 2013,” 2013), suggesting a need for future work to explore the transitions in a broader population and in diverse cultural contexts.

This work also reflects the viewpoints of parents alone and does not represent children’s perspectives. Though eliciting the perspectives of children as young as 1 can be challenging, recent work has begun to explore creative and non-traditional methods for collecting meaningful data from very young children (Einarsdóttir, 2007; Hourcade, Mascher, Wu, & Pantoja, 2015; Jensen & Skov, 2005). Future work observing screen time transitions directly and talking to children about their experiences would be a valuable complement to the data presented here.

Finally, these results are based on self-report and this diary data reflects self-reported behaviors that participants knew in advance they would be documenting. As interview participants reported a general negative perception of the practice of permitting screen time, diary results may be skewed by a Hawthorne effect in which parents acted in ways they would feel comfortable reporting to others.

4.4 SUMMARY OF CONTRIBUTIONS

This work contributes empirical data in support of T1 by providing an empirical understanding of parent attitudes toward young children’s screen time and contextual details about their transitions to and from screen-based experiences (RQ3). For parents, these transition points are a defining feature of children’s screen media experiences and their own mediation practices. Though parents want their young children to be able to indulge in occasional screen media use and are glad that this treat for the child provides a simultaneous break for the adult, the fact that they allow their child to transition to screens in order to meet their own needs gives them pause. By documenting this tension and parents’ perception of their own conflict of interest, I provide a clearer picture of the way in which screen media features in the lives of young families and the role it serves in meeting the needs of all family members.

From this work, it is clear that the answer to RQ2 (“What are children’s technology habits?”) is as much about parents’ and families’ needs as it is about the individual child. Parents enforce transitions away from screens

when they have finished attending to their own needs and when technology provides a natural stopping point. Transitioning without the support of technology is an uphill battle, and the second contribution of this work is to document the clear implication to design for this scenario. Parents set boundaries based on what technology makes easy to enforce, they blame technology for transitions when they need a scape goat, and they repeatedly said that they want the technologies their children use to back them up when they say screen time is over. Families experience features that offer potential boundaries as supportive and features that erode boundaries as manipulative and frustrating. Together, these results show that families value screen media for young children but want these experiences to come with limits. They show that technology can be their partner or their adversary, and that we have the opportunity to make design choices that are the solution to tantrums rather than the cause.

Chapter 5. Family Technology Rules³

One common way in which families encourage or limit the use of technology is by establishing rules or expectations about screen media use. Though much existing literature has investigated the rules families set for children (Ramirez et al., 2011b; Schmitt, 2000; Schooler et al., 2006), little of this prior work includes newer technologies, like smartphones and tablets, or examines the expectations families have for parents' use of technology. In order to explore T1 and identify design opportunities to facilitate boundary-setting and support families' self-defined limits, I investigated the limits that families currently set and the degree to which they live within these boundaries in practice. By surveying children and parents from the same families, I was able to investigate how each family member feels about their own technology use, as well as that of their counterpart, and to identify discrepancies between the two.

This project addressed RQ1-RQ6 and provided insight into families' current habits. As rules offer an explicit articulation of the behaviors people want to engage in, this project also allowed me to collect data about the habits families feel are best. By understanding both current and idealized behaviors, I used this data to derive design insights for closing the gap between the two, which I build on in Chapters 6 and 7.

5.1 METHODS

Working together with a team of collaborators, I prepared two related but independent surveys with one version designed for parents and a second corresponding version designed for children. These surveys were intended to elicit information about family rules and expectations regarding technology use. I intentionally left it to participants to interpret "technology" as they saw fit. Analysis of their free responses suggests that most reflected on technologies like mobile phones, television, computers, and other Internet-enabled devices. I included additional modules in the survey to collect data on topics beyond the scope of this investigation; this data is not reported here.

Parent Survey: The parent survey began by asking parents the first name of the child who was participating and the age of that child. In the recruitment, if the parent had more than one child, they were asked to pick one

³ Hiniker, A., Schoenebeck, S. Y., & Kientz, J. A. (2016, February). Not at the dinner table: parents' and children's perspectives on family technology rules. In *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing* (pp. 1376-1389). ACM.

child who was between the ages of 10-17 and to think of that one throughout the survey. The child's first name was coded into the rest of the survey questions to ask the parent specifically about that child.

Each parent was asked to describe two rules regarding technology use they have for this target child. The parent reported each rule through a free-recall, open-ended response. For each rule, I then asked a series of Likert questions probing:

- Whether the child knows about this rule
- How often the child follows it
- How difficult it is to enforce
- How acceptable it is for the child to break it
- How much input the child had in establishing it

I further asked the parent to provide an open-ended description of the biggest challenge they experience, if any, in trying to enforce each preference or rule. Finally, I asked each parent to provide two open-ended descriptions of technology-related rules they believe parents in general should follow.

For each adult, I also measured parenting satisfaction and parenting self-efficacy using the Parenting Sense of Competence Scale (PSOC). This scale was originally developed by Gibaud-Wallston and Wandersman (1978) for parents of infants and was later adapted by Johnston and Marsh (1989) for parents of older children (Johnston & Mash, 1989). The 17-item validated instrument measures parenting frustration, anxiety, and motivation (satisfaction) and competence, problem-solving ability, and capability (efficacy) (Ohan, Leung, & Johnston, 2000). The final set of questions were demographic in nature and drew on survey items used in Pew Research Center surveys.

Child Survey: The child survey was structured similarly to the parent survey, first asking the child's age and relationship to his or her adult counterpart (e.g., "Mother," "Stepfather," etc.), which I coded into the rest of the questions. I then asked each child for an open-ended description of two preferences, expectations, or rules that his or her parent has about how he or she uses technology. Using a series of Likert-style questions, I followed up on each rule, asking:

- How often the child follows the rule
- How difficult it is to follow
- How acceptable it is not to follow this rule
- How much input the child had in establishing it
- How fair the child believes it is

As with parents, I asked each child for an open-ended description of two rules about technology use that he or she believes parents should follow.

Each child then completed the Parent-Adolescent Relationship Scale (PARS) (Hair et al., 2005), a validated 8-item instrument that measures the quality of the parent-child relationship from the child's perspective. The first three questions investigate the child's identification with their parent (e.g., "S/he is a person I want to be like") and the next five measure perceived parental supportiveness (e.g., "How often does s/he praise you for doing well?"). Finally, I collected demographic information on the child's grade in school, gender, family composition, and average academic grades.

5.1.1 Recruitment and Analysis

Participants were recruited through a national recruitment service. An email solicitation invited one parent and one child per family to participate in an online survey about technology use. Once the parent completed the survey, he or she was presented with a new unique URL linking to the child survey described above. The parent was asked to provide this URL to his or her child and to give the child privacy while he or she completed the survey.

In total, 1,917 parents clicked on the recruitment message to open the survey. Of those, 766 clicked through the consent process to begin the survey. I filtered out incomplete surveys, surveys answered only by one member of the dyad, surveys with a large proportion of invalid (e.g., nonsense) responses, and surveys with implausibly high agreement between parent and child (such as identical lengthy descriptions of the rules) suggesting the child did not complete his or her survey independently. The final sample included 249 dyads representing 498 participants.

Participants were distributed across 40 different U.S. states. California, New York, Florida, New Jersey and Ohio had the highest rates of participation, roughly consistent with the geographic distribution of the U.S. population ("Florida Passes New York to Become the Nation's Third Most Populous State, Census Bureau Reports," 2014). Mothers participated more than fathers, and the median reported parent age was 43 (ranging from 27 to 76). Among child counterparts, 55% were female, and the median reported age for children was 13 (ranging from 10 to 17). I refer to this sample as "children" (rather than pre-teen, teen, or adolescent) throughout, to capture the 10-17 age range and to highlight the parent-child relationship in this framing.

This dataset oversampled white Americans, who currently make up 64% of the U.S. population ("Overview of Race and Hispanic Origin: 2010," 2011) but composed 78% of the sample. It also oversampled families

with two partnered adults (80% compared to 61% nationally) (“The Decline of Marriage and Rise of New Families,” 2010). 47% of parents reported an annual household income between \$30,000 and \$75,000, consistent with census data reporting a median household income of \$52,250 in the United States (Noss, 2014). Comprehensive demographic information is reported in Table 6.

Together with my collaborators, I coded all open-ended responses iteratively using a grounded-theory approach to qualitative analysis (Strauss & Corbin, 1990). We coded the following participant responses for themes:

- Rules for children, as reported by children
- Rules for children, as reported by parents
- Rules for parents generally, as reported by children
- Rules for parents generally, as reported by parents
- Enforcement challenges, as reported by parents

I repeatedly recoded data to accommodate emerging themes. I initially coded responses alone and established code categories with examples in a communal code book. The code book was reviewed and revised iteratively by the research team. After coding was complete, a second researcher coded a randomly selected 10% of the data (25 dyads) across all responses. Cohen’s κ was .703 for rules and .850 for enforcement challenges.

Table 6. Rules Study: Participant Demographics (N = 249 dyads)

Parent gender	Male (31%), Female (69%)
Parent age	Mean (sd) = 43.3 (8.8) years, Minimum = 27, Maximum = 76
Parent race	Non-Hispanic White (78%), Black (8%), Hispanic (7%), Asian (4%), Mixed Race (1%), Other (2%)
Parent education	High School or Less (18%), Some College (34%), Bachelor’s Degree (25%), Some Graduate (9%), Graduate Degree (14%)
Parent political views	Very Conservative (10%), Conservative (22%), Moderate (45%), Liberal (16%), Very Liberal (6%)
Parent marital status	Married (71%), Living with a Partner (9%), Divorced (10%), Separated (1%), Widowed (1%), Never Married (8%)
Parent employment	Employed (47%), Employed Part-Time (13%), Stay-at-Home Parent (31%), Looking for Work (4%), Retired (3%), Student (2%), Unable to Work (2%)
Child gender	Male (45%), Female (55%)
Child age	Mean (sd) = 13.3 (2.3) years, Minimum = 10, Maximum = 17
Child GPA	A (28%), A/B (46%), B (13%), B/C (10%), C/D (2%), School Does not Use Grades (1%)
Income	< \$30K (14%), \$30-50K (23%), \$50-75K (25%), > \$75K (38%)

5.2 RESULTS

5.2.1 Technology Rules for Children

Rules for Children as Reported by Children: Of all 249 child participants, 6% reported that their parents have no rules or expectations about technology use at all. Another 4% only described one rule or expectation. The remaining child participants described a combined 455 unique rules. Of these, 91% fit neatly into one of 12 thematic categories (see Table 7). Of the rule descriptions that we were unable to categorize, the majority were too vague to capture a specific rule (e.g., “*Keep it appropriate,*” “*Use it wisely*”). A few others described rules that were not specific to technology (e.g., “*No staying out late,*” “*No boyfriends*”). Of the full set of 455 child-reported rules, only eight were specific, technology related, and outside the themes listed in Table 7 (e.g., one rule about keeping the phone charged, another about keeping the volume turned down).

Rules for Children as Reported by Parents: Adults’ reports about rules and expectations for their children were similar. Among all 249 adult participants, 2% reported that they have no rules or expectations about how their child uses technology, and another 2% only described one rule or expectation. A Wilcoxon signed ranks test revealed that children were significantly more likely than parents to report having no rules at all ($Z = -2.673$, $p = .008$, $r = 0.12$), consistent with prior work showing that parents report more technology monitoring than their children (Gentile, Nathanson, Rasmussen, Reimer, & Walsh, 2012; Wang, Bianchi, & Raley, 2005).

Altogether, parent participants described a total of 481 rules for their children. As with data collected from children, 437 (91%) of these parent-reported rule descriptions fell under the same 12 categories reported in Table 7. Though the frequency with which adults mentioned each category differed slightly from the frequency with which each category was reported by children (Figure 4 shows ranked frequency for each group), the categories of rules and the salience of each category were well-aligned between children and adults.

Of the rule descriptions from adults that did not fit any of these themes, the majority either were too vague to convey a specific rule (“*Be cautious*”), described a rule that was not related to technology, or made a statement about technology usage habits that was not related to family rules. Of the 481 rules described by parents, only 16 described technology-related rules that did not align obviously with any of the dominant themes (e.g., “*He can’t let other people use his phone*”).

Table 7. Rules Study: Categories of rules for children

Category	Description: Example	Constraint
Be present	No technology at all in a certain social context: "I am not allowed to use anything during dinner, including TV. My dad is pretty strict about that."	Context
Privacy	Protect identity and personal information: "To be safe and not give anyone my real name or where I live."	Activity
Not at night	No technology after bedtime: "I can't have my cell phone in my bed when I'm sleeping."	Context
Parent audit	Real-time check-ups by parents: "My parents are allowed to check my phone anytime."	Activity
Content restrictions	Ban on a site, game, activity, or device: "He made me stop playing grand theft auto"	Activity
Responsibilities first	No technology until certain obligations are fulfilled: "I can't play with my computer games till I finish my school work."	Context
No sexual content	No producing, sharing, or viewing sexually explicit media: "Absolutely no racy pictures is his staunch rule."	Activity
Time-bound	Fixed time limits: "Even if I'm in the middle of a game, when my time is up that's all the time I get."	Context
Moderate use	Use technology in moderation and balanced with other activities: "Limit games during the weekend, go outside instead."	Context
Be kind	No hurtful comments about others: "I should always think about the possible consequences of my actions, would I like the post if it were about me?"	Activity
Cost restrictions	Specific restrictions to save money: "No data without wifi."	Activity
No bad language	No sexually explicit language or swear words: "I can't cuss online or in texting."	Activity

5.2.2 Activity Constraints and Context Constraints

Prior work has documented parents' concerns about the activities children engage in with technology (e.g., (Davis, 2012; Livingstone & Helsper, 2008)). My data suggests that parents also establish rules about the context of the technology use. That is, in addition to restrictions on what children do with technology, families also have expectations about when, where, and how they do it. Accordingly, I divided the 12 themes described above into those that constrain the ways in which children use technology (e.g., requiring that they post respectful comments or withhold personally identifiable information) and those that constrain the

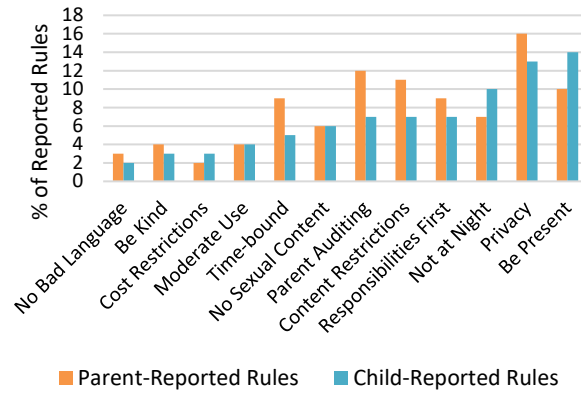


Figure 4. Rules Study: Theme frequencies for children and parents

contexts in which children are permitted to use technology at all (e.g., putting it away in certain social contexts or after a time-limit has elapsed). We labeled these categories *activity constraints* and *context constraints*. I found that rules reported by children were almost perfectly split between these two categories, with 213 activity constraints and 200 context constraints. Similarly, both categories were well-represented among rules reported by parents, with 254 activity constraints and 183 context constraints.

Across all rule categories, children reported that they follow 83% of these rules “most” or “all” of the time. They reported that 64% of rules were either “a little bit easy” or “very easy” to follow. Like children, parents felt that children were generally compliant and reported that children follow 87% of these rules either “most of the time” or “always.” Similarly, they reported that 70% of these rules were either “a little bit easy” or “very easy” to enforce. We examined the relationship between children’s input into rule-setting, children’s perceptions of the fairness of the rules, children’s compliance with rules, and how easy children feel it is to follow rules. We found highly significant correlations among all four of these measures (see Table 8).

To model these collinear relationships with higher fidelity, we drew on recent research demonstrating that individuals are more committed to contracts when they have input into contract definition, as active participation leads to perceptions of contract-fairness which in turn increase compliance (Fehrenbacher &

Table 8. Rules Study: Correlations among children’s beliefs about rules

	Rule is easy to follow	Had input in rule	Rule is fair
Follows rule	.563**	.070	.433**
Rule is easy to follow	-	.173**	.582**
Had input in setting rule	-	-	.292**

** $p < .001$

Pedell, 2015). A Sobel test confirmed that, within our sample, children’s perceptions of rule-fairness completely mediate the relationship between children’s input into rule setting and their ability to follow these rules (see Figure 5). This suggests both that a child’s perception that a rule is fair increases his or her commitment to follow it, and that involving the child in the rule-setting process is one effective way of fostering a sense of fairness.

We also examined how the type of rule affects children’s ability to follow it. We compared children’s perceptions of activity constraints (where children were asked not to engage in specific activities when using technology) with children’s perceptions of context constraints (where children were asked not to engage with any technology in certain contexts). An independent samples *t*-test revealed that children were significantly more likely to follow rules about activity constraints (mean = 3.46, sd = .733) than about context constraints (mean = 3.08, sd = .789, $t(411) = 5.02, p < .001, d = 0.54$). Similarly, children reported feeling that rules about activity constraints were significantly easier to follow (mean = 3.42, sd = .787) than rules about context constraints (mean = 2.72, sd = 1.01, $t(411) = 7.77, p < .001, d = 0.91$). Thus, children reported finding it easier to comply with rules that restrict them to particular technology activities than rules that prohibit them from using technology at all, even for short periods of time (such as during a family meal).

I further examined the relationship between rule type and children’s compliance in light of the high collinearity between children’s compliance and other rule-properties. I created a linear regression model that included rule type (i.e., activity constraint or context constraint), child age, child gender, strength of parent-child relationship (as measured by the identification and supportiveness subscales of PARS), the degree to

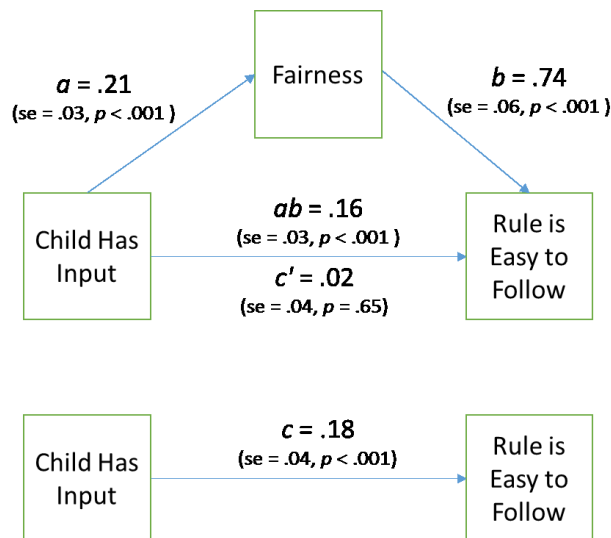


Figure 5. Rules Study: Children’s perceptions of rule-fairness completely mediate the relationship between child-input into rule setting and their ability to follow the rule

which the child had input into setting the rule, the degree to which the child believes the rule is fair, and the degree to which the child believes his or her parent would be tolerant of the child breaking the rule, as independent variables. I used the degree to which the child follows the rule as the dependent variable. This model explained a significant amount of variance in the degree to which the child followed the rule ($F(8, 404) = 20.24, p < .001$).

Parent supportiveness, believing a rule is fair, and whether a rule is an activity constraint or a context constraint each explained a significant amount of variance in rule-following (see Table 9). Thus, even after controlling for fairness, input, age, gender, and parent-child relationship, whether or not a rule requires a child to put technology away for a certain period of time remains a highly significant predictor of whether he or she will follow it.

To understand whether parents also perceived a gap in compliance based on rule type, we also examined the effect of rule type on parents' ability to enforce rules. An independent samples *t*-test revealed that parents find it harder to enforce rules about context constraints (mean = 2.91, sd = .977) than rules about activity constraints (mean = 3.38, sd = .862, $t(360) = 5.21, p < .001, d = 0.51$). And they agree with their children that children are less likely to follow rules about context constraints (mean = 3.12, sd = .763) than rules about activity constraints (mean = 3.57, sd = .707, $t(433) = 6.31, p < .001, d = .74$).

These results suggest that rules that create a context constraint are harder for children to follow than rules that create an activity constraint. From this, I hypothesized that when children are able to abide by these context constraints, doing so will require extra effort relative to the effort necessary to comply with activity constraints. To test this prediction, I ran a repeated-measures ANOVA with the degree to which a child follows a rule and the degree to which the child feels the rule is easy to follow as two different measurements

Table 9. Rules Study: Regression analysis predicting whether a child will follow a rule

Coefficients	<i>B</i>	SE _{<i>B</i>}	β	<i>p</i>
Intercept	1.18	.42		.006
Rule type	-.28	.07	-.18	< .001
Believes rule is fair	.39	.05	.38	< .001
Had input in setting rule	-.06	.03	-.08	.09
Identifies with parent	.10	.05	.09	.081
Parent supportiveness	.27	.09	.16	.001
Child age	-.01	.02	-.04	.367
Child gender	.123	.07	.08	.07
Average grades	-.03	.03	-.06	.174

B = unstandardized regression coefficient; β = standardized coefficient

of compliance. I treated rule type (activity constraint or context constraint) as a between-subjects' factor. I predicted that there would be a bigger gap between how easy it is to follow a rule and how often the child follows when the rule is a context constraint, reflecting the greater effort required to comply with rules which require a period of time when technology must be put away.

As shown in Figure 6, I found the predicted interaction effect between rule type and compliance measure. Though our child participants are significantly less likely to comply with rules about context constraints than rules about activity constraints ($F(1, 394) = 54.71, p < .001$), they are working harder to achieve this lower rate of compliance ($F(1, 394) = 15.57, p < .001$).

To better understand families' perspectives on the possible driving forces behind compliance and non-compliance, I looked to parents' self-reported enforcement challenges. For 381 of the 437 meaningful rules reported by parents (87%), the greatest enforcement challenge aligned with one of nine major themes (see Table 10). Of the challenges that did not align with these themes, the majority were not specific enough to be categorized ("He doesn't always listen," "A bit of a challenge"). Others were not truly descriptions of challenges but rather more general discussions of the respective rules ("Only during some emergency can this be broken"). Of the 437 meaningful rules reported by parents, 14 were accompanied by a description of a specific enforcement challenge that fell outside the themes listed in Table 10.

(such as inconsistent enforcement between two different parents or difficulty asking a child to follow a rule when parents do not).

I also examined the effect of rule type on the type of enforcement challenges parents reported. A chi-square test revealed highly significant differences in the types of challenges parents face when trying to enforce an

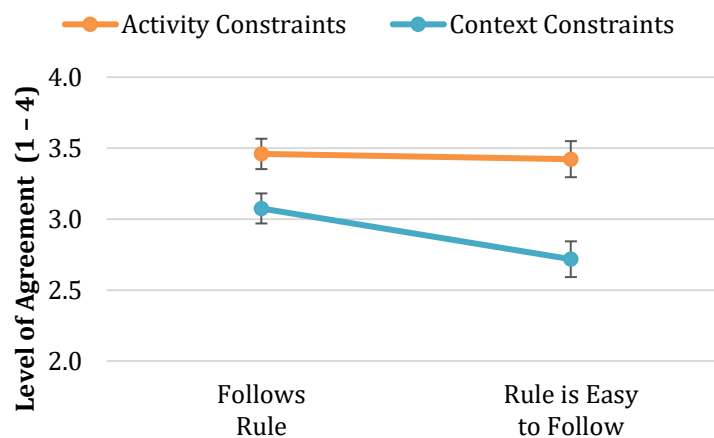


Figure 6. Rules Study: Children's ability to follow rules by rule type (activity or context constraint) and the effort they expend to achieve this level of compliance. Error bars = 95% CI.

Table 10. Rules Study: Enforcement challenges reported by parents

Challenge	Description: Example
None (57%)	Parents reported having no challenges enforcing this rule: "Not many [challenges]. He always comes and talks to me when he thinks he may be doing something questionable."
Hard to monitor (12%)	Parents feel unable to monitor their child's technology use: "I can't be with him all the time when he's using electronics, nor can I control what happens at other people's houses."
Can't put it down (7%)	The child is unable to disengage from technology: "She always wants it. She never wants to put it down."
Extrinsic motivation (7%)	Children only comply if faced with rewards and punishments: "Sometimes he doesn't listen until I take the device from him."
Ideology (6%)	Children disagree about whether these rules should be in place: "[She] wants to follow her own rules, she thinks she knows very well to take her own decisions."
Peer influence (4%)	Children's friends make it difficult to comply with rules: "She sometimes hears about things from her friends and thinks it's ok."
Work-arounds (4%)	Children have found ways to obviate parent monitoring: "Deleting history of sites visited."
Time-bound (2%)	Forgets the rules: "He forgets to shut down."
Technology influence (1%)	Features of the technology encourage children to ignore rules: "Even if she tries not to pay attention to the phone it is always beeping with texts and she finds difficult to control the urges to text back."

activity constraint compared to a context constraint ($\chi^2(8) = 51.7, p < .001$). Post-hoc contingency-table analysis revealed that specifically, parents are more likely to report that they have few or no challenges if they are trying to enforce an activity constraint ($Z = 4.00, p < .001$), and they are more likely to report that they struggle to enforce the rule because their child "Can't Put it Down" if they are trying to enforce a context constraint ($Z = 6.40, p < .001$). There were no significant differences between activity and context constraints with respect to any other enforcement challenges. A Bonferroni correction was applied to all comparisons.

5.2.3 Rules and Expectations for Parents

Separately, I examined both child and parent reports about the rules or expectations about technology use that they believe are appropriate for parents. I found that these differed substantially from the expectations families set for children. I report separately on children's and parents' expectations for parents.

Of the 249 children in my sample, 43 (17%) reported that they believe adults should not be held to any rules or expectations about their technology use, saying things like "they are adults, they can do whatever they want." Of the remaining 203 children, 29 only described one rule or expectation. Thus, children described 383 rules

for parents. Of these, 42 (11%) were not specific enough to be meaningful (“*No inappropriate stuff*”), 8 discussed technology but did not describe a rule, and 7 described a rule that was not technology-specific. This left 326 specific rules for parents. Of these, 92% fell into one of 7 major themes or 5 minor themes. The major themes are described in Table 6. The minor themes (which each composed less than 3% of all reported rules) were Time-bound (3%), Not at Night (2%), Be Kind (2%), No Sexual Content (2%), and Responsibilities First (2%). An additional 22 rules about technology use (7%) were unique and fell outside the themes listed above. These one-off rules varied widely (e.g., “*Type with two thumbs*,” “*Play games with me*,” “*Always check news media*”). However, the overwhelming majority of rules were thematic and fit within a small set of major themes.

Parents and children reported similar views on the types of technology use that are appropriate for parents. Of my 249 parent participants, 5 felt that parents should not be held to any rules while 9 described only one rule or expectation, and 2 chose not to respond. Thus, parent participants reported 475 rules for parents. Of these, 49 were not specific enough to be meaningful and another 14 either did not apply to parents, did not apply to technology, or did not describe a rule or expectation. Of the 412 meaningful rules, 91% fell into one of 10 themes: Be Present (25%), Supervise (21%), Privacy (9%), Moderate Use (7%), No Oversharing (7%), Model appropriate use for children (7%), Time-bound (5%), Not while Driving (3%), Be Kind (3%), and No Sexual Content (3%).

Adult responses surfaced 8 of the same themes that children reported, and the most common theme among children’s expectations for parents, “Be Present,” was also the most common expectation among parents. Like children, adults said that they believe parents should: “*Put all technology down when eating meals and talking with the kids*,” “*Not be on social media when you can be spending time with family*,” and “*When you're spending time with family you should not be on electronics*.”

While adults’ and children’s perspectives were largely aligned, the frequency with which they reported certain rule types differed significantly ($\chi^2(13) = 158.5, p < .001$). Post-hoc contingency-table analysis revealed that adults were more likely than children to state that parents should establish rules for their children’s technology use ($Z = 5.50, p < .001$), less likely than children to denounce oversharing ($Z = -4.27, p < .001$), were not concerned with differentiated rules for children and for parents (which children perceived as hypocritical) ($Z = -4.91, p < .001$), were more likely to bring up the importance of modeling appropriate technology use for children to emulate ($Z = 4.77, p < .001$), and were less concerned with

Table 11. Rules Study: Taxonomy of Technology Rules for Parents

Be present (19%)	No technology at all in a certain social context: “Pay attention/put down the phone when your child is trying to tell you something important”
No oversharing (18%)	No sharing information about children without explicit permission: “Don't post anything about me without asking me”
Child autonomy (11%)	Allow children to make their own decisions about their technology use: “Let kids have their private time on social media without their interference.”
Moderate use (10%)	Use technology in moderation and balanced with other activities: “Don't spend all your free time on this stuff.”
Supervise children (7%)	Establish and enforce technology-related rules for children: “I think parents should check out websites before kids my age use because there are a lot of bad people out there.”
Not while driving (6%)	“Don't text at red lights.”
No hypocrisy (6%)	Parents should follow the rules they set for children: “Practice what they preach, stay off internet during mealtimes.”

respecting children’s technological autonomy ($Z = -6.75, p < .001$). A Bonferroni correction was applied to all comparisons.

5.3 DISCUSSION

These results demonstrate that a well-defined set of common concerns govern the rules and expectations around modern technology use within families. Children and adults are largely in agreement about the expectations that are most salient, and they independently report the same types of household rules. Though children and adults report similar pictures of the world, the rules they describe for children and the rules they describe for adults are quite different. I discuss each of these sets of expectations in turn.

5.3.1 Rules for Children

Reported rules for children were divided roughly evenly between activity constraints, which limit the behaviors children can engage in when using technology, and context constraints, which limit the contexts where technology use is permitted. Thus, for these families, defining the bounds of appropriate use means both characterizing what children do with technology as well as when they do it.

This is consistent with prior work demonstrating that household rules about technology are driven by its effect on the family social system (M. Morrison & Krugman, 2001). Historically, this has led to rules that focus primarily on the content children consume and the total amount of time they spend with technology

(e.g., television, video games, desktop personal computers) (Davis, 2012; Livingstone & Helsper, 2008; Vandewater, 2005) with less emphasis on the context in which it is used. Today, families appear to be equally concerned with the content and social context of children's technology use, a difference that might be explained by the more portable and personal nature of technology today that makes context more important (e.g., texting at the dinner table) (Ito, Matsuda, & Okabe, 2005).

My results show that child buy-in predicts compliance irrespective of rule type, and giving children input into the rule-setting process was strongly correlated with children's ability to follow rules. The fact that this relationship was mediated by children's perceptions that these rules are fair suggests that establishing this sense of fairness could play a causal role in increasing children's compliance. This data is consistent with the intuition that collaborative rule-setting with children is an effective mechanism for engendering perceptions of fairness (Fehrenbacher & Pedell, 2015). Given the mediating influence of fairness on child input, these results are also consistent with the possibility that other mechanisms that build up children's perceptions of fairness and establish ideological consistency between parent and child could be similarly effective in increasing compliance. My data suggest that discussing the reasoning behind rules, holding parents to similar standards when appropriate, and applying rules consistently may all be successful approaches for increasing child compliance.

Recent work implementing technological supports for family rule-setting touched on these relationships between child input, fairness, and compliance by proactively including children in the rule-setting process (Hashish et al., 2014). My results support this approach and lay the groundwork for creating a predictive model of rule-setting practices, child beliefs, and rule-compliance. Future work is needed to develop these findings into formal theory. These results also align with the findings I report in Chapter 4 on young children's use of technology, in which explicit controls from parents (such as warnings and parent-triggered transitions) prompt resistance. Taken together, these findings suggest that understanding human motivation and autonomy within interdependent relationships is necessary to support boundary setting. Across multiple studies, my findings suggest that designing for boundary setting in families requires consideration of the extent to which boundaries are determined by parents and imposed on children and the extent to which children's autonomy is cultivated.

Independent of whether children believe rules are fair, my results repeatedly show that it is more challenging for them to abide by context constraints than activity constraints. Children reported that they were less likely to follow such rules and that they were working harder to follow them. This difficulty persisted even after

controlling for age, gender, academic grades, parent-child relationship, the child's perception of the fairness of the rule, and whether the child had input into setting the rule. Adults agreed; they reported that they expend more effort enforcing context constraints than activity constraints and that children are less likely to comply with such rules. When discussing context constraints, parents were more likely to say that their greatest challenge was that their child just cannot seem to disconnect, and they were less likely to report having no enforcement challenges at all.

These results suggest that not only is the context in which technology is used a concern that now accounts for roughly half of all family technology rules, it is also the largest source of technology-related disagreement between parents and children. Though parents reported no difference in children's awareness of family expectations of context constraints as compared to activity constraints, the inability to unplug makes this type of rule particularly challenging for children and a source of tension for families.

A large body of prior work outside family contexts has shown that it is difficult for adults to set aside technology, even when they believe continued connectivity is inappropriate or unnecessary (Harmon & Mazmanian, 2013; Jarvenpaa & Lang, 2005; McDaniel & Coyne, 2014; Middleton, 2007). The results of this study suggest that this theme extends to children as well and that resisting the urge to check in is more difficult than complying with any other kind of technology-related boundary.

Finally, these results suggest that all-or-nothing approaches to mediation are currently easier to maintain than more nuanced positions. Child participants found it easier to follow rules that prohibited them from owning smartphones or using social networking sites than rules that required them to put away smartphones and refrain from social networking in specific contexts. This suggests that designing to support context-specific use could improve families' experiences enforcing context constraints and facilitate family rules that limit—rather than ban—various technologies.

5.3.2 Rules for Parents

In most respects, expectations for adults differed from expectations for children. Adults were censured for using their phones while driving, modeling inappropriate behaviors for children, failing to live up to the family-wide rules they set themselves, and sharing content about children without permission—none of which emerged as common concerns about children.

Though parents and children surfaced many of the same themes about appropriate adult use of technology, there were several ways in which their perspectives differed. Children were twice as likely to report that

adults should not “overshare” by posting information about children online without permission. Children were also significantly more likely to report that adults should be held to the same rules as children and that adults should respect children’s autonomy with technology. Adults were significantly more likely than children to say that parents should supervise their children’s use of technology and model appropriate usage behavior.

While most of these discrepancies are consistent with tensions over shifts in authority that characterize adolescence, children’s frustrations with parents’ oversharing stands apart as a challenge that transcends existing power dynamics. Child participants reported that they find this content embarrassing and feel frustrated that parents publicly contribute to their online presence without permission. Prior work has shown that teenagers have such concerns about their peers as well and establish contracts within friend groups, such as agreeing not to tag one another in photos or doing so only with explicit consent, to mitigate this challenge (James & Jenkins, 2014). My results suggest that children’s need to control their online image is undermined by the common parent practice of sharing information about children online, a result that echoes recent works suggesting that parents feel other parents overshare as well (“Parents on social media: Likes and dislikes of sharenting,” 2015).

Prior work has shown that adults routinely share information about their children on social network sites during infancy and early childhood (Kumar & Schoenebeck, 2015; Morris, 2014) and that these parents worry about how children will perceive such posts in the future (“Parents on social media: Likes and dislikes of sharenting,” 2015). My data suggests that older children do indeed have concerns about this practice, and further, that a discrepancy exists between the extent to which children and parents find it problematic. This data calls for future work to understand how families negotiate the terms of acceptable information-sharing, whether adults feel this behavior is appropriate, and the long-term effects, if any, of routine oversharing. Future work is also needed to explore how children’s perspectives change with age.

Despite the differences in rules for parents and rules for children, the most commonly reported expectation for both groups was that they put all technology away in certain social contexts, such as family meals or during conversations, indicating that this concern applies to family members of all ages. Parents and children alike feel that all family members should be expected to set aside devices during dedicated periods of time. Children say that parents should be responsive, initiate family time, and follow their own rules about banning devices at the dinner table, despite the fact that these same children report struggling to follow such rules themselves.

My results suggest that families are wrestling with an unresolved challenge of how to live up to their own ideals about contextually appropriate technology use, consistent with the results I report in Chapter 3 and other prior work suggesting that parents struggle to pay attention to physically present family members while using technology (Hiniker et al., 2015a; McDaniel & Coyne, 2014; J. S. Radesky et al., 2014). My results further suggest that families are aware that technology compromises their attention and that they are actively holding one another accountable for this divided attention. Both adults and children report that they: 1) value parents' ability to attend to their physical surroundings, 2) believe that adults should set technology aside when the social context demands it, and 3) hold these expectations for both their own family members and for parents generally.

5.3.3 Conclusions and Future Work

My results indicate that families in the U.S. struggle with common challenges around technology use. Children find it difficult to comply with requests to disconnect, parents share more information online than their children are comfortable with, and the most salient concern among both parents and children is the desire for all family members, regardless of age, to pay attention to one another when in one another's company. My results also indicate common patterns of harmony within families and common tools for improving tension over technology use. Parents report less difficulty enforcing rules about the content children can access, and rule-setting processes that involve children are associated with improved ideological agreement between parent and child as well as increased commitment to abiding by rules.

This work suggests a need for future investigation to examine the source of the discrepancy between complying with activity constraints and context constraints. Though parents reported that, for children, this struggle stems from the fact that they just "can't put it down," I did not probe which technological and social affordances of children's technologies (e.g., texting, selfies, social media sites) make context constraints uniquely challenging. Further work in this area promises to inform the design of technologies that facilitate contextually appropriate usage. Today, commercially available supports for family technology rules, such as Net Nanny or iOS Restrictions, primarily address activity constraints. These results show that a design opportunity exists to address context constraints, rules that children and adults alike report are a struggle for families. They also suggest that a design opportunity exists to promote children's involvement and self-efficacy in the experience of using such supports.

5.4 SUMMARY OF CONTRIBUTIONS

This work provides empirical data in support of T1 by examining both the boundaries families would like to maintain around their technology use and the ways in which they experience these boundaries in practice. By documenting that: 1) families' desired behaviors are context-dependent, 2) establishing habits which shift with context is challenging, and 3) supporting children's autonomy increases their commitment to these boundaries, this work provides design guidance for supporting families in establishing practices they feel good about. I build on these findings in Chapters 6 and 7 by designing systems centered on users' self-efficacy. By documenting the presence of and distinction between activity constraints and context constraints, this work also contributes to our theoretical understanding of family technology use.

Chapter 6. MyTime: Persuasive Technology for Intentional Smartphone Use⁴

Many of the stories that families surfaced in the formative work I describe in Chapters 3 through 5 included reflections on families' use of mobile devices. These portable technologies provide users with the opportunity to leverage the power of ICT in nearly every context and at nearly every moment. As described in Chapter 2, prior work has shown that the potential to engage with technology at any time can come with costs (Ames, 2013; Bayer & Campbell, 2012; M. Mazmanian, 2012; McDaniel & Coyne, 2014; Przybylski et al., 2013), and my own work indicates that adults wish they self-limited their use of mobile devices more effectively (Chapter 3) and that they strive to restrict their use of mobile technologies in systematic ways (Chapter 5).

The purpose of this project was to build on these findings to investigate RQ7 (“how can designers support parents and other adults in self-regulating their smartphone use?”). To do so, I set out to understand how we might design for *targeted non-use*, the reduction only of the usage behaviors that users wish to limit. I defined this construct based on the all-or-nothing approaches to technology use that families reported in my formative studies. In contrast to all these extremes, targeted non-use is the concept of reducing or cutting out specific types of behavior or usage experiences without sacrificing others.

To conduct this work, I worked together with a team of collaborators to first examine the existing design space for supporting smartphone users in targeted non-use. As described in Chapter 2, productivity tools to help users self-monitor or self-limit have become common, but little research has evaluated such tools empirically. Even less research has examined the design considerations that are likely to make such tools effective. After mapping out this space and collecting design feedback from 232 online survey participants, I created MyTime, a system-level smartphone tool to nudge users toward an integrated balance of use and non-use they feel good about. I then conducted a two-week deployment study of MyTime with 23 smartphone users.

⁴ Hiniker, A., Hong, S. R., Kohno, T., & Kientz, J. A. (2016, May). MyTime: Designing and Evaluating an Intervention for Smartphone Non-Use. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (pp. 4746-4757). ACM.

As part of this work, I identified a small taxonomy of intervention approaches for targeted smartphone non-use. Through my online survey, I further identified two orthogonal user characteristics based on the non-use goals users set for themselves. In my deployment study, I found that MyTime was effective in reducing the time users spent with experiences that they feel are a poor use of their time, while leaving the time they spent with experiences they value unchanged. The user-characteristics I identified predicted which features users engaged with and the effectiveness of those features in helping them meet self-defined goals. In this Chapter, I link these user characteristics to the categories of my design taxonomy, creating a foundation for building a theory of designing for smartphone non-use. This model contributes to evaluating T2, as it documents how the choices designers make might foster or hinder users' satisfaction with their own habits.

6.1 PRELIMINARY WORK AND DESIGN PROCESS

6.1.1 Design Methods

Expert Panel Exercise: To explore the space of possible interventions, I conducted a design brainstorm with a team of five volunteer designers, one of whom was an expert in behavior change technologies and strategies. The design team expansively generated as many ideas as possible for smartphone-based tools that might encourage users to engage in behaviors that align with self-defined values or goals. The design team generated 100 different design ideas, e.g., a reporting tool that plots a user's usage relative to friends' usage, a lockout mechanism that makes certain apps unavailable each day until the user has walked 10,000 steps, and a background process that drains the phone's battery faster whenever the user opens an app that he or she has labeled as distracting. My collaborators and I clustered these designs through affinity diagramming to identify themes across solutions. These solutions clustered into eight different categories, shown in Table 12. We then created one canonical mockup for each category, intended to be representative of the most salient aspects of that category. Descriptions of these per-category canonical designs are shown in Table 13.

Formative Survey: I next created an online survey designed to both elicit participants' perspectives on their own smartphone use and to evaluate the design mockups we created. The first section asked participants a mix of 12 open-ended and scaled multiple choice questions about their feelings on their phone use. For example, one open-ended prompt asked: "If you could change one thing about the way you use your phone, what would it be?" while one scaled question asked: "How do you feel about the amount of time you spend on your phone?" with possible responses ranging from "I would like to spend much more time using my phone" to "I would like to spend much less time using my phone."

Table 12. MyTime: Design taxonomy of categories of intervention types for targeted smartphone non-use

Information	Agnostically providing information to the user about his or her behavior
Reward	Rewarding the user for engaging in behaviors that are consistent with his or her self-defined goals
Punishment	Punishing the user for engaging in behaviors that are inconsistent with his or her self-defined goals
Disruption	A temporary barrier momentarily prevents the user from engaging in a specific behavior
Limit	Certain behaviors are time- or context-bound or otherwise constrained within defined parameters
Mindfulness	The user is asked to reflect on his or her choices, before, during or after making them
Appeal to values	Reminding the user about the underlying values that shaped their decisions about desired use and non-use
Social support	Opportunities for including other individuals into the intervention

After completing the questions about smartphone use, survey participants saw eight different storyboards, one for each canonical mockup, presented one at a time in random order. After each mockup, an open-ended prompt asked them to describe what they liked and disliked about the proposed feature. A series of Likert-style questions then asked them how much they liked the idea, how interested they would be in trying this feature, how likely they think it would be to change their behavior, and how annoying they would find the functionality. After answering these questions for each of the eight mockups, they ranked the concepts in order of preference. Finally, I asked a series of questions about the contexts in which they find it difficult to manage their phone use and collected demographic information.

I recruited participants online through Amazon's Mechanical Turk service. All participants lived in the United States and had achieved a "Masters" qualification from Amazon for their prior work on Mechanical Turk, indicating a history of high-quality responses. We collected valid data from 232 participants (106 men) ranging from 21 to 66 years old (mean = 35, sd = 10). All participants were smartphone users, and reported smartphone ownership ranged from 1 month to 20 years (85% acquired their first smartphone within the past 2-6 years). Participants were compensated 2.00 USD for completing all required questions. I advertised the survey saying I was interested in understanding the perspectives of smartphone users who are: "*interested in reducing your phone use or in changing the way you use your phone or both,*" making it likely that I oversampled individuals who are interested in using their phones less. As a benchmark, prior work suggests that an interest in reducing phone use is widespread (Shin & Dey, 2013) and is reported by 60% of all smartphone users (Ko, Chung, et al., 2015).

I coded responses to open-ended questions for themes, using conventional content analysis (Hsieh & Shannon, 2005) and iteratively revised themes as I coded more data. Based on the themes that emerged, I chose to

Table 13. MyTime: Descriptions of mockups

Feature (Category)	Description
Timer (Information)	A timer in the corner of screen displays the amount of time spent on the current app
Charity (Reward)	You have the option to make a donation (of someone else's money) to a charity of your choice if you stay off an app you have marked as sometimes distracting
Phobia (Punishment)	Pictures of something you dislike (e.g. spiders) begin to appear sporadically in an application you have marked as sometimes distracting after you have spent a certain amount of time on it
Scramble (Disruption)	The icons of the apps you feel are sometimes distracting are periodically rearranged at random to new locations
Timeout (Limit)	You set a time limit for all distracting apps. The app automatically exits when you hit your limit
Aspiration (Mindfulness)	You see a prompt each morning asking what you would like to accomplish that day. This aspiration is periodically shown to you when you spend time on apps you sometimes find distracting
Watermark (Appeal to Values)	You select an image of something important to you (like your family, an image of yourself exercising, a picture representing a job you hope to obtain). This is used as a watermark in the background of distracting apps
Social (Social support)	Information about your progress toward your usage goals is shared with a small group of supporters

create three measures for each participant based on his or her response to the question: *"If you could change one thing about the way you use your phone, what would it be?"* For each participant I coded: 1) the type of change the user was most interested in making, 2) whether this change reflected some kind of reduction (such as reducing total use or reducing use of a particular app), and 3) whether the change the user wanted to make was context-based (such as only using the phone during lunch breaks at work or only using the phone after household chores are complete).

I also performed a selective coding of the open-ended descriptions of the things participants liked and disliked about each mockup (i.e., coding 400 of the 1,864 different descriptions). For each mockup, I randomly selected 50 different responses to code; in all cases I found this subsample sufficient to achieve data saturation.

6.1.2 Survey Results: Users' Perspectives on Current and Desired Habits

Habits and Goals I first examined survey participants' attitudes about their own phone use. The majority of participants (58%) reported that they want to spend a little less time using their phones, 16% reported that they want to spend much less time, and 15% said that they do not want to change the amount of time they spend on their phones. The remaining 10% of participants reported that they want to spend a little more time using their phones.

The behaviors that participants reported most wanting to change fit into 9 different thematic categories. The most common desired change (33% of participants) was to limit or cut back on the time they spend on a specific activity, e.g., *“I would not get on social media as much,”* and the second-most common was to stop a specific activity altogether (14%), e.g., *“I would never use it to social network.”* Though many responses reflected a clear non-use desire, this was not always the case. Approximately 8% reflected a desire to increase the amount of time spent on a specific activity, while 7% wanted to make a technical or usability change. Other responses reflected use and non-use desires simultaneously, with 10% of participants reporting that the thing they would most like to change would be to displace one phone use behavior with another phone use behavior, e.g., *“I would use text less and call people more often.”* All categories are shown with examples in Table 14.

User Attributes Two overarching themes emerged from users’ descriptions of the change they would most like to make. First, many responses reflected an interest in reducing phone use in some way, thus I coded each response for this dimension. Across all participants, 79% reported that the change they would most like to make would be one that involves cutting back in some way, while 21% reported wanting to make a change that would not introduce any such restrictions. I labeled these two groups *“reduction-focused users”* and *“non-reduction-focused users”* for the purpose of highlighting that cutting down on some aspect of use is the most salient concern for reduction-focused users. While non-reduction-focused users may also be interested in cutting back in some respect, they report that other concerns take top priority.

Orthogonally, responses across many categories reflected an interest in making a context-dependent change, such as, *“I would use it less, particularly before bed,”* or *“I would use it more for work related activities so I can make better use of my time spent commuting.”* Overall, 12% of participants reported that the change they would most like to make would involve a contextually specific adjustment. I refer to these groups as *“context-focused users”* and *“non-context-focused users.”* I used these two emergent user attributes, reduction focus and context focus, to guide my exploration of the ways in which differentiated non-use goals predict behavior.

Given participants’ interest in reducing some aspect of their phone use, I looked at their responses to the question *“Describe one thing you do with your phone (such as an app you use, a website you visit, or a specific time or situation when you use it) that leaves you feeling drained of energy, unproductive, or dissatisfied”* to gain a richer understanding of the ways in which they wish they could self-limit. Participants’ responses described eight different categories of activities which they routinely use in ways that leave them dissatisfied: communication (such as texting or instant messaging), dating apps, content aggregators, casual games, online shopping, pornography, social media, and video browsing. Of these, social media (37%) and games (30%) were the

Table 14. MyTime: What users most want to change about the way they use their smartphones

Category (%)	Description: Example
Limit Activity (33%)	Cut back on use of a particular activity: <i>“I would use games and social media less. They really don't contribute much to anything.”</i>
Stop Activity (14%)	Discontinue a particular activity: <i>“Uninstall facebook altogether”</i>
Reduce Total Use (13%)	Cut back on the total amount of time spent on using the phone across activities: <i>“I would like to look at less each day. It seems that it wastes my time a lot where I could be getting other things done.”</i>
Displace Activity (10%)	Replace time spent on certain phone activities with time spent on other phone activities: <i>“I would use my phone less for social networking and more for things like reading and keeping up with news.”</i>
Increase Activity (8%)	Engage in a particular activity more often: <i>“I would make use of the calendar and scheduling features more than I do. I tend to still remember appointments and dates and not bother putting them on my calendar.”</i>
Technical (7%)	Make a technical or usability change to the phone or the user’s pattern of interaction: <i>“I would like to know more about how to use it for data storage and as a word processor.”</i>
Limit Context (6%)	Cut back on an aspect of phone use in a context-specific way: <i>“I would stop using it when I was in the presence of other people.”</i>
Reduce Dependency (5%)	Reduce the need to check on the phone or to keep it always accessible: <i>“Not pick it up so frequently. It has become a nervous tic and almost an extension of my body.”</i>
Nothing (3%)	Not interested in changing: <i>“There is nothing I really want to change.”</i>

most commonly mentioned and made up roughly two-thirds of all responses. I also asked participants a parallel question probing the smartphone experiences they found satisfying, productive, or energizing. I spent less time analyzing these responses as participants expressed an overwhelming interest in reducing rather than increasing their smartphone use.

I also looked at the specific products that participants mentioned when describing experiences that leave them feeling drained of energy and unproductive. Of the 232 responses, 163 mentioned a specific app or website. The most commonly mentioned draining app was Facebook, which was described as draining and unproductive 70 times. The second-most frequently cited product was Reddit, mentioned 19 times. Eleven additional apps were mentioned by more than one person, specifically: Twitter, Candy Crush, YouTube, Instagram, Pinterest, Tumblr, Clash of Clans, Angry Birds, Tinder, and BuzzFeed.

6.1.3 Survey Results: Design Feedback

Next, I examined participants’ responses to the mockups we designed and compared the extent to which participants were interested in trying each of the eight experiences. A repeated-measures ANOVA revealed a highly significant difference in participants’ interest in trying these different designs ($F(7, 225) = 93.98, p < .001, \eta^2 = .691$). Post hoc analysis revealed that designs clustered into three groups, all of which were

significantly different from each other based on participants' interest in trying them. The most popular group included the Timer, the Aspiration, and the Timeout, which participants were, on average, interested in trying (mean = 3.61, sd = 0.79, scale: 1 = strongly do not want to try; 5 = strongly want to try). The second cluster included the Watermark and the Charity features, which participants were, on average, neutral about trying (mean = 2.67, sd = 1.00). The third cluster included the Scramble, the Phobia, and the Social features, which participants were disinterested in trying (mean = 2.03, sd = 0.83).

I examined themes in participants' open-ended descriptions of what they liked and disliked about each idea to better understand the properties that drove their responses. Across designs, the most common motivations participants gave for liking a feature were: the perception that it would increase their awareness or understanding of their own behavior, appreciation that it would remind them of their own priorities, and appreciation of enforcement so that they could not easily avoid breaking their own rules. The most commonly cited aspects that participants disliked across designs were: the perception that the feature would interfere with or diminish their experience of using the app they are monitoring, the perception that they would have less control over their experience, the expectation that the feature itself would be painful to use, lack of enforcement or accountability, and the perception that they would quickly habituate to the feature, rendering it ineffective.

Finally, I looked at characteristics of the participants themselves to see if subgroup attributes predicted differentiated interest in these designs. I compared the extent to which reduction-focused and non-reduction-focused users were interested in trying each of the well-received designs (Timer, Aspiration, Timeout). Independent samples *t*-tests revealed that reduction-focused users were significantly more interested in trying the Timer (mean = 3.84, sd = 1.12) than non-reduction-focused users (mean = 3.40, sd = 1.23, $t(229) = -2.38$, $p = .018$, $d = 0.37$). Reduction-focused users were also significantly more interested in trying the Timeout feature (mean = 3.70, sd = 1.23) than non-reduction-focused users (mean = 2.71, sd = 1.25, $t(229) = -4.97$, $p < .001$, $d = 0.80$). There was no significant difference between groups in their interest in the aspiration feature.

I hypothesized that this difference in interest was driven by reduction-focused users' interest in making a time-based change to their behavior, as well as the perception that the timer (information category) and the timeout (limit category) would keep them on a more regimented schedule. Given this, I predicted that the non-reduction-focused users would find the information provided by the timer more useful than the limit provided by the timeout. To test this, I ran a repeated-measures ANOVA with interest in trying each design

as a within-subjects factor and reduction focus as a between-subjects factor. This revealed a significant interaction effect ($F(1, 229) = 5.336, p = .022, \eta^2 = .023$), such that reduction-focused users were equally interested in both interventions, while non-reduction focused users were significantly more interested in seeing information (timer) than in setting limits (timeout). This is consistent the intuition that users' specific non-use interests predict the intervention features they value.

Based on these findings, I hypothesized that context-focused users would be more interested in the aspiration feature (mindfulness category) than non-context-focused users, as reminding users of the things they think they should be doing at the moment may align with these users' concerns that they are choosing to use their phones when they would prefer to make another choice. I did not expect these users to differ from non-context-focused users in their interest in the timer or timeout, as these features are situation-agnostic and provide information and limits across all contexts.

An independent samples *t*-test confirmed that context-focused users were significantly more interested in trying the aspiration feature (mean = 4.11, sd = 0.88) than non-context-focused users (mean = 3.53, sd = 1.17, $t(229) = -3.139, p = .003, d = 0.56$). However, I also found that context-focused users were significantly more interested in trying the timeout feature (mean = 4.00, sd = 1.05) than non-context-focused users (mean = 3.41, sd = 1.31, $t(229) = -2.67, p = .011, d = 0.49$). This is perhaps reflective of the fact that context-focused users are interested in making a change that could benefit from the enforcement that is central to the "limit" category, despite the fact that their focus is not specifically on time. As predicted, there was no significant difference in the interest in trying the timer.

6.1.4 Intervention Design

Based on these findings, I created "MyTime," an app for Android smartphones intended to encourage targeted non-use. I created an interface that displays all apps on the users' phone, allowing the user to select the icons of the apps he or she sometimes finds distracting (referred to as "monitored apps"). A time picker then allows the user to set the maximum amount of time he or she would like to spend with these monitored apps each day. Upon opening the app for the first time, the user is funneled through a setup experience which asks him or her to select these apps and set a limit (see Figure 7); these settings can be changed at any time by returning to the app's main interface.

I then created a background service which tracks the active app and maintains a complete record of the individual's usage. This includes silently recording the time the user spends with the monitored apps he or

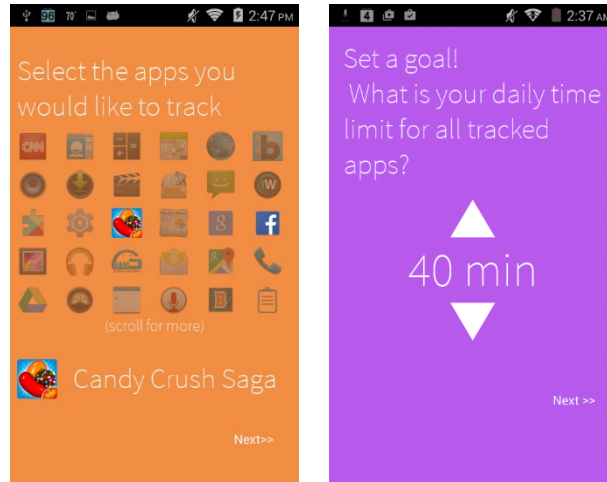


Figure 7. MyTime: Screenshots from the MyTime setup, selecting apps to monitor (left), and setting a daily time limit (right)

she has selected, as well as the time the user spends with all other apps on the phone. App-use is recorded in milliseconds.

I implemented all three of the canonical features that survey participants reported having an interest in trying: 1) passive information about time passing (Timer), 2) a message telling the user when he or she has hit the daily time limit (Timeout), and 3) a daily prompt asking the user what he or she would like to accomplish each day (Aspiration). Each of these features is described in more detail below and shown in Figure 8.

- *Timer.* Whenever a user opens a monitored app, a clock icon appears in the notification bar. If the user pulls down the notification shade, a progress bar is displayed showing the amount of time the user has spent on all monitored apps that day relative to the user's self-defined daily limit. This notification also displays the amount of time the user has spent on the current app. This image updates in real-time. This notification is persistent and does not disappear until the user exits the monitored app. See Figure 8.2. This feature represents the "Information" category of the design taxonomy by passively surfacing information with minimal explicit persuasion. Goal-Setting Theory documents the importance of providing individuals with feedback about their progress against their goals (Locke & Latham, 2006). This feature attempts to provide users with readily accessible feedback about the user's behavior relative to his or her self-defined goal.
- *Timeout.* When the user hits his or her daily time limit, a dialog appears saying "Time's up!" The user has two explicit choices: one button saying "I need a few more minutes," which brings up a time picker, and a second button saying "Exit [Current app name]." Selecting the second option moves the active app

to the background and returns the user to the launcher. The user also has a third option to dismiss the dialog by pressing the 'X' in the top right corner, pressing the back button, or pressing the home button. If the user dismisses the dialog without requesting an explicit extension, the warning dialog returns every 5 minutes or every 10% of the total daily limit (whichever is shorter) whenever the user has a monitored app in the foreground. See Figure 8.3 and Figure 8.4. Like the timer feature, this feature was designed to provide feedback to the user about progress against his or her self-defined goals, but with explicit persuasion instead of agnostic information. By setting the initial limit, the user is prompted to make a pre-commitment to a specific goal, while the extension dialog allows the user to set a secondary goal, if this initial goal becomes irrelevant or unattainable. Prior work shows that both can be effective in inciting behavior change (Kim, Wohl, Stewart, Sztainert, & Gainsbury, 2014; Munson & Consolvo, 2012). The extension dialog also gives users the ability to redefine their own boundaries dynamically, and prior work shows that this is a key element of the way families enact limit-setting (Mazmanian & Lanette, 2017).

- *Aspiration.* Each day, a push notification asks the user to enter an aspiration. Tapping on this notification brings up a dialog which asks “*What is one thing you would like to accomplish today?*” (Figure 8.1). The dialog provides a space for a free-response answer, as well as options to snooze the prompt (in which case it returns an hour later) or to dismiss it for the day without setting an aspiration. If the user chooses to set an aspiration, it is displayed back to her whenever she sees a “*Time’s Up!*” warning. If an aspiration has been set, the warning dialog says: “*Try this instead: ...*” and then reflects the user’s aspiration back to him. The user can choose to set additional aspirations throughout the day by going to the MyTime app. See Figure 8.3. Through this feature, I sought to support users both by prompting them to reflect on their own intentions (Brown & Ryan, 2003) and by encouraging goal-setting (Locke & Latham, 2006).

6.2 METHODS

I conducted a two-week deployment of MyTime with 23 Android smartphone users (4 men). Participants were recruited through a national recruitment service and represented 20 different U.S. states. Participants ranged in age from 25 to 60 (mean = 33.5, sd = 9.6) and represented 4 races and ethnicities (82% white). Participants’ household income ranged from <\$25,000 to >\$125,000, with 57% reporting that their income fell between \$50-75,000. Smartphone ownership ranged from 1 to 10 years. Participants were told that they

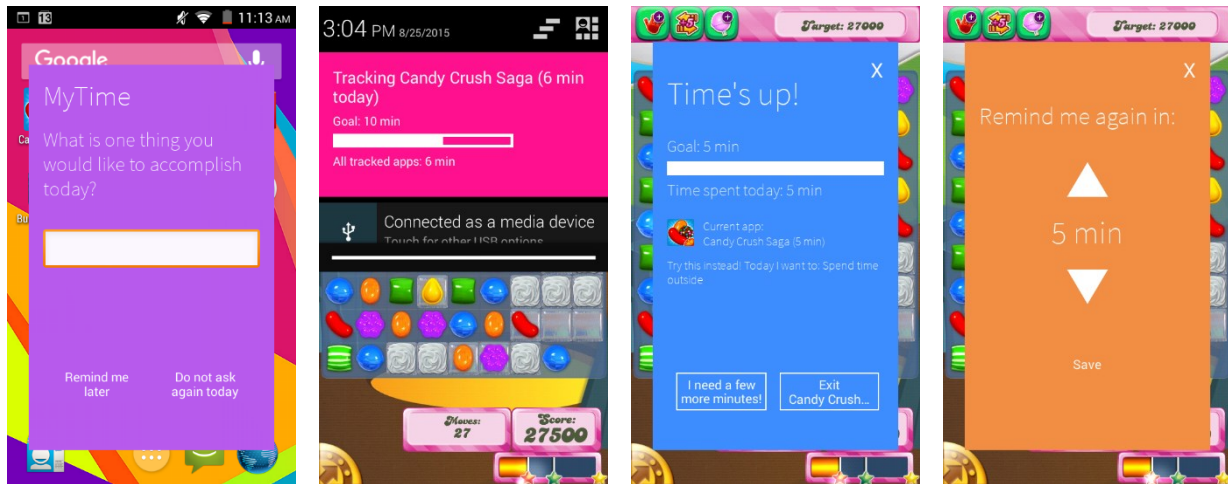


Figure 8. MyTime: Screenshots of MyTime features. From left: 1) a daily notification asks the user to think of one thing they would like to accomplish that day, 2) when the user uses a monitored app, they can pull down the notification shade to see the amount of time on the current app and the amount of time today on all monitored apps, 3) a dialog tells the user when they have hit the daily limit, 4) after hitting the limit, the user can always request an extension.

had been invited to participate in a study testing an app to help people monitor their own smartphone use. Participants who installed the service and kept it running for the entire study period received 45 USD in compensation, regardless of the amount of time they spent using their phone or the extent to which they engaged with MyTime.

Participants first completed the same survey as the 232 participants in the survey study (described in Preliminary Work and Design Methods), but with all of the mockups and their corresponding questions removed leaving only the questions about usage habits. They were then invited to install the MyTime application. The instrumented version of MyTime did not display any UI to participants for one week after it was installed. During this time, MyTime collected baseline information about the participant's phone use by passively running in the background and tracking all app use. During this time, none of the features described above were available, and opening the MyTime app displayed a blank screen with a message to return after the first week had elapsed. Although all participants spent exactly one week in the baseline period, start dates were staggered based on staggered recruiting and included all days of the week. After one week of baseline data collection, MyTime became available, and all features were turned on.

6.3 RESULTS

Deployment participants reported feelings about their own phone use that were similar to those reported by my initial survey participants. Most (77%) said that they either wanted to spend a little less time using their

phone or much less time using their phone. In response to checkbox options asking whether or not participants wanted to reduce their use of various types of apps, participants most frequently reported wanting to cut back on their use of social media (86%) and games (73%).

As with survey participants' responses, I coded deployment participants' responses to the question "*If you could change one thing about the way you use your phone, what would it be?*" and found that all responses fit into one of the 9 categories that emerged from the original survey study. Among deployment participants, 77% were reduction-focused users; a partially overlapping 18% were context-focused users.

To understand what targeted non-use might look like for each participant, I next examined the types of apps participants chose to monitor and compared these to their survey responses about their own phone use and desired phone use. Collectively, participants chose to monitor their use of 183 apps, 116 of which were unique. Monitoring was highly personalized, with the majority of apps monitored by only one person. Of the 116 distinct apps, only 9 were monitored by 3 or more people (see Figure 9). Of these, Facebook was the most frequently monitored, and nearly 90% of participants elected to monitor their Facebook usage. The second-most commonly monitored app was the Google Chrome browser (39% of participants).

I compared the list of apps that each participant had described as being "*a good use of your time*" and "*a waste of your time*" in the free-response section of the survey to the list of apps they chose to monitor. I found that participants were interested in monitoring their time with both types of experiences. Across all participants, 82% monitored at least one app that they mentioned explicitly as something they would like to use less. I also found that 59% of participants chose to track at least one app that they reported feeling is a good use of their time. Of the 183 apps that participants monitored, 42 were listed by the participant as a waste of time, 48 were listed by the participant as a good use of time, and 78 were not explicitly mentioned by name. Thus, despite the fact that I messaged the project as a mechanism for monitoring apps people sometimes find distracting, participants also elected to monitor experiences they value and patterns of behavior they feel

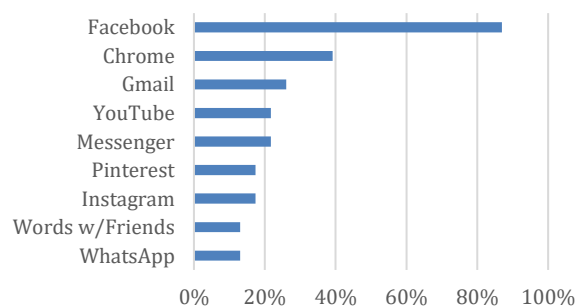


Figure 9. MyTime: Percentage of participants who monitored each app. Includes all apps monitored by at least 10% of participants.

good about. Monitored apps that were not explicitly mentioned by name were thematically similar to the apps participants explicitly listed as a waste of time (such as other casual games and content aggregators), thus I grouped these with the apps users reported are a waste of their time.

6.3.1 Time with Phones

Participants reduced their daily phone use by an average of 33 minutes (11% of total use) during week 2 (when MyTime was available) relative to week 1 (before MyTime was available). A repeated-measures ANOVA demonstrated that this was a significant decrease in total use ($F(1, 138) = 8.191, p = .005, \eta^2 = .056$). Specifically, participants reduced the amount of time they spent on the apps they monitored by 23 minutes, a daily reduction of 18%. A repeated-measures ANOVA revealed that this too was a significant decrease ($F(1, 138) = 15.292, p < .001, \eta^2 = .100$).

Given that participants monitored both the apps they feel are sometimes a waste of time and the apps they feel good about using, I next analyzed usage data based on participants' individual goals. There was no significant difference ($p = .364$) in the amount of time participants spent using the apps they monitored that they feel are a good use of their time during week 2 (with MyTime) compared to week 1 (baseline). However, participants spent an average of 24 minutes less per day (21%) on the apps they reported were a waste of their time. A repeated-measures ANOVA revealed that this reduction was significant ($F(1, 126) = 13.605, p < .001, \eta^2 = .097$). Thus, reduction in phone use was driven not only by the apps that users monitored, but specifically by the apps they monitored that they feel are sometimes distracting or a waste of their time. Figure 10 shows the change in participants' average use of the apps they value using and apps they find distracting.

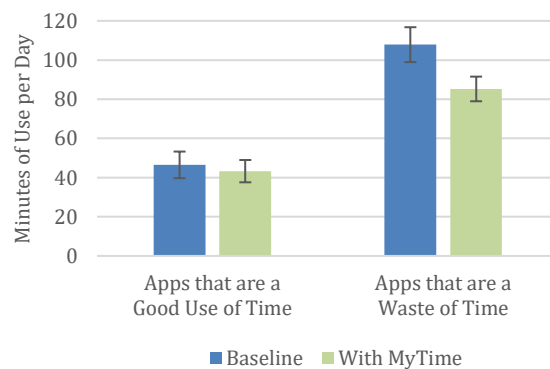


Figure 10. MyTime: Number of minutes participants spent per day on the apps they monitored during the intervention period

6.3.2 Timeout Feature

Across all participants, MyTime displayed a “*Time’s Up!*” warning 370 times. In response to these warnings, participants most frequently chose to dismiss the warning, doing so 64% of the time. Participants asked for an explicit time extension 30% of the time and immediately exited the monitored app they were using 6% of the time. The extensions participants asked for ($N = 113$) ranged from 1 minute to 490 minutes, with the median extension length being 15 minutes, and the most frequently requested extension length being 1 minute ($N = 16$).

Given that users appeared to be tracking some apps purely for informational purposes and other apps in order to reduce use, I examined participants’ responses to warnings in each of these two situations. First, I compared responses to warnings about apps users feel are a good use of their time and responses to warnings about the apps they feel are a waste of their time. A chi-square test comparing response type and app type revealed that participants’ responses were significantly different in these two situations ($\chi^2(2) = 10.077, p = .006$). Post hoc contingency table analysis revealed that participants were significantly more likely to ask for an extension ($Z = 3.0, p = .003$) and significantly less likely to dismiss the warning ($Z = -3.1, p = .002$) when the app they were using was one they felt was a good use of their time than when they were using an app they felt was a waste of their time. A Bonferroni correction was applied to all column comparisons.

As participants most frequently selected the options “social media” and “games” as the categories of use they would like to reduce, I examined participants’ responses to warnings about apps that fell into each of these categories. A chi-square test comparing participants’ responses to the warnings they saw when using social media, games, and all other apps revealed a significant difference in the way participants responded to warnings about these different app types ($\chi^2(4) = 38.268, p < .001$). Post hoc contingency table analysis revealed that participants were significantly more likely to exit a social media app after seeing a warning than they were to exit a game or to exit any other kind of app ($Z = 4.8, p < .001$). Participants were also significantly less likely to dismiss a warning that they saw when using a social media app ($Z = -5.2, p < .001$). Participants’ responses to the warnings they saw when playing games were not significantly different from their responses to other kinds of apps. A Bonferroni correction was applied to all column comparisons.

Finally, I analyzed participants’ responses to warnings in light of the fact that survey responses revealed that reduction-focused users are more interested in a feature to limit the time they spend on apps than individuals looking to make other kinds of changes. A chi-square test revealed that reduction-focused users were significantly more likely than non-reduction-focused users to quit the app they were using when they saw a

warning ($\chi^2(1) = 5.652, p = .017$). These users also made progress toward their goal and showed a significantly greater reduction in use across all monitored apps than non-reduction focused users ($t(20) = -2.26, p = .028$) and specifically on the apps that they feel are a waste of their time ($t(20) = -2.59, p = .014$). There was no difference between groups in the change in time spent on apps that they feel are a valuable use of their time.

6.3.3 Aspiration Feature

Over the course of the intervention week, participants set a combined 57 different aspirations in response to the prompt “*What is one thing you would like to accomplish today?*” Some of these were aspirations about their phone use, such as “*I want to spend less time using my phone,*” or “*Less Instagram usage!*” Others reflected general intentions and aspirations for the day, such as “*Get a wedding ring for my husband*” or “*Make cashew cheese.*” Thus, participants’ self-defined aspirations offered both reminders about their desired phone-use behaviors and suggestions for alternative activities. On average, participants set 2.4 aspirations over the course of the week, but this distribution was highly bimodal with half of all participants setting no aspirations and the other half setting an average of 5.1 aspirations ($sd = 2.7$). Thus, on average, participants appeared to either not engage with the aspiration feature at all or to engage with it regularly throughout the study period.

Because the daily aspiration, if set, was reflected back to participants when they saw the “Time’s Up!” warning, I compared participants’ responses to warnings when they did and did not have an aspiration set. A chi-square test showed that participants were significantly more likely to exit the monitored app they were using when they saw an aspiration than when they did not see an aspiration ($\chi^2(1) = 5.191, p = .023$). However, it is unclear whether this effect was driven by seeing an aspiration, by the commitment of setting an aspiration in the first place, by the possibility that participants who were more likely to set aspirations were also more committed to making changes, or some other causal mechanism.

Finally, I analyzed aspiration-setting behaviors in light of the fact that survey responses showed that individuals who want to change the context in which they use their phone are more interested in using a feature about intention-setting than other individuals. I compared the number of aspirations set by context-focused users to the total number of aspirations set by non-context-focused users. Because the distribution was non-normal, I used a non-parametric test. A Mann-Whitney U test revealed that context-focused users, who wanted to make contextual changes to their phone use, set significantly more daily aspirations (median = 8, IQR = 4.5) than non-context-focused users (median = 0, IQR = 3.5, $U = 2.65, p = .008$). Thus, survey participants’

intuition held up among deployment study participants: those who were interested in making contextual changes to their phone use engaged more with this feature than their peers.

6.4 DISCUSSION

These results reveal that stand-alone interventions to support targeted smartphone non-use can effectively bring users closer to their self-defined usage goals, at least in the short term. The majority of participants in this deployment expressed an interest in reducing their smartphone use and, relative to their baseline behavior, spent significantly less time using their phones when MyTime was turned on. These results further show that this reduction was not indiscriminate, but came specifically from the monitored apps that participants reported they feel are sometimes a waste of time, while time spent with monitored apps that participants feel are a valuable use of time remained unchanged. This suggests that MyTime effectively supported users in engaging in targeted non-use, tailored to their individual goals and perceptions of ideal behavior.

These results indicate that interventions to support non-use can preserve the value users reap from technology while surgically targeting experiences that users find to be a poor investment of their time. This differentiation is essential for building non-use persuasive technology in a world where users want to maintain many aspects of their smartphone use while simultaneously limiting others. It also demonstrates an advantage that technical solutions have over analog ones, as analog non-use strategies like asking a friend to change your password (Baumer et al., 2013), leaving your phone in the car (Hiniker et al., 2015a), or giving up Twitter for Lent (Schoenebeck, 2014), require all-or-nothing approaches that provide users with non-use benefits at the expense of experiences they value.

6.4.1 User Attributes and Design Taxonomy

Results from the design work for this project demonstrate that users have diverse interests with respect to desired patterns of use. Some users wish they never played games on their phones, others wish they spent less time texting and more time making voice calls, others wish they used their phone to take notes more often, while still others wish they did all the things they currently do, but never right before going to bed. Despite this breadth, a small set of themes accounts for all of behavior change desires reported by the combined 256 participants who participated in this project.

These categories of desired change predicted the extent to which users were interested in adopting different design solutions. Individuals who want to change the way they use their phones in certain contexts were more interested than others in seeing reminders of their own priorities. Individuals who want to reduce some aspect of their phone use were more interested than others in seeing information about the amount of time passing. Both of these groups were more interested in a solution with enforcement than their counterparts who do not want to limit their behavior.

These assertions by survey participants about their hypothetical use held up among our deployment participants in their actual use. Reduction-focused deployment participants were more likely to exit the monitored app upon seeing a “*Time’s Up!*” warning. This engagement paid off, and reduction-focused participants also cut back on their use significantly more than non-reduction-focused participants. Independently, context-focused participants recorded significantly more aspirations during their time with MyTime than non-context-focused participants, and participants who saw an aspiration were more likely to exit the app they were using. Reflecting users’ own words back to them appeared to prompt them to change their current activity, and users who want to make context-specific changes were more likely to take advantage of this support. Thus, the types of changes users want to make predict 1) their interest in trying hypothetical features, 2) their engagement with those same features in practice, and 3) the effectiveness of these features in fostering specific patterns of behavior.

These same results also tie users’ desired changes to specific intervention categories. I found that our instantiation of the “limit” category (the timeout feature) was of significantly more value to users who wanted to set boundaries on their use, and the “mindfulness” category (aspiration) was of significantly more value to users who wanted to make context-dependent changes. By mapping out the design space of non-use interventions and distilling it into eight organic categories, I hope to provide a skeleton for a predictive framework to link user goals to intervention approaches. I found that the types of changes users want to make cluster into a small set of themes, and that an expansive set of imagined interventions cluster into a small set of intervention categories. The fact that desired change predicts the differentiated effectiveness of these intervention categories suggests an opportunity for future work to establish a theoretical model of designing to support non-use goals.

6.4.2 App Type and Behavior Change

These results indicated that thematic app categories—specifically, social media and casual games—account for the majority of the experiences that users wish they limited more effectively. This is consistent with prior work in this space suggesting that particular types of experiences are most conducive to lagging resistance (Löchtefeld et al., 2013). Deployment results showed that participants were most likely to change their behavior in response to our intervention when using social media apps, suggesting that such interventions may be disproportionately effective in addressing social media-specific goals. Further work is needed to explore this possibility.

6.4.3 Limitations and Future Work

There are several limitations to this approach to supporting targeted non-use. First, smartphone use is a socially situated practice and this intervention is highly personal and individualized. It is harder for an individual to change a behavior when surrounded by social cues that run counter to his or her goals, though past work has shown that interventions for other socially situated practices (like eating or exercising) can be effective even when they are pursued individually (e.g., (Consolvo et al., 2008; Richardson et al., 2008)). Future work remains to examine how social interventions that support a community in achieving communal non-use goals might differ from individual interventions such as this.

Second, my collaborators and I broke down usage information by app as a first step in moving beyond a monolithic approach that views all phone use as equally problematic, but did not support users in distinguishing between “good” and “bad” use of a particular app. Though we felt that “active app” could be a useful proxy for a participant’s satisfaction with his or her current behavior (in part because there was very little overlap between the experiences that survey participants wanted to cut back on, like games and social media, and experiences they found valuable, like online banking and fitness tracking) this is certainly an imperfect proxy. Future work remains to explore context-specific non-use goals (e.g., avoiding social media during the work day, never using the phone at dinner), that allow users to target the patterns of behavior they wish to change with greater precision.

It also remains unclear how stand-alone or system-level solutions like MyTime compare to interventions built directly into the apps or experiences that users wish to limit. Perhaps redesigning the casual games or social networking apps that users find unproductive would be a more effective means of fostering a desired balance of use and non-use. Future work remains to determine when it is most appropriate for product designers to

treat non-use desires as a guiding principle in product design, and when it is most appropriate for outside augmentation to provide this support.

I do not know how the behavior change catalyzed by MyTime fares in the long term, and prior work has shown behavior change in other domains can be difficult to sustain indefinitely (e.g., (Pbert, 2013)). Other work has shown that self-monitoring tools are often insufficient in the long-run but can pave the way for adopting tools that support permanent change (Klasnja, Consolvo, & Pratt, 2011). Further work is needed to assess whether the short term gains I report here persist over time and how we might design for users as they progress in achieving their desired patterns of behavior.

Finally, these results examine two coarse-grain user attributes (reduction-focus and context-focus) while simultaneously demonstrating that users have many nuanced distinctions among their varied goals for behavior change. There is an enormous space for future work to support increasingly subtle distinctions in desired patterns of non-use.

6.5 SUMMARY OF CONTRIBUTIONS

My results suggest that lagging resistance among smartphone users is widespread, and a majority of participants wished they used their phones a little less. Here I contribute specific design artifacts and show in support of T2 that tools to bring users closer to these goals can be effective, and can be effective in inciting targeted change that differentially addresses a diverse set of specific goals. These results also demonstrate that the choices designers make when creating such tools predict the ways in which users will change their behavior, as well as the types of users who will change. I map out the intervention categories for this space and link specific intervention types to specific behavior changes, contributing to our theoretical understanding of designing for targeted non-use.

Chapter 7. Plan and Play: Supporting Intentional Media Use in Early Childhood⁵

My formative work exploring the ways families think about children’s media use (Chapters 4-5) led me to RQ8: “How can designers support children in self-regulating their use of entertainment media?” As these early studies suggested that authoritarian interactions may make transitions more challenging (Chapter 4) and giving children input into setting policies may make it more likely that stick to these boundaries (Chapter 5), I explored how I might design experiences that encourage children to set boundaries for themselves.

A variety of commercial offerings promise to support parents in managing their child’s use of digital technology. These parental controls offer to filter content, turn off specific functionality, enforce digital time limits, and impose other restrictions. While these tools effectively enforce limits in the moment, they do not attempt to address the larger task of mentoring children in becoming thoughtful, self-regulated consumers (Zaman & Nouwen, 2016). They also do not attempt to support parents in providing this mentorship (Zaman & Nouwen, 2016).

The goal of this work was to build on what is already known about how children acquire self-regulation skills, and to examine how technology might play a role in facilitating this process. To do so, I drew on two existing bodies of work. First, I examined the developmental arc of self-regulation and the way in which evidence-based preschool curricula support the development of this skill. Second, I grounded this work in self-determination theory to understand what structures are likely to foster children’s long-term intrinsic motivation to self-regulate their use of technology.

Using this foundation, I worked with a team of collaborators to conduct a participatory design workshop with preschoolers to elicit design insights for a tool for this scenario (Hiniker, Sobel, & Lee, 2017). We used this design guidance to develop “Plan & Play,” a system-level interface for Android devices. Plan & Play supports children and parents in collaboratively planning out their use of apps with intention. My colleagues and I then

⁵ Hiniker, A., Lee, B., Sobel, K., & Choe, E.K. (2017, June). Plan & Play: Supporting Intentional Media Use in Early Childhood. In *Proceedings of the 2017 Conference on Interaction Design and Children*. ACM.

conducted an observational lab study with 11 parent-child dyads and follow-up interview study with 14 parents to understand how preschoolers and their parents use and experience this system.

I found that all children made choices with intention as they created a plan for their play time and that parents used language to highlight children's autonomy and choice-making. I also found that within the context of the lab, children were highly responsive to transition cues from Plan & Play and only required parent intervention 7% of the time. Parents reported that they struggle with the tension between forcing children to make choices they approve of and trusting them with the freedom to make these choices autonomously. For many parents, the Plan & Play interface offers promise as a way of addressing this conflict.

7.1 SYSTEM DESIGN

7.1.1 Design Foundations

The features of Plan & Play are largely inspired by the features of two different evidence-based preschool curricula for teaching self-regulation: Tools of the Mind (TotM) and High/Scope. As described in Chapter 2, each of these curricula has been studied over many years and predicts long-term gains in self-regulation. TotM uses Vygotskian principles to distill guidance for practitioners working to support young children's development and learning (Bodrova & Leong, 2007). Based on Vygotsky's model of supporting development through a designed environment, TotM provides age-based guidance for supporting developmental accomplishments targeting infancy through primary school.

To support preschoolers and kindergarteners in developing self-regulation, TotM provides guidance for, among other things, supporting children in planning how they will play and monitoring the progress of play. For example, TotM specifies that children should be encouraged to construct drawn or written "play plans" (instead of making simple verbal commitments to the structure of their play). It also recommends that support for planning is provided immediately before play begins (instead of planning for the distant future) and that children be prompted to review their plans immediately after play ends. If children deviate from their plan during the play session, adult moderators ask questions during the play session that require reflecting on the original commitment (e.g., answering the question, "Are you the doctor or the patient?" would require reflecting on the planned play experience and the roles the child initially specified) (Bodrova & Leong, 2007).

The High/Scope curriculum has a similar emphasis on designing environments for children that are conducive to specific developmental goals. Like TotM, it also recommends formal opportunities for planning as a

mechanism for supporting self-regulation. Specific design features include following the “Plan-Do-Review” cycle, providing opportunities to talk through the plan as the child is formulating it, ensuring the child is the one initiating the plan and that it reflects the child’s desires and goals, and a post-play recall period during which the child is encouraged to recall, draw, and reflect on his or her play experience (G. S. Morrison, 2009).

Combining elements from TotM and High/Scope with design insights from a workshop I conducted with 7 children age 4–6 (Hiniker et al., 2017), I created a set of initial sketches for a system-level app to support planning screen time activities on a phone or tablet. I then iteratively developed and revised storyboards with my collaborators which we used to implement Plan & Play for Android devices.

7.1.2 Planning

Plan & Play first takes the user through a series of screens for planning out a session of device-based activity. A cartoon panda narrates the experience and asks the child to first set a total time limit in minutes. On the next screen, the user can select apps to put in the plan by tapping to include or exclude them (Figure 11.1). On the next screen, the user sees a numbered list of apps, with the first app in the plan at the top (Figure 11.2). Dragging and dropping on this screen allows the user to swap the order of the apps.

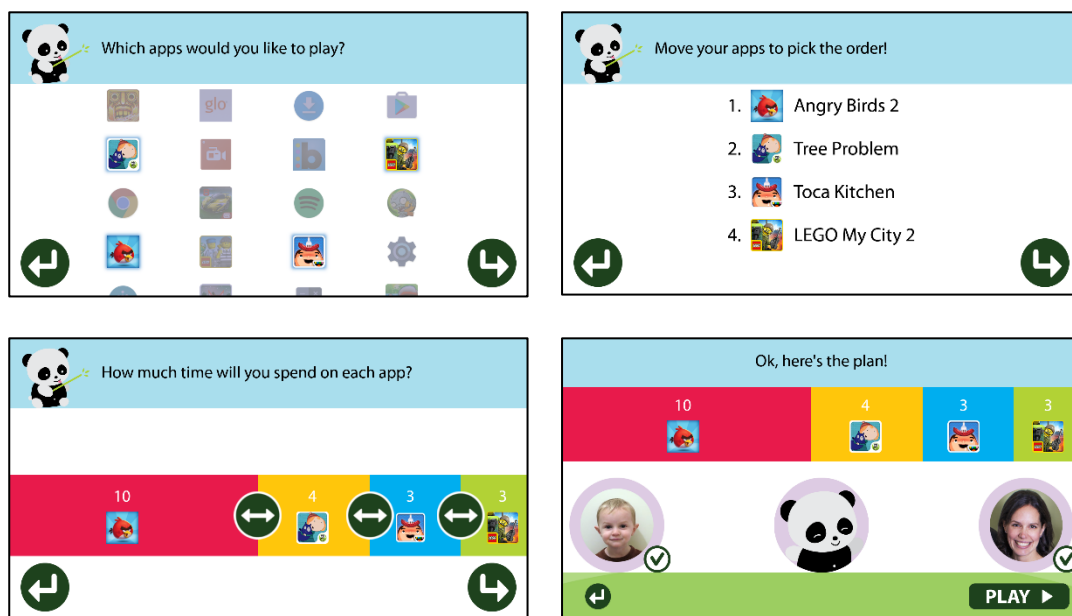


Figure 11. Plan & Play: Screens for planning. 1) Selecting apps by tapping to select/unselect, 2) ordering apps by dragging and dropping, 3) changing app duration by sliding thumbs of a slider, 4) parent and child agree to the plan by tapping their own buttons; after both agree, play button appears.

On the next screen, the user is presented with a slider with multiple thumbs (Figure 11.3). The slider represents the total duration of the plan, and each segment within it represents the duration of a single app. Dragging any thumb in the slider gradually reapporitions time. On the last screen, the plan is presented along with a picture of the parent and a picture of the child (Figure 11.4). Each picture has a button next to it, and tapping the button turns it into a checkmark. When both buttons have been tapped and display checkmarks, a “play” button appears at the bottom of the screen. Pressing this button begins the plan.

7.1.3 Playing

When the user presses the play button, the first app in the plan launches automatically, and a widget is overlaid above the app content in the top-right corner. This persistent widget displays one of three images: a cheering panda when the currently planned app in the foreground, a sad panda when a different app in the foreground, or a countdown with the appropriate number of seconds whenever the user is within 30 seconds of a transition (Figure 12).

During the users’ play time, a dialog box (Figure 13) is displayed whenever: 1) the user taps the widget or 2) the plan dictates that it is time to transition. The content of the dialog box changes slightly depending on the context. For example, it displays options like “Keep Playing” when the user is currently engaged in the planned activity and “Return to Plan” when the child has deviated from the planned activity.

The dialog box also has a close button and can always be dismissed. If the dialog box notifies the user of a transition and the user chooses to dismiss it without transitioning, the widget changes to display the “sad” panda (Figure 12, right). Thus, Plan & Play always provides visible information about whether the user is currently following the plan but never forces the user to comply. A central feature of Plan & Play is that it surfaces norms (i.e., that following the plan is a valued choice) but provides both the freedom to deviate from these norms, and information about this departure.



Figure 12. Plan & Play: Three possible states of the Plan & Play widget that is displayed in the top right corner above all screen content whenever a plan is active. Widget states: the active app is the planned app (left), counting down before a transition (center), the active app is not the planned app (right).

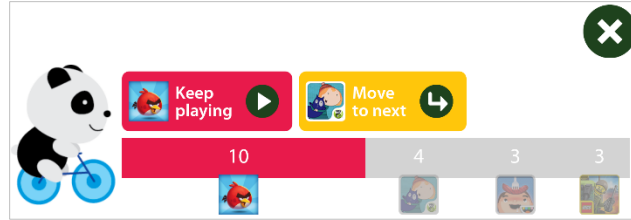


Figure 13. Plan & Play: Dialog box. Dialog options reflect the state of the plan and in other cases might say, “Return to Plan” or “End Plan.” The dialog box opens when the user taps the Plan & Play widget (Figure 12) that floats above all screen content. The dialog box is also displayed spontaneously when it is time to transition. It can always be dismissed

7.1.4 Reflecting

When the time has elapsed for the last app in the plan, the menu spontaneously appears again, and this time includes a button that says, “End Plan.” If the user presses this, the Plan & Play app itself reappears, this time asking the user, “Would you like to take a look at what you did?” If the user opts to do so, the reflection experience begins.

Plan & Play then tells the user: “This is what you planned,” and displays the same stacked bar chart that the user created when planning. After a brief pause, Plan & Play follows up with, “And this is what you played,” and displays a second stacked bar chart reflecting the apps the user actually engaged with (see Figure 14. Plan & Play: Screenshot from reflection experience. Presents planned activity plotted against activities the child actually played.). Plan & Play then prompts the child to, “show it to a grownup and decide together what you think” without making judgments of its own.

7.2 METHODS

Together with my collaborators, I combined lab observations with interviews to conduct an initial evaluation of Plan & Play. The goals of this study were to determine how parents and children collaborate to use the system and how parents feel about this approach to mediating their child’s use of digital media.

7.2.1 Participants

Fourteen parent-child dyads participated in this study (11 in the observation portion, as the other three brought incompatible devices to the study session). Child participants included 4 boys and 10 girls, and parents included 5 fathers and 9 mothers. Six children were 6-years-old, three children were 5, and five children were 4. Nine children were of Asian or Southeast Asian descent, four children were non-Hispanic

White, and one child was Afro-Caribbean. Families were recruited through institutional mailing lists, and mailing lists for local parents' groups and local preschools. Inclusion criteria for participating in the study were that parent and child speak English comfortably throughout the study session and that the child use an Android device to play apps for entertainment at least once a week on average.

Participants were instructed to bring the Android device that their child uses to the study session. Three families enrolled in the study but brought a device to the study session that did not support Plan & Play. In these cases, the family was not included in the observational portion of our study and only participated in the parent interview.

7.2.2 Materials and Procedures

All procedures were conducted in a user research laboratory and audio and video recorded. I installed Plan & Play on the family's device and then handed the device to the child. I told the child that I had put a new app on the device and showed the child where to find it. I explained that this app would let the child plan out what to play on the tablet, and I asked the child to make a plan for 15 minutes of play time. I further said that the child should make the plan, and that mom or dad could help. I then left the room.

I then gave the parent and child time to collaboratively create a plan for 15 minutes of play time and for the child to play through the plan. After observing this experience in its entirety, I returned to lab with a collaborator from the research team. The collaborator stayed in the room with the child to perform a follow-up exercise, and I escorted the parent to an adjoining room to conduct the parent interview.

In a follow-up exercise, my collaborator asked the child if he or she could show the researcher how to use the Plan & Play app. The child then led a walk-through of Plan & Play by setting up a 3-minute plan while the researcher watched and asked questions about each screen. The child then played through the planned activities.



Figure 14. Plan & Play: Screenshot from reflection experience. Presents planned activity plotted against activities the child actually played.

While the child completed the follow-up tasks, I interviewed the parent in a separate room. The semi-structured protocol included 12 questions and explored the child's typical screen media use, the limits the family sets on these activities, whether the family uses any parental controls, what the parent hopes for the child's future technology use, and feedback about the Plan & Play app. As a thank-you for their participation in both studies, each family received one gift card to Amazon for US\$150.

7.2.3 Data Analysis

I transcribed all parent-child Plan & Play sessions into field notes documenting participants' physical actions, interactions with the screen, and dialogue. I repeated this process for the follow-up session between child and researcher. All parent interviews were transcribed by a professional transcription service and spot-checked by the research team for accuracy.

I performed a holistic open coding of each set of transcripts and used this to develop a code book. After working with the research team to collaboratively narrow our focus to a subset of the most relevant themes, I conducted a directed coding to identify instances of each theme in each subset of the data. The final code book included codes about children's intentionality, parents' attempts to scaffold children's interactions, statements that children and parents made about the app's authority, parents' statements about the child's authority, children's responses to transition events, children's understanding of the interface, and parents' perspectives on parental controls, child autonomy, child compliance, and children's technology use. A second researcher coded a randomly selected subset of the data for comparison; nearly all codes matched, and disagreements were discussed until consensus was reached.

7.3 RESULTS

7.3.1 Children's Intentionality

As children used the app with their parent to construct a plan, they consistently showed evidence of using it with purpose to achieve specific objectives. All children showed this intentionality during the process of selecting the apps they wanted to play. In some cases, children narrated their choices as they made them, saying things like, "*I love these apps! I wanna play this one*" (C7), or "*I want to play...(pause)...this (pointing to app)*" (C10). Many children scrolled slowly through the full list of apps with their index finger hovering over the screen, appearing to search carefully for specific app icons. In one instance, the app crashed after the child

had finished selecting her apps to play (C17) and then restarted. The child re-selected the same apps, suggesting she was making choices with intention and not at random.

All children engaged in activities like scrolling past apps without selecting them and saying things like, *“That’s not one I want to play”* (C2), and announcing when they had finished making their selections. Many children showed this same intentionality as they ordered apps and specified their duration. These children said things like, *“I wanna do equal time [on each]”* (C11) while specifying each app’s duration, and *“So I already played that one... maybe we can do that last, because I played it”* (C9) while ordering the list of apps.

As children described their intentions, they sometimes directed their statements to the adult they were with, saying things like, *“[I want] this one”* (C16). In other instances, children’s descriptions of their intentions took the form of private speech (Kohlberg, Yaeger, & Hjertholm, 1968) and were not directed at any audience, such as, *“I’ll spend two on that (pause) I want (pause) no. There we go. I think I’ll do (pause) I think I’ll do (pause) equal”* (C14). Thus, in a variety of forms, children’s statements demonstrated that they were making choices and doing so with intention. All 11 children made statements of this type when constructing their plans.

7.3.2 Parents’ Support for Children’s Intentionality

During the planning phase, parents’ language not only respected children’s autonomy but also actively encouraged it. Parents said things like, *“Let’s pick the [apps] you really, really want,”* (P1), *“So what would you like to play?”* (P2), *“How much time do you want to play Lego?”* (P10), *“Is that a good order now?”* (P14), and *“Are you happy with this?”* (P3). All 11 parents made statements throughout the planning process prompting their children to identify their own intrinsic interests and take ownership of constructing a plan built with intention.

In addition to encouraging children’s agency, parents also played a central role in helping children learn to use the app interface. Though all children were able to construct and execute a plan the first time they used the app, they did not do so in a vacuum, and parents’ behaviors were central to children’s interactions. A few children mastered all components of the UI spontaneously and without support, but many others looked to their parent for help at least once.

Across all 11 children’s encounters with the planning interface, parents collectively provided 96 different facilitation attempts to teach children to use these controls correctly. I coded the ways that parents scaffolded children’s understanding and found that their approaches clustered into eight different techniques, such as modeling the correct interaction, asking a question about the purpose of a control, or describing the intended interaction (Table 15).

Table 15. Plan & Play: Categories of parent facilitation with examples.

Intervention	<i>Mom adjusts time limit immediately to 15 without saying anything to the child.</i>
Modeling	<i>Dad reaches over and demonstrates reordering, saying, "Set the order like this, wheep!"</i>
Purpose Description	<i>"So you're telling each one how long you're going to play."</i>
Purpose Question	<i>"Which one do you want to play first?"</i>
Purpose Instruction	<i>"Pick which apps you would like to play."</i>
UI Description	<i>"So if you move that it will add more time and take away time from that."</i>
UI Question	<i>"Do you think you hit the next [arrow]?"</i>
UI Instruction	<i>"Just drag it left to right."</i>

Further, I observed that parents frequently provided multiple types of scaffolding and that the order in which they engaged in each type of scaffolding was not arbitrary. If a child did not engage in a productive interaction pattern after one attempt at facilitation, the parent would try another approach. Parents tended to move from more open-ended instructions to more explicit ones, ostensibly providing more hands-on support if the child continued to struggle. For example, in the following exchange, the parent supports the child in using the duration control (Figure 11.3) correctly but only after increasingly explicit attempts at facilitation:

- P9:** *"So do you want it to be 5 minutes on each one? Or do you want more time on one?"*
Child leans in, has her pointing finger out, but hesitates and doesn't seem to have a clear mission.
C9: *"I... want... one." (Doesn't touch the screen)*
P9: *"Ok. Which one do you want more time on?"*
C9: *"This one." (Points to the first app)*
P9: *"The building one? Ok, so if you move that" (pointing to thumb) "it will add more time" (pointing to first app) "and take away time from that" (pointing to second app)*
Child taps the thumb.
P9: *"Oh. Drag it."*
Child taps in several spots around the thumb and it jumps.
P9: *"Oh, drag it that way" (motions back and forth with her index finger demonstrating the drag).*
Child drags it smoothly and allocates more time to the app she had specified that she wanted to play longer.
P9: *"There ya go."*

To better understand the systematic pattern to parents' scaffolding attempts, I coded each instance of support that parents provided to children according to the eight themes I identified. I modeled parents' 96 collective facilitation attempts as a directed graph, with each type of scaffolding (purpose question, model, etc.) as its own node, and each sequential pair of facilitation attempts as a directed edge from the first type of facilitation to the type that followed.

I then ordered the vertices of the graph using the minimum linear arrangement algorithm (Charikar, Hajiaghayi, Karloff, & Rao, 2006), which assigns an ordering that minimizes the distances among nodes.

1. Purpose Description
2. Purpose Question
3. {UI Description, UI Question}
4. Model
5. Purpose Instruction
6. UI Instruction
7. Intervention

Figure 15. Plan & Play: Hierarchical order to parents' attempts at facilitating their child's understanding of the interface.

Because minimum linear arrangement does not account for directionality, I applied the sum back-edge modification (Kozma, 2012), which minimizes the amount of error introduced by backward edges. This approach showed that parents systematically applied facilitation strategies that followed the progression in Figure 15, consistent with the impression that parents' facilitation became increasingly more explicit if hands-off attempts failed.

7.3.3 Children's and Parents' Responses to Transitions

After planning out their play time, all children initiated and engaged in their planned play session. Using data from these sessions, I next examined children's interactions with and responses to the cues Plan & Play provided to support the user in sticking to his or her plan. Collectively, children encountered 41 transition points. In these cases, Plan & Play indicated that it was time to either move on to the next app or stop playing. In 31 instances, the child immediately responded to Plan & Play's cue and transitioned to the next activity without parent input. For example, a child transitioned from one app to the next on schedule as follows:

Countdown finishes for the second app and the Plan & Play dialog box appears.

P14: "Did you finish?"

C14: "Yeah, I did."

P14: "Nice."

C14: "Next is Toca!"

Child taps the "Start Next App" button in the dialog box.

In an additional five instances, the child did not make the transition immediately and instead spent a brief period of time continuing the current activity, then transitioned without parent intervention. In two instances, the parent did not give the child the opportunity to make this choice; when Plan & Play presented the cue, the parent intervened immediately and moved the child to the next activity before the child had a chance to respond. Finally, in three instances, the child ignored the cue and the parent eventually intervened. Thus, when children were given the space to manage the transition, 92% of the time they moved to the next activity in the plan with no intervention or prompting at all from the parent.

As children played through their plans, both children and parents made comments describing the Plan & Play app as authoritative. Parents said things like, “*So you get 8 minutes with this app*” (P2), “*It looks like your 6 minutes are up,*” (P9), and “*Ok, so now it says ‘Start Next App,’ so press ‘Start Next App’*” (P11), implying that the on-screen prompts should be followed. Children similarly said things like, “*It looks like we’re all done*” (C7) and “*I have 28 seconds*” (C14). Some children also made statements tying these directions to their original planning like, (laughing) “*This one’s gonna be only one minute, I did one minute for this one!*” (C1), though this was less common.

7.3.4 Usability and Follow-up

Children created a second plan during their follow-up session in which they taught a researcher to use Plan & Play. In their second encounter with these UI elements, children spontaneously performed the correct interaction with no support 88% of the time (53 out of 60 instances). Furthermore, children described their own actions and the controls they were using, saying things like “*[this is] how many minutes I play all the games together*” (C14) to describe the interface for setting the initial time limit, and “*This one you can also, like, move... which one you wanna play first*” (C9) to describe the screen for reordering apps (Figure 11.2). Though several children required parent support to use aspects of the interface the first time they tried it, 10 out of 11 children could either explain the purpose of all six controls or use them purposefully during this second encounter.

7.3.5 Parent Perspectives and Interview

In addition to analyzing observational data about children’s use of the app, I also analyzed parents’ responses to Plan & Play and their broader perspectives on their child’s media use. As one measure of parents’ interest in the app, I offered to delete the Plan & Play app off the device at the end of each session. All 11 parents who brought a compatible device declined, saying things like, “*Do you need to delete it?*” (P9) and, “*Actually, can you leave it?*” (P1). Two parents spontaneously told their child at the end of the session that they thought they should start using the app at home, saying things like, “*So did you like making a plan to play? Do you think we should do that when you watch a screen?*” (P2). I did not ask parents at any point if they would be interested in trying Plan & Play again or using it at home, but at the end of the study session, several parents spontaneously mentioned that they felt inspired to make planning a part of their screen-time routine, saying things like, “*After seeing this, I am definitely motivated to set that kind of a plan for him.*” (P10). And all 11 parents elected to take Plan & Play home.

During the interview, parents continually brought up the inevitability of their child's use of digital media now and in the future. Some parents framed this negatively, saying things like, *"I know she's gonna get way too much just because it's gonna be part of her world"* (P7) while others described this neutrally, saying things like, *"I know that as they grow older, since the schools use tablets and things like that, they're going to take notes on that"* (P8). Though their value judgments of the phenomenon varied, parents consistently said that they expect digital media of all kinds to be deeply embedded in their child's daily life as they grow.

As a result, a recurring concern for parents is the need for their child to eventually become capable of limiting their use of technology to appropriate contexts and quantities. When describing their hopes for their child's future use of technology, parents said things like, *"I hope that she'll be able to limit herself pretty well on how much time she's spending on screen time or tablet time"* (P9) and that, *"He should know, 'Okay, this is not the time to do it'"* (P10). Within this participant pool, parents believe technology is going to play an increasingly prominent role in their child's life, and that this prominence is going to require children to develop the discipline and awareness to use it thoughtfully.

All 14 parents said that they set bounds on their child's media use and feel this is important. I pointed out that Plan & Play solicits child input in setting these limits and asked parents, *"How would that kind of approach fit with your family's values?"* Though 13 parents explicitly said that it would be a natural fit, as they believe children should be part of the conversation, parents surfaced two different perspectives on how these limits should be enforced.

Some parents felt strongly that children need to be regulated by parents, saying things like, *"You can [try to] rely on kids being good...but they are not. In all honesty, kids will try to push the boundaries wherever they can"* (P2). A non-trivial minority of parents expressed this view, and explained that, while children's voices should be part of the limit-setting process, children cannot be trusted to adhere to limits. However, the more dominant view among participants was that children need a balance of both oversight and independence. These parents said things like, *"You have to trust a little bit that your kids are gonna make smart choices"* (P7). Of 14 interviewees, 9 said that in addition to soliciting children's input when setting limits, they also want their child to take some agency and responsibility in regulating their behavior.

Despite their proactive interest in giving children control, this second group of parents explained that compliance and self-determination, both of which they value, are in natural conflict. As one parent said:

"It's very hard to give her a sense of control in things, because, as a parent, you kind of just want them to do it the right way rather than do it their way in a lotta things. And so when I think

about it, I do want her to make her own choices...those are good skills to develop because then it's going to help her become self-disciplined rather than parent-disciplined.” (P9)

Similarly, another participant described the challenge of valuing both compliance and self-regulation by saying that:

“We definitely try to give them choices and let them decide. Sometimes it becomes really difficult because sometimes as parents we think that, ‘Okay, we are telling you something. Just do it!’” (P8)

Despite this tension, these parents felt that it is essential to give children some control over the limits they live by and the opportunity to self-regulate. As another parent explained:

“I feel like that’s...necessary in this generation. The sooner...he figures out where his limits are and where the boundary is where like, ‘Oh, I spent too much time and now I feel weird,’ or like, ‘I really wish I wouldn’t’ – it’s good for him to figure that out earlier.” (P4)

While these parents feel it is important for children to have bounds on the time they spend with entertainment media, they also feel that internalizing the ability to set and adhere to those limits is an important skill in the media-rich world that their children will inherit.

Parents surfaced this same theme in response to the open-ended prompt asking for positive and negative feedback about Plan & Play. Parents repeatedly said that the most useful aspect of the app from their perspective was its ability to give children agency and ownership within defined parameters. As P11 explained:

“I like the idea of us defining the time limit, total, but I like the idea of her deciding, within that time limit, what it is she can do, cause I think that’s good for just building up those planning skills and kind of giving her a sense of control.”

Others spoke about Plan & Play saying that giving their child some input into explicitly setting up limits “*might give her a sense of responsibility*” (P7), or would lead to “*a conversation about it [the limits]. I think he would prefer that*” (P3). Similarly, another parent echoed that the approach would provide a valuable blend of boundaries and freedom, saying, “*I really like the idea... because we can say ‘Totally you get this much time. It’s now your decision’*” (P10). The majority of parent participants felt that an experience that both encouraged limits and supported autonomy would align with parents’ values and appeal to children as well.

To further explore families’ likelihood of adopting such a tool in daily life, I also asked parents about their interest in and experience with parental controls. Even though parent participants want their children to use digital media within certain limits, very few currently use technology support to enforce these boundaries. For some parents, parental controls are both unnecessary and insufficient, as they believe children in this age

range require supervision. They said things like, *“Honestly, I don’t want him to be using technology at this age without me being around”* (P2), and *“We try to just keep a close eye on what they’re doing”* (P17).

For other parents, the idea of using parental controls had appeal, but their past experience with these tools has been too laborious or buggy. These parents described the controls they had tried as *“a hassle”* (P12) and said that they *“don’t have time really”* (P1), *“don’t know exactly how it’s set up”* (P9), and *“don’t really use those anymore as much as I did when we first got them”* (P4). They described their lack of useful tools as a problem that they expect to get worse as children grow, saying things like, *“I have no idea how I’m going to be able to control that as he kind of grows up, and to make sure that he’s kind of safe by playing these games”* (P3).

While these parents are interested in reinforcement from technology, they reported a generally negative experience with the options that they have tried and a sense that they are not fully aware of the options that are available. Despite their dissatisfying past experiences, seven parents had tried using parental controls and 13 reported that they would like to do so in the future, suggesting that among these participants there is widespread interest in this space.

7.4 DISCUSSION

7.4.1 Children’s Behaviors When Planning and Playing

Prior work shows that between the ages of 3 and 6, children have the capacity to engage in planning activities, and exercises that explicitly prompt planning are accessible and pedagogically valuable in the development of self-regulation (Bodrova & Leong, 2007; Epstein, 2003). Consistent with these recommendations for non-digital settings, all 11 children were capable of understanding and using the Plan & Play interface to make intentional choices about their playtime. Children made two different plans over the course of the study; for several participants, their first attempt required notable parent support, but by their second encounter with the interface, children were able to set a time limit, select apps, order them, and set a duration for each. However, the parents in our study provided attentive, hands-on support, and we do not know if children would have been able to navigate the interface or understand its purpose without this aid.

As they planned, all 11 children stated goals out loud and showed instances of initiative, the mediating factor in achieving gains in self-regulation through planning (Schweinhart & Weikart, 1997). This evidence of children making self-directed, goal-oriented choices about the structure and content of their play experience is of particular interest, because it demonstrates the possibility for the interface to nudge children toward the

autonomous behaviors that foster intrinsic motivation. While all children displayed purposeful decision making when selecting apps, a few participants did not show the same intentionality as they chose app durations, suggesting that their emerging understanding of order and magnitude could be a barrier to developing intentions about these components of their plan.

Finally, children understood the transition cues that Plan & Plan presented as they played and used these as a guide to adhere to their self-defined choices with minimal intervention. Both parents and children treated the app as a kind of third-party mediator. A few children referenced their own decision-making when they deferred to the authority of the plan.

7.4.2 Parent Perspectives on Child Autonomy

When I asked parents if they want their child to participate in limit-setting, nearly all participants said that they do. The majority of parents further said that they value giving children some autonomy in living up to these limits, and that they feel it is essential for children to practice self-regulating. However, they also reported that giving children the freedom to exercise autonomy and self-regulation is not always straightforward. Even parents who value such opportunities, explain that there is an inherent tension between giving children control and keeping children within bounds. The majority of parent participants reported that they value both, and that they struggle with the contradiction between them.

A minority of parents said that, though they want to solicit children's input when setting limits, they do not trust children to adhere to them without parent intervention. These parents reported wanting to maintain control over enforcing limits and did not place the same value on children's autonomy or opportunities for self-regulation. One contribution of this work is to identify these two distinct schools of thought among parents of young children.

Though I designed Plan & Play with the intention that children would have opportunities to proactively choose for themselves whether or not to comply with limits, it is clear from this small set of participants alone that the desire to foster children's self-determination is not universal among parents. I see the potential for Plan & Play to fit the lifestyles of families with diverse perspectives on this topic, and all parents proactively chose to bring the app home. However, future work remains to understand how families with these differing values and mediation styles use the tool in practice.

7.4.3 Parent Support

Independent of my exploration of self-regulation, I saw that parents played a central role in children's mastery of the UI. When children planned for the second time with a member of the research team, they were almost always able to work with all aspects of UI independently, but this was not true when they initially encountered the app with a parent. Many of our child participants' initial interactions were bolstered by support from their parents, and parents' facilitation attempts clustered into a taxonomy of eight techniques which they used hierarchically. Without prompting, parents spontaneously attempted to support their children with indirect techniques first and increasingly became more hands-on.

This progression is consistent with prior work in other domains demonstrating that providing instructions and support in a least-to-most intrusive fashion is an effective way of increasing children's learning (Doyle, Wolery, Ault, & Gast, 1988; Hilsen, 2013). Parents' spontaneous use of this hierarchy suggests that adults may have an inherent or learned awareness of how they can best support their children in mastering novel interfaces.

However, other work has shown that scaffolding children's use of digital media can be challenging (Takeuchi et al., 2011), thus it may be valuable to develop a formal theory to define effective practices for scaffolding child users. The systematic pattern to participants' successful facilitation suggests that this hierarchy is worth exploring as a general-purpose model for supporting novices learning to use new interfaces. Future work remains to determine whether the categories I report here and the progression participants followed are useful in other contexts.

7.4.4 Limitations and Future Work

I do not yet know what children's experiences with Play & Play will be like in the wild or with repeated use for a longer period of time. While it is likely that children will continue to be capable of using the interface, I do not know whether they will continue to respond to the app's cues or follow their own plans. It is possible that children will habituate to these cues and ignore them, or even that repeated instances of planning without follow-through lead to diminished self-regulation. Through a future field deployment, I intend to evaluate children's media use, autonomy, and self-regulation after extended use of Plan & Play. I hope that these efforts will enable me to characterize the habits children develop in response to this system, and the role that the family plays in this habit formation.

I conducted this study with a small number of families from a single geographic area, and I recruited from high-tech populations. I saw that the ways in which parents engaged in the interaction together with their children played a central role in the child's experience, and I do not know how different parenting styles, levels of parent involvement, parent familiarity with technology, or parent attitudes toward technology will change children's experience with Plan & Play. While the lab setting gave me the opportunity to perform a close and detailed study of users' interactions with the system, the contribution of these findings is knowledge of these users' values, mental models, and interactions, not a generalizable understanding of the effects of Plan & Play.

7.5 SUMMARY OF CONTRIBUTIONS

Today's preschoolers will come of age in a world where they have the opportunity to engage with digital media at almost any moment. Technology has the potential to support them in the challenging task of becoming self-regulated individuals who take advantage of all that technology has to offer, but who also proactively disengage from technology as they feel is conducive to their well-being. Current mediation tools are effective in setting and enforcing limits, but this restriction-only approach is unlikely to catalyze development of the regulatory skills children need to become responsible and independent digital citizens.

Here, I address T2 by presenting a system for guiding preschoolers in using digital media purposefully. These results show that, in the short-term, this system prompts intentionality and guides children in following through on these intentions. Parents play an integral role in determining the way children use and respond to digital media, and I show that, for most of the parents who participated in this study, the system directly addresses the tension they wrestle with as they strive to both set boundaries for their children and give children the opportunity to learn to set boundaries for themselves.

Chapter 8. Discussion

Across these studies, I have examined the ways in which families integrate technology into daily life and the ways in which the technologies they use can support them in engaging in habitual patterns of use that align with their own desires and values. Beginning with groundwork to investigate how families both encourage and limit technology use, I have developed two system-level interventions designed to support users in establishing intentional habits. Through this body of work, I have sought to build new knowledge to sensitize the design community to the needs of families, to model the systematic ways in which families experience ubiquitous technology, and to provide concrete examples of designs that simultaneously support both ubiquity and intentionality. In this chapter, I revisit my thesis statements in the context of the results from these collective projects.

8.1 UNDERSTANDING FAMILIES (T1)

8.1.1 The Importance of Autonomy

Several cross-cutting themes emerged from these formative studies and deployments. First, I repeatedly saw that autonomy is central to forming intentional habits. Children work harder to stick to limits that they have helped to set (Chapter 5), toddlers are more resistant to transitions when they are imposed by parents (potentially posing a threat to children's autonomy) than when they come from technology (Chapter 4), and parents feel that it is essential that children learn to define boundaries for themselves (Chapter 7). While the role of autonomy in self-regulation is already well-understood, my work demonstrates the relevance of this relationship to interface design for limit-setting. Together, my results show that designing for intentionality requires designing to empower—rather than control—the user, even when the user is a child. Today's parental controls offer restrictions, but I am excited to evolve this design space to center on mentoring children and promoting their autonomy and self-efficacy.

8.1.2 The Importance of Interdependence

Second, I found that family members do not make decisions about their technology use as isolated units, but as a function of their own interests interwoven with the demands of others. Parents report that they minimize

smartphone use while spending time with their children, because they feel it enables them to be more responsive and to provide necessary supervision (Chapter 3). Children report that they adopt the technology rules outlined by their parents and that they believe parents and children alike should feel obligated to unplug when spending time with each other (Chapter 5). Parents of young children find that both their own technology use and their children's technology use provides them with a break from the tedium and the demands of parenting, but they consider this a concerning conflict of interest and intentionally turn off screens (both their own and their child's) for their child's benefit (Chapter 4). These studies consistently show that personal policy setting is a function of interdependencies among family members. This suggests a need for family-centered design practices in which supports are designed with input from all family members and design methods probe individuals' sense of obligation toward one another.

8.1.3 The Importance of Context

Third, my work shows the importance of context in establishing limits and policies. Historically, studies of families' rules and expectations around technology use have documented that families set limits on how much time children can spend with technology and what kinds of content they are allowed to consume (Davis, 2012; Livingstone & Helsper, 2008; Vandewater, 2005). Today, the context in which children use technology is a concern that accounts for roughly half of all family policies on this topic (Chapter 5). The personal and portable nature of newer technologies has shifted the dynamics of family technology use, which was once centered around spaces in the home carved out for media use, such as communal television viewing or dedicated office space for desktop computers (M. Morrison & Krugman, 2001). As a result, the limits families create now emphasize where, when, and with whom technology can be used. These expectations apply not only to children but also to adults.

Not only are policies about context pervasive, they are also a challenge. Children report that they have a harder time complying with rules about context than rules about what they are permitted to do with technology. Parents and children alike report that challenges living up to context-specific rules are the greatest source of technology-related parent-child conflict (Chapter 5). Parents also report that they have different ideals for their own use of technology when they are spending time with their children, and a plurality of participants said that they struggle to live up to this self-defined context constraint (Chapter 3). Many of the adults I surveyed reported that the most pressing way in which they would like to change their usage behavior was context-specific, and the knowledge that an individual was "context-focused" enabled me to predict how they would respond to the interventions I designed (Chapter 6). Together, these results show that supporting

families in establishing boundaries they feel good about requires supporting limits that are flexible, dynamic, and context-specific.

8.1.4 Beyond “All-or-Nothing”

Similarly, families reported that nuanced expectations for technology use are harder to abide by than hard-and-fast rules. Younger children were able to disconnect from technology when it was routine but struggled to transition in more flexible situations (Chapter 4). Older children struggled with context constraints but found activity constraints to be relatively easier to live with (Chapter 5). Parents reported that they took extreme measures to enforce boundaries on their own use, like locking their phone in car (Chapter 3). This all-or-nothing approach to managing technology engagement is unfortunate, as it leaves the “all” users with a lack of agency over their own behaviors and the “nothing” users unable to take advantage of aspects of technology use that they value.

As technology becomes increasingly pervasive, it will become increasingly useful for families to feel confident in their ability to set nuanced policies that shift with context, allow for exceptions, and enable children to engage with technology without extreme use or non-use. For modern families, setting nuanced, context-dependent rules is a struggle, and all-or-nothing limits that ban or permit all use are easier to comply with. These findings make clear that there is an underexplored design opportunity to reduce all-or-nothing approaches to technology use.

8.2 DESIGNING FOR SELF-REGULATION (T2)

In addition to building new knowledge about families’ practices and desired behaviors, this dissertation explores how the design of technology itself promotes or hinders self-regulation. Parents of toddlers reported that autoplay and next-video suggestions undermine their child’s ability to self-regulate (Chapter 4), suggesting one mechanism by which design choices erode users’ intentionality. Adults consistently said that social media and casual games entice them into patterns of behavior they would like to change (Chapter 6), suggesting that systematic design elements common to these types of experiences undermine users’ ability to self-regulate.

These studies also suggest that concrete design elements can *promote* self-regulation. My taxonomy of non-use intervention styles describes design approaches for promoting intentionality that could apply across a wide variety of form factors and experiences. My deployment results reveal that users are open to several of these

design styles, and that, in practice, these approaches are effective in bringing users' behaviors closer to their professed intentions. Surfacing information about usage, prompting users to reflect on their own intentions and the broader context in which their technology use is situated, and reminding users of their goals in the moment were each effective in shifting habits and catalyzing behavior change. This suggests that design has the power not only to erode but also to promote intentionality, and that those creating new technologies can choose to undermine, remain agnostic to, or promote users' self-defined limits.

My work designing for preschoolers' intentional use of technology (Chapter 7) further shows that designers can draw inspiration and guidance from evidence-based practices in other domains. Existing pedagogy to teach self-regulation translated into concrete design choices, such as prompting goal-setting, highlighting progress against goals, and supporting reflection. These were effective in surfacing children's autonomy and promoting goal-directed behaviors. These results suggest that existing research on human motivation and intentionality provides a blueprint for building systems that support users in engaging with technology with intention.

Some existing, commercially available tools for adults provide non-use supports that are similar to those I found to be effective. But tools to promote children's non-use are uniformly designed for restriction, not intentionality. For me, the most exciting take-away from this dissertation is the clear design opportunity to create supports that mentor children in becoming thoughtful, self-regulated technology users. Choosing what technologies to use, how much time and energy to invest in these experiences, and how to engage with others through them, are all complex skills that today are highly relevant to daily life. I look forward to reimagining what parental controls might be and designing new tools to support parents in mentoring their children through the process of integrating technology into daily life in diverse and meaningful ways.

8.3 CONTRIBUTIONS

The first contribution of this work is to document design opportunities for supporting families in managing their use of technology. To date, much of the research in this space has focused on restricting children's media exposure. The studies outlined here take a family-centric view, and I document both children's and parents' perspectives about technology use, goals, frustrations, and ideals, and the ways these change as children grow. They also present details about parents' technology use. I hope that this will present a more comprehensive set of design opportunities that consider the needs and interactions of all family members.

The second contribution of this work is the creation of design artifacts and empirical evidence documenting how users respond to these artifacts. MyTime and Plan & Play demonstrate instantiations of specific design ideas, and I hope that these will serve as inspiration to others. By linking these interfaces to underlying design guidance and user responses, I contribute new knowledge about predictive relationships between specific design choices and user behaviors.

Finally, both my formative and deployment studies contribute new theoretical ideas which I will continue to develop in future work. New constructs like the parent profiles I describe in Chapter 3, the activity and context constraints I describe in Chapter 5, and the reduction-focused and context-focused users I describe in Chapter 6, all help to model this space and give the research community new structure to build on. The taxonomy of intervention styles I present in Chapter 6 provides design guidance for those interested in creating novel tools for non-use. The predictive relationship between technology mediation and children's transitions that I document in Chapter 4 provides theoretical guidance to those designing in this space. I hope that these contributions extend current sociotechnical theories of use and non-use and help the HCI community better serve individuals in establishing usage habits with which they are satisfied.

8.4 FUTURE WORK

Several clear next steps emerged from this work, and I am excited to continue to build on the foundation I describe here. First, the two interventions I have designed are both system-level tools for promoting intentionality on a macro scale. I have created experiences for users that nudge them to consider the broad ways in which they want to engage with mobile devices. However, my formative work suggests that micro-level design choices built into usage experiences that people engage with may be at least as effective in supporting intentionality. What UI features of social media and casual games lead users to consistently engage with these apps in ways they wish they could change? Can designers build natural stopping points into social media that support users in consuming this content in portions they feel good about? How does autoplay influence children's ability to self-regulate the video content they consume?

I plan to conduct future work to explore how isolated experiences like these can be designed to promote intentionality and to respect users' boundaries. I am currently conducting a deployment study of three different versions of a video player for preschoolers with targeted design changes intended to make these implementations, respectively, corrosive to self-regulation, neutral to self-regulation, and supportive of self-regulation. I look forward to making sense of how these design manipulations relate to children's behaviors.

Second, my work surfaced the influential role that context plays in determining what behaviors people find appropriate, suggesting a clear design opportunity to support context-specific habits and goals. Using light-weight sensing to determine contextual factors like location, co-located devices, or time of day, designers have the ability create persuasive tools that enable context-specific goal-setting. I look forward to conducting future work to explore the effectiveness of such techniques.

Finally, families' perspectives were necessarily colored by the cultural context in which they use technology. As western ideology discourages the use of technology in family contexts, it is difficult to tease apart the extent to which families' pushback against technology comes from past negative experiences with their own usage habits, and the extent to which it comes from the broader social climate in which they consider this topic. I am excited to investigate this further in the future.

8.5 CONCLUSIONS

Each day, the average American adult spends more than 10 hours with digital experiences (“The Total Audience Report: Q1 2016,” 2016) and checks their phone 150 times (Winnick & Zolna, 2016), generating advertising revenue for others as they do so. While these designed experiences enrich people's lives in countless ways, at times they also capture and hold people's attention when they say they would prefer to spend it elsewhere. Today, technology is designed with user engagement as a primary objective, but I see the potential for a more sophisticated future approach which respects and encourages both engagement and disengagement. By designing media offerings that funnel users toward behaviors that they are most likely to feel good about over the long term—rather than funneling users toward behaviors that maximize the amount of time they spend using a product—designers can create experiences that offer greater value. And by supporting people in engaging with digital experiences with intention, designers best serve users living in a world of ubiquitous computing.

This is particularly relevant in family contexts, where interpersonal dependencies, deep attachments, behavior modeling, limit setting, shared authority, and responsibility for one another's well-being are all salient concerns. With the ability to engage with technology at any moment, learning to self-regulate media consumption has become an essential life skill. Parents are tasked not only with finding this balance for themselves, but with supporting their children in doing so as they grow up in a media-rich world. Cultural conversations that stress the dangers of technology only make this task more daunting.

Here, I show that designing to support families in finding the balance of technology use that feels best for them demands respect for: autonomy of all family members, the interpersonal nature of the boundaries families set, and the continually shifting context that surrounds families' technology use. I model this space by describing clusters of parenting values, categories of family policies, and factors that predict smoother transitions to and from digital experiences. I present designs to promote intentionality and empirical evidence documenting how these systems influence users' behaviors. And I outline much that remains to be done.

My findings show that designers have the power to create experiences that erode or support users' intentionality, and I present concrete mechanisms by which they can do so. Technology is only going to become more embedded and essential to daily life, making it vital that users are able to engage with these experiences on their own terms.

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