Missing Out on Life: Parental Perceptions of Children's Mobile Technology Use

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Abstract. Mobile devices have become an integral part of everyday life due to their portability. As literature shows, technology use is not only beneficial but also has dark sides, such as addiction. Parents face the need to balance perceived benefits and risks of children's exposure to mobile technologies. However, no study has uncovered what kind of benefits and concerns parents consider when implementing technology-related rules. We built on qualitative responses of 300 parents of children aged two to thirteen to explore concerns about, and perceived benefits of children's smartphone and tablet usage, as well as the rules parents have developed regarding technology use. Findings point to concerns regarding children's development, as well as benefits for both children and parents, and ultimately to new insights about mobile technology mediation. These results provide practical guidance for parents, physicians and mobile industry stakeholders, trying to ensure that children are acting responsibly with mobile technology.

Keywords: Mobile Technology, Smartphone, Children, Parental Mediation, Rules

1 Introduction

Whether it is television, gaming, or the Internet - the entry of new technologies into households has always brought new discussions and uncertainty about if and how these technologies might impact family dynamics and influence the development of young family members [1]. The arrival of smartphones and tablets, however, has brought these discussions to a new level, sparking fierce debates among the proponents and opponents of early childhood exposure to technology [2]. Indeed, recent evidence suggests that 42% of U.S. children age eight and under already own a tablet [3], and spend up to 8.5 hours per day on technological devices [4], suggesting that a significant share of leisure time has become screen time. Importantly, schools routinely introduce tablets as a new teaching medium, exposing children to such technology at an early age [5].

While children's interaction with technology is often justified with the educational benefits (e.g., learning apps), the intimate connection children have with new mobile

technologies is also fueling parental concerns about the developmental effects of this use, as well as the exposure of children to inappropriate content, advertisements, predators and other potential risks [6], [7]. Current research supports the validity of these parental concerns, demonstrating an association between excessive screen time and a range of adverse outcomes, including negative effects on children's cognitive, socio-emotional and physical development [8]. Among other concerns, smartphone use during early childhood has been linked to undesirable consequences such as behavioral problems, impaired self-regulated learning [9], decreased sleep duration and quality [10], as well as dry eye syndrome [11]. Recognizing the graveness of these consequences, the World Health Organization (WHO) has recently drawn attention to the negative health-related outcomes of increased sedentary screen time among children. According to the new WHO guidelines, children under five should spend less time watching screens and, instead, have more time for active play [12]. In an attempt to circumvent dysfunctional technology behavior [13], [14], yet maintaining the benefits of technology, parents are facing the tricky challenge of establishing and enforcing rules regarding their children's technology use.

Current research offers only limited insights into *how parents regulate* their children's interaction with smartphones and tablets, or into *the nature* and *the magnitude* of *parental concerns* about and *perceived benefits* of these devices. So far, existing studies on parental mediation have mainly focused on stationary technology, such as television [15]. However, smartphones and tablets differ significantly from a traditional TV since they allow users access to an unlimited variety of content and applications anytime and anywhere [16]. In light of these differences, understanding parental perspectives on children's smartphone and tablet use is important. Additionally, parenting behaviors are critical determinants of children's excessive use of technology [17] and, in general, affect child development outcomes [18].

In this study, we aim at making first strides toward addressing this research gap. We specifically set out to explore parental perceptions of child smartphone and tablet use, including *the parental concerns and the perceived benefits of providing children with access to mobile technology at an early age*. We further investigate the *rules and strategies parents establish in order to guide children's use of mobile technologies*.

By addressing these pressing research questions, this study advances our understanding of children's technology use. Our work specifically extends prior research on the antecedents of mobile technology use, with an emphasis on the parent-child interaction. Thus, we contribute to a growing body of Information Systems (IS) literature that focuses on the cognitive and emotional aspects of information and communication technology (ICT) adoption [19], [20]. We expand existing insights into children as users of technology. This age segment represents an increasingly important, yet vulnerable group of technology users, which current IS research has now started to study as a user group [17]. This way, this study provides a basis for future investigations of children's use of technology, effectiveness of parental strategies, as well as interventions to reduce potential harms of early technology exposure. On a practical level, this study has multiple implications for a variety of stakeholders, including parents, app developers, educators, clinicians and policy-makers.

2   Related Work

Parental involvement in children's technology use has been the focus of various studies, because it determines how children learn, play and develop in interaction with such devices [21]. Referred to as "any strategy parents use to control, supervise, or interpret [media] content" [22, p. 212], parental mediation has been mainly studied in the context of children's television use so far. In this context, research generally distinguishes between three types of mediation strategies: *restrictive mediation, active mediation, and co-use* [23]. Restrictive mediation includes parental rule-setting regarding the duration and frequency of children's technology use as well as content restrictions [24]. Active mediation describes parental attempts to engage in direct and indirect conversation and reflection with their children about technology and the content they may be exposed to [25]. Lastly, co-use refers to the joint consumption of media without the necessity of discussing the content [14], [25].

However, mobile technologies, such as smartphones and tablets, differ from stationary technologies in a number of ways. First, access to a myriad of apps allows for a versatile experience, ranging from education and communication to entertainment [16]. Second, mobile technologies provide users with unlimited content, which is increasingly tailored to their needs and preferences [26]. Importantly, the presentation of this content is frequently optimized to extend user time on site [27]. Third, the portability of mobile technologies allows for user interactions anywhere and at any time [28]. As a result, mobile technologies support diverse user goals or values [16], but also confront caregivers with new challenges [14] that require new approaches to mediation.

In the mobile technology use context, *technical mediation* emerges as an additional form of parental regulation [7], [17]. This strategy involves the use of technical controls to monitor children's use of digital technologies, allowing parents to put restrictions on both the time children spend with the device and the content they are exposed to, as well as to track children's online behavior and physical movement offline. Furthermore, Venkatesh et al. [17] point out parental *monitoring/supervision*, defined as surveillance of the child, and *unstructured time*, defined as providing freedom and opportunities for responsible behavior, as parenting behaviors influencing children's technology usage.

Importantly, parents differ in whether they tend to restrict or enable the use of technology, and the extent to which they implement a combination of the mediation practices depends on their child, their circumstances and their values [7]. Parental attitudes towards technology have been established as important determinants of parental decision-making and mediation behavior [24], [29], also in the mobile technology use context [6], [30]. These attitudes, in turn, might be determined by parents' subjective values or evaluations of the technology [31], mainly the perception of risks and benefits of children's exposure to it [32]. Specifically, parents with negative attitudes regarding children's technology use have been shown to be more likely to regulate their children's screen time [4]. These parents may anticipate the infringement of their values and act proactively in order to avoid dysfunctional technology behavior [33]. In contrast, parents with positive attitudes exhibit less parental mediation, which results in longer screen time for children [34]. Despite the risks that parents perceive, families generally ascribe mobile technologies a positive impact on daily life and well-

being [35], and, indeed, some features of mobile technologies are beneficial to children (e.g., increase of social capital, factual learning) [36], [37]. Research shows that parents have a wide range of motives and values when it comes to their children's mobile technology usage [34], while, at the same time, expressing uncertainty about how to best adopt new technologies [38]. Overall, existing insights into the tensions surrounding children's mobile technology use, as well as the ways in which parents resolve these tensions, remain limited. To shed light on these parental perceptions, we conducted a qualitative study which will be explained in the next section.

3 Qualitative Study

3.1 Study Design and Sampling

An online survey with open-ended and closed-ended questions was conducted on Amazon Mechanical Turk, which has become an established survey tool for data collection in IS research [39]. The survey was targeted at parents of children aged two to 13. Using this platform allowed us to gather respondents with the premium qualification parenthood and the location United States. Only respondents with a HIT approval rate greater than 98% and a number of HITs greater than 500 were accepted. Participants received a monetary incentive of one U.S. Dollar for participating in the study. All responses that failed quality control were removed after the data collection [39]. To investigate parental mediation strategies, we asked *"Please indicate the most important rules/strategies you use for [child's name]'s smartphone and/or tablet usage"* (Q1). Parental concerns with regard to children's mobile technology use were elicited with the question *"Do you have any concerns regarding the smartphone/tablet usage of children?"* (Q2), and perceived benefits with *"Which advantages arise from the smartphone/tablet usage of [child's name] for you, your family or your child itself?"* (Q3). Parents were asked to focus on one of their children and the questions were adapted to the child's name in order to elicit more concrete answers. If parents indicated that their child is using neither smartphone nor tablet, they were only asked for their concerns, not for applied rules or perceived benefits.

The final sample consisted of 300 parents with children aged between two and 13 years: 15.3% with children two to five years old, 66% with children six to nine years old, and 18.7% with children between ten and 13. The majority of children (54.3%) was male (46.3% female, 0.3% diverse). The average age of parent respondents was 37.4 years and 61% of parents were female (38.7% male, 0.3% diverse). The majority was university-educated (60.7%) and married (74.0%). 290 parents (96.7%) indicated that their child used a mobile device. Of these children, 245 (84.5%) used a tablet, whereas 158 (54.5%) used a smartphone. 94 (32.4%) already owned their own smartphone and 182 (62.8%) their own tablet, whereas 50 children (17.2%) owned both devices. 22.1% of children used the mobile devices of parents, siblings or other family members. On weekdays, most children spent between 30 minutes and one hour with their devices (37.6%) and between one and two hours on weekends (32.8%).

3.2 Data Analysis

Guided by existing literature on parental mediation of children's technology usage [7], [17], answers to Q1 were analyzed with the help of a deductively derived coding scheme [40], which consists of six mediation strategies. The responses were first coded by the authors of the study, and an independent coder was subsequently trained to ensure the reliability of the coding. Since previous research does not offer a systematic view on parental concerns and perceived benefits in the context of children's smartphone and tablet use, we conducted an inductive content analysis to derive coding schemes [40]. Prior research on child development [41], [42] and parent-child perception of technology [29], [43] informed our decisions in the process of coding and merging codes into higher-level categories. For example, we draw on the classification of child developmental areas [42] to derive concerns relating the cognitive, socio-emotional and physical development of the child. Finally, seven categories of concerns and two categories of perceived benefits emerged, and theoretical saturation was reached [40]. Coders were permitted to code single units of analysis into several categories. To take account of the one-to-many coding approach, we determined inter-coder reliability based on Kirilenko and Stepchenkova [44] and calculated fuzzy kappa, an extension of Cohen's kappa. A comparison of the coding revealed a high inter-coder agreement of 0.80 for Q1 and 0.86 for Q2 and Q3, respectively. In cases of disagreement, the coders came to a final decision on the attribution of a code by consensus.

3.3 Results: Parental Smartphone/Tablet Rules and Strategies

Our analysis confirmed six mediation strategies, as summarized in Table 1. In line with Blum-Ross and Livingstone [7], these strategies can be condensed into the two overarching categories *restrictive mediation* (90.9%) and *enabling mediation* (9.1%), which, in turn, can be either of *social* (93.8%) or *technical* (6.2%) nature. The category *"other"* includes answers which were too vague to capture a specific strategy or were outside of the identified categories. Out of the 290 respondents who indicated that their child is using a smartphone or tablet, only 2.1% reported not having any strategy regarding the device usage of their children. In total, parents mentioned 476 rules and strategies, with respondents, on average, adopting 1.7 mediation strategies.

We found that the majority of parents engaged in *restrictive* mediation. In accordance with Hiniker et al. [13], parents did not only establish rules regarding the *duration and frequency* of device usage (34.5%) or the *activities* and behaviors children are allowed to engage in while on the device (23.1%), but they mainly set rules about the *context* (78.6%) in which technology can be used. For example, one respondent stated: *"All schoolwork and chores have got to be completed before playing games. He has to spend some time with the family. No phones during mealtimes as a family"*. Besides these social forms of restrictive mediation, 5.2% of parents made use of *parental controls* as technologically enabled restrictions. These include child-specific devices, profiles and software (e.g., YouTube Kids) as well as software to limit the time

on the device, or the content that can be accessed. Furthermore, time and content can be restricted based on the time of day or the time already spent on specific apps.

Table 1. Coding scheme for smartphone/tablet strategies and share of respondents (in %)

	Main categories with key subcategories from coding (selection) & share of respondents, in % (N=290)				
	Social mediation			Technical mediation	
Restrictive mediation	*Context constraints*	78.6		*Parental controls*	5.2
	No technology in certain contexts/until certain obligations are fulfilled	(228)		Parental content filters, content restrictions via apps, time limiting apps, child-specific devices and profiles	(15)
	Time constraints	34.5			
	Fixed time limits (e.g., for one hour)	(100)			
	Activity constraints	23.1			
	Only educational/pre-approved content	(67)			
Enabling mediation	*Active supervision*	9.6		*Monitoring*	4.5
	Usage only within parents' sight/in public spaces, checking content in real-time, device presented on demand	(28)		Screen monitoring apps, checking apps/browser history, share passwords	(13)
	Other				8.6
	No excessive use, self-responsibility for devices, no arguing				(25)
	No rules/strategies				2.1
	No fixed rules, free availability of the device				(6)

Parents aiming at enabling smartphone and tablet use, mainly made use of *active supervision* (9.6%). Supervision can take place by allowing usage only in sight of a caregiver, by parents either using the device together with the child, or by demanding to check the children's activities: *"She must show us what she is watching or doing at any given time"*. 4.5% of parents applied digital technologies for *monitoring*. This includes checking the child's browser history and installing screen monitoring software. Some parents have their children access websites through parental accounts, download apps with the parents' digital signature or have them share their passwords.

3.4   Results: Parents' Concerns about Children's Smartphone/Tablet Usage

As depicted in Table 2, we identified seven parental concerns on two different levels. First, parents expressed *concerns regarding the immediate risks* children are exposed to while on the device; we named this category *"proximal concerns"*. Specifically, three proximal concern subcategories emerged from the data: content, time, and contact concerns. Second, parents expressed *concerns regarding the long-term, abstract and less deterministic harms* that may result from children's exposure to these risks, namely addiction, physical, cognitive, and socio-emotional concerns; we named this category *"distal concerns"*. Some answers were too vague, so we captured them in the *"vague concerns"* category (e.g., *"I wish it weren't so prevalent"*). 270 (90.0%) parents indicated having at least one concern about their children's usage of smartphones and

tablets, while 27 (9.0%) parents reported not having any concerns at all. In total, parents expressed 408 concerns, and on average, each respondent reported having 1.5 concerns.

Table 2. Coding scheme for parents' concerns and share of respondents (in %)

Main categories		Key subcategories from coding	Share of respondents, in % (N=300)
Proximal concerns			
Content concerns		Sexual, violent, scary, silly content, misleading information	30.7 (92)
Time concerns		Too much time, use in moderation, necessity of screen time limits	12.7 (38)
Contact concerns		Communication with and personal information to strangers, online predators, security and safety	7.7 (23)
Distal concerns			
Addiction concerns	Dependency	Obsession, attachment, addiction	13.3 (40)
	Neglect	Neglect of other things (e.g., schoolwork), loss of interest, inactivity, missing out on life, less fun/not functioning in real-life situations, not experiencing being a kid	9.3 (28)
	Absorption	Getting sucked in by electronics, being detached from the world, less awareness of surroundings	2.7 (8)
Physical concerns	Activity	Less outside play, less active, sedentary	12.0 (36)
	Physical health	Health issues, impaired vision, posture and motor skills	6.7 (20)
	Other	Radiation, harmful headphones	1.0 (3)
Cognitive concerns	Cognitive development/ learning	Impaired brain development, learning ability and thinking, impaired ability to perform tasks, impaired creativity/imagination, speech deficits	10.0 (30)
	Attention deficits	Decrease in attention span, impaired ability to concentrate on complex tasks	2.3 (7)
	Other	Instant gratification, overstimulation, autism	2.0 (6)
Socio-emotional concerns	Decrease of in-person interactions	Decrease of social time/play, less observation of in-person interactions, isolation, less socialization, distancing from family members	7.0 (21)
	Impaired social skills	Impaired social/communication skills, affecting relationships, imitation of consumed content and slang/adult language, antisocial behavior	4.7 (14)
	Other	Anxiety, frustration, impaired emotional competence	2.3 (7)
	Vague concerns	General social media usage, harm, general negative effects	11.7 (35)
	None	No concerns	9.0 (27)
	Not applicable	No/wrong answer	1.0 (3)

Proximal Concerns. Many of the 408 concerns referred to the immediate risks (37.5%) children may be exposed to. Parents feared exposure to *inappropriate content* (30.7%), including violence, pornography, scary or just silly material: *"Children are very impressionable, and the internet has a lot of misguided information"*. Parents were also concerned about their children coming into contact with age-inappropriate advertisements. Furthermore, parents mentioned concerns regarding the *amount of time* children spend with mobile technology (12.7%), assuming that too much time with a mobile device may be harmful. Finally, parents expressed a range of concerns related to children coming into *contact with strangers* online and disclosing personal information to people they do not know (7.7%): *"[...] the number one reason [to be concerned] is because there are disgusting people out there that can ruin it for them"*.

Distal Concerns. 53.9% of total concerns were expressed with regard to potential long-term and less deterministic harms. Above all, 76 parental concerns dealt with addiction, including its typical behavioral symptoms, such as dependency, neglect of activities, and absorption [45]. Specifically, a number of parents were concerned that the interaction with smartphones or tablets would make their children *"addicted"*, *"obsessed" or "dependent"* (13.3%). Parents were afraid that excessive use might lead to their children *neglecting* (9.3%) more valuable activities, such as homework. Furthermore, parents worried about their children losing interest in their offline environment and, as a result, missing out on real-life experiences: *"I worry that if they focus too much on electronics, they will miss the fun of just being kids and playing"*. Parents feared that their children might become too *absorbed* (2.7%) by the technology and would not pay attention to their surroundings. Additionally, parents expressed 59 concerns about potential physical consequences, 43 concerns about cognitive consequences and 42 concerns had to do with socio-emotional consequences.

Physical Concerns. 12.0% of respondents were concerned about time taken away from *physical activity*: *"I sometimes feel they spend too much time just sitting around and not getting enough exercise"*. 6.7% of parents feared *physical health* effects, with parents worried most about their children's eyesight: *"I never had that as a child, so I'm concerned about his eyes. It may be a myth that watching too close to the TV hurts your eyes, but when the tablet is just inches away, it bothers me"*. Some parents also feared that their child's posture and fine motor skills might be negatively affected.

Cognitive Concerns. Parents also expressed concerns about the impact of digital devices on their children's cognitive skills, with the majority of responses relating to *cognitive development and learning ability* (10.0%): *"I am afraid of how it is affecting their brains"*. Parents also worried that their children's creativity and imagination might suffer and feared deficits and delays in their children's linguistic development. Finally, parents were also worried about possible *deficits in children's attention* (2.3%), primarily a decrease in attention span: *"I am concerned that it is affecting her attention span and ability to concentrate on complex tasks"*.

Socio-emotional Concerns. Our respondents were also concerned about the socio-emotional repercussions of smartphone use, including concerns regarding *impaired social skills* (4.7%) and *a decrease of in-person interactions* (7.0%). Parents were concerned that time spent on the smartphone or tablet would leave less room for offline

interaction and would therefore lead to social isolation: *"The kid doesn't have socialization as it's just locked into the screen all day"*. Additionally, parents feared that children might not be able to develop appropriate social and communication skills or build social relationships outside the online world: *"I worry that they will not develop the ability to communicate and enjoy each other without the use of a device"*.

3.5   Results: Perceived Benefits of Children's Smartphone/Tablet Usage

Our analysis revealed that out of the 290 parents whose children had access to a smartphone or tablet, 280 (96.6%) parents cited a large set of benefits as a reason for providing their children with mobile devices. These benefits were grouped into two categories: five benefits parents perceived *for their children* and two benefits *for the parents* themselves, presented in Table 3. Parents expressed 462 benefits, with 75.1% being about their children and 24.9% of benefits relating to the parent. On average, each of the 280 parents reported perceiving 1.7 benefits.

Table 3. Coding scheme for perceived benefits and share of respondents (in %)

Main categories		Key subcategories from coding	Share of respondents, in % (N=290)
Children's benefits	Education/skill development	Skill development, rapid learning, support with schoolwork, exposure to new knowledge, ability to know more, real-time information	66.9 (194)
	Technology literacy	Familiarity with technology, being up to date/comfortable with technology, introduced to technology at an early age, learning to type fast/how to navigate and find information	16.2 (47)
	Entertainment/ enjoyment	Not getting bored, distraction from life, having fun, being entertained	16.2 (47)
	Socialization	Socialize with family/friends, bonding, keeping in touch/keeping up socially with other kids, support for children with special needs (e.g., muteness)	7.9 (23)
	Relaxation	Calming down, relaxing, quiet time, escape	4.5 (13)
	Other	General cognitive development, independence, help with developmental problems, focusing	7.9 (23)
Parental benefits	Parental leisure time	Keeping the child busy/the house calm, no distractions, getting things done, free time for parents, child stays out of trouble/indoor	22.4 (65)
	Reachability	Ease of contacting parent/child at any time, keeping in touch, location tracking	10.3 (30)
	Other	Facilitating homework, technical support for parents, reward, incentive	6.9 (20)
	None	No benefits	0.7 (2)
	Not applicable	No/wrong answer	2.8 (8)

Children's Benefits. The main reason parents provided their children with smartphones and tablets was the perceived *educational* benefit (66.9%). Parents feel that children are able to develop and solidify a broad range of skills with the help of technology and identified the following domains in which mobile technology benefited their children: math, speaking and spelling, reading, art, communication, creativity, problem solving, productivity, decision making and fine motor skills. Parents also mentioned *technology literacy* (16.2%) as a skill the interaction with mobile technology may develop. They emphasized that, in their opinion, being familiar with technology at a young age and knowing how technology works are necessary skills to be able to keep up with future technologies: *"She has to understand how such things work in order to fit into society"*. *Entertainment/enjoyment* (16.2%) as a benefit was often mentioned in relation to specific activities children enjoyed doing on the device. Most of the parents accepted entertainment itself as a valuable activity and as a way to keep children from getting bored: *"Use of his tablet keeps him from becoming bored and simply watching TV for extended periods of time"*. Interestingly, parents awarded their children entertainment time when they themselves needed some child-free time. Parents also named children's ability to *socialize* (7.9%) via mobile devices. Smartphones and tablets facilitate connection and communication with others, which is beneficial according to parents, since it makes it easier to keep in touch with family and friends. Parents also see smartphones and tablets as a source of *relaxation* (4.5%) that give a child time to wind down: *"It allows her some time to get away from having an active brain while at school for several hours"*.

Parents' Benefits. Parents admitted that the smartphone and tablet use of their children not only benefits their children, but also themselves. The parental benefit of children's independent engagement with the device which was most frequently mentioned was *parental leisure time* (22.4%). These devices provide parents with free time that allows them to accomplish other tasks (e.g., doing chores) or simply relax: *"I appreciate having a little bit of a break when he's on the tablet. I can get some work done, or just have a few minutes of silence"*. At the same time, the portability of these devices provides the possibility of constant *reachability* (10.3%) for both the parent and the child: *"She is able to go to a friend's home or to the park and I can reach her when I need to"*. The fact that their children are able to contact them in case of an emergency also brings parents a sense of safety.

4 Discussion

This study is the first step in providing an in-depth understanding of the positive and negative consequences of mobile technology use as perceived by parents. It is important to understand how parents expect mobile technology to affect their children, since these expectations serve as motivators for parental mediation [30]. A better grasp of parental views on children's technology use can inform future research aimed at understanding when and why some parents do and others do not engage in various parental mediation strategies. Our results suggest that parents do not believe children's mobile technology

use to be either strictly beneficial or concerning, but rather, they face the need to constantly balance a variety of perceived benefits and concerns.

Our work extends research on children's use of mobile technology in several ways. First, we add to prior research on parental mediation of children's technology use. In contrast to the literature on mediation of traditional technologies [25], we find that only few parents reported actively engaging in discussions and reflections with their children about the content they may be exposed to, or the activities they engage in. The rise of technical mediation provides parents with real-time information about a child's activities, giving parents a sense of control and safety. Therefore, active, continuous discussions about the content and activities a child engages in might be perceived as somewhat redundant. This is sub-optimal, as active engagement can help children develop healthy habits and a priori prevent the need to further regulate behaviors [46]. However, our findings suggest that the interactive aspects of smartphones and tablets and the unlimited content available, increase parental involvement and lead to a perceived need for supervision. Furthermore, the portability of such devices allows for interactions anywhere and at any time, necessitating rules about the social context in which technology use is deemed appropriate [13].

Second, by offering a comprehensive overview of parental perceptions of smartphones and tablets, this study further enriches our theoretical understanding of why parents allow their children to use mobile technologies. According to Bronfenbrenner [47], parents play a crucial role in the development of their children and make decisions in the interest of their child and its health up to a certain age. It is therefore essential to investigate the perceptions, attitudes and emotions that influence parents' decision-making and behavior. Specifically, our findings complement the findings of Radesky et al. [38] who were the first to investigate parental views regarding children's mobile technology use. Our work extends prior research by demonstrating that parents have concerns on multiple levels, proximal and distal, when it comes to children's mobile technology use. So far, less attention has been paid to the conceptual differences between proximal and distal concerns, and their various influences on parental mediation [7]. We found that parents were most concerned about the content children might come across when on the device. Besides proximal concerns, parents also stated a broad range of concerns about distal probabilistic outcomes (e.g., physical development), but mentioned associations in the individual subcategories less frequently. Thus, parents share a more concrete idea of the immediate risks associated with children's exposure to mobile devices, yet show a higher diversity of concerns and uncertainty regarding delayed and, hence, hard-to-assess harms [48].

Decision-making about another person's health is complex and requires weighing one's own concerns against the perceived benefits for the other person [49]. However, our data reveals that parents make decisions about their children's use of mobile technologies not only in terms of how it affects their children, but also in terms of the consequences for them as parents. Many parents admitted to making use of mobile devices in order to keep children occupied with a safe activity. Regarding their children, parents especially praised the educational benefits of technology. Although mobile devices might be beneficial to convey factual knowledge [37], [50], skills such as imagination, problem solving, and empathy are usually learned through an unstructured

exploration of the environment and symbolic play with peers and caregivers [50], [51]. Moreover, creative, unstructured play is further curtailed by parents' attempts to prevent children from becoming bored and giving them access to devices that are sources of constant distraction.

Understanding the different benefits and concerns that parents associate with children's interaction with mobile devices might help educators and physicians engage in more productive discourse with parents. Awareness of how parents perceive children's mobile technology usage might help professionals to promote a healthy relationship with technology by addressing particular concerns. By referring to existing evidence on the effects of mobile technology usage, educators and physicians could more easily address and correct common misperceptions and provide practical guidance. Moreover, our results give parents an idea of the concerns about and benefits of smartphone and tablet use that are prevalent in the parenting community, thereby making it easier for parents to identify incorrect views. This is especially important as it has been found that parental awareness is potentially the most effective way to protect children from negative usage effects [52].

Our findings can help guide application designers on how to create software for children that meets parental expectations and reduces their concerns, while at the same time making sure to promote healthy technology behavior so that children benefit from technology. Our findings also help inform device and application manufacturers about parental motives for regulating children's device use and provide directions on how to design technologies that support parents' mediation attempts. Policy makers should respond to parental concerns by putting in place an independent review board that evaluates the effects of individual smartphone and tablet applications on children's development. With such ratings at parents' disposal, they will be able to assess the effect of a specific application on children more easily and realistically.

Our investigation has several limitations that offer promising opportunities for future studies. First, this research relies on a convenience sample of parents from the United States. Hence, generalizability to other demographic segments or cultures may be limited. Second, participants were recruited via Amazon Mechanical Turk. Although we implemented remedies taken from the literature to increase reliability of the data [39], [53], we are aware of the increased risks for non-independence, attentiveness and social desirability biases [39]. The use of an online platform presupposes a certain familiarity with technology which, in turn, might have an influence on how respondents view children's use of technology. Moreover, parents' responses might to some extent be biased by social norms, thus leading to an over- or underestimation of some of the categories (e.g., parental leisure time). Third, our study captures parents' self-report of concerns and perceived benefits of children's technology usage. However, parents might rely on other factors not mentioned in the survey when making decisions about their children's exposure to mobile technologies. Fourth, we did not differentiate between children's age groups as this study serves as a first step to uncover the range of concerns and perceived benefits shared by parents. However, we expect that due to differences in developmental demands and cognitive or emotional resources [54], some parental concerns and benefits may be age-dependent. Given that children's mobile technology use is still an emerging phenomenon in research, this exploratory and

descriptive study offers rich insights into parental perceptions of children's exposure to smartphones and tablets. Future research could build on the identified factors to quantitatively test how different parental perceptions influence parental mediation.

5 Acknowledgements

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