Technologies to Engage Young Children in Physical Activity: An Online Study of Parenting Practices

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ABSTRACT

This paper explores how parents use interactive technologies to encourage young children (under the age of 5) to be physically active, as well as how technologies might undermine physical activity. Based on an analysis of 1528 posts made online on Reddit and Quora, we found that many parents regard time spent with technologies as time taken away from physical activity. However, we also identified how parents appropriated technology to promote physical activity, i.e., through rewarding, modelling, facilitating, participating, tracking and documenting. We hope these practices will inspire design work with families to create new exertion interfaces, games, and persuasive technologies. In framing our findings as practices, we hope to expand the focus of future design activities from narrow concerns with health, tracking, and competition, towards broader concerns with what families do in everyday life, how they socialize, and what resources and technologies they have available to flourish.

CCS CONCEPTS

• **Human-centered computing**~Empirical studies in HCI

KEYWORDS

Physical activity; exercise; parenting; online community; Reddit.

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1 INTRODUCTION

Being physically active, restricting sedentary behaviours, and getting enough sleep is important for the healthy growth and development of young children (defined as 0-5 years of age). To support parents in creating healthy and safe routines for their children, the Australian Government recently released the "Australian 24-Hour Movement Guidelines for the Early Years (Birth to 5 years)" [25]. According to the guidelines, young children should not be restrained for more than 1 hour at a time (e.g., in a stroller). Infants should be physically active several times a day, e.g., through crawling or tummy time, and get 14 to 17 hours of sleep. Toddlers (1-2 years) should get at least 3 hours of physical activity and 11 to 14 hours of sleep. Pre-schoolers (3-5 years) should be active for at least 3 hours, with 1 hour of energetic play, and get 10 to 13 hours of sleep. Activities should be spread throughout the day; more physical activity is better [25].

Parents and interactive technology exert strong influence on children's lifestyles. Parents can promote physical activity in children by supporting activity and creating an environment free from barriers, by encouraging and reinforcing children for physical activity, and by being an active role model themselves [22, 39]. Preschool children who receive both maternal and paternal support are more physically active and eat more healthily than other children [36]. Regarding technology, the Australian movement guidelines recommend no screen time for children under the age of 2 years. For children above the age of 2 it is recommended to replace screen time with other activities like reading, singing and puzzles [25]. However, the guidelines also acknowledge a lack of research on sedentary behaviour and screen time: "No studies examined newer/evolving technologies that contribute to sedentary time (e.g., tablets, FaceTime/Skype, small screens)" [25, p. 182]

To start addressing this issue, this paper presents a qualitative study of parenting practices and the influence of technologies on physical activity in children. Based on an analysis of 1528 online discussion forum posts on Reddit and Quora, this paper shows how parents often regard time spent with technologies as time taken from physical activity. However, the findings also show how parents employ technologies to promote physical activity: parents used technology to reward children, to model and inspire active lifestyles, to facilitate playful activity, to encourage whole-family participation, and to track and document physical activity.

We seek to offer two contributions to the HCI community. Firstly, inspired by the turn to practices in HCI [17, 26] and a theory of parents' physical activity practices [22], this research offers insights into how technologies permeate parenting practices. Secondly, we hope that other researchers will draw inspiration from these practices to design technologies that go beyond the commonly used design strategy of competition.

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2 RELATED WORK

Several areas of HCI research focus on the design of technology to promote physical activity, often by motivating people through competition. Exertion interfaces encourage intense physical activity through digitally enhanced sports where people compete in jogging, table tennis, and soccer [23, 24]. Persuasive technology focuses on behaviour change through strategies like nudges, self-monitoring, simulations, social support, and competition [6, 12, 29, 31]. Location-based games like Pokémon Go [1] and Woody [38] have shown potential for short-term increases in physical activity. Gamification through badges, scoreboards, and rewards is common to many designs that promote exercise, which again encourages competition [7, 15, 19, 35, 41]. Finally, under the umbrella of personal informatics, HCI researchers explore how physical activity tracking with mobile and wearable devices promotes knowledge and self-optimisation [18, 21, 32].

Some of these research areas have also investigated physical activity in family settings. Personal informatics has been explored in families with school-aged children [14, 27]. These studies show that family members can benefit from collaborating to track and manage health conditions [27]. However, these studies also highlight privacy tensions and the risk of potentially undermining the development of trust between children and parents [14, 27]. Video games like Kinect and Wii use the body as game controller. Studies in family homes show that these games can support rich social experiences and exertion [9]. Research into outdoor play has examined how to enhance objects like sticks for throwing as well as enhancing playground equipment with technology [3, 13].

Focussing specifically on preschool-children, Saksono et al. [33, 34] have started to explore ways of encouraging interaction and reflection on physical activity between parents and young children. The design of Spaceship Launch [34] encouraged parents and children to track physical activity together with a Fitbit device, and a game provided virtual rewards and encouragement. In another study [33], they created a digital storybook that brought reflection on physical activity into stories read at bedtime. They found that some children were indeed reflecting on family activities and personal experiences. However, some children found it hard to reflect due to their young age and developmental stage, while other children had limited experiences to reflect on, or they brought up negative experiences which undermined their parents' efforts to promote physical activity.

HCI research is also exploring how parents use online information and social media for support. Many parents go online to find information about birth, health questions, disciplining children, purchase suggestions, and education [2, 28]. Finding information online allows parents to access a wider audience. Online communities like Reddit also allow parents to remain anonymous, which makes it easier to find answers to potentially embarrassing questions [2]. Social network sites like Facebook allow parents to ask for information and support from people they know, or with whom they have some connection, which can enhance the credibility of information received [8]. Finally, social network sites are also a place for parents to share photos and experiences and to exchange emotional support [10, 16]

In summary, HCI offers a large body of research on technologies to promote physical activity or to find relevant information, but research focussed on families with young children is scarce. What is also missing from these studies, is an understanding of how parents employ existing technologies in their parenting practices to engage their children in physical activity, as well as the possible adverse effects of technology.

3 RESEARCH APPROACH

The aim of this study was to understand how parents use technologies to encourage their children to be physically active, as well as how technologies might undermine physical activity.

The study was based on an analysis of 1528 posts from two popular online discussion forums for parents: Reddit and Quora. Like previous studies [2, 5, 20, 40], we found that these online discussion forums provide a variety of perspectives on technology practices related to parenting and wellbeing, without requiring additional input from participants. These forums are also openly accessible and easy to search. After receiving ethics approval from our university, the first author browsed through all parenting discussions on these sites, reaching back to 2012, to identify relevant posts. Keywords like exercise, sports, fitness, technology, apps, and video games were used to find further posts. A total of 1528 relevant posts was retrieved and copied into Saturate [37], an online tool for data management and analysis. The length of posts varied from 3 to 921 words, with an average of 122 words.

The dataset of 1528 online discussion forum posts was analysed based on the principles of a thematic analysis [4]. Initial codes on technology influence on physical activity were generated by the first two authors, who read through some discussions on paper, made annotations, and discussed emerging codes. The first author then applied these codes to the analysis in Saturate and continued with open coding. Themes were generated through an affinity diagram: codes were written on post-it notes and clustered on a whiteboard to identify how technology was used to promote physical activity, barriers, and values. Guided by related literature on parenting [22, 39] and practice theory [11, 17, 30], we refined the themes to highlight different sets of technology-mediated parenting practices: rewarding, modelling, facilitating, participating, tracking and documenting, which will be presented in the next section.

We acknowledge that this sort of analysis is limited. We do not have interview data to provide contextual information about each family who posted online, or to check that the discussion only related to children under the age of 5. While this analysis aimed to present a variety of views, we do not suggest that the findings offer a representative and comprehensive account of parenting practices. The number of posts coded is presented in each findings section to provide context about the prevalence of discussion topics to this qualitative analysis, but these numbers do not indicate actual prevalence of practices. Information about the source of a quote (R for Reddit or Q for Quora, and the discussion topic) is presented in brackets after each quote to add context about the online discussion. Places and names in quotes have been modified to protect the anonymity of online community members.

4 FINDINGS

4.1 Technology as Displacement and Reward

Technology as displacement and as reward can be seen as two sides of the same proverbial coin. On one side, technology creates the challenge of time displacement. 23 posts featured concerns that time spent using technology is time taken from physical activity. These concerns focussed on Internet, TV, and video games, which were seen as a source of instant gratification that uniquely draw the attention of children. Some discussions also referred to the parents' own childhood, comparing their relatively technology-free childhood with their own children's situation.

> "Video games offer a sense of accomplishment, exploration, excitation, etc. It gives a rush that offline activities don't." (R, video game addiction)

On the other side, technology provided an opportunity for parents to reward children for physical activity (8 posts). According to parents, access to TV, Internet, and video games (as well as new toys or praise) provided an incentive for their children to by physically active, play outside, or do household chores.

> "One thing I've found that works is 'buy in' for video games. For every hour of physical work/play you do away from a screen, you get 15 minutes of video games." (R, addiction to video games)
> "We're avid geocachers. We don't plan a hike unless there's a geocache that I've researched to make sure it's likely to have a toy inside for them." (R, hiking)

4.2 Modelling and Inspiring Active Lifestyles

Parents can encourage physical activity in their children by modelling a healthy, active lifestyle. We found 41 posts where parents reported that they sought to encourage their children to be active by setting a good example themselves, e.g., by walking, jogging, and working out in the gym. Two further posts mentioned that friends and relatives can also be role models.

> "We model a healthy lifestyle as much as we can…. A onetime conversation about healthy living most likely will have little effect but modelling will help to instil it." (R, right time to teach kids about healthy lifestyle)

Similar to modelling, parents used technologies to inspire their children to engage in physical activity (7 posts). Parents reported that videos of other children being active, documentaries of sports stars, and videos educating about healthy lifestyles were effective in getting their children more active.

> "I started showing her YouTube videos of kids around her age riding balance bikes. And that kind of got her started. The thing that was most effective in getting her to try it for a longer period of time was her watching her dad to leave on a bike ride." (R, exercise for toddlers)

4.3 Facilitating Playful Activity

Parents highlighted that physical activity needs to be playful (40 posts). Rather than framing physical activity as exercise regimes or as a health need, activities for children need to framed as playful and fun. Parents discussed how they facilitated playful activity by employing games like hide and seek, playing with a ball, rolling down a grassy hill, and dressing up as superheroes.

> "It has to be 'active play' and not 'exercise activity'. The most important thing you can do is get the 2-year-old to enjoy moving. Grown-ups often shun 'activity' because having been forced into it. When something becomes a 'must' it tends to drain out the 'fun'." (Q, exercise activities for toddlers)

Technologies were often discussed by parents as a way of facilitating playful activities for their children (28 posts). Several parents suggested game consoles like the Nintendo Wii system to encourage indoor exercise. Some parents had downloaded mobile apps and YouTube videos that engaged their children in exercise, yoga, and dance. One parent added a shelf with a laptop to her treadmill so that her children can walk and play video games.

> "My 4yo daughter loves the Super Stretch Yoga app. She will pull it up and do it on her own." (R, fitness apps)
> "There's a show on the CBeebies (preschool BBC channel) called Waybuloo where they do 'yoga' with the kids. My sons love it and roll around on the floor trying to do the stretches." (R, fitness apps for children)

4.4 Participating in Activity as a Family

The most direct form of encouraging physical activity in children is to be active together as a family. We found 15 posts where parents reported on activities that worked for them or on their intentions to get the whole family to go for a walk, a bicycle ride, or a swim. Some parents involved their children in choosing and planning these activities to ensure their interest.

> "We hike every weekend with our 4 and 2.5 years old." (R, hiking with young children)

A range of technology options were discussed that allow parents and children to participate in physical activity together (14 posts). A common theme was playing video games that encourage exercise or dance as a family. Some parents had mobile apps for exercise or yoga that they used together with their children. A final theme was that parents and children use mobile phones to enhance walks, e.g., through location-based games like Pokémon Go that invite them to catch virtual creatures.

> "Do you have a video game system? [Kinect] Just Dance makes all of us sweat and gasp for air after a while." (R, exercise inside the house)
> "My two boys and I went on a Pokémon hunt on our way to the park. My oldest (4yo) caught a ratatta and my youngest (3yo) caught a spearow. My observations: … Watch where you are going! This is a great exercise to teach kids young to be aware of their surroundings when they are looking at their phone. The park we were playing in is nice and open with lots of room for safe walking and exploring. I would give little reminders of, "Hey! What's to your right?" And make them acknowledge something." (R, Pokémon Go)

Safety concerns were commonly raised online (25 posts). Technologies can introduce risks for children's safety. For example, the Pokémon Go example above highlights that mobile phones introduce the risk of diverting attention from the environment to the phone. However, the example also shows that parental participation provides an opportunity to help children become more mindful of where they are walking. Beyond that, parents often raised concerns that their children lacked access to safe environments for physical activity, because they lacked access to gardens and parks, or because the roads and neighbourhoods were not deemed safe.

> "As winter approaches, I am growing nervous about how to ensure my almost-2-year-old gets enough physical activity in our small home. There aren't a lot of places I can take her in our community to run and play, so I'm interested in hearing what others do in your homes to get your toddlers active and moving. I have tried "dance party" time with her, but so far, she is not really into it." (R, indoor toddler activities)

4.5 Tracking and Documenting Activity

Technology was discussed by parents to track and document their children's physical activity. Discussions of tracking (3 posts) focussed on the ability of technology to quantify exercise, e.g., by counting steps through wearable technology like Fitbit. Parents were not necessarily interested in monitoring their children but rather suggested that children could use technology to set goals and to compete with others. It is important to note that all these posts were suggestions, rather than accounts of parents who had actually used tracking with their children.

> "Get them Fitbits and make it a contest to see who can get the most steps." (Q, encourage children to exercise)

Documenting is similar to tracking in that technology is used to capture physical activity (4 posts). Unlike with tracking, the focus is not on quantifying and analysing activity. Instead children or parents capture activities, people, and environment through photos and video recordings. Engagement in this way goes beyond the exercise activity itself, allowing children to role-play, edit photos and videos, and to share them with others.

> "I get them to run around in circles chasing and having a laugh under the pretence of turning it into some kind of action game for them to watch and participate in the editing of. They always come back from the park exhausted and have a lot of fun, every time one is done they are eager to start the next and have begun to start climbing things and doing random gymnastics while asking me to film it." (R, inspire children to exercise rather than play video games)
>
> "See if she wants to go on a walk or pick flowers or get her see if she'd like to photograph some new things. I feel like 95% of girls dig photography." (R, weight loss)

5 DISCUSSION

This study provides insights into how technologies are incorporated into parenting practices, as well how technologies undermine efforts to encourage children to be physically active. Based on online discussions by parents, we found that technologies, especially video games and TV, can displace physical activity time. However, the findings also highlighted how parents have harnessed technologies to engage their children in physical activity: as a reward for physical activity, to model active lifestyles, to provide inspiration, to facilitate playful and fun activities, to encourage participation from the whole family, and to track and document physical activity. These findings extend previous work on physical activity parenting practices [22], by showing how technologies can enrich practices like encouragement and modelling. Furthermore, our findings highlight how mobile technologies enable new practices where children document activities through photos and videos.

In framing our findings as practices, we also sought to shift the focus of physical activity away from pure concerns about health towards a more holistic understanding of what families do in everyday life, how they interact, the recourses they have available, and how technologies are appropriated [17, 26]. From this perspective, it was encouraging to see that digital games like Pokémon Go were appropriated for family outings and nature exploration. Likewise, the findings highlighted that documenting and tracking was less focussed on the personal informatics approach of counting steps [18], but rather on how outdoor and play activities provide opportunities for creative engagement with visual media to document and share experiences.

The findings also highlight that technologies that encourage physical activity do not have to be limited just to competition, which appears to be central to many persuasive technologies, gamified designs, and exertion games [6, 23, 24, 41]. Competition played only a minor part in our findings. Parents suggested competition in combination with activity tracking, but they had not tried it out with their own children. Furthermore, competition may have been part playing physical video games like Kinect. Similar to prior research [9], we found that even in these instances, parents viewed game play primarily as an opportunity to be active together and to socialize, rather than as a competition. This is not to say that competition may not be a motivating factor. However, there are many other practices that parents employ: encouragement, co-participation, and free play, which provide opportunities for designing technology.

6 CONCLUSIONS

This article started with the premise that less time spent with digital technology and more time spent being physical active is best for the health and development of young children. In analysing the online discussions of parents, we have indeed found that time with technology is often seen as time taken from physical activity. However, we also found that parents appropriated technology to promote physical activity, ranging from using it as a reward to co-participation to documentation.

Online discussions have provided a good starting point to understand the practices and concerns of parents. However, more work is needed to engage with families in situ, both to understand their practices and contexts, as well as to design technologies that allow children and parents to flourish.

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