Family-Centered Exploration of the Benefits and Burdens of Digital Home Assistants

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Figure 1: Families use Amazon Echo devices together. Photo: *Amazon.com*

ABSTRACT

Parents receive conflicting information on the benefits and burdens of children's technology use, especially novel technologies such as digital home assistants *Figure 1*. To understand parents' views, we analyzed relevant Amazon Echo device product reviews posted to *Amazon.com*, and deployed a User Benefit and Burden Survey to 131 parents on Amazon Mechanical Turk to explore their perspectives of Amazon Echo digital home assistants. Our work explores parents' perceptions of the devices with regards to their children and families, in terms of attributes such as benefits and burdens. This study contributes an empirical, family-centered understanding of and design opportunities for whole home personal assistants in support of a diversity of families.

CCS CONCEPTS

• **Human-centered computing → User studies**; **Empirical studies in HCI**.

KEYWORDS

amazon echo; voice assistant; family; amazon reviews

INTRODUCTION

Human-computer interaction (HCI) researchers have shown that many families are incorporating digital home assistants in their living environment with children [2, 5, 7]. Voice is considered a preferable method for information seeking and entertainment control when your body or hands are occupied (i.e. driving, exercising, cooking). As voice technologies continue to improve, voice assistants such as Siri, Alexa, Google Now, and Cortana are becoming everyday friends [9] to consumers, but a source of confusion to others.

Several digital home assistants have been developed for consumers *(Table 1)*. We began our investigation into parents' perceptions of digital home assistants with a qualitative analysis of online product reviews from a popular shopping site, *Amazon.com*. Since reviews for Google Home are unavailable on *Amazon.com*, we were limited to reviews of the Amazon family of Echo devices for analysis.

The design space for voice assistants is still relatively under-explored to meet the unique needs of families. The goal of our work is to answer the following research question: What benefits and burdens do parents perceive of digital home assistants? Using a foundation of existing research, we address this question by analyzing relevant product reviews and deploying a survey to gain insights into parent's perspectives of the benefits and burdens of digital assistants for their children and family.

Table 1: Popular Digital Home Assistants on the Market.

Amazon	Google	Microsoft	Apple
Echo	Home	Invoke	HomePod
Echo Dot	Home Mini		
Echo Plus	Home Max		
Echo Show			
Echo Spot			
Echo Dot for Kids			

RELATED WORK

The popularity of voice technologies provides new opportunities to study how people use and perceive digital assistants. Researchers have examined children's perception of digital assistants with respect to intelligence, abilities and trust [2]. Luger et al. studied user expectations of conversational agents and found user expectations to be far more complex than the rather simple operation of the systems, especially regarding known machine intelligence, system capability and goals [5]. Although researchers have considered the perspectives of children and parents individually, we explore the parent perspective in the family context.

Researchers have worked to understand the experiences of both parents and children and have gained insight into family technology practices using several methods of data collection using in-home cameras and home visits [3], home-deployments of digital assistants [7], and lab studies [2]. More specifically, Druga et al. [2] studied how 26 children interacted with and perceived their compared intelligence to several digital assistants and internet connected smart toys, and found that differing modes of interaction can affect this level of perceived intelligence. Several parent perspectives of the internet connected toys shared in this study were confirmed in our Amazon review analysis as they

wished for more parental controls and were concerned for jokes that weren't age-appropriate [6]. Since previous research was conducted in the lab setting, we specifically study parents' lived family experiences.

Several researchers have leveraged Amazon Echo reviews to gain insights into user perceptions and use of the devices, but the parent perspective is still under-explored. Purington et al. studied the way that users personified their Echo device in Amazon reviews, and concluded that users who personify their Echo device are more likely to be generally satisfied with it [9]. Pradhan et al. examined the accessibility of digital home assistants off-the-shelf and studied how voice-based intelligent personal assistants are being used by people with disabilities, by interviewing users and analyzing Amazon Echo reviews written by Amazon Echo users with disabilities [8]. The researchers found that, although there are accessibility challenges, consumers with varying disabilities are using the Amazon Echo for speech therapy and to support their family and friend caregivers. The depth and breath of Amazon Echo product reviews provides an opportunity to learn what families perceive as the benefits and burdens of their Echo devices.

METHODS

Review Data Collection and Analysis

All Amazon Echo product reviews posted before June 27, 2018 were scraped and filtered for relevant content using words such as *kid*, *child*, *son*, *daughter*, and *grand* (for grandchild). Although Alexa is growing to be a feature on a number of new devices from Amazon and third-parties, we limited ourselves to the Echo family of devices as of June 2018 *(Table 2)*.

We first excluded reviews with fewer than 100 characters due to their brief nature. We then filtered the reviews for relevance to our research. We manually deleted and excluded reviews irrelevant to our research. We took a bottom-up approach for qualitative analysis where one researcher randomized the set of 7,200 relevant reviews, read the reviews, and extracted notes containing portions relevant to the research question. We analyzed reviews until we reached data saturation after 205 reviews. Two researchers created an affinity diagram with these notes [1], iterating on themes through discussion. After analysis, we developed the codebook that consisted of the themes listed in *Table 3*.

User Benefit and Burden Survey

We created a survey to assess the burdens and benefits of digital home assistants to parents with children. The survey included 1) User Burden Scale (UBS) [10], a validated questionnaire that measures negative impact of a computing system to its users; 2) User Benefit Scale, a new measure we developed as a counterpart to the UBS to gauge positive impacts of digital home assistants; 3) questions on general use of digital home assistants; and 4) demographic questions. The UBS scale measured the

Table 2: Reviews from Devices Used in Analysis.

Amazon Echo Product	Total*	Total Applicable*
Refurbished Echo *Gen. 1*	48,900	806
Echo *Gen. 2*	22,563	813
Refurbished Echo Dot	2,259	31
Echo Dot	113,200	4,425
Echo Plus	2,863	92
Echo Look	73	1
Echo Spot	4125	172
Echo Show	11,628	758
Echo Dot for Kids	228	174

* Posted on Amazon.com as of June 27, 2018

Table 3: Codes- Benefits and Burdens of Voice Assistant Use in Families.

Themes	Affect
Autonomy	Benefit
Experience	Benefit
Information	Benefit
Social	Benefit
Financial	Both
Physical	Both
Usage	Both
Time	Both
Privacy	Burden

constructs listed as themes in *Table 3* minus autonomy. We created a complementary User Benefit Scale to assess perceived benefits of digital assistants, covering benefits including ease-of-use, experience, financial, health and well-being, informational, social, and time and productivity. The benefit scale uses a five-point scale from 0 (strongly disagree) to 4 (strongly agree), and the burden scale uses a five-point scale from 0 (not at all / never) to 4 (extremely / all of the time). We are working toward validation of User Benefit Scale. As a preliminary result, we found the User Benefit Scale had good inter-item reliability as well as concurrent validity with existing scales.

Our University's IRB determined the study to be Exempt. We deployed the survey to participants on Amazon's Mechanical Turk (MTurk), which has been validated as a reliable data collection platform [4]. We required MTurkers to own an Amazon Echo device and be over 18 years old and a parent of a child aged 21 years old or younger. We verified this information in several survey questions. In line with best practices, we measured attention through how long they spent on each questionnaire [4], and placed attention checks throughout the survey and disqualified all participants that failed at least one. We expected the survey to take 7-10 minutes and compensated participants $1.00. 204 participants completed the survey. We filtered several responses (i.e. 62 who failed the attention check or provided invalid commands and 11 who took too little time (less than 3 minutes) to complete the entire survey). We analyzed the remaining 131 responses to examine the benefits and burdens of digital home assistants for families.

RESULTS AND DISCUSSION

We found that parents perceive minimal burdens of Echo devices mostly related to privacy, over-use and usability; and the benefits of Echo devices are related to good financial value, social connection, positive experiences with the device, and learning new information. After analyzing the themes present in 205 Amazon Echo device product reviews, we developed a codebook *(see Table 4)* that resulted in 531 codes for instances of benefits, and 91 codes for burdens.

In general, we found that the parents who owned an Amazon Echo longer (6 months or longer) found it to be easier to use (t(129) =-2.488, p < .05), more informational (t(129)=-2.817, p < .01), and more financially beneficial (t(129) =-1.985, p < .05). The survey result also showed that the people who used Amazon Echo frequently (more than once a day) found it to be significantly more beneficial in terms of ease of use (t(129) =-2.566, p < .05), experience (t(129) =-2.689, p < .01), informational (t(129) =-2,633, p < .05), social (t(129) =-2.375, p < .05), time and productivity (t(129) =-3.111, p < .01) and overall (t(129) =-3.403, p < .01).

Benefits

Our findings indicate parents seem to benefit more from their digital assistants with each additional device in the home *(Review A)*. Nearly 24.4% of parent reviewers mentioned enhanced social connection

Table 4: Amazon Echo Product Review Codebook Results (based on 205 reviews). Percentages indicate the number of reviews that were coded for that theme.

Theme	Benefit	Burden
Experience	79%	0%
Information	44%	0%
Financial	34%	6.8%
Physical	32%	2.9%
Social	30%	0%
Usability	15%	29%
Time	10%	3.9%
Autonomy	8.3%	0%
Privacy	0%	1.9%

Review A: *If you're planning on purchasing the Amazon Echo Dot for Christmas, Don't. PURCHASE TWO OF THEM OR MORE INSTEAD... I'm astounded at the absolute usefulness of this item FOR $29.99"*

Review B: *"I am still learning what Alexa can do and how to get the most information from her. Yes, I am guilty of thanking her for answering questions and solving family debates. I am growing in confidence as Alexa grows in knowledge."*

Review C: *"Loved it so much I got one for every room! I made multi room music groups so its basically like having speakers all throughout the house. Also, a huge bonus is the drop in feature. Umm... HELLO HOME INTERCOM SYSTEM! Do you know how easy it is to talk to the kids in the basement while I'm upstairs!? No more yelling :)"*

Review D: *"Bought this for my daughter who has motor and visual disability challenges. Now instead of having folks do things for her or trying to mess with small dials and buttons she checks the weather herself and decides what to wear, chooses her own music, listens to her audiobooks, gets information all by just asking Alexa...All in all worth the money."*

to friends and family, within the home and beyond, using the *Drop-In* feature on Amazon Echo devices. Alexa is even treated as a unbiased, mediator in family conversations *(Review B).* In addition to the convenience of enhanced communication, parents can physically benefit from digital assistants as *Review C* shares about an Echo Dot. This validates the effectiveness and popularity of the *Drop-In* feature, even though some consumers consider it *creepy.* Parents reported that the Amazon Echo devices empower children to learn how to *"operate it and control things. (Survey)"* This sense of control is something that children and parents appreciate *(Review D)* . This autonomy benefits parents too as one shared that *"It makes things more accessible and convenient"* beyond their child's empowerment with added conveniences since *"The kids can play songs they want without me having to do it. (Survey)"*

Parents shared company-advertised benefits such as productivity assistance: *"I feel like it just increases my productivity. I also like to set times for my daughter for studying, room cleaning, TV time, etc. (Review)"* But, another parent admitted that *"Sometimes we get distracted with it. (Survey)"*

Burdens

The most common burden for families *(Table 4)* was usability, and especially Alexa's inability to understand several voices at once. Children often struggle with this according to one parent who noted that *"They fight over who talks to her."* Also, parents lack recommendations on suggested use per day because voice interactions are incredibly different from screen time. Parents shared a fear of *over-relying* on Alexa for simple functions and a potential perceived burden of their children's *over-use* of their device(s). However, technologists have not defined what overuse actually means in the space of voice technologies and, more specifically, digital home assistants.

Privacy was also a concern for parents but it seemed to decrease over time. Our survey results showed that the parents who owned Amazon Echo for 6 months or longer reported significantly lower privacy burden (t(129) =2.176, p < .05), compare to families who recently adopted it. In a similar fashion, people who use Amazon Echo more than once a day had significantly lower privacy burden compared to those who use it less frequently (t(129) =2.040, p < .05). However, it is possible that people without privacy concerns in the first place are more likely to use it longer or more frequently.

CONCLUSION

To understand parents' perspectives of digital home assistants, we analyzed 205 relevant Amazon Echo device product reviews from *Amazon.com* and deployed a User Benefit and Burden survey on Amazon Mechanical Turk to 131 parents. These findings reveal emergent parental perspectives of Amazon Echo devices, but their generalizability is limited by the sample of users who chose to review the products and answer our survey, as their opinions may differ from those who were not included.

Our work contributes an empirical, family-centered understanding of and design opportunities for digital assistants. We found that families generally experience more benefits than burdens when using

the devices. This speaks to the promise of voice assistants as an emerging technology, but gaps remain in understanding how these devices can better fit into a shared family context. We believe there are opportunities for the HCI community to provide more guidance to both technology developers as well as to families in understanding how to navigate effective use of digital home assistants.

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