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

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Abstract

Parents receive conflicting information on the benefits and burdens of children's technology use, especially novel technologies such as digital home assistants. To understand parents' views, we analyzed relevant Amazon Echo device product reviews posted to *Amazon.com*, deployed Amazon Echo Dot's to 9 families, and conducted surveys and interviews. Our work explores parents' perceptions of the devices with regards to their children and families, in terms of attributes such as burdens and benefits. This study contributes an empirical, family-centered understanding of and design opportunities for whole home personal assistants in support of a diversity of families.

Author 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 family living environment with children at a young age [11, 15, 17], as well as older adults [21]. Voice is considered a preferable method for information seeking and entertainment control when your body or hands are occupied (i.e. driving, exercising, biking, cooking, crafting). As voice technologies continue to improve, voice assistants such as Siri, Alexa, Google Now, and Cortana are becom-

ing everyday friends [19] to many consumers, but a source of confusion to others.

Voice interfaces are an ever growing technological realm that are often missing from the homes of low-to-middle income American families. In fact, according to Rakuten Intelligence, over 50% of Amazon Echo buyers have an annual household income over $75,000 per year [10]. The average Echo user spent $400 more than the average Amazon Prime member [13] in 2017, showing that Echo owners are a generally affluent user base. Thus, children living in low-to-middle-income homes often don't have the opportunity to explore or be empowered by cutting-edge voice technologies.

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.

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			

The design space for voice assistants for families is still relatively under-explored to meet their unique needs. The goal of our work is to answer two research questions:

1. What burdens and benefits do parents perceive of digital home assistants?

2. How can digital home assistants be better designed to support families?

Using a foundation of existing bodies of work, we address these research questions by conducting an interview study to gain insights into the adoption and use of digital home assistants in low-to-middle-income families. We examine parents' perceptions of the devices' benefits and burdens for their children and families by outlining themes from 205 filtered Amazon product reviews.

As data analysis is ongoing for the larger study, we will discuss preliminary findings for both research projects covered this summer.

Related Work

The popularity of devices like the Amazon Echo provides new opportunities to study how people use and perceive conversational agents. Researchers have examined children's perception of intelligent personal assistants with respect to intelligence, abilities and trust, including Amazon Echo and Google Home [11]. Luger et al. studied user expectations of conversational agents, including Siri, Google, and Alexa, and found user expectations far more complex than the rather simple operation of the systems, particularly regarding known machine intelligence, system capability and goals [15].

Researchers have become creative with methods of data collection in order to understand how families use technology in their natural environment, as their are challenges that emerge in doing research in participant homes [22]. Researchers gained insight into family technology practices in their multi-screen living rooms using a camera to detect TV and smart phone usage [20]. Ferdous et al. [12] also leveraged video capture for data collection, along with frequent home visits to track technology use during family mealtime. Porcheron et al. [17] deployed Amazon Echo devices with a general population of participants, as well as a Conditional Voice Recorder, that activated when the "wake word" Alexa is heard by the Echo. We take a similar approach in leveraging a conditional voice recorder that records a longer period of time to understand the context of conversations surrounding the device.

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 [19]. 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 analyzing Amazon Echo reviews by users with disabilities and interviewing disabled users of the Amazon Echo [18]. 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.

Researchers have worked to understand child and parent-child interaction with internet connected toys in the lab setting. Druga et al. [11] studied how 26 children interacted with and perceived their compared intelligence to several digital home assistants and smart toys, and found that differing modes of interaction can affect this level of intelligence. Several parent perspectives of the toys were confirmed in our Amazon review content analysis as they wished for more parental controls and were concerned for jokes that weren't age-appropriate [16]. Since previous research was conducted in the lab setting, we specifically study everyday interactions for families. Through our work, we study how families adopt digital home assistants, how they interact with them, and what specific benefits and burdens they encounter. Once ongoing analysis is complete, we will share how the Echo devices could be better designed to support parent-child and child-only interactions with digital home assistants.

Methods

Amazon Echo Deployment Study
We conducted 10 initial and 10 final semi-structured interviews with 10 families that have children at home. This research was approved by the university's Institutional Review Board (IRB). The interview participants were found through a request put to a university affiliated research page and social media pages targeting parents in the surrounding area. Flyers advertising the research study to eligible families were also placed in local libraries, athletic centers, and bus stations. The eligible participants that reached out were screened for eligibility and then the research team conducted an initial home interview.

The goal of the initial interview was to gain insights into their current understanding of voice assistants and their

expectations of the device, and also understand how the challenges that families face in the set up process.

We transcribed the audio recordings of our participating families' interactions with Alexa and use of their Echo Dot, over the month of their participation in the study. The DREU student helped conduct 7 of the 20 total interviews. For each initial and final interview, the interaction was recorded and later transcribed to facilitate analysis. To thank the interview participants for their time and effort, we provided each family with gift cards. The families were also able to keep the Echo device. To ensure the confidentiality of participants, unique identifiers were assigned to each interviewee. Data analysis is ongoing.

Data Collection and Content 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 and grandkid. Although Alexa is growing to be a feature on a number of new devices, such as the Echo Fire TV Cube, a hands-free streaming media player, and Amazon Tap, a portable Bluetooth speaker, as well as several third-party devices and products, we limited ourselves to the Echo family of devices *(see Table 2)*.

We first excluded reviews with less than 100 characters due to their nature. We then filtered the reviews for relevance to our research by including only reviews with one or more of the following words: kid, child, grand, daughter, son, family, and year old. We manually deleted and excluded reviews irrelevant to our research such as *(Echo 1089- "I bought the Echo for my 83 year old Mother and she loves it")*. Finally, we compiled the relevant reviews, assigned a random decimal to each of the 7,200 reviews and randomized the list of reviews. We hit data saturation after analyzing 205 reviews and the code book consisted of the following themes:

Table 2: Reviews from Devices Used in Content Analysis

Amazon Echo Product	Total*	Total Applicable*
Refurbished Echo *Gen. 1* [8]	48,900	806
Echo *Gen. 2* [1]	22,563	813
Refurbished Echo Dot [9]	2,259	31
Echo Dot [2]	113,200	4,425
Echo Plus [4]	2,863	92
Echo Look [7]	73	1
Echo Spot [6]	4125	172
Echo Show [5]	11,628	758
Echo Dot for Kids [3]	228	174

* As of June 27, 2018

Preliminary Results and Discussion

Home Echo Deployment Study
Data collection for the study is ongoing and data analysis has recently begun. We will share preliminary insights from the data we have collected so far.

In the initial interview, families share an understanding of the device obtained mainly from conversations with coworkers, family and friends, as well as commercials on TV, radio and the internet.

During the setup process, the light rings on the device are particularly confusing for families, which confirms researchers belief that ambient technologies without screens trigger both curiosity and confusion [14]. Although Amazon provides few device setup instructions and the process relies mostly on existing confidence and knowledge of technology set-up procedures, families take advantage of the opportunity to be guided by Amazon; they pay close attention to an introductory video about their new Echo and read

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

the small pamphlet folded in the box. This video is shown toward the end of the set up process.

Data is still being analyzed from their use of the devices but the final interview data shows that families generally use the devices less often than they expected. It seems as though the device is used mostly for entertainment. A common burden for families was Alexa's inability to be bilingual. There will be several design recommendations made regarding improvements to support families.

Amazon Review Content Analysis
Based on relevant Amazon Echo reviews [1, 2, 3, 4, 5, 6, 7, 8], parents and grandparents have a sense of hope and confidence regarding the features and capabilities of their Echo device(s). Nearly 7.4% of product reviewers specifically mentioned that their device(s) will get better with time. Although every user doesn't love every skill that Alexa has to offer, families seem confident that Amazon will improve the skills and enhance Alexa's capabilities.

Alexa is often treated as a mediator in family conversations and an unbiased, third party in the home. A user rated their Echo Dot with five stars, writing *"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"* - Dot 3727.

Communication within the home and social connection with family outside of the home is also a popular use, as 24.4% of family users mentioned their in-home or out-of home communication using Echo devices. This validates the effectiveness and popularity of the "Drop-In" feature on the devices, even though some consumers consider it "creepy." Parents can physically benefit as Echo Dot Review #4477 *"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 :)"* Additionally, several reviews that detailed enhanced social connection to friends and family using the "Drop-In" feature.

These findings reveal emergent parental perspectives of Amazon's Echo device family and Alexa, but their generalizability is limited by the sample of users who chose to review the products, as their opinions may differ those who did not post reviews. However, the findings of this exploratory study offer insight into how families use Echo devices in their homes and what parents perceive as benefits and burdens of the Echo devices.

Contributions
This study contributes an empirical, family-centered understanding of and design opportunities for whole home personal assistants in support of a diversity of families.

Acknowledgements

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