

Childproofing smart homes from children with access to natural language user interfaces

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Background and research questions

The Internet of Things (IoT) is coming. In fact, some might say it's already here. IFTTT already provides APIs for over 150 smart home products, from washing machines to coffeemakers to cars to even dog collars [IFTTT 2016]! Though these products are readily available, as of 2014, only 11% of heads of broadband households in the US are “very familiar” with these products, with 62% claiming to be “not familiar” with smart home products [Parks Associates and CEA, 2014].

Due to aforementioned APIs, these products are all controllable through natural language user interfaces (NLUI) such as Amazon Alexa and Google Assistant. This creates new affordances that bypass traditional physical interaction. Young children are among the vast populations who may acquire these affordances, enabling them to reach knobs they couldn't reach, unlock locks they didn't have the key for, and so on.

The lack of understanding parents possess of how a new technology enables their young children can lead to undesirable consequences. The recent decade of mass smartphone adoption was no exception. Amazon, Google, and Apple have all faced requests from the Federal Trade Commission to offer refunds for unauthorized in-app purchases made by children totaling \$78 million [Brant, 2016; Gibbs, 2014].

In light of these risks, **in what ways might young children using natural language user interfaces to control smart home products be concerning to their parents?** To prevent undesirable consequences for parents as they and their children transition into a new era of household technology, we would like to:

Gather data on what home products that have potential to be “smart” are already on the minds of parents in regards to childproofing, as well as what smart home products are not already on the minds of parents in regards to NLUI childproofing that they might/should be concerned about.

Determine general attitudes of parents toward letting children use NLUI to control smart home products.

IFTTT. See all services - IFTTT. Retrieved November 5, 2016 from <https://ifttt.com/search/services>

Parks Associates, CEA. 2014. Smart Home Ecosystem: IoT and Consumers. Retrieved November 5, 2016 from <http://www.parksassociates.com/bento/shop/whitepapers/files/Parks%20Assoc%20CEA%20Smart%20Home%20Ecosystem%20WP.pdf>

Brant, Tom. (2016, November 11). Amazon Ordered to Refund Kids' In-App Purchases. PCMag.com. Retrieved November 12, 2016 from <http://www.pcmag.com/news/349531/amazon-ordered-to-refund-kids-in-app-purchases>

Gibbs, Samuel. (2014, March 11). Google facing US lawsuit over \$66 of in-app purchases. The Guardian. Retrieved November 5, 2016 from <https://www.theguardian.com/technology/2014/mar/11/google-us-lawsuit-in-app-purchases>

62
PERCENT

of heads of households with broadband access are “not familiar” with smart home products

78
MILLION
DOLLARS

requested by the FTC to be refunded by Amazon, Google, and Apple to parents for unauthorized in-app purchases made by their children

Participant population

We are interested in study participants who are parents of young children that live with them, and will likely own a smart home product in the next 10 years. We have already scheduled 25 participants for study sessions in the coming two weeks, with 5 backup participants.

Our criteria for choosing these participants were as follows:

They are a parent of a child who lives with them at least 2 days of the week. We wanted our participants to have genuine reasons to be concerned about childproofing their home. We set a lower bound at 2 days a week rather than 7 days a week to make sure divorced parents were not unnecessarily filtered out.

The child which lives with them at least 2 days a week is from the ages of 2 to 8, inclusive, and does not have a major speech disability. The different between a child's capabilities with and without NLUI is probably greatest at these ages where they are not physically as developed, but can speak well enough to operate NLUI.

The parent regularly uses a smartphone or tablet, and has broadband internet access in the home. This population seems likely to own a smart home device in the next 10 years, and will probably be able to contribute meaningfully to our study session.

The parent does not currently own a smart home device. We are interested in people who have not already begun a transition to a household with smart home devices.

Grouping

Our participants have been scheduled with other participants that have similarly-aged children. Some participants have multiple children, which we have accounted for by building some flexibility in our research activities.

Research activities overview

Over the next 2 weeks, we will have 5 study sessions of 3 to 6 participants each.

Scheduling confirmation

Up to 10 minutes per participant on average

2 days before each session, we will call the scheduled participants of that session to confirm their attendance. If they no longer can attend, and also are unable to reschedule to another session in the future, we will contact a backup participant to see if they can attend.

Employees involved
Lobby representative

Greeting

Up to 20 minutes

We will have drinks (water, juice, soda, coffee, tea) available for them as they come in the lobby.

Have the participant read and sign the consent form.

If the participant has brought children, refer them to the representative from the childcare service we have hired, who will also be in the lobby. The childcare service has their own forms to be filled out and signed.

Call anyone who has not arrived at 10 minutes to confirm their attendance, assisting them with directions to our building.

If anyone arrives after the card sorting portion has started, have them wait in the lobby and have them join for the focus group discussion.

If anyone arrives after the focus group discussion portion has started, have them sign the non-participant gratuity release (which states a value of \$50), give them a business card, thank them for coming out, and then send them on their way.

If anyone decides/has to leave in the middle of the study session, have them sign the participant gratuity release, thank them for coming out, and then send them on their way. This situation might arise if their children have issues while in the hands of our hired childcare service. The childcare service will contact our lobby representative in such a situation.

Employees involved
Lobby representative
Childcare service representative

Card sorting

10 to 15 minutes

The participants will be led to a room where they can spread out and do their card sorts individually. Detailed information on the card sorting portion is available later in the document on pages 6 to 8.

Employees involved

Facilitator

Documenter 1

Documenter 2

Lobby representative

Childcare service representative

Focus group discussion

60 to 90 minutes

The participants will bring their card sorts to a conference room to do a focus group discussion. Detailed information on the focus group discussion portion is available later in the document on pages 9 to 12.

Employees involved

Facilitator

Documenter 1

Documenter 2

Lobby representative

Childcare service representative

Conclusion

5 minutes

The participants will leave their card sorts in the conference room and be led back to the lobby.

Have each participant read and sign the gratuity release form.

Give each participant the generic company business card in case they would like to contact us in the future.

If the participant left children with our childcare service we hired, the childcare service representative will be in the lobby with the children at this time.

Employees involved

Lobby representative

Childcare service representative

Card sorting

10 to 15 minutes

Why we are doing this

We would like to **gather data on what home products that have potential to be “smart” are already on the minds of parents in regards to NLUI childproofing.**

We are also priming the participants to think about home products in relation to their children in preparation for the focus group discussion. Their card sort will be an experience that they or others can refer to spark discussion.

The cards

Air purifier	Humidifier
Alarm clock	Key finder
Blinds	Lights
Car locks	Oven
Clothes dryer	Printer
Clothes washer	Refrigerator
Coffeemaker	Robot vacuum
Dishwasher	Slow cooker
Door locks	Sprinkler system
Electrical outlet	Thermostat
Fan	Voicemail
Home security system	Water heater
Home theater	

Materials

Each participant will be given a pre-sectioned/pre-labeled 3 ft x 2 ft poster, pre-labeled sticky notes (the cards), and a black fine-tip marker. Another poster and set of sticky notes will be given for the second card sort.

The participants will be working alone, spread out across the room where they cannot see each other’s posters or interpret quiet conversation from other participants.

You will have your notebook to take notes if needed.

Card sort 1: Child capabilities

Have each participant go to their preset stations spread across the room. Explain the following:

“Thank you for participating in our study. The first thing we are going to have you all do is sort these sticky notes on the posters. There are four sections:

“**PHYSICALLY CAN’T**. This section will be for products your child is physically incapable of using. For example, if your child does not have enough height to reach a light switch, your child **physically can’t** use lights.

“**UNCOMFORTABLE**. This section will be for products your child is physically capable of using, but you would be **uncomfortable** with them operating it on their own.

“**WITH MY HELP**. This section will be for products your child is physically capable of using, but you would only be comfortable with them operating it **with your help**.

“**ON THEIR OWN**. This section will be for products your child is physically capable of using, and you would be comfortable with them operating it **on their own**.

“After you are finished sorting the sticky notes, feel free to add any commentary you’d like to the poster with the marker.

“[If applicable:] If you have multiple children, we’d like you to focus on your children that are [age cluster of participants’ children] years old. However, we’d love it if you added information about how your sorting might differ for your other children.

“If you have any questions, please motion to any of us three and we’ll come over to answer your question individually. Please do this activity on your own without discussing with others in the room. Please give us your honest opinion; there are no ‘correct’ answers.”

Give them 5 minutes to sort the cards and add commentary. Be sure to note any codes/symbols they might use in their commentary in your notes. If they finish before 5 minutes, encourage them to add any commentary they wish with their marker.

After 5 minutes, take photos of them with their posters (see right) and then swap their posters/sticky notes for a new set of sticky notes and the poster for the next card sort.

Photos:

Take a couple photos of each participant over the shoulder with their upper body and head in the foreground, and poster in the background. They may be holding a sticky note or marker.

Take a couple photos of each participant that frames their head/face while they are looking at the poster. You might include their hand that is holding a sticky note or marker. Make sure that they don’t look like they’re looking at the lens.

Take a close-up photo of each participant’s hand placing a sticky note among other sticky notes on their poster. You might also take one with wider framing.

Take a close-up photo of each participant’s hand writing with a marker on their poster. You might also take one with wider framing.

After they are done with the card sort, take a photo of them holding up their poster in front of them, under their face.

Card sort 2: Childproofing measures

After taking photos from the previous card sort and giving them their second set of materials, explain the following:

“Great job, everyone! We’re going to do the same exercise one more time, but with different sections regarding childproofing. We define childproofing as taking action to change how something is placed or set up that you normally would not have done if your children weren’t a factor. For example, if you normally would place your keys on a high hook even if your child did not exist, that would not be childproofing. However, if you only started to cover your electrical outlets once you had a child, that would be considered childproofing. Here are the sections:

“**USED TO CHILDPROOF.** This section is for products you used to take measures to childproof your children from them.

“**CURRENTLY CHILDPROOFED.** This section is for products you have already taken measures to childproof and are currently still childproofed.

“**WILL CHILDPROOF.** This section is for products you envision childproofing in the future that are not already childproofed.

“**WILL NOT CHILDPROOF.** This section is for products you don’t envision childproofing in the future and have never childproofed.

“Like last time, after you are finished sorting the sticky notes, feel free to add any commentary you’d like to the poster with the marker, and let us know if you have any questions. Also, remember to do this activity on your own without discussing with others in the room. Again, there are no ‘correct’ answers.”

Give them 5 minutes to sort the cards and add commentary. Be sure to note any codes/symbols they might use in their commentary in your notes. If they finish before 5 minutes, encourage them to add any commentary they wish with their marker.

After 5 minutes, take photos of them with and without their posters (see right) and then gather their materials.

Photos:

Take a couple photos of each participant over the shoulder with their upper body and head in the foreground, and poster in the background. They may be holding a sticky note or marker.

Take a couple photos of each participant that frames their head/face while they are looking at the poster. You might include their hand that is holding a sticky note or marker. Make sure that they don’t look like they’re looking at the lens.

Take a close-up photo of each participant’s hand placing a sticky note among other sticky notes on their poster. You might also take one with wider framing.

Take a close-up photo of each participant’s hand writing with a marker on their poster. You might also take one with wider framing.

After they are done with the card sort, take a photo of them holding up their poster in front of them, under their face.

Then, take a full-body shot, waist-up shot, and portrait shot of them without their poster. They should be standing casually, whole body facing the camera.

After they have all returned their materials, take a photo of the whole group standing from waist-up (no need for them to get friendly unless they want to for some reason).

Focus group discussion

60 to 90 minutes

Why we are doing this

We would like to **gather data on what home products that have potential to be “smart” are already on the minds of parents in regards to childproofing, as well as what smart home products are not already on the minds of parents in regards to NLUI childproofing that they might/should be concerned about.**

We would also like to **determine general attitudes of parents toward letting children use NLUI to control smart home products.**

Things to keep in mind

The facilitator should keep the discussion to less than 90 minutes. During the first part of the discussion, participants may bring up products or situations that are not currently commercially available as a smart home product (e.g. clothes hangers). That is okay, since we cannot say with certainty what products will exist in the future.

If the facilitator senses any animosity or fear between participants due to differing opinions, they should attempt to let each participant have a voice, without seeming to favor one side or another.

Documenters should take notes throughout the discussion, sitting on opposite sides of the room. Pay particular attention to people’s facial/body language, since those will not be captured in the audio recording. When you take photos, don’t worry about writing down the context; the timestamp of the photo can be matched with the timestamp of the audio recording.

Materials

Documenters should have their notebooks ready to take notes.

The furniture should be set up in such a way that the documenters can maneuver around the table to take photos.

Break

5 minutes

Let everyone have a bathroom break before starting the discussion. Also offer drinks to the participants.

Introductions

Up to 15 minutes, about 2 minutes per participant

“Thanks again for joining us. We’re now going to have a guided discussion as a group. As a reminder, you have consented to be recorded by audio. Is that still okay with everyone?”

If it’s not okay, then escort those who do not consent to the lobby where they will sign their participant gratuity release.

Start the recording.

“Alright. Let’s start by introducing ourselves. I’m [facilitator name], and I am a [facilitator title] with [company]. With me are [documenter 1] and [documenter 2], who will be taking notes and photos during our discussion.

“Let’s go around and tell everyone our name, what part of town you’re from, the ages of your children, and something your children have been into lately.”

Part 1: Childproofing the “dumb home”

20 to 30 minutes

Discuss the following questions/topics:

Is there anything you physically prevent your children from doing? How do you prevent them? Why do you do so? (e.g. hiding keys, covering outlets, etc.)

Is there anything you restrict your children from doing? How do you enforce it? Why do you do so? (e.g. limits on TV time, limits on eating, etc.)

[To others:] Do you also do the same thing? Why or why not?

Answers about why/how will probably not answer our current research questions but likely will inform future research. You may have to play even more dumb than you usually might for questions such as “why don’t you let your 2 year-old use the blender?”

Photos:

Take a few photos of the whole group or part of the group paying attention to someone other than the facilitator. Wider framed photos will probably be angled downward somewhat.

Take a few photos of people talking to the group. These may be close-up framing the face, or further away, showing the upper bodies of multiple participants.

Take a few photos of people reacting to others. These may be close-up framing the face, or further away, showing the upper bodies of multiple participants.

Take photos of silences when people are thinking of what to say. These may be close-up framing the face, or further away, showing the upper bodies of multiple participants.

Take a couple photos of the facilitator talking to the group. These should include most if not all the participants in the frame.

Part 2.1: Introduction to the smart home and voice interface

5 to 10 minutes

Photos:

“All your responses so far have been insightful. We’re going to switch topics. How many of you have heard of the term ‘Internet of Things’ or ‘smart home’?”

If someone has heard of it, let them explain, and then tailor your explanation accordingly.

“(Yes, it’s kind of / just like that // At [company], we think of the term a differently.) In the future, more and more parts of your home are going to have the ability to connect to a network and communicate with you and other parts of your home. For example, you might let your blinds communicate with your TV so that whenever your TV is on, your blinds will close so that there’s no sunlight hitting the screen. These products also have the ability to automate themselves, such as a thermostat that has a schedule. These products are available to purchase right now from various companies. In fact, every single sticky note that you sorted today has a ‘smart’ version of right now.

“Another emerging technology that can interact with all of these smart home products is voice assistants. You’ve probably heard of Siri, Cortana, Alexa, or Google Assistant. You can use voice assistants in your home to control and automate smart home products.

“Do you have any questions about smart home products or voice assistants?”

Answer their questions, keeping in mind that you probably don’t have time to make them an expert; quickly get them up to speed enough to contribute to the next portion.

Take a few photos of people reacting to the facilitator. These may be close-up framing the face, or framed further away, showing the upper bodies of multiple participants.

Take a couple photos of the facilitator talking to the group. These should include most if not all the participants in the frame.

Take a couple photos of people asking the facilitator questions. These may be close-up framing the face, or framed further away, showing the upper bodies of multiple participants.

Part 2.2: Childproofing the smart home

20 to 45 minutes

Photos:

“[If this has not already come up:] Something that might be of concern to you all is that your children can probably operate any smart home products with just simple sentences from their mouths.”

Discuss the following questions/topics:

Is there anything you don't currently childproof that you'd want to childproof if you had a voice assistant? Why? How might you like or imagine the childproofing to work?

What might you use voice assistant for that you don't want your child using a voice assistant for? Why?

How do you feel about your children using voice assistants?

[To others:] Do you agree / feel the same way? Why or why not?

Answers about why/how will probably not answer our current research questions but likely will inform future research. You may have to play even more dumb than you usually might for questions such as “why don't you let your 2 year-old use the blender?”

If discussion comes to a halt, feel free to prompt another type of smart home products that hasn't been discussed yet.

If you have covered all the types of smart home products already, you might shift the conversation to things that NLUI might enable a child to do that the parent would want them to do, such as make a phone call in an emergency. This does not answer our current research question but will likely inform future research.

If you somehow have exhausted all the previous topics, you might try discussing hypothetical future smart home products.

Conclusion

5 to 10 minutes

“We're reaching the end of our time together. Are there any other thoughts or feelings anyone would like to voice today?”

Take a few photos of the whole group or part of the group paying attention to someone other than the facilitator. Wider framed photos will probably be angled downward somewhat.

Take a few photos of people talking to the group. These may be close-up framing the face, or framed further away, showing the upper bodies of multiple participants.

Take a few photos of people reacting to others. These may be close-up framing the face, or framed further away, showing the upper bodies of multiple participants.

Take photos of silences when people are thinking of what to say. These may be close-up framing the face, or framed further away, showing the upper bodies of multiple participants.

Take a couple photos of the facilitator talking to the group. These should include most if not all the participants in the frame.

Additional documentation procedures

In addition to the photos that are described on the right-hand column of pages 6 to 12 and the audio recording of the focus group discussion, we will want to take photos/scans of the following:

Each poster with sticky notes by itself

Notes taken by documenters

We will also pay attention to and document the following:

Difficulties in timing

Costs of childcare service

Costs of drinks

Any event where a participant leaves early, including the reason

Any difficulties participants have in travelling to our location

Consent agreement

I volunteer to participate in a research project conducted by representatives from [company].

My participation in the study activities are voluntary.

I understand that I will be compensated \$200 for my participation. I may withdraw and discontinue participation at any time without penalty. If I feel uncomfortable in any way during the study session, I have the right to decline to participate fully in any activity or to leave the study session, knowing that my compensation will not be reduced in such an event.

Participation involves sorting things into categories, as well as group discussion with other participants led by representatives from the [company].

Photos will be taken during both activities, with and without other participants, and I give my consent to be photographed.

An audio recording of the group discussion will be captured, and I give my consent to be recorded.

Notes will be written about participants during both activities. I understand that the researcher will not identify me by name in any reports using information obtained from this interview, and that my confidentiality as a participant in this study will remain secure. Subsequent uses of records and data will be subject to standard data use policies which protect the anonymity of individuals and institutions.

I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to participate in this study.

Name:

Signature:

Date:

Participant gratuity release

I acknowledge that I have received \$200 from the representatives of [company] for my participation in their study on the date written below.

I acknowledge that I have been given the appropriate contact information should I have any concerns about the study, the third-party childcare services provided (if applicable), and/or the gratuity.

Name:

Signature:

Date:

Non-participant gratuity release

I acknowledge that I have received \$50 from the representatives of [company] as a goodwill gift for attempting to participate in their study on the date written below.

I acknowledge that I have been given the appropriate contact information should I have any concerns about my non-participation in the study and/or the gratuity.

Name:

Signature:

Date: