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"Computer, how do smart speakers support aging in place?" – A feature analysis focusing on smart speaker applications in Amazon's skill store for older persons

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Abstract

Background: Since smart speakers like Amazon's Echo have been introduced in 2015, the devices show rapid diffusion. Older users have been identified as a user group that can benefit from smart speakers as the devices can be operated by voice commands and do not require knowledge of visual interfaces. Smart speakers can be customized and individualized with downloadable software applications called "skills" or "actions". Due to this "fit", there is a growing number of skills available for download that target older users. As known from other technologies, design choices are affected by images of aging that are often simplistic or negative.
Objective: Focusing on Amazon's skill store, the aim of this paper is to identify skills available specifically for older users. We explore the extent to which skills for older persons are determined by deficit-oriented images of aging.
Method: We searched Amazon's skill store for terms such as "elderly", "senior", and "older person" and abbreviations and included skills that target older users. To analyze the identified skills, we applied a feature analysis that allows us to investigate the design choices of developers and their images of aging. As part of the feature analysis, we used qualitative content analysis to interpret the data.
Results: The search revealed 67 skills targeting older persons. The dominant category was "Health and Fitness", followed by "Education and Reference" and "Productivity". The analysis revealed the following most frequent features: News about events, informing relatives about health and emergencies, physical and mental exercise, and medication reminders. We identified multiple skills that follow negative images of aging and aim at compensation.
Conclusion: Smart speakers are a technology with a rising proliferation and increasingly become relevant for older users. The feature analysis underlines that deficit-oriented images of aging are still common in technology development.

Keywords: Apps, smart speaker, skills, images of aging

Introduction

Voice-operated virtual personal assistants or smart speakers have been a big success story in recent commercial technology development. Adoption rates of products like Amazon Echo, Google Home/Nest or Apple Homepod have increased continuously since the first market launch of the Echo in the US in 2015: According to comScore (2020), as of 2020, smart speakers are being used in one-third of all US households with a broadband internet connection. Furthermore, statistics for the year 2020 show that around 34% of all Internet households in the United Kingdom use such technology (AudienceProject, 2020).

One of the central advantages of the devices is that they are supposedly easy to use. To activate a smart speaker, users need to say a "wake work". In the case of Amazon's Echo, this would be "Alexa" or "Computer", followed by a voice command such as asking for information about the stock market or weather conditions. A smart speaker comes with several built-in features and can be used to operate smart home devices or to access entertainment content. Moreover, smart speakers can be personalized by downloading and installing applications offered by manufacturers or third-party providers. Very similar to app stores for smartphones, 'skills' (Amazon) or 'actions' (Google) can be accessed via online stores maintained by the companies themselves. There are several smart speaker products available today, including devices that come with a display and/or touchscreen.

Smart speakers and older users

As the devices are mainly operated via voice and do not require navigating a user interface such as smartphones do, one user group of smart speakers that have been of particular interest is older persons: Nimrod and Edan (2021) note that smart speakers can be operated despite visual impairments or limitations in mobility and without the need of getting accustomed to a visual user interface. The benefits of smart speakers for this group have already been discussed (see e.g. Farr, 2018; Ianzito, 2018; Nimrod & Edan, 2021) and companies like Amazon started offering specific services such as "Alexa together", that aim at supporting older persons living independently by offering multiple features like fall detection alerts and activity responses (Amazon, 2022). Besides this service, there are several smart speaker applications or skills available specifically designed for older adults. Nimrod and Edan argue in their study on the domestication of smart speakers by older persons that "they have great potential to support aging in place by promoting activity, fostering social connectedness, and sustaining health." (2021:3). Moreover, the authors found that these notions have been demonstrated and supported by other studies (see e.g. Kowalski et al., 2019; O'Brien et al., 2020; Pradhan et al., 2020; Trajkova & Martin-Hammond, 2020; Nimrod & Edan, 2021). Hence, several studies focus on the use of smart speakers for older users and particularly in the context of aging in place (e.g. Choi et al., 2020; Corbet et al., 2020; Heo & Yoon, 2019; Pradhan et al., 2019; Pradhan et al., 2020; Purao & Meng, 2019) or in residential care facilities (Trajkova & Hammond, 2020; Budd, 2020; Chung et al., 2021).

Research on the use of the technology covers multiple aspects but comes to diverse results. Kowalski et al. (2019) show that tech-savvy older persons can intuitively learn to use a smart speaker and "naturally" identify other applications (including networked smart home applications) without the need for further training (Kowalski et al., 2019). Other studies report that users do not know much about applications, do not know how to activate applications, or have general difficulties discovering new application possibilities (Koon et al., 2020; Pradhan et al., 2018). There is also evidence of negative attitudes and reservations about the devices. For example, the interaction with a smart speaker is perceived as "unnatural" (Pradhan et al., 2020). Similarly, fears of being surprised or scared by the voice of the devices were expressed (Pradhan et al., 2020). Several studies also show privacy concerns and worries of older test users about data gathered due to the constant monitoring of the devices (Kim, 2021; Chung et al., 2021). Regarding first impressions on the usefulness of smart speakers, both positive and negative evaluations are found: While some older test users can imagine using the functionalities such as reminders and information requests as daily support (Chung et al., 2021), others do not see any significant added value for their current life (Kim, 2021). The possibility of using the devices to compensate for age-related restrictions/changes is recognized as useful for the future, but applications such as reminders for taking medication or appointments are more likely to be associated with negative aspects of age or the process of aging (Kim, 2021).

Images of aging

The last observation addresses a recurring argument within gerontology and gerontechnology: deficit-oriented design approaches based on negative images of aging. As Vines et al. (2015) point out, the mainstream public discourse on technology and aging has been dominated by images or the way aging is imagined by individuals and/or society. These images often show aging as a societal problem and connect to deficit-oriented images of older persons (Peine & Neven, 2021). Thus, aging processes are primarily associated with multiple declines (Peine et al., 2014), and characteristics such as frailty, immobility, and passivity are stereotypically ascribed to older persons (Gilleard & Higgs, 2010; Katz, 2015; Giaccardi et al., 2016; Burema, 2021). According to Peine and Neven (2019), the adoption of such images has led to an "interventionist logic" focusing on the compensatory and preventive potentials of "technological instruments", which address supposedly existing and identifiable needs of older persons (Peine et al., 2014; Giaccardi et al., 2016; Peine & Neven, 2019;). In the design processes of (geron-)technology, images of aging influence design decisions and are often accompanied by certain – negative or simplistic – assumptions about older persons as technology users (Peine et al., 2014; Peine et al., 2021). Following this interventionist logic, technology is seen as a way to address alleged declines (Endter, 2020).

Since commercial smart speakers are intended for all user groups, the basic design of the artifact and the functioning of smart speakers cannot be traced back to an image of aging. It can rather be assumed that Amazon's smart speakers precede the idea of being used by older persons. Thus, to reflect on images of aging the analysis must focus on software explicitly designed for older persons. Although the devices have been discussed within the literature of social sciences, science and technology studies (STS), human-computer interaction, and aging studies, among others (see e.g. Vollmer et al., 2017; O'Brien et al., 2019; Choi et al., 2018; Nimrod & Edan, 2021) to our knowledge there is no study examining skills or actions designed specifically for older persons. In view of

the growing proliferation of the technology, the fact that Amazon´s Echo and co. have received very little attention in gerontechnology seems surprising. Against this background, the aim of this paper is twofold: (1) to identify skills and their features for older persons; (2) to explore whether skills for older persons are determined by deficit-oriented images of aging. We focus on Amazon's skills store as Amazon is still the market leader with a share of 26.4 percent (statista, 2022).

Methods

As pointed out by Chung et al. (2018) there are no clear review methods for smart speaker skills, which is why we follow a methodology for the analysis of smartphone applications ('apps'). Hasinoff and Bivens (2021) argue that most studies analyzing apps focus on health apps and follow a quantitative design, ignoring the relationship between app design and dominant ideologies. On the other hand, studies that take the relationship between design and ideology into account mainly focus on examining the interface of a small sample of apps (see e.g. Bivens & Hasinoff, 2021; Lupton, 2015). Given the fact that skills do not have a visual interface, many methodologies at hand cannot be applied one-on-one to the analysis of skills for smart speakers. Therefore, we followed a method called 'feature analysis' described by Hasinoff and Bivens (2021). According to the authors, it aims to "systematically answer questions about how app developers' design choices reflect existing cultural norms, assumptions, and ideologies." (Bivens & Hasinoff, 2021:90). A feature is defined as "an action, option, or setting afforded by the mobile app and access to the user" (Bivens & Hasinoff, 2021:4). Therefore, the method focuses on social problems that apps address, e.g. apps for smoking cessation. The authors suggest first specifying a problem that is targeted by applications. Afterward, keywords are defined, which are then used to identify applications in app stores and to collect basic information such as name, store category, description, etc.

As we wanted to find out which skills for older persons exist in general, we conceptualized aging as the "problem" and not for instance risk of falls, becoming forgetful, or other negative stereotypes that are often associated with old age. As a second step, features of the apps such as sounding an alarm are identified based on content analysis. This step builds on inductive content analysis as it is used in Grounded Theory (Glaser & Strauss, 1967). As a third step, "each feature's mechanisms, conditions, and expected outcomes" are assessed (ibd.: 99). The main aim of the third phase is hence to look at practices rather than content. Here, feature analysis makes use of Davis & Chouinard's (2017) concept of "affordances". Affordances allow researchers to assess "what features can do, for whom, and under what conditions" (Hasinoff & Bivens, 2021: 99). One of the main assumptions of the concept is that technologies such as apps apply mechanisms that enable or constrain users (Davis, 2020). The fourth phase uses speculative design methods to imagine alternative apps, i.e. apps with features that were not included in the sample but address the same problem. We applied the first three steps of the method. We did not go through step four – using speculative design methods – as we wanted to explore what skills are available today and what features they use and not design new features.

We searched Amazon's skill store in October 2021. One author (AK) obtained the title of the skill, its description, and the user ratings and decided whether it met the inclusion criteria. In case the title or description was not clear, a second author (SS) was consulted. As we were interested in skills for older users, we searched the US Amazon's skill store for the terms "elderly", "senior*", "older person*", "older people", and "older adult*". The syntaxes were selected based on a pretest and the queries that produced the most hits relevant to this research question were used. Based on the description of the skills we included applications that explicitly but not necessarily exclusively target older persons as users. Furthermore, we included skills targeting family members, friends, or caregivers with the purpose of supporting older persons. We excluded skills that target a broad range of users and thus are not explicitly aimed at older persons. Furthermore, skills related to dementia were not considered, as we wanted to wide focus on the general view of older persons.

We developed a template to gather information on the skills: The name, the description, the user ratings, and comments. The data were analyzed with the method of qualitative content analysis (Mayring, 2000), including an inductive development of analysis codes based on the features of the skills, e.g. making emergency calls. To assign features, coding rules were explicated. One researcher (SS) went through the entire sample and developed inductive analysis codes based on the description of the application (in one case, there was no description available, hence features were assigned based on the user reviews). Finally, our list consisted of 12 codes representing the features. Subsequently, two authors (AK and SS) independently evaluated the skill descriptions of all 67 skills to assign the features for the entire data set. To address the second aim of the paper, which is to analyze the images incorporated in the skills, we followed a deductive coding based on the work of Burema (2021) who studied user repre-

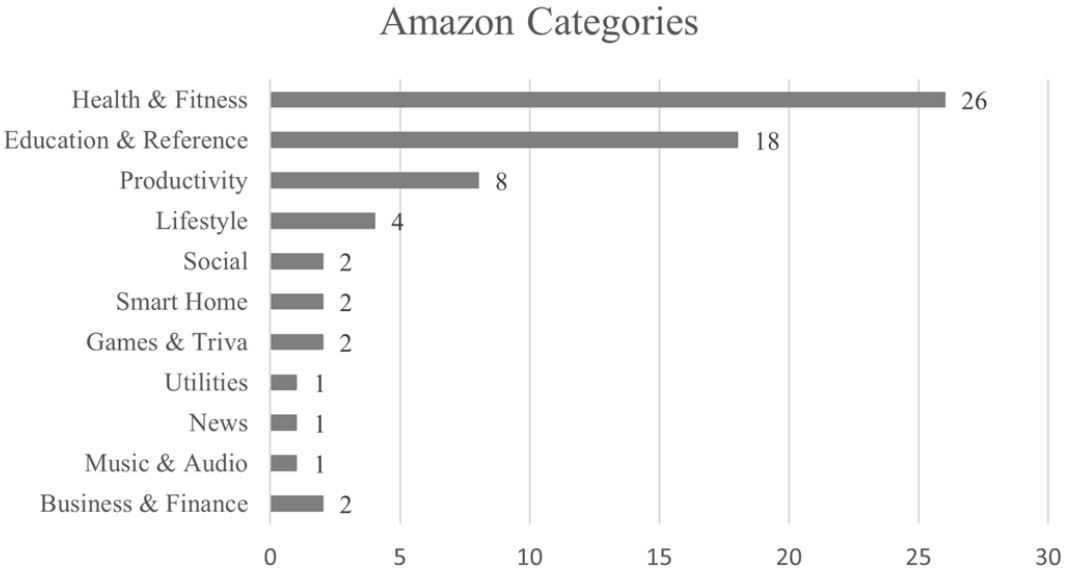

Figure 1. Skill categories within Amazon's skill store

sentations of older users in the field of service robots. The author identified four themes: "older adults and their general functioning, older adults as users of new technologies, older adults and others, older adults and society" (Burema, 2021:459). Based on the description of the applications we selected quotations reflecting those themes.

The user ratings were analyzed using descriptive statistics. Positive ratings indicate approval by users. Negative or no ratings can therefore show the opposite, i.e. that users do not find this application suitable for them. It should be noted that the analysis of the ratings can only be seen as a weak indicator as skills can be used frequently even if they have no ratings at all.

Results

The search revealed 67 skills for older persons. Of those 67 skills, 14 are provided by one developer and are variations of one skill. Looking at the official categories of Amazon's skill store, we found skills in eleven different categories, with "Health & Fitness" encompassing the most skills (26), followed by "Education and Reference" with 18 skills, and "Productivity" with 8 skills (*Figure 1*). At the time the search was carried out, there were 22 categories listed in the store.

The following features were identified in the analysis of the descriptions (*Figure 2*). It should be noted that a single skill can have several features.

In terms of skill features, we found that events calendars (14), podcasts (11) and cognitive training (11), and information (11) were the most common (*Figure 2*). The skills that we assigned to the skill feature "events calendars" are in most cases events or meetings that take place in e.g. residential communities. Skills in this area typically aim at connecting older persons with their peers and neighbors and encouraging them to take part in activities and events. As the following description of a skill shows, they inform mainly about events in the neighborhood.

"Legacy Oaks Activities informs seniors at Legacy Oaks of Midlothian of today's activities. Stay connected in your community with this skill." (Skill Legacy Oaks Activities)

The feature "Podcasts/Radio" summarizes all skills that allow you to directly tune into a radio station or stream a podcast. These skills deal with topics like health, depression in old age, or loneliness (*Table 1: #19-30*). It is noticeable here that the topics relate exclusively to health-related aspects. Furthermore, the topic of loneliness in old age is frequently considered in the skills. It must be noted that nearly all these skills are offered by the same developer.

"Cognitive training" contains skills with features allowing users to play a trivia game or solve equations, etc. A typical description of a skill is the following:

"This is a trivia game for senior citizens who might be alone due to the pandemic. It's a great way to keep the mind moving, especially if you are confined to your room all day. The questions are not too hard and are mostly geared towards seniors." (Skill Villa Trivia)

"Information" covers mainly skills that provide e.g. daily news, how to stay healthy, also elderly care. In many cases (9) the skills provide the feature to receive information on menus offered e.g. in

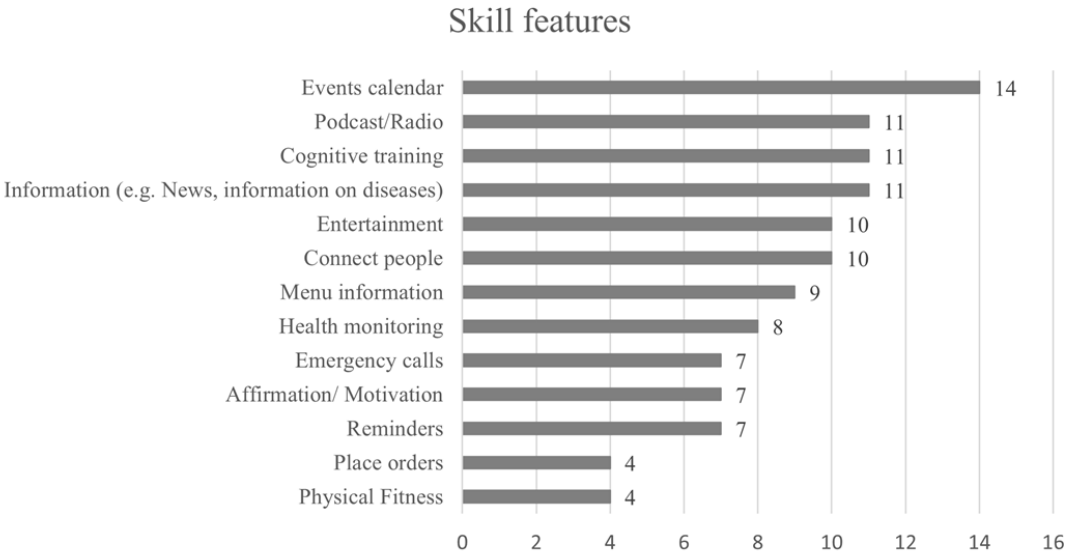

Figure 2: Skill features

care homes.

The two features "health monitoring" and "emergency calls" are often offered in one single application. The monitoring and recording of health data allow users to analyze, for example, their vital signs, medication intake, or sleep rhythm. In addition, third parties such as nurses, doctors, or children can be enabled to access the data. Furthermore, it is possible for patients to make emergency calls when they are in a health emergency. This is possible either manually by actively making an emergency call or indirectly by the system automatically making an emergency call in the event of a fall, for example. This emergency function can be connected to the emergency call center or, in the case of non-life-threatening messages such as the forgetting of medication, to the formal or informal caretaker. The following quote shows an example of skills designed to support medication intake:

"Activities could be any phrases like […] 'I am taking the red pill'. […] This skill is also useful for people needing memory assistance due to any medical condition or elderly people." (Skill Activity Monitor)

We could also identify multiple skills that make use of similar features as "Alexa Together" and aim at connecting older persons and their relatives or caregivers, but also with friends and neighbors which are grouped as "connect people". While some of these skills aim at older persons themselves and provide e.g. the opportunity to connect with other users in case one feels lonely, others allow e.g. family members to contact their older relatives.

Looking at the ratings of the skills, it is noticeable that out of 67 skills, only 28 skills received at least one rating. This corresponds to only 41.8% of the skills found. The number of individual ratings for a skill varies between 1 and 230 (*Table 1*). The skills "My Day, a well-being program for older adults" and "Staying Sharp Memory Game from AARP" received the most ratings with 230 (3.6 stars on average) and 61 (3.5 stars on average) respectively, which indicates that these skills have the highest usage in our sample. Considering the average star ratings of the skills with at least one rating (28), we found a minimum of 2.2 stars and a maximum of 5 stars. The average star rating of all 28 skills with ratings is 4.09 stars (*Table 1*). These results indicate that only a small part of the skills available are widely used.

Considering the images of older persons, we mainly identified what Burema calls "older adults and their general functioning" (2001:459). Older persons are reduced to narratives of "(in)dependence and (loss of) capabilities". This covers "loss in social participation, health and mobility, and cognitive and mental functioning" (2001:459). The loss of capabilities and particularly mental capabilities seems to be a common theme. Older users are seen as a group in need of memory assistance as skills that support medication intake indicate. For instance, "Skill Villa Trivia" aims at keeping oneself mentally fit without being „too hard" by offering questions specifically designed for older users. Other skills refer to the discourse on loneliness and aging, which has been strongly affected by the pandemic.

Discussion

67 skills in total do not seem like a high number. This impression is underlined by the relatively

Table 1. The number of individual ratings for a skill

#	Name	Amazon category	Skill features	Average star rating	Number of ratings
1	AARP Now News	News	Information	3,5	12,0
2	Activity Monitor	Productivity	Reminders	3,7	2,0
3	Advance Addition Spot Quiz	Education & Reference	Cognitive training	3,0	2,0
4	Advance Division Spot Quiz	Education & Reference	Cognitive training	0,0	0,0
5	Advance Subtraction Spot Quiz	Education & Reference	Cognitive training	0,0	0,0
6	Age Smart	Health & Fitness	Cognitive training Entertainment	2,5	2,0
7	Aldersgate Activities	Education & Reference	Connect people Events calendar	0,0	0,0
8	Aldersgate Menu	Utilities	Menu information	0,0	0,0
9	All About Caring For the Elderly	Education & Reference	Information	0,0	0,0
10	Ariel Pointe Activities	Education & Reference	Connect people Events calendar	0,0	0,0
11	Ask AARP	Education & Reference	Cognitive training Information Entertainment	0,0	0,0
12	At Home Senior Fitness	Business & Finance	Information Events calendar Physical Fitness	0,0	0,0
13	Body Works: Senior Workout	Health & Fitness	Information Physical Fitness	3,2	13,0
14	Care Ringer Companion (medicine man)	Health & Fitness	Reminders	3,8	2,0
15	Connect2Affect Connected Community	Lifestyle	Connect people Events calendar Reminders Menu information Information	3,5	19,0
16	Constance	Education & Reference	Health monitoring Emergency calls	5,0	2,0
17	Division Spot Quiz	Education & Reference	Cognitive training Entertainment	0,0	0,0
18	Elder Affirmations Sampler	Health & Fitness	Affirmation/ Motivational Connect people	0,0	0,0
19	Elder Care Stories	Health & Fitness	Podcast/ Radio Entertainment Connect people	5,0	1,0
20	Elder Daily Affirmation	Health & Fitness	Podcast/ Radio Affirmation/ Motivational	5,0	1,0

Table 1. The number of individual ratings for a skill (cont')

#	Name	Amazon category	Skill features	Average star rating	Number of ratings
21	Elder Flashcards Sampler	Health & Fitness	Podcast/ Radio Affirmation/ Motivational Connect people Entertainment	0,0	0,0
22	Elder Happiness Facts	Health & Fitness	Podcast/ Radio Affirmation/ Motivational Connect people Entertainment	5,0	1,0
23	Elder Mood Helper	Health & Fitness	Podcast/ Radio Affirmation/ Motivational	0,0	0,0
24	Elder Party Line	Health & Fitness	Podcast/ Radio Entertainment	0,0	0,0
25	Elder Talks	Health & Fitness	Podcast/ Radio	0,0	0,0
26	Elder Talks Caregiving	Health & Fitness	Connect people Entertainment Cognitive training	0,0	0,0
27	Elder Talks Elderhood	Health & Fitness	Podcast/ Radio	0,0	0,0
28	Elder Talks Happiness	Health & Fitness	Podcast/ Radio Affirmation/ Motivational	0,0	0,0
29	Elder Talks Loneliness	Health & Fitness	Podcast/ Radio	0,0	0,0
30	Elder Talks Unknown	Health & Fitness	Podcast/ Radio	0,0	0,0
31	EngAGE Exercise	Health & Fitness	Physical Fitness	4,2	3,0
32	Galloway Ridge Senior Living Community	Productivity	Events calendar Menu information	0,0	0,0
33	I Wanna Hear You	Health & Fitness	Health monitoring Emergency calls	0,0	0,0
34	I'm Hurt non-emergency alert	Health & Fitness	Health monitoring Emergency calls	2,6	25,0
35	InTouchLink Voice Access	Lifestyle	Menu information	0,0	0,0
36	Legacy Oaks Activities	Education & Reference	Events calendar	0,0	0,0
37	Legacy Oaks Dining	Productivity	Menu information	0,0	0,0
38	Legacy Oaks Reservations	Productivity	Events calendar	5,0	1,0
39	Legacy Oaks Work Orders	Productivity	Place orders	0,0	0,0
40	My Azle Activities	Education & Reference	Events calendar	0,0	0,0
41	My Day, a well-being program for older adults	Health & Fitness	Health monitoring Emergency calls Reminders Cognitive training Physical Fitness Affirmation/ Motivational	3,6	230,0

Table 1. The number of individual ratings for a skill (cont')

#	Name	Amazon category	Skill features	Average star rating	Number of ratings
42	My Life Story	Social	Entertainment Cognitive training	5,0	2,0
43	My SOS Family	Smart Home	Health monitoring Emergency calls	3,4	16,0
44	OnGuardian	Health & Fitness	Health monitoring Emergency calls	4,4	2,0
45	Palmnest	Health & Fitness	Health monitoring/ emergency calls Information	0,0	0,0
46	Park Creek Reservations	Productivity	Events calendar	0,0	0,0
47	Park Creek Work Orders	Productivity	Place orders	0,0	0,0
48	People Power Family	Smart Home	Health monitoring/ emergency calls	5,0	1,0
49	Red Oak Activities	Education & Reference	Events calendar	0,0	0,0
50	Senior Citizen Prepping English Spanish	Education & Reference	Health monitoring Emergency calls	5,0	1,0
51	Senior Shopping Hours	Lifestyle	Information	5,0	2,0
52	Sentai Button	Health & Fitness	Health monitoring Emergency calls	0,0	0,0
53	Spot-Care	Lifestyle	Information Menu information	0,0	0,0
54	Staying Sharp Memory Game from AARP	Games & Triva	Cognitive training	3,5	61,0
55	Sundial	Social	Connect people Reminders Place orders	4,6	3,0
56	The Brooks Activities	Education & Reference	Events calendar	0,0	0,0
57	The Carrington Activities	Education & Reference	Events calendar	0,0	0,0
58	The Carrington Menu	Education & Reference	Menu information	0,0	0,0
59	The Views Activities	Education & Reference	Events calendar	2,2	2,0
60	The Views Dining	Productivity	Menu information	0,0	0,0
61	The Views Menu	Education & Reference	Menu information	0,0	0,0
62	The Weinberg Place	Music & Audio	Events calendar	5,0	1,0
63	Villa Trivia	Games & Triva	Cognitive training Entertainment	0,0	0,0
64	VoiceFriend Notifications for Seniors	Health & Fitness	Reminders	3,5	37,0
65	VoiceFriend StaffAlert for Seniors	Health & Fitness	Health monitoring Emergency calls	5,0	3,0
66	VoiceR	Health & Fitness	Health monitoring Emergency calls Reminders Information	4,4	3,0
67	Wilson Rides	Business & Finance	Place orders Connect people	0,0	0,0

small amount of skills that have received at least one rating (41,8%). Such a small number of rated skills may be an indication that the majority is not actively used – or used at all. It seems as if developers wanted to see whether there is a market without investing many recourses as multiple very similar apps by one developer indicate. The "fit" of smart speakers and the presumed challenges of older persons might have encouraged developers to engage in the field in an explorative way. It may be argued that developers have just begun to experiment with the possibilities of the devices, an interpretation that is supported by the fact that Amazon itself has recently entered the field, which underlines the market potential. Overall, it seems as if the possibilities – "promoting activity, fostering social connectedness, and sustaining health" (Nimrod & Edan, 2021:3) – seen by some authors have not yet been tapped.

Commercial smart speakers personalized with skills can function as "quality-of-life" technologies for older persons (Schulz et al., 2015). As such they are understood as being "(…) person- and/or context-aware technologies that maintain or enhance the physical, cognitive, social, or emotional function of humans" (Schulz et al., 2015:725). Schulz et al. (2015) point out that this includes technologies fulfilling compensatory, assistive, preventive, entertaining, (psychologically) stimulating as well as informational functions. While we could identify at least a few skills making use of the technology in a proactive and stimulating way, the majority of the 67 skills in our sample are designed for compensation or offer assistive features.

Deficit-oriented images of aging

Critically reflecting images of aging plays an important role here. As Lupton (2014) has shown for health apps, an analysis of skills provides an overview of challenges in the fields of aging that are considered as important by the developers of those skills. In the case of smart speaker skills, the dominant challenges seem to be supposedly negative aspects of aging like forgetfulness or being lonely. Against the background of the pandemic, particularly the latter seems to be a central problem that many skills aim to address. The applications in our sample and the features they use emphasize rather deficit-oriented and medicalized images of aging. Many of them work with negative stereotypes and thematize physical or cognitive decline often combined with the need for supervision by others. Skills following an interventionalist logic seem to be common which also implies that older persons need special support and training. Overall, the analysis of skills underlines what has already been shown and criticized (see e.g. Höppner & Urban, 2018; Peine & Neven, 2019). For instance, a similar finding has also been reported by Burema (2021) who has shown that representations of older adults in the field of human-robot interaction are often based on negative images and stereotypes. In this sense, technology can be used to address and fix these problems of older age.

Such an interventionalist logic might lead to several issues: A possible lack of memory for example can be compensated by setting reminders, a feature that several skills in our sample provide. A new critical perspective to understand the implications of smart speaker use in old age could try to examine how this skill replaces a prior practice to remember. The skill might simply be a useful possibility to replace handwritten notes, or it could also cause new dependencies and even be counter-productive to maintaining memory abilities if other persons continuously set reminders. Research finds that some older persons felt less engaged in looking up information when using smart speakers instead of conventional methods (Selke, 2019). The skill might be more convenient as information is presented right away, but it might also replace the task of individually search, selecting and critically assessing information. Thus, as Selke argues, intelligent assistants foster tensions between active use and more passive consumption, which can in turn lead to more dependency.

Limitations

Our paper has several limitations. First, we did not conduct all four steps that are part of the method. In the fourth and final step, alternative features of apps are imagined using speculative design and potentially involving users or designers. This could provide new insights into images of aging particularly when designers are involved. This would, however, require new and additional methods. Still, we think that the first three steps are sufficient to explore the images of aging that influenced the design decisions of the developers. Another limitation is that we did not download and test the skills and that our analysis is based on the descriptions and user ratings. Due to the simplicity of some skills, e.g. those that provide only a single feature such as a trivia quiz, the main features can be studied based on the description, which, besides the name and the rating is one central aspect of users to judge if they want to test the skill. However, as outcomes are not only influenced by the features but also by the context in which the skills are used, future studies should not only look at the skills themselves but also investigate how skills are used by older persons in their living environments. For our analysis, we conceptualized aging as one central "problem" that needs to be addressed by technology. Future analysis can focus

on a specific challenge associated with increasing age such as falls or loneliness.

However, as we wanted to explore the field of skills for older users in general, we set a wider focus. Moreover, investigating other stores such as Google could also be covered, also we do not expect any differences in our results. Lastly, we did not differentiate between the standard version of smart speakers and other forms, for instance, those with a display or touchscreen offering additional features. We did not find any skill that explicitly makes use of these possibilities.

Conclusion

Smart speakers are a relatively new technology but show very high diffusion rates. The possibility to place smart speakers into private home environments and personalize them with skills offers various possibilities. Still, it seems as if skills for older users are in their infancy and developers are yet exploring possibilities. In doing so, many of the skills in our sample rather emphasize deficit-oriented and medicalized images of aging and/or offer compensatory functions. Here, designers and developers should be more aware of how images of aging can influence the design process and design decisions and should avoid negative stereotypes. A promising way is a participatory design involving (future) users in the design process as this might help to counter stereotypes. Even though participatory approaches place high demands on all actors involved, including the users, they can still help to avoid negative stereotypes. Users can actively influence decisions in the development process and negotiate design decisions. Such interaction between developers and users alone can help to challenge negative images of aging.

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References

Amazon. (2022). Alexa Together: Introducing a new service to help you care for the ones you love. https://www.amazon.com/Alexa-Together/b?ie=UTF8&node=21390531011

AudienceProject. (2020). INSIGHTS 2020: Device usage. https://www.audienceproject.com/wp-content/uploads/audienceproject_study_device_usage_2020.pdf

Bivens, R., Hasinoff, A. A. (2017): Rape: is there an app for that? An empirical analysis of the features of anti-rape apps, Information, Communication & Society. https://doi.org/10.1080/1369118X.2017.130944

Budd, B. (2020). Smart Speaker Use and Psychological Well-Being Among Older Adults. Master of Philosophy. Master Thesis. University of Cambridge. Department of Psychology. Online verfügbar unter http://fpciw.org/wp-content/uploads/sites/15/2020/11/BB-Thesis.pdf

Burema, D. (2021). A critical analysis of the representations of older adults in the field of human–robot interaction. AI & SOCIETY. Advance online publication. https://doi.org/10.1007/s00146-021-01205-0

Choi, Y., Demiris, G., & Thompson, H. (2018). FEASIBILITY OF SMART SPEAKER USE TO SUPPORT AGING IN PLACE. Innovation in Aging, 2(suppl_1), 560. https://doi.org/10.1093/geroni/igy023.2073

Chung, A. E., Griffin, A. C., Selezneva, D., & Gotz, D. (2018). Health and Fitness Apps for Hands-Free Voice-Activated Assistants: Content Analysis. JMIR MHealth and UHealth, 6(9), e174. https://doi.org/10.2196/mhealth.9705

Chung, J., Bleich, M., Wheeler, D. C., Winship, J. M., McDowell, B., Baker, D., Parsons, P. (2021). Attitudes and Perceptions Toward Voice-Operated Smart Speakers Among Low-Income Senior Housing Residents: Comparison of Pre- and Post-Installation Surveys. In Gerontology & geriatric medicine. Vol. 7, S.1-9. https://doi.org/10.1177/23337214211005869.

comScore. (2020). Digital device penetration in Wi-Fi connected households in the United States from 2017 to 2020 [Graph]. https://www.statista.com/statistics/177558/penetration-rate-of-mobile-devices-in-the-us

Corbett, C. F., Combs, E. M., Wright, P. J., Owens, O. L., Stringfellow, I., Nguyen, T., van Son, C. R. (2021). Virtual Home Assistant Use and Perceptions of Usefulness by Older Adults and Support Person Dyads. In International journal of environmental research and public health 18 (3), S.1-13. https://doi.org/10.3390/ijerph18031113

Davis, J. L. (2020). How artifacts afford: The power and politics of everyday things. MIT Press.

Davis, J. L., and Chouinard, J. B. (2017). Theorizing affordances: From request to refuse. Bulletin of Science, Technology & Society, 36(4), 241-248. https://doi.org/10.1177/0270467617714944

Farr, C. (2018) Amazon's secretive health team talking with AARP about making products for older people. https://www.cnbc.com/2018/03/20/amazon-exec-babak-parviz-interested-in-elderly-health-consulted-aarp.html

Endter, C. (2020). User Participation as a Matter of Care: The Configuration of Older Users in the Design of Assistive Technologies. Tecnoscienza, 11(2), 93–116.

Giaccardi, E., Kuijer, L., & Neven, L. (2016). Design for resourceful ageing : Intervening in the ethics of gerontechnology. Proceedings of DRS 2016, Design + Research + Society Future-Future-Focused Thinking: 50th Anniversary International Conference, Brighton, UK, 27-30 June 2016. https://research.tue.nl/en/publications/design-for-resourceful-ageing-intervening-in-the-ethics-of-geront

Gilleard, C., & Higgs, P. (2010). Frailty, disability and old age: A re-appraisal. Health (London, England: 1997), 15(5), 475–490. https://doi.

org/10.1177/1363459310383595
Glaser, B. G., & Strauss, A. L. (1967). The discovery of grounded theory: Strategies for qualitative research (11th printing). Aldine Transaction.
Hasinoff, A. A., & Bivens, R. (2021). Feature Analysis: A Method for Analyzing the Role of Ideology in App Design. Journal of Digital Research, 3(2), 89–113.
Heo, J.,Yoon, W. C.(2019). Use of Smart Speakers by Elderly in Home Environment. In ACHI 2019: The Twelfth International Conference on Advances in Computer-Human Interactions, S. 46–49.
Höppner, G., Urban, M (2018). Where and how do aging processes take place in everyday life? Answers from a new materialist perspective. Front Socio 3(7). https://doi.org/10.3389/fsoc.2018.00007
Ianzito, C. (2018). Isolation and Loneliness: Voice-Activated Technology Might Help. https://www.aarp.org/home-family/personal-technology/info-2018/isolation-loneliness-technology-help.html
Katz, S. (2015). Ageing, risk and the falling body. In J. Twigg & W. Martin (Eds.), Routledge international handbooks. Routledge handbook of cultural gerontology (pp. 165–172). Routledge.
Kowalski, J., Jaskulska, A., Skorupska, K., Abramczuk, K., Biele, C., Kopeć, W., & Marasek, K. (2019, May). Older adults and voice interaction: A pilot study with google home. In Extended abstracts of the 2019 CHI Conference on Human Factors in Computing Systems (pp. 1–6). ACM. https://doi.org/10.1145/3290607.3312973
Lupton, D. (2014). Apps as Artefacts: Towards a Critical Perspective on Mobile Health and Medical Apps. Societies, 4(4), 606–622. https://doi.org/10.3390/soc4040606
Nimrod, G., & Edan, Y. (2021). Technology Domestication in Later Life. International Journal of Human–Computer Interaction, 38(4), 339–350. https://doi.org/10.1080/10447318.2021.1938395
O'Brien, K., Liggett, A., Ramirez-Zohfeld, V., Sunkara, P., & Lindquist, L. A. (2019). Voice-Controlled Intelligent Personal Assistants to Support Aging in Place. Journal of the American Geriatrics Society. Advance online publication. https://doi.org/10.1111/jgs.16217
Peine, A., Neven, L. (2021): The co-constitution of ageing and technology – a model and agenda. In: Ageing and Society 41 (12), S. 2845–2866. https://doi.org/10.1017/S0144686X20000641
Peine, A., & Neven, L. (2019). From Intervention to Coconstitution: New Directions in Theorizing about Aging and Technology. The Gerontologist, 59(1), 15–21. https://doi.org/10.1093/geront/gny050
Peine, A., Rollwagen, I., & Neven, L. (2014). The rise of the “innosumer”—Rethinking older technology users. Technological Forecasting and Social Change, 82, 199–214. https://doi.org/10.1016/j.techfore.2013.06.013
Pradhan, Alisha; Findlater, Leah; Lazar, Amanda (2019). "Phantom Friend" or "Just a Box with Information". In: Proc. ACM Hum.-Comput. Interact. 3 (CSCW), S. 1–21. https://doi.org/10.1145/3359316
Pradhan, A., Lazar, A., & Findlater, L. (2020). Use of intelligent voice assistants by older adults with low technology use. ACM Transactions on Computer-Human Interaction (TOCHI), 27(4), 1–27. https://doi. org/10.1145/3373759
Purao, Sandeep; Meng, Chenhang (2019). Data Capture and Analyses from Conversational De-vices in the Homes of the Elderly. In: Giancarlo Guizzardi, Frederik Gailly & Rita Su-zana Pitangueira Maciel (Hg.). Advances in Conceptual Modeling, S. 157–166. Bd. 11787. Cham: Springer International Publishing (Lecture Notes in Computer Sci-ence).
Schulz, R., Wahl, H.-W., Matthews, J. T., Vito Dabbs, A. de, Beach, S. R., & Czaja, S. J. (2015). Advancing the Aging and Technology Agenda in Gerontology. The Gerontologist, 55(5), 724–734. https://doi.org/10.1093/geront/gnu071
Selke, S. (2019). Entscheidungsmaschinen. In N. B. Heyen, S. Dickel, & A. Brüninghaus (Eds.), Öffentliche Wissenschaft und gesellschaftlicher Wandel. Personal Health Science (pp. 133–154). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-16428-7_7
Statista (2022): Market share of global smart speaker shipments from 3rd quarter 2016 to 2nd quarter 2021, by vendor. https://www.statista.com/statistics/792604/worldwide-smart-speaker-market-share/
Trajkova, M., & Martin-Hammond, A. (2020, April). “Alexa is a toy”: Exploring older adults’ reasons for using, limiting, and abandoning echo. In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems (pp. 1–13). ACM. https://doi.org/10.1145/ 3313831.3376760
Vines, J., Pritchard, G., Wright, P., Olivier, P., & Brittain, K. (2015). An Age-Old Problem. ACM Transactions on Computer-Human Interaction, 22(1), 1–27. https://doi.org/10.1145/2696867
Vollmer Dahlke, D., & Ory, M. G. (2017). Emerging Opportunities and Challenges in Optimal Aging with Virtual Personal Assistants. Public Policy & Aging Report, 27(2), 68–73. https://doi.org/10.1093/ppar/prx004