

# Amazon Echo Show as a Multimodal Human-to-Human Care Support Tool within Self-Isolating Older UK Households

EWAN SOUBUTTS, University of Bristol, UK

AMID AYOBI, University of Cardiff, UK

RACHEL EARDLEY, University of Bristol, UK

ROISIN MCNANEY, Monash University, Australia

KIRSTEN CATER, University of Bristol, UK

AISLING ANN O'KANE, University of Bristol, UK

Although the use of voice assistants to support older adults at home shows promise, little is known about how the next generation of these devices, which also include displays, can support health and care needs. This question has become more important during COVID-19, when issues of social isolation for older adults have been exacerbated. During social distancing measures in the UK, eleven older adult households (16 participants) were interviewed before receiving an Amazon Echo Show, shortly after receiving it, and after three months of use. We identify ways in which this multi-modal device is used by people in social isolation to support *social, care, and information* needs in the home. We frame these findings within the growing research area of smart homes for health and care, and provide implications for the adoption, use and acceptance of these devices to support aging in place together.

CCS Concepts: • **Human-centered computing** → **Collaborative and social computing**; *Empirical studies in collaborative and social computing*;

## KEYWORDS

Smart speakers, social isolation, social presence, social facilitation, automation, search, health, care

## ACM Reference format:

Ewan Soubutts, Amid Ayobi, Rachel Eardley, Roisin McNaney, Kirsten Cater, Aisling Ann O'Kane. 2022. Amazon Echo Show as a Multimodal Human-to-Human Care Support Tool within Self-Isolating Older UK Households. *Proc. ACM Hum.-Comput. Interact.*, 6, CSCW2, Article 302 (November 2022), 30 pages. <https://doi.org/10.1145/3555193>.

---

## 1 INTRODUCTION

The impact of the COVID-19 pandemic on people's lives across the globe has been unparalleled [49]. The pandemic has put a spotlight on the importance of supporting health, wellbeing and care needs within the home, especially for those who do not have immediate access to the people and resources that they normally would. Social distancing during the pandemic is linked with social isolation, which occurs when people have "limited contact with others" (p. 241) [87]. At the outset of the 2020 pandemic in the UK, some adults were instructed to reduce face-to-face engagement with other people, including family and friends, and therefore become more physically and socially isolated. These "shielded" adults were people who are at serious risk of illness during the pandemic due to being "immunocompromised or hav[ing] chronic conditions," and this included older adults [4]. The act of shielding fostered a unique self-imposed social isolation for individuals and households, which is predicted to have long-term negative consequences on people's health and their own

social efficacy (the ability of a person to collaborate with others for their own, or another person's benefit) [67].

The pandemic exacerbated a problem common to older and vulnerable adults, social isolation [12,22,42,67,84], with further restrictions on their physical and social efficacy, both self-imposed and due to circumstances outside of their control. This situation risks worsening existing health inequalities for specific demographics (e.g. culturally and linguistically diverse shielded people, who often depend on their wider community to support their physical and social wellbeing [38]). As shielded adults were recommended to isolate alone at home, we look to the home itself where self-isolation is enacted and experienced in order to investigate how technology can support older people here.

Smart homes and voice assistants hold great potential for helping people to live well at home. Recent research has shown how smart speakers such as Amazon's 'Echo' devices have been used to support older adults in their homes to live independently and support their own health and wellbeing [1,13,16]. The HCI community has also taken a focused view of the ways in which this technology is used, mis-used and abandoned by older adults (e.g. [43]), and in particular why this technology is abandoned more commonly in shared spaces [83]. Smart home technology that is shared in the home has also been discussed in relation to the roles of family caregivers in the home [26], how privacy is preserved there [30], and how technology can be used by non-owners to support the health and wellbeing of the people around them [17]. Studies published at the outset of the 2020 pandemic also highlight opportunities for design to support health and wellbeing using smart speakers, chatbots or voice assistants (e.g. Amazon's 'Alexa'), during the pandemic (e.g. [50]).

In this study, we take an approach that builds upon the opportunities for smart home technology to support health needs by examining the use of a next generation smart speaker with embedded display, the Amazon Echo Show, by older adults social distancing in the UK. The Echo Show (an Amazon 'Alexa' device with a screen) provides a unique context, extending existing studies on voice assistants in this area and adding a visual medium, which has been reported to enhance social interaction in other health and care settings [73]. We interviewed eleven households (16 participants) before they received the device, shortly after initial use and after three months of use in order to understand their individual and shared social isolation contexts and how the Echo device impacted each home. Through investigating the shared use of the device, we discuss how the Echo Show helped the wider household to support their interpersonal care relationships, seek and navigate important and mundane information online, and step in as an online social presence to make residents feel less isolated during COVID-19 lockdown isolation conditions. In this study, we focus on experiences of health, care and wellbeing during the pandemic of both the individual (self-care) and collective (shared care) in each household, to explore the efficacy of a novel, multimodal voice assistant with screen in delivering effective health and care in home environments. Our findings explore how the Echo Show provides *social*, *care* and *information* facilitation support to shared households who are isolated, which in turn supports their ability to look after one another, through making use of the device. We contribute to smart home health and care CSCW research by examining the use of voice assistants for health and care in households and describe novel, shared approaches for using voice assistants in the context of social isolation.

## 2 RELATED WORK

This section scopes contributions within the voice assistant literature and adjacent work in trust and social presence, that frame our contributions for this paper. We examine existing work here on how social presence and social tension arise in shared settings with a voice assistant present; how trust is fostered in smart home technology, with a focus on care (motivating our work); research conducted since the outset of the COVID-19 pandemic around the use of voice assistants (published from March 2020 to October 2021); and existing work regarding how the social presence of voice assistants can foster human-to-human communication.

## 2.1 Social Impact of Voice Assistants

Voice assistants (VAs) are devices which allow their users to converse, ask questions, and obtain information simply by speaking to the device [61]. Often a trigger word is used to wake the device and begin a conversation. VAs are not confined to the mobile device landscape (e.g. Siri on iPhones) and can also be integrated as standalone, fixed devices that are a part of people's homes. The current commercial leader is the Amazon Echo [28]; an Alexa-enabled smart device that has been the source of academic attention as a socio-technical component of households (e.g. [3]).

Research shows that voice assistants have been used extensively as shared (communal) devices within the home. Porcheron et al. [60] discusses challenges of VA use within multi-person households, in situations such as when conversational breakdowns occur. In these situations, a multi-person family might try to engage in conversation with the device at the same time. As voice assistants only respond to one person at a time, this can cause interpersonal tensions as well as difficulty operating the device if it is receiving conflicting commands [60]. As the device can also only respond to one command at a time, many conversational interactions are missed and as such, fully multi-person interactions with the device cannot occur. A study by Fuentes et al. [27] suggests moving away from 'scripted' interactions, with a single person speaking to the device at once and instead, developing the technology to support open-ended conversations with multiple actors. Other findings [11,29] demonstrate how this lack of support for multi-person conversations has implications for family interactions, for instance where parents and their children are trying to use a voice assistant for different purposes (e.g. parents running errands, shopping and children wishing to play games on the device) causing tension [10].

However, VAs show much potential for health and care support for shared devices, including the shared use of voice assistants that facilitate care, for example amongst families with mixed visual ability [80] stroke survivors [2] compensating for physical and cognitive impairments and people living with Parkinson's [24]. Similarly, recent studies discuss how VAs provided an opportunity to better engage with marginalised groups (e.g. older adults, the differently abled), who may otherwise struggle to use non-voice based technology [72].

Older adults and the people they live with both make use of and also abandon care technology in their homes [83]. Research on voice assistants has explored how older users show varying levels of satisfaction with sharing their health data with clinicians or other family members/friends, dependent on their ability to secure their own privacy, retain autonomy and sustain their own quality of life [76].

Beyond this, studies have also shown the negative sides of using VAs for positively-intentioned health and wellbeing support, where they have been over-relied upon (e.g. by adults of all ages to tailor and personalise content in different multimedia formats [40]), caused nuisance to other adults or arguments, when many household members talk over one another to ask the device a question [65]. Similarly, Liu et al. discuss how some VAs, whilst well intentioned for supporting shared caregiving can in fact, increase the cognitive load on already burdened informal family caregivers [40]. Despite these everyday uses, they have also been used for the care of people with Parkinson's, to help understand complex symptoms and disease progression [46].

These studies show how VAs can support individual and shared health and wellbeing situations in people's homes, but there is also the ability for these devices to be mis-used and there are trade-offs when considering decisions that need to be made between serious and non-serious use (e.g. between using the device for leisure or practicality, having simple conversations or trying to ask more complex queries of the device). As a result, tensions can arise between one person and the device or between multiple people within the same home and a VA, due to the lack of functionality for supporting more complex, voice-based interactions. It is of interest within our study to investigate whether these or similar tensions will arise in our research context of social isolation and how the Echo Show will impact the burden of caregiving in the home space.

## 2.2 Developing Trust in Voice Assistants

Fostering trust in new technology during a pandemic poses a unique challenge, considering other people cannot physically be present to support its adoption and use. Trust in smart home technology has been shown to be fostered between different devices and older adults through the device being able to provide reliable, predictable actions that help people to conduct everyday, mundane household duties such as washing, cleaning or cooking [32]. In contrast, a study of technology use in residential care settings showed that older adults who lived with non-wearable sensors (e.g. wall-mounted devices that detect motion, falls), reported greater trust in this technology when they could interact with other residents to discuss the technology. These shared conversations helped to foster greater trust in the devices through dispelling negative self-perceptions [17]. The shared and communally discussed use of technology in different living spaces has fostered greater adoption of smart home technology, increasing independence and supporting aging in place [32].

For older adults, much aging in place literature focuses on technology that supports connecting them with friends, family and caregivers (either formal or informal) [33,37,55,69]. However, older adults report issues with adoption and ultimately, trust in smart home technologies, if they feel that the use of technology is not reciprocated by others around them [6]. Caldeira et al. [17] build on this, reporting how negative perceptions arise for older adults in care settings when a new technology is thrust upon them, as opposed to trust being built incrementally, through sustained use [77]. In addition, research on multi-generational households show that adult children, spouses and other live-in or live-out residents can impact misuse, non-use and adoption of health and care technology [6,33,37]. As a result, it is of benefit then to consider how factors such as trust in VAs and other devices, develops at an individual level (e.g. for a person who is isolated), in order to gain a situated understanding

of the wider, more complex process of adoption and acceptance of VA technology for health and care that is influenced by others.

### 2.3 Technology Use and COVID-19

The pandemic provides a context through which to understand the unique circumstances in which technology is used (or used differently). Research has explored the mediums through which investigations into the home are conducted, for example, through studying technology-mediated support, where health and care is managed in isolation online, through remote consultations and patient diagnostics, as opposed to face-to-face contact [37]. These pandemic specific novel and shared approaches changed the way people engaged with healthcare, from doctor appointments to emergencies. Experiences of long-term health conditions in demographics such as isolated older adults were also shaped by engagement with technology and services during the pandemic [23,48,90].

Studying the use of technology also changed during the pandemic as study protocols and research methods were able to engage groups of people with more diverse health and care needs. These include, for example, recruiting older adults with low vision who, before the pandemic, may have been excluded from research into technologies because they require greater visual support, but who are now being more broadly considered and supported e.g. through providing visual aids during research studies [90]. Studies such as Kendall et al.'s [31] and Seetharaman et al.'s [72], were able to engage with marginalised populations to identify opportunities to use VAs in communities in the global south and to better understand how a greater range of people engage in VA technologies for purposes such as community connectedness and education.

The pandemic offered a unique lens to look at the in depth use (and shared use) of a multimodal VA to support health and care with older adults social distancing in their home. This is in line with previous studies of smart homes for health and care emphasise the need to avoid smart home technology design that simply follows trends in popular culture, in order to conduct in-depth investigations into the impact of technology on people's everyday lives [88]. Within the context of increased need and more time spent at home, the lived and shared experiences with this technology can be examined in detail during a time of social distancing.

### 2.4 Social Presence and Voice Assistants

The CSCW and HCI literature describes the phenomenon of "social presence" broadly. Pereira et al., for example, define it as "the sense of being with another [human being]" (p. 1450) [58]. Others define the phenomenon in greater detail, stating that it is the "human-like qualities" of a technology that "embody" social presence within a specific device [34,89]. Efforts to provide these embodied human characteristics that enable greater social presence reportedly range from giving devices artificial limbs (i.e. robots) [34] to replicating the human face [86] and voice [89].

Others also identify specific 'parameters' to social presence, or degrees to which social presence is apparent within a particular technology. Lee et al. [39] describe a set of degrees to which a technology has 'similarity' to another person's personality and thus, the greater the similarity, the stronger the perceived social presence. Cho et al. [20] describe factors such

as the device owner's gender and the degrees of trust shown by a person, which affect the perceived strength of the social presence for a given technology. The design of the technology itself also appears to be a factor in the strength of the social presence. In Lee's study, male participants perceived a stronger social presence from a smaller device screen (reported as being less imposing) as opposed to female participants who identified a stronger sense of social presence from large screen devices. In Cho's study of voice assistants, vocal quality of the VA was again noted as influencing trust, which in turn resolved into a stronger sense of social presence, the more the device was trusted.

Interestingly, work in the CSCW domain, focusing on group-based perceptions of social presence in different technology settings (outside of VAs), has revealed that a stronger sense of social presence is perceived dependent on the degrees to which the agent becomes involved in a group's activities [39,58]. Specifically, in a study by Shamekhi et al. [5] of shared use of voice assistants, participants detailed a number of factors that influenced the strength of the 'presence' of the technology, such as the amount of time spent in that setting with the device, the number of successful interactions, and the ways in which the device could interact with participants (modality e.g. screen, voice, arms, legs etc.).

However, the factor that most strongly influenced 'presence' of a technology was when the device was assigned a human name [5]. It is here that this study's own research begins to intersect the existing work on social presence found in voice assistants. The understanding of social presence by Shamekhi et al [5], also directly informs our understanding and research approach; acknowledging that shared perception of social presence is the sense that other intelligent beings co-exist and interact with people, even if those beings are non-humans. The lived and shared experiences of the 'presence' of a multi-modal voice assistant can be examined in detail during a time when almost all health, care and wellbeing needs are being experienced and actioned at home by older households. Therefore, understanding the impact of social presence can lead to an understanding of the boundaries between the social presence imbued by e.g. voice assistants, and the social presence innate to human-human communication. This can help digital health and care designers to build more appropriate conduits for social engagement rather than technology driven social presence.

We build on work that has shown how health and wellbeing studies have shown the need to evaluate different healthcare interventions at different points in time [57] e.g. pre- and post-installation, for the research and design of novel technologies [7], where health and wellbeing interventions are well documented [14]. A deeper understanding can be gained from studying VAs before and after installation, balancing between looking at users [33] and at the technology [63].

Consolidating this existing literature, we propose the following research question: 'How can multimodal voice assistants impact the day to day health, care and wellbeing of household experiencing shared isolation circumstances?'

### 3 METHODOLOGY

We conducted a qualitative study of how households with socially isolated older adults use Amazon Echo Show devices during the COVID-19 pandemic in the UK from March to August 2020. 16 participants from older households were recruited for a three-part interview study to investigate health, wellbeing and care practices in each home.

### 3.1 Recruitment

11 households were recruited that had either an older adult, aged 65+ or a vulnerable person of working age and above, aged 50+. Up to three additional adult (18+) members of the household could also be involved in the study (the maximum number that the researchers could financially reimburse for their time), and included people such as live-in carers and live-out adult children who provided care remotely. Some residents who lived in a household but did not take part in the study (e.g. those under 18) were discussed anecdotally.

Participants first expressed interest through seeing one of our online advertisements, contacting our partner charity organisation (see Acknowledgements), or through viewing our recruitment brochure. Interested participants contacted the research team via email or telephone contact information, provided in the recruitment materials. Once decided that they would like to take part in the study, participants were provided online informed consent documentation (participant information sheet, consent form and demographic questionnaire<sup>1</sup>) to read through and complete, before the study could begin. This research received institutional ethics (IRB) approval from [blind for review].

It is important to note that we wished to capture shared isolation experiences and not those of individuals, to study the collective use of Echo Show in a shared isolation context. Therefore, the households with the greatest number of residents living together were selected to provide greatest insight into the lived and shared experiences of the Echo Show. Table 1 (below) details each Household ID, which interviews participants took part in, their assigned pseudonymised name in this study, a brief description of their role in each household, and their self-identified age, gender and ethnicity. All participants were reimbursed £10 in shopping vouchers for each hour of interview time they completed, including extended household members (live-out), as well as the household being compensated with Echo Show device at the end of the study.

Table 1. Participant demographic information.

| Household ID | Interviews      | Name  | Role  | Age           | Gender | Ethnicity |
|--------------|-----------------|-------|---|---------------|--------|-----------|
| H-A          | Pre, Post, Exit | Alan  | Describes himself as "Britain's oldest lab rat", keenly takes part in clinical trials, embraces new technology having previously had cancer and pulmonary condition. Travels around the world, house-sitting with his wife. | 68            | M      | White     |
| H-B          | Pre, Post       | Bisma | Live-in carer for his aunt (68), during the pandemic; providing her daily meals, company specified and connecting her with friends. He has bought her smart   | Not specified | M      | Indian    |

<sup>1</sup> Filling in specific demographic questions in this form was optional and at the discretion of each participant.

| Household ID | Interviews | Name          | Role   | Age | Gender | Ethnicity   |
|--------------|------------|---------------|--|-----|--------|-------------|
|              |            |               | devices to keep her connected to others.   |     |        |             |
| H-C          | Pre, Exit  | Post, Ceri    | Normally lives alone, but has a son who has stayed with her during the UK lockdown. Keeps a small social circle and has diverse hobbies from knitting to cleaning for “grand houses” in the UK.  | 70  | F      | White       |
| H-D          | Pre, Exit  | Post, Debbie  | Device owner. Drug and alcohol rehabilitation worker. Lives with and self-manages her Type II diabetes. Keen swimmer. Struggled during the UK lockdown to maintain physical activity. Caring for older mother in her 80s who lives with her due to the pandemic. | 52  | F      | White       |
|              | Pre, Post  | Derek         | Techno-enthusiast and spouse of Debbie. Initially set up the Echo Show in their home. Keen to embrace new tech and works in software development.  | 55  | M      | White       |
| H-E          | Pre, Exit  | Post, Erin    | Choir singer and self-described “people person”. Prefers visual communication with others due to self-described high anxiety from the UK lockdown. Formerly a body posture coach, keen on movement, exercise and body language.                                  | 63  | F      | White       |
| H-F          | Pre, Exit  | Post, Frances | A healthcare technology developer. Likes finding out about new ways to “fortify” her home. High-risk from COVID-19, so has compromised on lifestyle, which she hopes to retain through using the Echo Show.  | 59  | F      | White       |
| H-G          | Pre, Exit  | Post, Guang   | Keen storyteller and teacher. Likes engaging with others but has recently moved to a new city before lockdown, so has struggled to find new people. Describes how living with anxiety and depression is exacerbated due to COVID-19 lockdown conditions.         | 51  | M      | South Asian |
| H-H          | Pre, Exit  | Post, Hetty   | Device owner. Activist and mother of a family of seven. Lives with multiple chronic conditions and uses a stair lift to support her mobility.  | 68  | F      | White       |
|              | Post       | Henry         | Spouse of Hetty. Supports her care in their home, Not along with their   | 65  | M      | White       |



| Household ID | Interviews      | Name   | Role   | Age           | Gender        | Ethnicity      |
|--------------|-----------------|--------|--|---------------|---------------|----------------|
| H-I          | Pre, Post, Exit | Isaac  | adult children. Keen technology specified adopter. Former nurse and healthcare consultant. Keen to adopt new technology to look after his own health and his wife's who he is looking after during the lockdown. | 65            | M             | White          |
|              |                 | Jemila | Regular church-goer (pre-pandemic) and former nurse. Lived with chronic anxiety due to the pandemic and reduced social contacts. Cared for on alternating schedule by daughters.                                 | 80            | F             | Afro-Caribbean |
|              |                 | Jani   | Manages a local society to provide care to BAME groups. One of 3 carers (daughter) for Jemila.   | Not specified | Not specified | Afro-Caribbean |
| H-K          | Pre, Post, Exit | Jala   | Works as a lecturer and part-time paid carer. Also an informal carer and one of 3 daughters of Jemila.   | Not specified | Not specified | Afro-Caribbean |
|              |                 | Kelly  | Device owner. Worked in care for many years and has experience of different types of care delivery.  | 61            | F             | White          |
|              | Pre, Post       | Kilian | Spouse of Kelly. Interested in new technology, nature and wellbeing.   | 68            | M             | White          |

Not all residents were able to take part in all interviews due to either health or time commitments, and these are labelled in the findings as: "PRE" (pre-installation of Echo Show), "POST" (up to 3 weeks after installation of Echo Show) and "EX" for Exit (at 2-3 months after the installation of the Echo Show in households) interviews.

### 3.2 Interview Procedure and Data Collection

To prepare participants to take part in the study, we provided YouTube videos<sup>2</sup> which would brief participants on how the study would run. Semi-structured interviews allowed for in-depth conversations which took place between the researcher and each participant over the telephone. Telephone calls were selected over videoconferencing (e.g. Skype/Zoom), to cater for participants' differing levels of digital literacy and comfort with technology, and to make use of the ubiquity of telephone connections in our study's demographic. Participants were interviewed sometimes individually and sometimes together, depending on that household's preference at the time of the interview and lasted from 13 minutes – 60 minutes. Interviews were recorded and transcribed verbatim after each interview took place.

The three interviews that households took part in were structured according to "pre-install" (prior to getting the Echo Show device), "post-install" (a second interview conducted up to 1 week after the households received the Echo Show) and "3 month" (up to 3 months

<sup>2</sup> [Link anonymised for review].

after receiving the Echo Show). The intent with this structure was to capture longitudinal experiences of the use and changes in shared practises with the Echo Show over a longer duration of the lockdown than just weeks at a time. Whilst this structure did not inform our later thematic analysis, we acknowledge that the pre-install interviews allowed us to gather unique snapshot of households' technology experiences right at the start of the first COVID-19 pandemic lockdown, that contrasted the latter accounts. These pre-install interviews allowed us to examine the household context before the technology was deployed, focusing on each household's lifestyle and their expectations for the Echo Show device (e.g. "Can you tell me about a typical day in your home?", "How useful do you expect the Echo Show device to be?"). After this interview, participants were mailed an Echo Show device for use in the study. Post-install interviews up to three weeks after the device arrived provided us with an understanding about the initial reactions to the Echo Show devices, how they had learned how to use it, given minimal instruction and their expectations during the "out-of-box" experience [46] (e.g. "What were your initial reactions to the device?" and "Have you used the device to support your health or wellbeing yet?"). Exit interviews with participants were captured after 2-3 months of use of the technology. During exit interviews, participants were asked questions regarding their use of the device over a longer timeframe, whether any adjustments had been made to the way they used the Echo Show as well as their expectations for living with the device in the coming year (e.g. "Has your use of the device been as expected?", "Has anything changed about the way you are using the device?", "What are you mostly using the device for now?").

### 3.2 Data Analysis

Data analysis took place between all authors and was led by the first author. NVivo (qualitative data analysis software) was used to organise themes and to perform an inductive thematic analysis on the interview transcripts. Pre, post and exit interviews were inductively analysed to develop themes that could be iterated upon and developed further, following an inductive thematic analysis methodology [21]. Authors developed low-level codes that reflected the data from our interview transcripts. Initial codes were then discussed and higher-level codes were synthesised that reflected cross-cutting themes between interviews. The experiences of each member of each household was considered, which reflected the experiential use of the Echo Show devices. Similarities and differences between participants' experiences in each household were reviewed in order to develop trends (e.g. the need for residents to keep up daily exercise and physical activity and the difficulty of this, during the pandemic) and our final, higher-level themes were finalised, which focussed on all aspects of health, care and wellbeing in the home, as these have been discussed together in the adjacent literature that we have reviewed. The over-arching theme of 'facilitation' was developed which informed our understanding of the Echo Show's social presence, which we discuss below.

## 4 FINDINGS

Our data analysis of the three interviews with each household yielded three over-arching themes and sub-themes that informed our understanding of the use and acceptance of the Echo Show devices in each home. These are: *social facilitation*, *care facilitation* and

*information facilitation*. Apart from 4.1, the other subsections within this section are not structured temporally (as in, when each interview took place), but instead focus on shared themes from across the three interviews. 4.1, instead acts as a point of reflection for the latter sections, to help ground and contrast people's technology experiences with their own devices before they received the Echo Show for this study. We also highlight when, within our findings, participants discuss aspects of health, wellbeing and care.

The *social facilitation* theme discusses how participants engaged in social interactions with one another and with the Echo Show, within their households, and where points of tension arose between people and the device individually or together, as a result of shared interaction with the device. The *care facilitation* findings showcase how care activities were fostered between people in the household, through the use of the Echo Show. We also show the limitations of the device as a care facilitator, and how households automated their self-care together, using the device. Lastly, the *information facilitation* theme discusses, more broadly, the social impact of the device as a means of sourcing information to support care in the household, of trusting that information and trusting the device to connect them to care authorities, and how the device's overall reliability as a source of information is discussed, that can be trusted and relied upon for self-care practices.

#### **4.1 Pre-Echo Show Shared Self-Isolation Experiences**

This section discusses households' social isolation experiences from in the pre-installation interviews during the imposed self-isolation at the outset of the first COVID-19 pandemic lockdown in the UK (starting March 18th 2020). These interviews captured strategies that households deployed to stay socially connected, using their existing technology (e.g. smartphones, laptops etc.) and the ways in which households tried to protect themselves and practise care (in particular self-care) for one another, whilst also providing social support.

*4.1.1 Changes in self and shared care activities.* Participants discussed a range of shared physical and social activities that they were involved in with others, before being isolated by the lockdown, ranging from dinner parties ("*I usually have friends coming round for a meal, about twice a week*" - Ceri, PRE), group hobbies ("*I'm part of a choir group, so do that twice a week usually.*" - Erin, PRE), to group exercise ("*I did [a] swimming group before all this shit kicked off!*" - Debbie, PRE), and exercise with their household outside the home ("*[husband] and I used to workout together three times a week at the gym*" - Frances, PRE). These accounts show the diverse range of social activities that our households engaged in with friends, acquaintances, and household members. These were often linked with aspects of health, care and wellbeing, and they extended beyond mundane self-care activities, to shared health and care practices as well.

These in-person experiences were contrasted against the ways in which participants had begun to make use of digital alternatives to these social interactions, that were mediated through their own smart devices. Nevertheless, participants described a sense of loss (compared to the directness of person to person interaction, or the difficulty in making new social connections online). Ceri describes; "*it just isn't the same. Something's missing...*" (Ceri,

PRE) in relation to the loss of face-to-face contact with her extended family during the lockdown. Similarly, Erin describes: *"it's a different interaction [on Zoom] [...] I think you interpret people's body language when they're in the same room as you."* (Erin, PRE). Guang, having recently moved to a new city, discussed the drawbacks of not having a pre-established social network and living alone during the start of the lockdown, which greatly affected his ability to network with colleagues at work and make new connections, or to establish new friendships physically or digitally: *"lonely, yes. [...] But I don't think that's easy to do at first, to [find new friends]. [...] I mean the university's very good at talking to new starters [but], I think you miss [out on] something. [When first moving to the new city] it was very dark. I just [...] [couldn't] take on the day."* (Guang, PRE). Here, Guang describes how his lack of exposure to new social contacts, followed by the enforcement of strict restrictions through the lockdown resulted in a significant negative impact on his mental health, despite his workplace trying to support his arrival through technology.

**4.1.2 Changes in household care and wellbeing.** Health and care practices (both self- and shared) were compared with by participants against personal life experiences before the lockdown took place, with what changed during the restrictions. This included some major changes, for example, moving to care for relatives: *"my aunt [...] I'd go to see her every day and check she's ok [...] now, I'm living [with her] there [in her house] all the time, cooking, cleaning ..."* (Bisma, PRE). However, smaller changes were also noted in relation to the ability to enact shared care practices (*"they [daughters, husband], sort of, help me with preparing my meals and different things"* - Hetty, PRE), as well as changes in the quality of shared care experiences (*"I'll go and get [wife's] prescription most days now [...] [I] will pop it on the calendar [...] she's shielding you see [...] before she would, or we'd both go out and get things together. Now we can't of course."* - Isaac, PRE). In these cases, participants who may have had less care-focused contact with their loved ones describe the investment of considerably more time into providing care with restrictions in place, as well as changes in the fundamental ways that shared care is practiced.

For digital-social engagement, most participants indicated that they regularly used a *"smartphone"* (Kelly, Alan, Guang, Erin, Isaac, PRE), less commonly, a *"tablet"* (Ceri, Guang, Hetty, Erin, PRE) or a *"laptop"* or desktop PC (Debbie, POST; Alan, Frances, Isaac, PRE). Some households used older or non-digital technologies to stay in contact with people outside their household: *"I'll call up [using a landline telephone] [doctor] and check-in from time to time. We go back you see, so while he's over in Guernsey, I can just drop him a line now ..."* (Alan, PRE) and *"we have an old rotary phone, my wife uses more than me [...] if you remember such things!"* (Isaac, POST). Some preferred the use of pen and paper letters over the use of digital devices; *"yes, I'll write [daughter, overseas] sometimes, she gets back to me, yes. [...] we don't call..."* (Jenny, PRE). However, participants also discussed the ways in which their use of online services and their own devices changed to help combat the new curbs on their social lives: *"As soon as I wake up, I usually WhatsApp my daughter, my son-in-law and my son-in-law's mum"* (Ceri, PRE). Using social media and messaging applications for smartphones and tablets was quite common for our participants, citing a range of online and mobile services that they used during lockdown, including: *"weekdays [...] for my job [...] Skype"* (Guang, PRE), *"Facebook for my friends"* (Hetty, PRE), *"[the choir] is on Zoom now"* (Erin, PRE).

However, drawbacks to these tools were apparent fairly soon after they replaced in-person social encounters:

**4.1.3 Exercise experiences with technology.** Exercise and the ability to socialise was impacted too for participants during the lockdown, where online substitutions were not equivalent in enjoyment to their offline counterparts: *"I love swimming. Or loved it. [...] I have to shield in the bloody house and the garden and that's my lot really. [...] I'm not a person that can lie on the floor and start doing [online] yoga classes and stuff like that."* (Debbie, PRE) and *"well, it's all online, I know and some people have these FitBits and do their workouts, [but] [...] that's not for me, my highly flexible limbs don't have the concentration, or motivation [laughs]."* (Alan, PRE). The reasons for this lack of enjoyment was cited by participants too, where they described e.g. technological fatigue: *"well, I think there's only so much Joe Wicks [Youtube online] classes I can take [...] before I go mad."* (Frances, POST). This disillusionment at technology replacing a shared physical activity between household members was also made difficult due to shielding restrictions outside the home, where devices could not replace an experience, such as taking a walk together: *"We [Debbie, Derek] can't really go walk the dog together now [...] and I can't really take a camera out with me [for Debbie to join in]."* (Derek, PRE).

**4.1.4 Information seeking expectations for Echo Show.** During the beginning of the 2020 UK lockdown, our isolated participants had to alter significant parts of their lifestyle, including the everyday self-care and shared care activities. Our participants looked to technology to support these activities—from the mundane cleaning tasks and informal social engagement, to medication reminders and online searches for information—and had expectations for positive benefits from the use of the Echo Show during social isolation.

Participants described frequently seeking out information and services online during the early lockdown to mitigate their isolation where possible. Here, a participant speculated on how they might source information from the Echo Show to reduce isolation and maintain health-related safety: *"I suppose it'd be useful [...] if you wanted to find places where you could go outside. Where's safe and that [during the COVID lockdown], you could ask it"* (Debbie, PRE), whilst others speculated about know more on how the device could support personal security: *"I'd love it to tell me how it can secure my home..."* (Frances, PRE). Some participants theorised how the device could prompt them with health-related information they had input: *"if it [Alexa] was set at a predetermined time, [Hetty], take your tablet', and things like that, yes, that would be brilliant."* (Hetty, PRE). Alan, Ceri and Isaac all echoed this sentiment in their PRE interviews, saying that if Alexa was reminding them about their, or other people's, medications in their households, this would significantly improve their care experiences during the lockdown.

Participants who cared for others living with them during the lockdown described Echo Show's possible use in providing input information about more mundane aspects of in-home care: *"yes, I think it will help me prioritise chores, cleaning, which will benefit [aunt] long-term."* (Bisma, PRE). Jenny's daughters described the disruption of their everyday in-person support for their mother (*"we see mum most days. One of us [her daughters] is always with her. [...]"* - Jala, PRE), and how they felt the voice modality of the device could replace her other device use and supplement some of the more mundane aspects of support provided for her: *"[I think*

*being able to just speak to something to navigate some of the things that are available will be much easier [for her mother] than trying to use the keyboard and buttons [on computer, phone]."* (Jani, PRE).

## 4.2 Echo Show as a Social Facilitator

In the POST and EXIT interviews, participants described how the Echo Show device facilitated, supported and enhanced social interaction for their existing shared activities, including care and searching for information. Whilst there are overlaps from the social activities described in this section with other activities described in both the 'care' (4.3) and 'search' (4.4.) themes below, in this section we focus predominantly on accounts from participants which describe engagements in everyday individual and shared social activities to specifically support their wellbeing, with support from the Echo Show device. In particular, this section focuses on participants' wellbeing, especially their mental wellbeing through making use of the device.

*4.2.1 Changes in self and shared care activities.* The Echo Show facilitated a range of social activities in people's homes across the three month duration of the study. One participant, Guang, took it upon themselves to learn more about the back-end functioning of the Echo Show, and developed an Alexa skill to share with their friends and greet visitors to their home (when social contact was able to resume): *"It greets [them] as they enter like 'Welcome [friend] to [Guang]'s home. How are you today.' [...] I used the Amazon Blueprint to make it."* (Guang, EX). Early on, during his initial interview, Guang described his enthusiasm for generating social support amongst new neighbours when he invited them into his home: *"Like [...] my Indian neighbours. [...] there's an advantage and a disadvantage to different types of [technology in the home] environment [...] and I wish I could support that. [...] Make it work [better] for some people who visit [me] to feel accommodated,"* (Guang, PRE). Guang also took the skill development further once he received the Echo Show and experimented more, thinking further about ways to entertain new friends with this social interaction in his home: *"I did discover that there's an option that you can actually create a story for my friends to follow, but that one sound a little bit complicated, so I'm still working on it."* (Guang EX). In this way, Alexa was used as a playful intermediary to engage socially with other people in a shared setting, which also sparked conversations: *"[they'd] comment, something like 'ooh, look at that [laughs]"* (Guang, EX). Building on Guang's activities between him and the device, we also see the Echo Show benefitting established relationships and habits in the home, between people, with Isaac using Echo Show to plan activities outside with his wife, as the lockdown restrictions eased: *"my wife and I think it's lovely, because we ask it what the weather's going to be like before we go for a walk [...] it integrates into [the family] the more you use it."* (Isaac, EX).

The Echo Show also supported the social activities that participants felt had suffered from being moved online due to the lockdown. For instance, its ability to support video calling through its multimodal screen and voice capabilities returned participants a greater sense of the embodied presence for others, which participants use here instead of e.g. text-based apps used PRE-Echo Show: *"it's real time [video], [so] you can see people's faces, read their body language"* (Erin, POST). Although some participants struggled to immediately use all the social functionalities supported by the Echo Show, *("I haven't investigated it fully [but] I like*

*[that] you can facetime through it, I suppose just by saying. [...] It wouldn't have a camera otherwise, would it?" - Ceri, POST), some found that it made calling others easier: "very easy to follow. [...] It's very useful that obviously she [has] a touch screen. [...] Calling's a lot simpler." (Kelly, POST).*

**4.2.2 Echo Show as an interpersonal experience.** Participants described in greater detail too, how the device was shared not only with live-in residents, but with their extended household as well, with Ceri describing her son's actions when visiting: *"Oh, my son was mucking about when he came in. [...] I think he might have been swearing at it. [...] making it say bad things. [...] I said, '[son], behave yourself.'" (Ceri, POST).* Erin described anticipating the enhanced social engagement with her son through activities on the device: *"[son]'s coming here again tomorrow so I'm sure he will be asking it things and doing other things with it." (Erin, POST).* Probing as to the 'other things', Erin described using her tablet for antique jewellery shopping and the added benefits of using the Echo Show with her son to attend online viewings of pieces of jewellery: *"I like to go to car boots and antique fairs and things like that [...] I think because we're so confined at the moment for shopping [...] it's a bit like a virtual shop. [son] and I can look at something in real time [on a video] call, which makes it a lot easier to shop." (Erin, POST).* When asked why she prefers this method, as opposed to using online listing sites such as eBay, Erin described the interaction between the Echo Show, herself and her son: *"it's real time, so somebody is actually holding up the brooch or the ring or whatever, and you get a better idea of the quality of it rather than looking at a photograph. [...] [Then] [son] and I can say 'oh yeah, I like that one.' [...] it's a better experience." (Erin, POST).*

Other households who owned pets commented on the advantages of having the Echo Show facilitate interactions between themselves and their animals. Erin and Hetty separately reported their amusement at their birds responding with fully-formed words to Alexa's speech, saying: *"Oh yes, my [budgie] responds to her [Alexa]. Long conversations those two!" (Erin, POST), "[I've tried] different things [with] the parrot and that, I'd be really interested to see how far those two could get if [I] just left them at it!" (Hetty, POST).* Debbie and Derek described using an Alexa skill to try and get vocal responses from their dog, and indeed using this functionality as a form of entertainment and interaction between Debbie's mother, the device, and their dog: *"We've been using that app [PetTalk skill] on Alexa... I'll get [husband, Derek] and my mum to entertain the dog with it." (Debbie, POST).* Whether human to human, or human to animal, these interactions demonstrate positive social engagements fostered through use of the device.

Participants described some of their mundane self-care activities that contrasted with their earlier accounts of similar activities. The Echo Show is described as socially facilitating and supporting self-care here. In one case, shared exercise for extended households, where family members were separated due self-isolation, was supported through the use of the device. For instance, Frances used the device to do a guided video workout whilst also on a call with her partner remotely. She described how its voice and screen functionality could allow for the avoidance of awkward social aspects of public exercise: *"you're doing it on your own in your own home, you wouldn't feel intimidated by anybody, whereas I know if you go to the gym it can be a bit intimidating. But, yeah, [with Alexa] where you can keep going back and repeating it, and asking her to repeat it, which I thought was a good thing." (Frances, POST).* Contrasting

this, Kelly's previous experience working as a healthcare professional influenced her view on the usefulness of Echo Show. She describes the perceived benefits of exercise support during social isolation for someone older than herself, who would need a continued or guided programme of exercise to follow (a routine) to be delivered for the device with another person, to be able to give a lasting impact: *"No, I don't have any challenges [using Alexa for exercise]. The [online videos] you get are all fine. But then I'm relatively young and fit. [...] But for an older person [...] Doing isolated exercise [...] really is of little benefit. You need to do an exercise programme [...] with maybe a health visitor or [friend] [...] to be of any use to an older person."* (Kelly, POST). Kelly's last point contrasts with the other accounts here, showing that people understand that the device cannot simply be deployed for novel effect without sustained human social facilitation present.

**4.2.3 Echo Show as a source of social tension.** We also see negative interactions between people living in the same household (facilitated through Alexa) and negative interactions between an individual and the Alexa device itself. Whilst the device provided opportunities for social engagements and acted as a positive social actor itself, tensions also arose where shared use of the device occurred. Debbie describes an interaction between herself, her mother (who was temporarily shielding with her family) and the device: *"she's often asking it various questions on things that she wants to know, or is trying to tell it to play her Latin music, and [researcher] it's [expletive] awful listening to them because she talks to it too fast and it never works, drives me up the wall."* (Debbie, POST). This ongoing annoyance at the disjointed interactions between the device and her mother caused Debbie to move the device to where she could intervene: *"it's currently in the dining room because it's where I'm working, and when mum comes in now, I can just go alright - mum, slow down"* (Debbie, POST). Guang and Alan also experienced situations like this, with Alan describing impatience with the device when conversations with it broke down: *"you find yourself shouting [...] 'play me the bloody music."* (Alan, EX). Guang describes how these frustrations could lead him to be mean to 'her': *"She doesn't hear sometimes [...] But, I get embarrassed. I couldn't kind of shout it at Alexa - 'Alexa, show me the to-do list' or something. [...] [laughs] No, that's too mean."* (Guang, EX).

In the situations described here, interactions with the agent (Alexa) showed frustration, resulting from breakdowns as well as inciting frustration between household members in one another. Nevertheless, Alexa continued to foster social engagement here, as an emotionally oblivious non-human actor. This contrasts accounts in the previous section, that show that in some cases, another human is required (or desired) to be present to ensure accurate or prolonged use of the device.

### 4.3 Echo Show as a Care Facilitator

This theme focuses on the ways in which Echo Show was used by our participants to support more clinically-related self-care and/or shared care in the home and as a result how the use of the device impacts their health in the home. Whilst the findings in this section do not show overt changes to participants' physical health (e.g. through their self-care routines in the home), these findings show how the most positive impacts of using the Echo Show, benefit our participants' mental health, through e.g. feelings of relief from their own anxieties about their day to day health at home. Participants used the Echo Show in a variety of ways to support their care at home, from contacting others to discuss healthcare, to automating



previously manual care tasks using the device, to sharing in activities related to care by including the device in everyday care-focussed routines.

**4.3.1 Changes in self and shared care activities.** Using the Echo Show to contact others about their health, care or wellbeing (e.g. informal caregiving family members or clinicians) was a common practise for many of our participants: *"Oh yes, I call my daughters every day. Every day. [...] They [...] look after me."* (Jemila, EX). During lockdown before receiving the Echo Show, Jemila would make frequent calls to her doctor whenever she had even a minor problem with her health, however Jani and Jala both described how the introduction of the device supported their mother (who has low vision) with her health related queries that they would have normally engaged with when they were able to visit her: *"It was difficult. [...] We found out she'd had these sort of panic calls that's she was making to the doctor [...] whenever [...] we weren't around to help her out. [...] because they [GP] have an easy [to remember] number for her."* (Jani, EX). With the introduction of the Echo Show, both Jani and Jala were able to video call their mother and found that the calls to the doctors had reduced, which contributed to their characterisation of the device as *"part of our family"*: *"It's been.. I hesitate to say, but a lifesaver. [...] It's been part of our family, in a way. [...] [those] panic calls [...] Nowhere near as much now. [...] We can check in on her [using drop-in function on the device]."* (Jala, EX). In another household, the Echo Show is shown to be used to support conversations between people directly, in this case, for Alan, between himself and a healthcare professional. Alan described his use of 'her' (Alexa) to call multiple doctors across different countries, all who provide different medical expertise to him: *"I used to have [one] really good GP and had a good dialogue with him, [...] so I have others all around the globe who [help with] different problems, back with [one GP] in Oz, and another I can get on the phone to, about cancer [...] I like that she [Alexa] can store all their names, where they're at and I can get in touch [...] without my little address book to hand."* (Alan, POST). These accounts, which describe the Echo Show facilitating both human-to-device interaction and human-human communication show that the device can provide both relief (Jemila) and convenience (Alan) respectively to support care in the home.

**4.3.2 Clinical limitations.** Despite the aforementioned self-care benefits, the limitations of the Echo Show in facilitating interpersonal health and care were also discussed, with participants describing boundaries to what types of clinical interactions they would want through the device (*"I don't mind if it's just [arranging] an appointment. [...] but beyond that..."* (Frances, EX)). For instance, they did not want to receive sensitive, personal or 'bad news' from Alexa, but would use the calling function to talk directly to a clinician: *"If it was the bad stuff, I still go to the GP [...] Don't want to ask the internet for that! [...] But I will use it [Alexa, to make the call]"* (Ceri, EX).

Some participants did not even want to use it for health calls, describing how its qualities/functionality, its placement in the home and its perceived purpose prevent it being used for serious calls: *"I think that I see Alexa as part of a multitasking situation. So, because I have placed Alexa in the kitchen that is where I'm most comfortable with her. And so therefore, I'm on my feet. [...] But to receive a call from the doctor, to discuss how I'm feeling or if I'm ill, I would prefer to have a sit down and I wouldn't use Alexa for that."* (Kelly, POST). Her partner

Kilian agreed that a telephone call would be more appropriate in their household: *"But I think I'd just use my phone for that, to be truth[ful]."* (Kilian, POST).

The accounts above amount to a lack of trust in the Echo Show when holding up the abilities of a human clinician against the limits of the Echo Show. Contrasting these accounts though, other households demonstrated greater confidence in the device bridging the gap between people when care-related administrative tasks were required. Participants speculated on the benefits (for them and for others e.g. health service providers) of letting Alexa convey important or sensitive information about their health: *"I'd be very happy if Alexa said in the morning, 'your blood tests are coming today [...] at what time would you like to be told?' And that would be a really useful thing" that would "take the load off the [GP] surgery"* (Derek, EX). However, even Alan conceded that 'she' (Alexa) is not human enough to deliver bad health-related news: *"I worked in radio production for a number of years [...] voice is powerful. That's why people listen to radio [...] She's [Alexa is] powerful with that, but for telling me something like 'it's terminal [Alan]', I don't know."* (Alan, EX).

**4.3.3 Health and care automation.** Other uses of the Echo Show also focussed on the automation of previously manual self-care and shared care activities to support self and shared care in households. Before the Echo Show, non-digital tools (e.g. Isaac's household using a shared wall calendar to place medical reminders on) and other technologies (e.g. smart phones) were used manually to store important health-related information and reminders. After receiving the device, many participants described how care information had been consolidated and automated in one place, the Echo Show, for simpler and convenient retrieval (using voice): *"a lot easier than using my phone. 'Cuz I don't have to look up [from phone screen/other activity] now. I just know it [will remind me]."* (Ceri, EX). Participants also described how the device allowed them to multi-task and better manage their household duties around other important self-care tasks: *"it's all to do with multitasking for me."* (Kelly, EX), *"a person of my age [...] they wouldn't spend their time [jumping between] all these different things [devices] [...] pill bottles [...] so I like having things in one place, yes."* (Killian, EX). However, some participants were skeptical about the benefits that the Echo Show would provide beyond available tools: *"It's just the same as using your phone, isn't it. [...] I'm not sure what it's doing that I can't already do on my phone."* (Frances, EX).

Many participants described how Echo Show was useful for automated medication reminders, but also described frustration that the multi modal nature of the device was not used to provide a more salient voice and visual alarm: *"it's become so much easier now I can just say 'remind me to [take insulin] at 6 o'clock'. [...] But, I wish it spoke it to me [at the time], rather than just showing on the screen."* (Isaac, EX). Hetty and Henry also described their frustration that the device did not verbally remind them about a medication, when looking after one another: *"[We] got annoyed about that. I did do a reminder, but it just flashed up on the thing, it didn't make any noise or anything, so I thought that was rather a waste of time."* (Hetty, POST). Despite some disappointments, some participants saw potential for the device to support their bespoke health and care needs: *"it's clever, but I just think creatively it could probably do a great deal more. [...] I'd like to dictate notes to it [...] when I will next talk to my GP let's say"* (Isaac, POST). Here, whilst the Echo Show provided a simple digitalisation of some care activities (e.g. asking Alexa to call someone using the device), the scope for extended

features to allow for voice to text transcription and combined audiovisual prompting were desirable.

However, there were also instances where manual self-care practises did not translate well onto the device, such as the use of a Dossette (medicine) box with small labelled compartments that is used to store different medications *"that gets delivered once a week."* (Hetty, PRE). There was initial enthusiasm for the positive impact of translating complicated practices of self-care to the device (*"oh yes, I'd order these [medication] over Alexa if I could [...] Save me a bunch of hassle."* -Hetty, POST) and supporting complicated shared care practises with the device: *"[daughter] would just come in and ask it what I need, if it was set [up on the device at a predetermined time] [and she told me], [Hetty], take your tablet, and things like that [...] brilliant."* Describing her own positive thoughts on interacting with the device, she even mentioned: *"I mean you just tell it – tell Alexa what you want, a lot easier than a phone, yeah."* (Hetty, POST). Yet, the replacement of a physical 3D care tool by a 2D screen and voice device was not successful: *"I didn't like that. It didn't work for me. Bit too complicated [...] 'cuz everything's in one place, I can go to [the medicine box] for everything I need [...] with [Alexa], you've got the whole spiel to get through first. [...] Don't think I'll go back to it for that."* (Hetty, EX).

In these accounts, we see mixed feelings towards the Echo Show's ability to automate manual self and shared care tasks for convenience in the home. On the one hand, the device coped well with automating simple everyday tasks like medication reminders, and the simplicity of voice over manually searching using a smart phone. However, more complex non-digital devices (Dossette box) had no digital equivalence on the Echo Show and as such, the process of trying to automate such a manual object became convoluted resulting in the perceived usefulness of the device for care, decreasing.

#### 4.4 Echo Show as a Searching Facilitator

Beyond the direct aspects of health and care it supported, through being a social and care facilitator, the Echo Show also supported online information search; the ability for our participants to collect, organise and comprehend information, primarily about their day to day health and care, retrieved using digital tools (e.g. the web) [59], which our participants made use of to support either themselves, or to enact shared care when being supported by others.

**4.4.1 Shared care-enacted queries.** Some participants actively encouraged other people in their extended households, e.g. spouses and adult children, to use the device and find information for them, when they could not (due to e.g. perceived personal inexperience with technology): *"I'll always make [husband] go and look up GP drop in times for mum or something, or [...] what we can do round here [...] with COVID"* (Debbie, POST).

In their Pre-Echo Show interview, Jani and Jala described how the household phone was their mother's go-to device to find information about her wellbeing. With the Echo Show, her daughters became nominated information finders, which they performed using both their own devices and the Echo Show: *"Mum [Jemila] likes to get me and [Jala] to look things up on line for her. That happens pretty often actually. [...] We do [...] visit regularly, so it's taken getting used to [finding information on the Echo Show] for us [daughters] as much as her."* (Jani, POST).

These nominated information seekers also gained expertise in using Echo Show for shared care queries: *"[aunt] may ask me a question about [how to treat] her back and I'll say 'I don't know really' but I can ask Alexa and she'll give me what I need to know. [...] I can [...] change my question if she doesn't understand."* (Bisma, POST).

**4.4.2 Changes in self and shared care activities.** The quality of information that the Echo Show provides to participants was also discussed, including the variety of quality in online health information: *"you take it with a pinch of salt [...] [you] realise what sites are good and what sites are bad [at being credible sources]"* (Isaac, POST). Some participants discussed the device's ability to provide 'credible' (accurate, reliable) information from online sources that they could also trust: *"It's about credibility [...] It would have to be saying to me, this has come from such and such a place and I would then say, OK, I believe that because it's come, for example, from the NHS."* (Isaac, POST). In the search for information through the Echo Show, cross-checking information from different sources emerged as a practise which our participants deployed in order to determine information's credibility, with Debbie joking: *"If it says, you're going to die, I'd just generally take that answer [researcher]. [...] No, of course, we cross-reference stuff like that [...] if I Google something and it comes up with Mr Magic Wizard Wonder answer as opposed to the NHS, I'm like, well, I'm going with the NHS' answer"* (Debbie, POST).

**4.4.3 Changes in self and shared care activities.** Trust in the device for health information was comprised of the trust in the information's source. For some types of health information, a trusted clinical source was preferred to navigate information (*"I really prefer to talk to the GP than finding some sources of information on Google because that would give more clear picture than getting lost with all the information on the internet."* -Kelly, EX). However, this was not always possible, so participants described relying on other household members to use the device for information seeking: *"if she [GP] wasn't available then I would get somebody to go on the internet with Alexa and find out."* (Hetty, POST). Some participants still preferred speaking to another person over asking the Echo Show to find information, and in some cases only used the device as a secondary resource for their searches: *"yeah, if [son] was here, I'd ask him, but otherwise, Alexa's the next best for me. [...] It'll make sense [to me] when I ask her too."* (Claire, POST).

Voice interaction with the Echo Show influenced the preference for it as a messenger over other technologies, with the added benefits of its timeliness: *"I mean, it's probably slightly longer just typing the information in than speaking the information [into Google] [...] I mostly [...] use it for every day facts that I need to know now."* (Guang, POST). Some participants looked towards what they might expect the Echo Show to be able to accomplish in the near future with health information, and described how it would need to provide this information in a similar format to other trusted messengers, for instance to a health provider phone service: *"So, I think I would trust it [Echo Show] [...] if I could go as far as I could to say, well, look, Alexa, should I worry about this, that and the other [...] I would trust it to do that, as I would [the UK's NHS] 111 [phone service]."* (Alan, POST). However, similar to literature that shows attitudes to health information shift with temporal health changes [54], individual circumstances influenced the trust of the messenger of health and care information. For example, Jemila's low vision influencing her trust in herself to get health information: *"If I can get it from someone, I will do that [referring to daughters and own GP], because it's much better than*

*looking through it [information online] myself. [...] I wouldn't ask anybody and everybody, I would ask somebody that I know can give me an answer.*" (Jemila, EX). From this, we can see a trust-driven, information search hierarchy emerge that is related to the levels of trust placed in caregivers (whether formal care providers, through to informal caregivers in the home), who select and mediate the information that a person receives. Whilst the Echo Show's voice interaction was considered quicker for information searching for some participants, the interaction itself influenced trust in the device as a reliable messenger in relation to its quality of information.

**4.4.4 Changes in self and shared care activities.** Some participants discussed that they considered Alexa another layer between them and the health information with the voice interaction, giving them less perceived control than other interfaces: *"the difficulty is [...] it's bad enough on the internet [trying to find information][...] on Alexa [...] you wouldn't be driving it [...] Alexa would be driving it."* (Alan, POST).

Participants found conversational breakdowns influenced trust in the device's reliability, and indeed the reliance on voice interaction for important information was not strongly trusted by some: *"I don't trust anything with searching [on Alexa]. I always ask the question one way and then try asking the question another way."* (Derek, POST). A tension arose between Debbie (who works in healthcare) and Derek (who works in IT) when discussing their methods of searching on the Echo Show and their trust of it: *"We've argued about this you see, [researcher]... do we, don't we trust Alexa for our work life as well as our home life [laughs] [...] because [...] she's not always right like Google, you know."* (Debbie, POST). Derek interjects, *"and that question I was asking Alexa this morning about giving honeydew melon to the dog, didn't I? I thought 'that sounded weird', so I asked it differently, and it came up with some different stuff."* (Derek, POST). This discrepancy also influenced Alan's (who has hearing loss) trust in the device's reliability, despite the visual back-up of information on the screen: *"I also have to admit I am deaf, so [...] if I don't hear [Alexa's] answer terribly well [...] so [if] I only get it [Alexa's response] the first time round, then I have to say repeat it, and I'm being more led, so it's more unnerving, it would be to me, to hear it from Alexa, because I can't re-reference it very quickly at a glance in the way that I can on Google on its screen."* (Alan, EX).

Despite the screen on Alexa, the participants described a less straightforward 'path' to credible information: *"it's not easy [to] know right away, if what you asked her is leading you down a wrong path [because] you have to think 'hmm, hang on a minute', is that really the case. Does she [Alexa] know herself that this is right?"* (Guang, POST). Participants noted that the lack of visual options and visual credibility could lead to stress or misinformation for those who are vulnerable, as the first results on health and care information searches can often not be the appropriate information: *"I mean most people turn into Dr Google don't they [...] As soon as they feel not well with something they will Google it [...] [it] could be quite terrifying [...] it gives you broad spectrum. You then need to close it down to what it actually is so always go to your GP for advice, get rid of that fear."* (Guang, POST).

From these discussions we can see that the Echo Show sits somewhere between mobile or desktop screen-based devices and in-person interactions with other humans when it comes to sourcing information but is not considered a trusted (and often unreliable) messenger of serious health information, with the voice interaction creating an additional layer of mistrust.

## 5 DISCUSSION

In this section we discuss the qualities of the Echo Show's interactions with our participants; highlighting those interactions that were successful in supporting health, care and wellbeing needs and those that can be improved. Through examining the use of this device in older adults' households during a time of health uncertainty and restrictions on movement and socializing, this section provides insights based on our understanding of the use of this multi-modal smart home technology for health. Whilst our findings expanded on how interpersonal health, care and wellbeing practises in the home were facilitated through the use of a digital medium: the Echo Show (with social, care, and information facilitation), we consolidate in this section, both the social and technical aspects of supporting health, care and wellbeing at home here. As such, these discussion points in this section build directly on our findings, and we discuss inclusivity and accessibility, credibility and intersubjectivity, closeness and comprehension and transferability, which the authors found to be key to understanding and talking about this type of multimodal voice assistant within CSCW research.

### 5.1 Supporting Inclusivity through Accessibility at Home

Our study suggests that the Echo Show was capable of supporting accessibility in a range of ways. Positive support for the accessibility of voice assistants has been seen in research on people with Parkinson's [47] and this was seen with Jemila's experience with low vision - the use of the Echo Show reduced her reliance on physically dialing her telephone. Instead, she could use her voice to ask Alexa to call her daughters frequently and easily, making their relationship easier, which is in line with existing work on supporting those who are differently abled in using technology to augment or replace manual operations (e.g. through using voice control or VR) to support their health and wellbeing [52]. The Echo Show's voice interaction was inclusive with regards to vision, thereby improving people with low vision's access to everyday shared wellbeing and care activities with their informal caregivers, allowing for visual presence during video calls even at a distance, which again supported long-distance household relationships during enforced isolation. These interpersonal shared care benefits have been documented previously within CSCW due to the reciprocal nature of informal caregiving relationships [18]. In Jemila's case, this inclusivity, built into the Echo Show, may have reduced the burden on the health service as well because all three household members suggested the "*life saver*" device reduced her anxiety and so-called 'panic' calls to her doctor, thus saving the GP time spent during interactions and improving their relationship. This care burden reduction here (both formally and informally) is significant in comparison to the cost of this off-the-shelf, non-medical, popular, commercial technology. The opportunities for extending the device's range of support include providing better support for formal care through integration with health and care providers, as well as the informal care support observed in this study. This is an important consideration beyond the COVID-19 pandemic, but in light of preparation for any future pandemics or unforeseen periods of mass social isolation, where individuals may be physically cut off from health and care service providers. The efficiency of remote consultations through e.g. voice assistants is essential to consider to ensure a robust continuity of care between patient and healthcare provider, for those who are isolated.

However, there were downsides to the device's inclusivity and accessibility that impacted its ability to support health and care in relation to hearing. Hearing issues could make the PACM on Human-Computer Interaction, Vol. 6, No. CSCW2, Article 302, Publication date: October 2022.

back and forth searching interactions with Alexa disjointed, and therefore not useful. Discussions of medication reminders highlighted that whilst the device will respond to its users' commands (e.g. to set a reminder), the static nature of the device meant that sometimes it could not be heard in all places in the home, or where reminders would only appear on-screen without being spoken, thus making it less inclusive for supporting hearing. Our participants described both individual and shared frustrations directed at the device, but beyond poor user experience, there is a wellbeing [81] (sustained, positive, mental and physical functioning) concern here related to relying on Echo Show as a critical part of healthcare. Missed or mismanaged healthcare tasks, such as taking medication, can lead to safety risks if the device does not inclusively support users (or fails for other reasons e.g. where there is no habit formed by a person with their medication and over-reliance is placed on the device's use [79]).

The newness and the unfamiliarity of this technology may have resulted in a feeling of exclusion with the device for some older participants. The device's ability to facilitate online searching through its voice and screen supported the use of the device for much needed health and care information searching during the pandemic. However, participants still described asking others in the household or extended household to use the Echo Show for them to find this information. This indicates that some older participants may not feel very comfortable with the technology or familiar with its functionalities. There are significant opportunities here for creative, inclusive approaches to the design of multimodal voice assistant interactions with people with less technology experience, to maximise these devices' usefulness and user experience to support health and care in their households.

## 5.2 Credibility & Intersubjectivity

Credibility was crucial to participants' engagement with the device and their ability to trust and use the information the Echo Show provided. However, shared use of the device influenced how trustworthy [74,75] the device was perceived to be, with differing opinions on trustworthiness within households. Tensions around trust issues with the device share similarities to feelings of trust in other smart home technologies, discussed in studies situated in other shared household settings [30,35]. In particular, when participants searched for information, they demonstrated the greatest levels of trust in 'official' (clinical) sources (e.g. doctors), followed by trust in another person (e.g. relative), followed by trust in the device itself at the lowest point. This was likely due to the variation in answers that participants captured, when asking questions in different ways. As such, and unlike a human, the Echo Show does not demonstrate the ability to reason, as it also has no internal experience to draw upon [71]. In contrast to this, we see again the worthiness of the other human actors in each shared home, when residents would ask one another to cross-check information or look it up again for them to be sure (e.g. Debbie's household). This indicates a far lesser sense of trust in the device to check itself, as opposed to another human actor to be the one to verify the trustworthiness of the information source, especially in cases of care in the home. This not only adhere's to Moran's [51] principle of devices which enable people to follow their own conventions of social interaction (and not with the device), but builds on Schutz' work about how individuals will reason together until they reach an "approximate value" [71, p. 109] (or agreement), upon a topic.

Nevertheless, the device was often personified (e.g. "Dr. Google", "her", "she), yet this is not discussed as generating any stronger confidence in the device's ability to provide credible information, as has been discussed in previous CSCW literature around fostering shared use [66], and it is in fact suggested by participants that sustained human use is required in order to make (e.g. exercise) a credible long-term health benefit. This holds implications beyond the pandemic, for households who wish to continue to use devices such as the Echo Show for remote exercise and for healthcare authorities who wish to develop new means of engaging with isolated older individuals, to ensure that their overall health is not deteriorating at home, due to lack of sustained exercise.

The Echo Show also encouraged a higher level of scrutiny and crosschecking, which has previously been observed with other smart home technology and VAs [60]. In our study, the seriousness of the information impacted the experience: safety-related health and care information (e.g. deciding together whether or not to feed a dog a new fruit) were repeated and additional follow-up searches were made on the device, where participants asked their search query in a different way or re-phrased a question with another household member present. This is in contrast to their other, less safety-critical information searches related to wellbeing (e.g. weather for a shared walk) which was welcomed and enhanced shared care activities. We found that there is less trust overall in the Echo Show's ability to return accurate online information compared to traditional screen-based interactions, but the context of use and importance of a particular situation determines whether people will deem it necessary to seek verification of this information obtained by voice.

As seen in previous investigations into VAs, conversational breakdowns between participants and the device [10,11] quickly led to reduced perceptions of trust in the device. Whilst some participants experienced breakdowns due to vision or hearing loss, the act of repeating their question to the VA caused unease and anxiety in the credibility of the information. It was indicated by a number of participants that the mode of interaction generally impacted trustworthiness (e.g. whether the information was mostly conveyed through the device's voice or screen). This added an additional layer of uncertainty, that at times made people feel less in control with the device (e.g. seeing a reminder but not hearing it). This understanding suggests that future investigations should focus on continuing to support nuanced and human-like conversations, where VAs can provide e.g. reassurance around the credibility of information sources and the modality through which this information is conveyed. Providing greater support to informal caregivers and other household residents who may interact with the device and perform actions with it, on behalf of another resident, should be considered. Investigations into this type of feature support could build on existing work in the AI domain, detecting multi-user interactions with smart devices [44,45].

### 5.3 Closeness & Comprehension

According to Schulte et al. [70], "*many instances of intimacy take place in the home...*" (p. 124) and the qualities of intimacy in relation to the acceptance of technology can be largely defined as: "*the social closeness [or] connectedness*" between people and between people and artefacts. Whilst our findings did not reveal a specific intimacy between the Echo Show and its users (in fact, many remained skeptical of its social abilities), our findings did support our isolated households' closeness with one another (human to human). Therefore, this understanding of PACM on Human-Computer Interaction, Vol. 6, No. CSCW2, Article 302, Publication date: October 2022.



the relationship between the Echo Show, the primary users, and others in the household frames the discussion of our participants' social experiences of the Echo Show within beyond the home.

With regards to human relationships within the home and outside of it, the Echo Show facilitated closeness. This was between partners preparing for a shared walk, connecting physically separated family members through video calling, looking after pets and through shared use of the device to experience hobbies (e.g. collect antique jewelry) that were made difficult in isolation. Although social isolation is a significant issue for older households generally, isolation experiences were exacerbated during the lockdown for older adults [42] who were restricted in the social support they normally received through social engagements outside the home. The type of social support experienced by our participants is in line with Towey et al. as: "*An established social network of other people including family, friends, who a person can turn to in times of need or crisis, to enable broader focus and positive self-image [and] a sense of security.*" (p. 177) [82]. Considering this context and the qualities of the device discussed above, we observed social support being provided with the Echo Show in a distinct way; not focussed on intimate interactions between a person and the device itself, but through the device acting as a proxy to support pre-established social relationships between people (which existed either before the pandemic or during, as the lockdown restrictions were eased). From Jemila's discussion of their daughters' closeness, to Debbie's caregiving to her mother and pets; these accounts, along with related research shows that there are opportunities to enhance human interpersonal relationships using the device as opposed to, for instance, simply supplementing conversation in a social setting with an additional virtual 'personality' [41]. This too, builds on the work of Moran and Stahl which describes how different types of technology affect the strength of social interactions, and how they can be disruptive too [51,78]

With regard to the vocal qualities of the conversational agent (Alexa) on the Echo Show, participants likened the facilitation of information through the device, to that of receiving news or information from a radio presenter. This finding builds on the work of Kuzminykh et al. [36] and Voit et al. [85] who found that when prompted with visual aids (different computer-generated faces), participants either anthropomorphised the conversational agents in a way that suited them. For some participants, the vocal qualities conveyed an understanding between the listener and the device, that was not apparent in their discussions of visual information retrieval. This lack of an auditory barrier between the information recipient and the device in this study, is in line with the work of Parviainen et al. [56] who discuss how the quality of whispering brings humans closer to a more empathetic experience of interacting with machines. The household's likening of being in receipt of 'bad news' (e.g. outcomes of cancer diagnoses), from the Echo Show shows some personification of the device, although it was not recognised in the same vein as a human actor giving the same information. There was also little discussion or strong feeling from households about their feelings towards Alexa revealing this type of information to them in a shared space and no strong indication provided (e.g. from Alan here), whether he would be comfortable with another household member overhearing this 'news' from Alexa. For these more complex emotional engagements, a human was always discussed as an alternative (either e.g. to facilitate long-term use or to support health or care). Instead, the Echo Show was viewed again as a device

to facilitate closeness between people who were isolated (e.g. through video calls). As such, future research and design work should consider how the qualities of voice connected with the screen, could be built on further to convey (and reciprocate) more nuanced interactions to support self- and shared care, or the benefits of substituting in-person interaction with audiovisual communication that can better extend health and care from formal care settings (e.g. GP practises) and into the home.

With this in mind, it is beneficial for future research and design on screen-based voice assistants to also consider whether the social presence of the conversational agent (e.g. Alexa) could be adapted so that the device can be more convincing and supportive of diverse and complex self- and shared care activities that were met with skepticism in this study (e.g. collecting and storing medication ('digitising' the Dossette box'), reducing anxiety etc.) that are specific to each home and household. Equally, supporting device failures (e.g. if the Dossette box cannot be digitised, or a healthcare search returns conspicuous results), seems equally important, in order to help reassure household members and as discussed previously, to give the device's owners a greater sense of understanding of its operation, to reduce time spent e.g. asking multiple queries about the same topic. Investigating the ways in which a device's social presence can be balanced in household settings, so that the device does not become dominant or overbearing and detract from existing human-to-human social interactions is also of interest here.

#### 5.4 Transferability

A lack of knowledge around what the device's specific purpose was in a home (which might be useful to promote creative and varied uses of this particular Amazon product) was also detrimental for those who might benefit from specific health and care support through it. The Echo Show is not set up for a specific purpose in their homes like other familiar technology is (such as a telephone or a television) nor is it set up to specifically provide healthcare support (such as a dossette box). Previous literature has shown that digitising formerly manual activities can be difficult for a myriad of reasons (which we discuss further below) [8,9], however there is a design opportunity here to more inclusively support the translation of manual self-care practices onto smart home technologies and smart speakers, similar to previous endeavors with personal informatics systems [8,53].

Building on Isaac's discussion of his own isolation too, there are opportunities for VAs to do more than simply leveraging the use of Alexa 'skills' to handle occasions where people speak to the device when they are experiencing high anxiety [62]. This reflects Roth's description of how engagement technology can move from the individual to the wider, social environment [66]. As such, this reflects an opportunity that the device again, does not currently support; the transition to social settings for an individual. Guang's isolation living situation (in a new town, with few social contacts) was unique and from it we see that only through considerable social effort (inviting new friends round, creating Alexa 'skills' for social purposes), that he was successful. Therefore, allowing the Echo Show to be tailored (or setup) to facilitate human-to-human social engagement (e.g. by suggesting social activities) removes a burden of responsibility on the individual to be social and could instead help with greater social integration for those who are isolated, beyond the pandemic.

Despite the aforementioned opportunities, tensions frequently emerged during shared use of the Echo Show, caused by people's different expectations of it and the different ways of

engaging with it e.g. Hetty and Alan's failed use of reminders. These discoveries build on work highlighting how VAs should respond in difficult situations, from being verbally abused [19], to replying according to people's specific (positive or negative) character traits [25]. Despite these instances of conflict, it can be argued that the Echo Show still supported social engagements here, albeit around negative interactions and whilst appearing seemingly neutral, in fact facilitates many non-neutral [64] social interactions.

## 6 LIMITATIONS & FUTURE WORK

We acknowledge limitations to our study method and execution. Despite the value of capturing qualitative data over a three month period, it would be of benefit to go further still and understand the use and acceptance of Echo Show devices (e.g. after one year of use) to identify further ingrained patterns of use in homes with residents and their extended households. Beyond this, it would be of interest to capture the views of healthcare providers and other formal care providers, to understand their views as to the benefits and detriments of this multi-modal device, for households they provide care to. Whilst the voices of some informal caregivers (household members) were captured within the scope of this study, there is scope to better understand the complex interplay of roles and exchange of information, activities and resources through these devices, for supporting both formal and informal caregiving.

The authors acknowledge the impact that providing Echo Show devices to participants entails; as opposed to studying participants who have purchased these devices of their own accord. In particular, we acknowledge this impact and suggest that future researchers consider how this may affect the frequency of use of the devices, the ways in which participants used the Echo Show devices together and also how power imbalances can occur as a result of researchers gifting technology to participants. In particular, it is important to consider how gifting technology can impact the process of e.g. informed consent and also participants willingness to engage with the study itself, based on their perceptions of the device. Nevertheless, the nature of 'in the wild' research [15] and the compounding difficulties of conducting research remotely and in a timely manner, during COVID-19, reassured us that it was correct to gift these devices, both as financial compensation, but also as a reliable means of studying their use during a pandemic. As a result, there is a need to conduct further longitudinal studies engagement with voice assistants beyond the pandemic. to understand for example how use of multimodal VAs might diminish as social contact is restored between friends, family members and neighbours.

A further limitation sits with the fact that the Echo Show and voice assistants more generally, are targeted predominantly at young audiences in their design [68]. This builds on the previous limitation we discussed, around who may inherently have access to this technology outside of a research setting, where these devices are not being provided to older adults by the researchers. This is a necessary consideration for the validity of studies in this area, and when considering more broadly, aspects of responsible innovation, for who can and how best, older adult populations can access and obtain voice assistants for the benefit of their health and wellbeing.

Lastly, we acknowledge the benefits of quantifying these qualitative accounts in future investigations into voice assistants. Whilst our qualitative study provided a rich variety of accounts of use of the Echo Show, a quantitative or mixed-methods approach could yield additional or supplementary data to inform further longitudinal or larger-scale rollouts of these devices to specific health communities or individuals with specific needs. This could be extended further by capturing log data from the devices and performing analyses on these to derive, e.g. specific design requirements based on usage, voice or screen initiated requests or based on specific engagements with the device from different residents.

## 7 CONCLUSION

Our study provided a range of in-depth qualitative accounts of the use of the Amazon Echo Show; a multi-modal voice assistant (speech and screen), for socially isolated older households during the 2020 COVID-19 lockdown in the UK. Our engagement with eleven older adult households showed that whilst the Echo Show provides clear benefits to health, care, and wellbeing needs through supporting social engagement, specific home-based care practices, and health information gathering; the social benefits of the device primarily arise from supporting new and existing human-to-human social interactions as opposed to those with the conversational agent. Although useful for many participants (and a so-called lifesaver for one household), more work can be done to better tailor the device to inclusively support unique and nuanced household-specific healthcare activities, synchronise audiovisual accessibility support features, foster trust in the device's abilities through fostering better human to human relations and supporting more the increasingly complex nature of shared healthcare tasks in the private realm of the home. Overall, there is great potential for further engaging with multi-modal voice assistants like the Echo Show to make use of their versatile functionality for delivering health and care support to people who are aging at home together.

## ACKNOWLEDGMENTS

Many thanks to all of our participants, Bristol City Council and the Elizabeth Blackwell Institute at the University of Bristol who co-funded this work. This work was performed under the SPHERE Next Steps Project funded by the UK Engineering and Physical Sciences Research Council (EPSRC), Grant EP/R005273/1.

## REFERENCES

- [1] Ali Abdolrahmani, Ravi Kuber, and Stacy M. Branham. 2018. Siri talks at you: An empirical investigation of voice-activated personal assistant (VAPA) usage by individuals who are blind. *ASSETS 2018 - Proc. 20th Int. ACM SIGACCESS Conf. Comput. Access.* (2018), 249–258. DOI:<https://doi.org/10.1145/3234695.3236344>
- [2] Felipe J. Aidar, Ricardo J. De Oliveira, António J. Silva, Dihogo G. De Matos, André L. Carneiro, Nuno Garrido, Robert C. Hickner, and Victor M. Reis. 2011. The influence of the level of physical activity and human development in the quality of life in survivors of stroke. *Health Qual. Life Outcomes* 9, (2011), 1–6. DOI:<https://doi.org/10.1186/1477-7525-9-89>
- [3] Leah Findlater Alisha Pradhan, Kanika Mehta. 2018. "Accessibility Came by Accident": Use of Voice-Controlled Intelligent Personal Assistants by People with Disabilities. *Proc. CHI 2018* (2018). DOI:<https://doi.org/10.1111/j.1754-4505.2007.tb00339.x>
- [4] Lisa Amani, Rabia Warraich, Nishil Patel, and Hasan Tahir. 2020. COVID-19 and rheumatology: is shielding really necessary? *Br. J. Hosp. Med. (Lond.)* 81, 6 (2020), 1–3. DOI:<https://doi.org/10.12968/hmed.2020.0284>

- [5] Thomas Erickson<sup>2</sup> Ameneh Shamekhi<sup>1\*</sup>, Q. Vera Liao<sup>2</sup>, Dakuo Wang<sup>2</sup>, Rachel K. E. Bellamy<sup>2</sup>. 2018. Face Value? Exploring the Effects of Embodiment for a Group Facilitation Agent. *CHI 2018* (2018), 1–13. DOI:<https://doi.org/10.1108/09654289610112402>
- [6] Arlene J. Astell, Colleen McGrath, and Erica Dove. 2019. ‘That’s for old so and so’s!’: does identity influence older adults’ technology adoption decisions? *Ageing Soc.* (2019), 1–27. DOI:<https://doi.org/10.1017/S0144686X19000230>
- [7] Amid Ayobi, Paul Marshall, and Anna L. Cox. 2016. Reflections on 5 Years of Personal Informatics: Rising Concerns and Emerging Directions. *CHI ’16 Ext. Abstr.* (2016), 2774–2781. DOI:<https://doi.org/10.1145/2851581.2892406>
- [8] Amid Ayobi, Paul Marshall, and Anna L. Cox. 2020. Trackly: A Customisable and Pictorial Self-Tracking App to Support Agency in Multiple Sclerosis Self-Care. *DI.Acm.Org* (2020), 1–15. DOI:<https://doi.org/10.1145/3313831.3376809>
- [9] Amid Ayobi, Tobias Sonne, Paul Marshall, and Anna L. Cox. 2018. Flexible and mindful self-tracking: Design implications from paper bullet journals. *Conf. Hum. Factors Comput. Syst. - Proc.* 2018-April, (2018). DOI:<https://doi.org/10.1145/3173574.3173602>
- [10] Erin Beneteau, Ashley Boone, Yuxing Wu, Julie A. Kientz, Jason Yip, and Alexis Hiniker. 2020. Parenting with Alexa: Exploring the Introduction of Smart Speakers on Family Dynamics. (2020), 1–13. DOI:<https://doi.org/10.1145/3313831.3376344>
- [11] Erin Beneteau, Olivia K. Richards, Mingrui Zhang, Julie A. Kientz, Jason Yip, and Alexis Hiniker. 2019. Communication breakdowns between families and alexa. *Conf. Hum. Factors Comput. Syst. - Proc.* (2019), 1–13. DOI:<https://doi.org/10.1145/3290605.3300473>
- [12] Lisa A. Best, Moira A. Law, Sean Roach, and Jonathan M.P. Wilbiks. 2020. The Psychological Impact of COVID-19 in Canada: Effects of Social Isolation During the Initial Response. *Can. Psychol.* (2020). DOI:<https://doi.org/10.1037/cap0000254>
- [13] Timothy W. Bickmore, Ha Trinh, Stefan Olafsson, Teresa K. O’Leary, Reza Asadi, Nathaniel M. Rickles, and Ricardo Cruz. 2018. Patient and consumer safety risks when using conversational assistants for medical information: An observational study of siri, alexa, and google assistant. *J. Med. Internet Res.* 20, 9 (2018), 1–13. DOI:<https://doi.org/10.2196/11510>
- [14] Heidi Bjering, Joanne Curry, and Anthony Maeder. 2014. Gerontechnology: The importance of user participation in ICT development for older adults. *Stud. Health Technol. Inform.* 204, (2014), 7–12. DOI:<https://doi.org/10.3233/978-1-61499-427-5-7>
- [15] Ann Blandford, Dominic Furniss, and Stephann Makri. 2016. Qualitative HCI Research. (2016), 137.
- [16] David C. Burdick and Sunkyo Kwon. 2016. *Gerontechnology*. DOI:<https://doi.org/10.1016/B978-0-12-809324-5.06436-1>
- [17] Clara Caldeira, Matthew Bietz, Marisol Vidauri, and Yunan Chen. 2017. Senior Care for Aging in Place: Balancing Assistance and Independence. *Proc. 2017 ACM Conf. Comput. Support. Coop. Work Soc. Comput. - CSCW ’17* (2017), 1605–1617. DOI:<https://doi.org/10.1145/2998181.2998206>
- [18] Yunan Chen, Victor Ngo, and Sun Young Park. 2013. Caring for caregivers: Designing for integrality. *Proc. ACM Conf. Comput. Support. Coop. Work. CSCW* February 2013 (2013), 91–102. DOI:<https://doi.org/10.1145/2441776.2441789>
- [19] Hyojin Chin, Lebogang Wame Molefi, and Mun Yong Yi. 2020. Empathy Is All You Need: How a Conversational Agent Should Respond to Verbal Abuse. *Conf. Hum. Factors Comput. Syst. - Proc.* (2020), 1–13. DOI:<https://doi.org/10.1145/3313831.3376461>
- [20] Eugene Cho. 2019. Hey Google, can i ask you something in private? The effects of modality and device in sensitive health information acquisition from voice assistants. *Conf. Hum. Factors Comput. Syst. - Proc.* (2019), 1–9. DOI:<https://doi.org/10.1145/3290605.3300488>
- [21] Victoria Clarke and Virginia Braun. 2017. Thematic analysis. *J. Posit. Psychol.* 12, 3 (2017), 297–298. DOI:<https://doi.org/10.1080/17439760.2016.1262613>
- [22] Adelina Comas-Herrera, Jose Luis Fernandez, Ruth Hancock, Chris Hatton, Martin Knapp, David McDaid, Juliette Malley, Gerald Wistow, and Raphael Wittenberg. 2020. COVID-19: Implications for the Support of People with Social Care Needs in England. *J. Aging Soc. Policy* 32, 4–5 (2020), 365–372. DOI:<https://doi.org/10.1080/08959420.2020.1759759>
- [23] Nancy J. Donovan, Qiong Wu, Dorene M. Rentz, Reisa A. Sperling, Gad A. Marshall, and M. Maria Glymour. 2017. Loneliness, depression and cognitive function in older U.S. adults. *Int. J. Geriatr. Psychiatry* 32, 5 (2017), 564–573. DOI:<https://doi.org/10.1002/gps.4495>
- [24] Orla Duffy, Jonathan Synnott, Roisin McNaney, Paola Brito Zambrano, and W. George Kernohan. 2021. Attitudes toward the use of voice-assisted technologies among people with Parkinson disease: Findings from a web-based survey. *JMIR Rehabil. Assist. Technol.* 8, 1 (2021), 1–13. DOI:<https://doi.org/10.2196/23006>
- [25] Patrick Ehrenbrink, Seif Osman, and Sebastian Möller. 2017. Google now is for the extraverted, cortana for

- the introverted. *Proc. 29th Aust. Conf. Comput. Interact. - OZCHI '17* (2017), 257–265. Retrieved from <http://dl.acm.org/citation.cfm?doid=3152771.3152799>
- [26] Pin Sym Foong and Shengdong Zhao. 2016. Design Considerations for Volunteer Support in Dementia Care. *Proc. Int. Symp. Interact. Technol. Ageing Popul. - ITAP '16* (2016), 54–63. DOI:<https://doi.org/10.1145/2996267.2996273>
- [27] Carolina Fuentes, Martin Porcheron, Joel E. Fischer, Enrico Costanza, Obaid Malik, and Sarvapali D. Ramchurn. 2019. Tracking the Consumption of Home Essentials. *CHI Conf. Hum. Factors Comput. Syst. Proc.* (2019), 1–13. DOI:<https://doi.org/10.1145/3290605.3300869>
- [28] Yang Gao, Zhengyu Pan, Honghao Wang, and Guanling Chen. 2018. Alexa, My Love: Analyzing reviews of amazon echo. *Proc. - 2018 IEEE SmartWorld, Ubiquitous Intell. Comput. Adv. Trust. Comput. Scalable Comput. Commun. Cloud Big Data Comput. Internet People Smart City Innov. SmartWorld/UIC/ATC/ScalCom/CBDCo* October 2018 (2018), 372–380. DOI:<https://doi.org/10.1109/SmartWorld.2018.00094>
- [29] Radhika Garg and Subhasree Sengupta. 2020. Conversational Technologies for In-home Learning: Using Co-Design to Understand Children's and Parents' Perspectives. (2020), 1–13. DOI:<https://doi.org/10.1145/3313831.3376631>
- [30] Christine Geeng, Franziska Roesner, and Paul G Allen. 2019. Who's In Control?: Interactions In Multi-User Smart Homes. 13, Section 4 (2019), 1–13. DOI:<https://doi.org/10.1145/3290605.3300498>
- [31] Linus Kendall, Bidisha Chaudhuri, and Apoorva Bhalla. 2020. Understanding Technology as Situated Practice: Everyday use of Voice User Interfaces Among Diverse Groups of Users in Urban India. *Inf. Syst. Front.* 22, 3 (2020), 585–605. DOI:<https://doi.org/10.1007/s10796-020-10015-6>
- [32] Bran Knowles and Vicki L. Hanson. 2018. Older Adults' Deployment of 'Distrust.' *ACM Trans. Comput. Interact.* 25, 4 (2018), 1–25. DOI:<https://doi.org/10.1145/3196490>
- [33] Bethany Kon, Alex Lam, and Jonathan Chan. 2017. Evolution of Smart Homes for the Elderly. *Proc. 26th Int. Conf. World Wide Web Companion - WWW '17 Companion* (2017), 1095–1101. DOI:<https://doi.org/10.1145/3041021.3054928>
- [34] Dimosthenis Kontogiorgos, Sanne Van Waveren, Olle Wallberg, Andre Pereira, Iolanda Leite, and Joakim Gustafson. 2020. Embodiment Effects in Interactions with Failing Robots. *Conf. Hum. Factors Comput. Syst. - Proc.* (2020), 1–14. DOI:<https://doi.org/10.1145/3313831.3376372>
- [35] Martin J. Kraemer and Ivan Flechais. 2018. Researching privacy in smart homes: A roadmap of future directions and research methods. *IET Conf. Publ.* 2018, CP740 (2018), 1–10. DOI:<https://doi.org/10.1049/cp.2018.0038>
- [36] Anastasia Kuzminykh, Jenny Sun, Nivetha Govindaraju, Jeff Avery, and Edward Lank. 2020. Genie in the Bottle: Anthropomorphized Perceptions of Conversational Agents. *Conf. Hum. Factors Comput. Syst. - Proc.* (2020), 1–13. DOI:<https://doi.org/10.1145/3313831.3376665>
- [37] Amanda Lazar, Hilaire J. Thompson, Shih-Yin Lin, and G Demiris. 2018. Negotiating Relation Work with Telehealth Home Care Companionship Technologies that Support Aging in Place. *ACM Hum.-Comput. Interact.* 2, CSCW, Artic. 103 2, November (2018), 17. DOI:<https://doi.org/10.1145/3274372>
- [38] Joseph Lee, Oliver Van Hecke, and Nia Roberts. 2020. Vitamin D: A rapid review of the evidence for treatment or prevention in COVID-19 View questions under review Most viewed Global Covid-19 Case Fatality Rates. *Cent. Evidence-Based Med. Univ. Oxford* (2020). Retrieved from <https://www.cebm.net/covid-19/vitamin-d-a-rapid-review-of-the-evidence-for-treatment-or-prevention-in-covid-19/>
- [39] Kwan Min Lee and Clifford Nass. 2003. Designing social presence of social actors in human computer interaction. *Conf. Hum. Factors Comput. Syst. - Proc.* 5 (2003), 289–296. DOI:<https://doi.org/10.1145/642611.642662>
- [40] Yun Liu, Lu Wang, William R. Kearns, Linda Wagner, John Raiti, Yuntao Wang, and Weichao Yuwen. 2021. Integrating a Voice User Interface into a Virtual Therapy Platform. *Conf. Hum. Factors Comput. Syst. - Proc.* (2021). DOI:<https://doi.org/10.1145/3411763.3451595>
- [41] Irene Lopatovska, Katrina Rink, Ian Knight, Kieran Raines, Kevin Cosenza, Harriet Williams, Perachya Sorsche, David Hirsch, Qi Li, and Adrianna Martinez. 2019. Talk to me: Exploring user interactions with the Amazon Alexa. *J. Librariansh. Inf. Sci.* 51, 4 (2019), 984–997. DOI:<https://doi.org/10.1177/0961000618759414>
- [42] Bárbara Cristina da Silva Lopes and Rusi Jaspal. 2020. Understanding the mental health burden of COVID-19 in the United Kingdom. *Psychol. Trauma* 12, 5 (2020), 465–467. DOI:<https://doi.org/10.1037/tra0000632>
- [43] Shareen Mahmud, Jessalyn Alvina, Parmit K. Chilana, Andrea Bunt, and Joanna McGrenere. 2020. Learning Through Exploration: How Children, Adults, and Older Adults Interact with a New Feature-Rich Application. (2020), 1–14. DOI:<https://doi.org/10.1145/3313831.3376414>
- [44] Alessandro Masullo, Tilo Burghardt, Dima Damen, Toby Perrett, and Majid Mirmehdi. 2020. Person Re-ID by fusion of video silhouettes and wearable signals for home monitoring applications. *Sensors (Switzerland)* 20, 9 (2020). DOI:<https://doi.org/10.3390/s20092576>
- [45] Alessandro Masullo, Toby Perrett, Dima Damen, Tilo Burghardt, and Majid Mirmehdi. 2021. No Need for a

- Lab: Towards Multi-sensory Fusion for Ambient Assisted Living in Real-world Living Homes. 5, Visigrapp (2021), 328–337. DOI:<https://doi.org/10.5220/0010202903280337>
- [46] Roisin McNaney, Emmanuel Tsekleves, and Jonathan Synnott. 2020. Future Opportunities for IoT to Support People with Parkinson's. *Conf. Hum. Factors Comput. Syst. - Proc.* (2020), 1–15. DOI:<https://doi.org/10.1145/3313831.3376871>
- [47] Róisín McNaney, John Vines, Daniel Roggen, Madeline Balaam, Pengfei Zhang, Ivan Poliakov, and Patrick Olivier. 2014. Exploring the acceptability of google glass as an everyday assistive device for people with Parkinson's. *Conf. Hum. Factors Comput. Syst. - Proc.* (2014), 2551–2554. DOI:<https://doi.org/10.1145/2556288.2557092>
- [48] Addie Middleton, Kit N. Simpson, Janet Prvu Bettger, and Mark G. Bowden. 2020. COVID-19 pandemic and beyond: Considerations and costs of telehealth exercise programs for older adults with functional impairments living at home—lessons learned from a pilot case study. *Phys. Ther.* 100, 8 (2020), 1278–1288. DOI:<https://doi.org/10.1093/ptj/pzaa089>
- [49] Edward Alan Miller. 2020. Protecting and Improving the Lives of Older Adults in the COVID-19 Era. *J. Aging Soc. Policy* 32, 4–5 (2020), 297–309. DOI:<https://doi.org/10.1080/08959420.2020.1780104>
- [50] Adam S. Miner, Liliana Laranjo, and A. Baki Kocaballi. 2020. Chatbots in the fight against the COVID-19 pandemic. *npj Digit. Med.* 3, 1 (2020), 1–4. DOI:<https://doi.org/10.1038/s41746-020-0280-0>
- [51] Thomas P. Moran and R. J. Anderson. 1990. The workaday world as a paradigm for CSCW design. *Proc. 1990 ACM Conf. Comput. Coop. Work. CSCW 1990* October (1990), 381–393. DOI:<https://doi.org/10.1145/99332.99369>
- [52] Martez E. Mott, John Tang, Shaun K. Kane, Edward Cutrell, and Meredith Ringel Morris. 2020. “I just went into it assuming that I wouldn't be able to have the full experience”: Understanding the accessibility of virtual reality for people with limited mobility. *Assets 2020* (2020), 1–19.
- [53] Francisco Nunes, Nervo Verdezoto, Geraldine Fitzpatrick, Morten Kyng, Erik G R Onvall, and Cristiano Storni. 2015. Self-Care Technologies in HCI: Trends, Tensions, and Opportunities ACM Reference Format: r r. *ACM Trans. Comput. Interact.* 22, 6 (2015), 1–45. Retrieved from <https://doi.org/10.1145/2803173>
- [54] Aisling Ann O'Kane, Helena M. Mentis, and Eno Thereska. 2013. Non-static nature of patient consent: Shifting privacy perspectives in health information sharing. *Proc. ACM Conf. Comput. Support. Coop. Work. CSCW* (2013), 553–562. DOI:<https://doi.org/10.1145/2441776.2441838>
- [55] William Odum, John Zimmerman, and Jodi Forlizzi. 2010. Designing for dynamic family structures: Divorced families and interactive systems. *DIS 2010 - Proc. 8th ACM Conf. Des. Interact. Syst.* (2010), 151–160. DOI:<https://doi.org/10.1145/1858171.1858199>
- [56] Emmi Parviainen and Marie Louise Juul Søndergaard. 2020. Experiential Qualities of Whispering with Voice Assistants. (2020), 1–13. DOI:<https://doi.org/10.1145/3313831.3376187>
- [57] Sebastiaan T.M. Peek, Eveline J.M. Wouters, Joost van Hoof, Katrien G. Luijkx, Hennie R. Boeije, and Hubertus J.M. Vrijhoef. 2014. Factors influencing acceptance of technology for aging in place: A systematic review. *Int. J. Med. Inform.* 83, 4 (2014), 235–248. DOI:<https://doi.org/10.1016/j.ijmedinf.2014.01.004>
- [58] André Pereira, Rui Prada, and Ana Paiva. 2014. Improving social presence in human-agent interaction. *Conf. Hum. Factors Comput. Syst. - Proc.* (2014), 1449–1458. DOI:<https://doi.org/10.1145/2556288.2557180>
- [59] Peter Pirolli. 2009. An elementary social information foraging model. *Conf. Hum. Factors Comput. Syst. - Proc.* (2009), 605–614. DOI:<https://doi.org/10.1145/1518701.1518795>
- [60] Martin Porcheron, Joel E. Fischer, Stuart Reeves, and Sarah Sharples. 2018. Voice interfaces in everyday life. *Conf. Hum. Factors Comput. Syst. - Proc.* 2018-April, (2018), 1–12. DOI:<https://doi.org/10.1145/3173574.3174214>
- [61] Alisha Pradhan, Leah Findlater, and Amanda Lazar. 2019. “Phantom friend” or “just a box with information”: personification and ontological categorization of smart speaker-based voice assistants by older adults. *Proc. ACM Human-Computer Interact.* 3, CSCW (2019). DOI:<https://doi.org/10.1145/3359316>
- [62] Juan C. Quiroz, Tristan Bongolan, and Kiran Ijaz. 2020. Alexa depression and anxiety self-tests: A preliminary analysis of user experience and trust. *UbiComp/ISWC 2020 Adjun. - Proc. 2020 ACM Int. Jt. Conf. Pervasive Ubiquitous Comput. Proc. 2020 ACM Int. Symp. Wearable Comput.* 1 (2020), 494–496. DOI:<https://doi.org/10.1145/3410530.3414374>
- [63] Parisa Rashidi and Diane J Cook. 2013. COM: A Method for Mining and Monitoring Human Activity Patterns in Home-Based Health Monitoring Systems. *ACM Trans. Intell. Syst. Technol.* 4, 4 (October 2013). DOI:<https://doi.org/10.1145/2508037.2508045>
- [64] Tom Rodden Richard Harper. 2008. *Being Human - HCI in the year 2020.*
- [65] Olivia K. Richards. 2019. Family-centered exploration of the benefits and burdens of digital home assistants. *Conf. Hum. Factors Comput. Syst. - Proc.* (2019), 1–6. DOI:<https://doi.org/10.1145/3290607.3308458>
- [66] Wolff Michael Roth, Josh Tenenber, and David Socha. 2016. Discourse/s in/of CSCW. *Comput. Support. Coop. Work CSCW An Int. J.* 25, 4–5 (2016), 385–407. DOI:<https://doi.org/10.1007/s10606-016-9258-5>
- [67] Leia Y. Saltzman, Tonya Cross Hansel, and Patrick S. Bordnick. 2020. Loneliness, Isolation, and Social

- Support Factors in Post-COVID-19 Mental Health. *Psychol. Trauma Theory, Res. Pract. Policy* 12, (2020), 55–57. DOI:<https://doi.org/10.1037/tra0000703>
- [68] Sergio Sayago, Barbara Barbosa Neves, and Benjamin R. Cowan. 2019. Voice assistants and older people: Some open issues. *ACM Int. Conf. Proceeding Ser.* (2019), 22–24. DOI:<https://doi.org/10.1145/3342775.3342803>
- [69] Marén Schorch, Lin Wan, David William Randall, and Volker Wulf. 2016. Designing for Those who are Overlooked - Insider Perspectives on Care Practices and Cooperative Work of Elderly Informal Caregivers. *Proc. 19th ACM Conf. Comput. Coop. Work Soc. Comput. - CSCW '16* (2016), 785–797. DOI:<https://doi.org/10.1145/2818048.2819999>
- [70] Britta F Schulte. 2020. Don't Blush : Sexuality , Aging & Design. (2020), 405–408.
- [71] Alfred Schutz. 2019. *The Phenomenology of the Social World*. DOI:<https://doi.org/10.5840/schutz2019115>
- [72] Priya Seetharaman, Saji K. Mathew, Maung K. Sein, and Ravindra Babu Tallamraju. 2020. Being (more) Human in a Digitized World. *Inf. Syst. Front.* 22, 3 (2020), 529–532. DOI:<https://doi.org/10.1007/s10796-020-10020-9>
- [73] Lucas Martinus Seuren, Joseph Wherton, Trisha Greenhalgh, Deborah Cameron, A Court, and Sara E Shaw. 2020. Physical Examinations via Video for Patients With Heart Failure: Qualitative Study Using Conversation Analysis Corresponding Author : 22, (2020), 1–12. DOI:<https://doi.org/10.2196/16694>
- [74] William Seymour and Max Van Kleek. 2020. Does Siri have a soul? exploring voice assistants through shinto design fictions. *Conf. Hum. Factors Comput. Syst. - Proc.* (2020). DOI:<https://doi.org/10.1145/3334480.3381809>
- [75] William Seymour, Martin J. Kraemer, Reuben Binns, and Max Van Kleek. 2020. Informing the Design of Privacy-Empowering Tools for the Connected Home. (2020), 1–14. DOI:<https://doi.org/10.1145/3313831.3376264>
- [76] Deepika Singh, Ismini Psychoula, Erinc Merdivan, Johannes Kropf, Sten Hanke, Emanuel Sandner, Liming Chen, and Andreas Holzinger. 2020. Privacy-Enabled Smart Home Framework with Voice Assistant. In *Smart Assisted Living: Toward An Open Smart-Home Infrastructure*, Feng Chen, Rebeca I García-Betances, Liming Chen, María Fernanda Cabrera-Umpiérrez and Chris Nugent (eds.). Springer International Publishing, Cham, 321–339. DOI:[https://doi.org/10.1007/978-3-030-25590-9\\_16](https://doi.org/10.1007/978-3-030-25590-9_16)
- [77] Alessandro Soro, Aloha Hufana Ambe, and Margot Brereton. 2017. Minding the Gap : Reconciling Human and Technical Perspectives on the IoT for Healthy Ageing. 2017, (2017).
- [78] Gerry Stahl. 2016. From Intersubjectivity to Group Cognition. *Comput. Support. Coop. Work CSCW An Int. J.* 25, 4–5 (2016), 355–384. DOI:<https://doi.org/10.1007/s10606-016-9243-z>
- [79] Katarzyna Stawarz, Anna L. Cox, and Ann Blandford. 2014. Don't forget your pill! Designing effective medication reminder apps that support users' daily routines. *Conf. Hum. Factors Comput. Syst. - Proc.* (2014), 2269–2278. DOI:<https://doi.org/10.1145/2556288.2557079>
- [80] Kevin M. Storer, Tejinder K. Judge, and Stacy M. Branham. 2020. “All in the Same Boat”: Tradeoffs of Voice Assistant Ownership for Mixed-Visual-Ability Families. (2020), 1–14. DOI:<https://doi.org/10.1145/3313831.3376225>
- [81] Anja Thieme, Madeline Balaam, Jayne Wallace, David Coyle, and Siân Lindley. 2012. Designing wellbeing. *Proc. Des. Interact. Syst. Conf. DIS '12* (2012), 789–790. DOI:<https://doi.org/10.1145/2317956.2318075>
- [82] Mariah Snyder Towey, Susan. 2014. *Complementary & alternative therapies in nursing*. DOI:<https://doi.org/10.5860/choice.51-4474>
- [83] Milka Trajkova. 2020. “ Alexa is a Toy ”: Exploring Older Adults ' Reasons for Using , Limiting , and Abandoning Echo. (2020), 1–13.
- [84] Caitlin J. Tyrrell and Kadija N. Williams. 2020. The Paradox of Social Distancing: Implications for Older Adults in the Context of COVID-19. *Psychol. Trauma Theory, Res. Pract. Policy* 12, (2020), 214–216. DOI:<https://doi.org/10.1037/tra0000845>
- [85] Alexandra Voit, Jasmin Niess, Caroline Eckert, Maike Ernst, Henrike Weingärtner, and Paweł W. Woźniak. 2020. It's not a romantic relationship': Stories of Adoption and Abandonment of Smart Speakers at Home. *ACM Int. Conf. Proceeding Ser.* (2020), 71–82. DOI:<https://doi.org/10.1145/3428361.3428469>
- [86] Isaac Wang, Jesse Smith, and Jaime Ruiz. 2019. Exploring virtual agents for augmented reality. *Conf. Hum. Factors Comput. Syst. - Proc.* (2019), 1–12. DOI:<https://doi.org/10.1145/3290605.3300511>
- [87] Jenny Waycott, Greg Wadley, Stefan Schutt, Arthur Stabolidis, and Reeva Lederman. 2015. The challenge of technology research in sensitive settings: Case studies in “Sensitive HCI.” *OzCHI 2015 Being Hum. - Conf. Proc.* February 2019 (2015), 240–249. DOI:<https://doi.org/10.1145/2838739.2838773>
- [88] T Wilson and C Hargreaves. 2017. Analytical Framework for Research on Smart Homes and Their Users. *Human-Computer Interact. Ser.* (2017), 15–35. Retrieved from file:///Users/inkalahteenaro/Downloads/9783319680170-c2 (1).pdf
- [89] Rainer Winkler, Sebastian Hobert, Antti Salovaara, Matthias Söllner, and Jan Marco Leimeister. 2020. Sara, the Lecturer: Improving Learning in Online Education with a Scaffolding-Based Conversational Agent. *Conf. Hum. Factors Comput. Syst. - Proc.* (2020), 1–14. DOI:<https://doi.org/10.1145/3313831.3376781>
- [90] Bo Xie, Neil Charness, Karen Fingerma, Jeffrey Kaye, Miyong T. Kim, and Anjum Khurshid. 2020. When



Going Digital Becomes a Necessity: Ensuring Older Adults' Needs for Information, Services, and Social Inclusion During COVID-19. *J. Aging Soc. Policy* 32, 4–5 (2020), 460–470. DOI:<https://doi.org/10.1080/08959420.2020.1771237>

Received: April 2021, Revised: November 2021, Accepted: March 2022.