Contextual design of a novel elderly-centered system for video-based communication

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ABSTRACT

Since the Covid-19 pandemic, computer-mediated communication (CMC) became more crucial than before for staying in touch and maintaining social contact with family members and friends. However, older adults might have a knowledge gap or age-related barriers using CMC technologies like messenger services or video-based platforms on a mobile device. Consequently, and especially now, they often feel lonely since no physical meetings are possible, which in turn is negatively impacting their mental health. Therefore, a new CMC video call system for older adults that addresses these age-related issues is designed. This article presents the designing process, which was based on a contextual design approach.

CCS CONCEPTS

• **Human-centered computing** → **Accessibility systems and tools**; **Accessibility design and evaluation methods**; • **General and reference** → General conference proceedings.

KEYWORDS

Computer-Mediated Communication, Contextual Design, Elderly-Centered Design

1 INTRODUCTION AND INITIAL SITUATION

During the Covid-19 pandemic, many people were confined to their home for long periods of time. Social distancing was practiced globally [9] as an effective protective measure against the coronavirus. Yet, older adults who stay home alone feel isolated and detached from their families and friends since they cannot visit them anymore [2]. Social isolation can cause loneliness, which negatively impacts the psycho-social health of older adults. Loneliness has a plethora of negative effects: It impairs sleep and mental health, leads to daytime dysfunction, higher mortality rates, reductions in physical activity, and even supports Alzheimer's disease [5]. Information and communication technologies like internet-based CMC systems can reduce loneliness [5]. Especially video calls can reduce loneliness and social isolation among older people and help them be better connected than just having phone calls. What older adults usually miss are conversations in which the partners can see each

other [7]. Furthermore, visual cues can help people with dementia since the picture can aide memory [2].

Against this background, a video call solution for the elderly is being developed. The contextual design approach is adopted to ensure the design is not based on the designers' assumptions about older adults' lives but the actual context of older adults. This position paper focuses on the approach taken to design the solution. The resulting novel video call system itself is not specified here. This is due to legal circumstances, since a commercial implementation is being looked into right now.

2 THE ELDERLY-CENTERED CONTEXTUAL DESIGN APPROACH

The design approach for the project was based on 'Contextual Design Envolved' by Holtzblatt and Beyer, which integrates elements from participatory design [3]. Additionally, since this system is designed especially for older people, aspects from elderly-centered [1] designing were integrated. To make the designing process, especially the Usability Testing of the user interface mock-up, more elderly-centered, it was enhanced with suggestions from the paper '3 x 7 Usability Testing Guidelines for Older Adults' by Silva and Nunes [8].

The contextual design approach is divided into four main stages. The four stages out of [3] are data collection and interpretation (participative), consolidation and ideation, detailed design, testing, and validation (participative). The third and fourth phases should be iterative to continually improve the product in participation with the future users[3].

2.1 The data collection and interpretation stage

To get more familiar with how older people stay in touch with their families in the current Covid-19 pandemic situation, the problems they face regarding CMC, and to find out what they would need to use it, contextual interviews were conducted. Therefore, three people with older family members, two older adults, and a nurse in a residential and nursing home were interviewed in the first step. Participants had different cultural backgrounds and nationalities. In the contextual inquiry process the researchers should go where people are working and living and engage in their everyday lives. On-site, field interviews should be conducted so the interviewer can see how they work and live and how the future product can be integrated into the user's live [3]. This participation is significant for designing a system for older adults since their problems and point of view are often not familiar to the designers and developers. Also, cultural probes can be used to get insights into older adults everyday life [6]. Due to the Covid-19 pandemic and its constraints on co-presence and time, telephone interviews were used to replace

the missing probes, including detailed questions about how things are done. After the contextual interviews, the design team went through the content and identified critical key issues in the so-called interpretation session.

The key findings of the contextual interviews and the interpretation session were that devices like smartphones or tablets are too small, too complex, and include too many features for older adults - and should be somehow replaced if possible. Furthermore, the device should have only the bare minimum of user interaction for the elderly. The user interface design should be straightforward and stripped of any interaction that does not lead to the goal of getting in contact with family or friends. This way, people with dementia or other age-related conditions can still successfully use the solution. On the other hand, the family members and friends can use their regular devices to stay in contact with their older or impaired relative.

2.2   The consolidation and ideation stage

In the next step - the data consolidation phase - the goal was to bring all the collected information and main findings from the interviews and research together into one perspective to gain a general overview of the problems the future users currently face [3]. Before coming to the actual ideation of a concept, Holtzblatt and Beyer suggest using contextual design models about the users' lives and workday viewpoints from the contextual interviews. These models form a basis for the actual ideation process and can be referred to with different ideas to see if the solution helps resolve the problems — for instance, user personas and a sequence model got created and analyzed [3]. In this consolidation phase, several hot ideas emerged from the discussion. For instance, design a video call system device with less or no user interaction at all for older adults, so the elderly do not need to use any computer-like device that might already be an anchor for a fear of failing.

The next step was the actual ideation phase with a visioning where a more detailed idea was developed. Holtzblatt and Beyer suggest creating a hand-drawn sketch while brainstorming about the idea - the so-called visioning session [3] - from which then the actual novel video call system arose.

2.3   The detailed design stage

The next challenge was designing a user interface and a great user experience design for both - the older and the younger users - since one of the main issues found in the interviews was that the design should be more understandable and straightforward for older people. Therefore, a deep understanding of existing interaction design patterns was necessary to determine which one to use. In Holtzblatt and Beyer, a few design patterns were introduced and studied [3]. Afterward, storyboards and user interaction designs were made. Later, a detailed design of the system was created with the Sketch tool for each storyboard, which served the previously developed user interaction designs. The individual ways of interacting were then connected to a "click" dummy which was available in the cloud for the first tests and validation.

2.4   Testing and validation stage

As proposed by Holtzblatt and Beyer, mockup interviews were contacted to see in a participatory approach if the designed product and the design components used are suitable [3]. Therefore test cases were created according to the user stories (storyboards). These mockup interviews happened (almost) all the time in the user's context and on the user's devices to see how the user works with the system in the real world. The mockup interviews followed - besides the advice of Holtzblatt and Beyer – steps and tips from the 'Handbook of usability testing' from Jeffrey Rubin et al.[4] to get better results out of the participation. For instance, following the "ThinkAloud"-Approach and similar techniques. Also, ideas were collected from the demo users. Furthermore, to make the process elderly-centered, the paper '3 x 7 Usability Testing Guidelines for Older Adults' from Silva and Nunes [8] was consulted, and the test cases were adjusted accordingly for the older adults. Test users were recruited with a large distribution over age, technical experience, gender and health status. The tests were conducted with three users in the role of the younger relative and with two people that were over 80 years old: One female without age-related (or other) cognitive impairment and one male with the beginning state of dementia. These two were not familiar with computers, smart phones, or tablets altogether.

The test results provided helpful information. For instance, missing confirmation screens, unclear and inappropriate wording, icons and logos, uncertainties in the setup process, and so on. Furthermore, valuable ideas were added, like the ability to specify call times so that an older adult with dementia is not calling midnight or multiple times in a row. Most of the feedback and ideas were then added to the "click" dummy and retested once with one younger and one older person.

2.5   Next steps

The solution that resulted from the design process allows the older adult to get in touch with their loved ones in the easiest possible way. The next step is to bring the system idea alive with a proof of concept implementation. This implementation will then be re-evaluated in a natural context and with the participation of different older and younger people to optimize and improve it and check if it actually gets used as an alternative to existing technologies.

ACKNOWLEDGMENTS

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