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Co-Watching 360-films in Nursing Homes

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Abstract. This work investigates experiences and practical aspects of co-located and co-watched 360-videos in head mounted displays by groups of older people at nursing homes. In a study involving 19 residents at two different nursing homes, co-watching screenings were arranged with 360-videos produced in the local area by filmmakers. Data was collected through non-participant observation and semi-structured interviews with the participants. Input from nurses and facilitators were also collected. We found this to be a much appreciated, feasible, and enjoyable immersive experience improving short-term well-being, expressed through (e.g.) new conversations, pride in participation, and spontaneous movements. However, the value of co-watching was mainly captured for residents who already knew each other, and we found limited indications of virtual co-presence. We further recognized the value of the videos themselves and the desire for new 360-video experiences. But also, a need for better headsets suitable for older people and shared use at nursing homes to avoid social isolation due to the introduction of VR technology.

Keywords: 360-films, Virtual Reality, Nursing homes, Co-Watching.

1 Introduction

Social isolation and loneliness are well-recognized health problems among older people [22, 30]. To prevent these issues nursing homes typically arrange social activities. However, limited and restricted mobility still lowers the sense of life quality, simply through the lack of new experiences and limited variety of environments and happenings to experience. Notably, although not our focus, the situation has worsened by the current and ongoing Covid-19 pandemic. Within the era of social distancing as prescribed by the pandemic, older citizens are like never before isolated with limited activities. To counter these issues, a broad range of new technologies are being explored and tested.

This work concerns an intervention conducted by Swedish filmmakers in collaboration with the caregiver Tiohundra in Norrtälje municipality in Sweden. Using short 360-videos recorded in the local area, the aim was to improve the quality of life of the older people living at the nursing homes through new social virtual experiences. Examples of films featured were a boat trip in the archipelago, a canoe ride in a local canal, a

fortress, an art walk, and the fascinating lemurs at a nearby zoo. This case has conceptual similarities to *The Photostroller* by Gaver et al. [19], though their design exploration concerned navigation of Flickr images rather than 360-video VR content.

The purpose of this work was to study how co-watched 360-films are experienced among older people living in nursing homes, as well as practical aspects and the feasibility of facilitating 360-video screenings at nursing homes. Co-watching, in this case experiencing short 360-videos in a group setting, presumes that several residents are watching synchronously and co-located in a room. This is novel research as there is generally little research on experiences of 360-videos viewed in HMDs, particularly in contexts such as nursing homes. Although some research has been done on co-watching regular films in VR on a virtual TV [35] [21], none of these studies have looked at 360-videos, which is a very different media covering the whole field of view in all directions. This allows for looking around as if being in a real environment. Furthermore, the medium is different to TV since everyone wears an HMD and is therefore visibly shielded from each other.

Using non-participant observation, we followed five screenings with 19 participants at two different nursing homes. The screenings were facilitated and arranged by the nurses. Without intervention we filmed these screenings and afterwards we interview the participating residents in groups. Post screenings, we also collected input from other stakeholders such as nurses and head of divisions at the nursing homes. Our overall aim was to examine how this technology played out when residents co-watched synchronized 360-videos in head mounted displays (HMDs) as a social group activity. The recorded data was thematically analysed focusing on practical implications and experiences, feasibility, and potential improvements regarding setup and design.

The project has received substantial attention in Sweden, which has caused a widespread interest at other nursing homes. Currently, without our involvement, the approach is spreading to new nursing homes and municipalities in Sweden.

2 Background

Virtual Reality (VR) is a well-established research area in HCI, concerned with methods that let people take part of three-dimensional visual material using different types of stereoscopic displays, a topic that has been explored from an artistic and technical standpoint ever since the 1950s [55].

2.1 VR in Medical and Clinical Settings

In the medical domain, there are several dedicated centres and programs for VR-based treatment methods, such as the VR Medical Center¹ and the VR treatment program at Duke University². Examples of applications include pain management for adults [1, 23, 33, 45] and children [4], post-stroke rehabilitation [31], treatment of

¹ <http://www.vrphobia.com/>

² <http://psychiatry.duke.edu/divisions/general-psychiatry/virtual-reality-therapy-phobias/>

stress-related disorders [6], tinnitus [32], balance impairment [43], intellectual disabilities [9], dementia [22], exposure-based cognitive behaviour therapy (CBT) [42] for self-treatment of spider phobia [11, 37], rehabilitation of neck injuries [13], fear of heights [16, 49], social phobia [26], fear of flying [39], and PTSD for war veterans [48]. Studies have shown that VR can save time and lead to more effective exposure therapy [34] in safe and controlled environments [47]. There is also evidence that cognitive behaviour therapy using VR is an attractive entry to real environments [29]. VR has also been used for education in dental [50] and medical [46] school where simulators allow students to practice procedures without human subjects and less supervision.

The above examples are based on systems where 3D graphics have been produced specifically for a clinical case. However, immersive 360-degree videos are also considered a form of VR [2]. Similar to 3D graphics-based VR, 360-films [30] are experienced via head-mounted displays (HMDs), but are based on real recorded video footage instead of computer-generated graphics. Recently, several research groups have, like us, experimented with this new media format in various applied interactive settings [8, 27, 58]. Examples from the healthcare domain include preparing patients for anaesthesia [53], MRI scanning [3] and exposure therapy [17].

One technical limitation of VR [18] is the limited horizontal view. In newer HMD's, the field-of-view (FOV) is usually limited to around 110 degrees [61]. Another limitation is network delays, such as transmission of data which could cause delays in an experience, especially when users are in different geographical locations [18].

2.2 VR and related technology for older adults

HCI research in relation to older adults are diverse. For example, there are studies focusing on different methods of digital game design for older adults [24], and studies focusing on using multimodal interfaces to allow users to communicate with their social network [14]. In healthcare, HCI for older adults is used as an intervention for, e.g. cognitive training to slow down deterioration of cognitive function [65] or to encourage physical movement and counteract loneliness through games [10].

Examining the use of VR in a group setting, one study [15] investigated how the use of VR, by older adults in assisted living communities, over a two-week period of time might contribute to the residents' social and emotional well-being. The study consisted of two groups, the control group watched the same content on a regular TV, the other group co-watched virtual TV using HMD's. The VR group was reported less socially isolated, being less likely to show signs of depression, experiencing positive effects more frequently, and feeling better about their overall well-being.

A case study [40] showed that the first encounter with VR-glasses elicited positive feedback and an overall positive experience in long-term care facilities in Austria. Furthermore, the residents reported being interested in the technology and desired to see different types of nature scenes in Austria. Another study [57] examined how the well-being of older adults could be improved with VR and found that the experience stimulated positive emotions, triggered memories, and led to discussions. However, it only partially affected the participants' measured subjective well-being (SWB). The

weight of the HMD have also been highlighted as a concern when designing to enhance the virtual reality presence for older people [36].

Wallace, Wright et al. [62] has identified characteristics of anchoring, capturing and supporting sense of self and connecting relationships to work as guides within design for personhood, particularly for people with dementia. Personhood in dementia is distinguished by focusing on the immediate social circle becoming active in maintaining their sense of self. One conclusion was that while reminiscence is seen as a potential value of digital technologies, there is a risk that looking back can be perceived as loss of self and what has been lost. Hence, they emphasize on the importance to focus on the present and imagined futures as well as remembering the past. In an associated study, Wallace et al. [63] found that in dementia, possessions including places, groups and local culture, are essential in preserving parts of a person's sense of self and this can be supported by the ones in proximity (e.g. staff at nursing home) finding "ways in" to the person with dementia. This means that design needs to encourage conversations in which the people with dementia can share their knowledge and expertise.

Hodge et al. [22] has studied VR-experiences for people with dementia and their caretakers to outline implications for design and use in future experiences. They found that the weight and the fit of the HMD is of concern for the participants and that they wanted to share the experience with their caretakers. The authors suggest that the latter can be helped by having caretakers follow their experience on an additional screen displaying the same view. Another finding was that it is important to personalize the experience to the preferences of the user.

A related non-VR study [19] used a device called the Photostroller, designed for older people at care homes. It showed continuous slideshow of pictures from predefined categories with the aim to support older people's experiences with pleasure, engagement and sociability, while allowing for diversities by designing for flexibility in interpretation. They found that the elderly was happy with drifting along with an ambiguous slideshow that allowed an openness to reminisce and socialize about their own memories rather than prescribed and closed topics.

2.3 Co-watching and co-location

The act of watching film together, e.g., on TV or YouTube, can be described with different, yet not always synonymous terms. In the present study, the term co-watching will be used to describe the act of a group watching something synchronized. The research done on co-watching has mainly focused on watching TV (long formats) [5, 38] and watching online videos (shorter formats) [59]. In terms of online videos, there are systems with the purpose to enable co-watching, such as Zync [52], by allowing people to watch videos synchronized.

In this study, we focus on co-watching of 360-films in VR in a co-located setting. Co-location, according to the Merriam-Webster, means to "be located together", this may both concern physical or virtual co-location. In a virtual environment, it can be described as the subjective "sense of being there" [36] together as if it was reality through "virtually generated streams of sensory information" [51]. Perceiving

co-location in virtual environments hence also entails perceiving co-presence with others, to sense others presence. We define a co-watching experience – as different to a watching experience – in VR as the perceived experience of virtually watching a 360-film together, in opposition to experience a film in isolation.

One study explored the co-watching process and suggested that co-watching was a way for people to manage “other’s impressions of themselves” [54]. The results also indicated that co-watching could alter the engagement and intentionality depending on, for instance, where the users are located (e.g., public space). Another study [35] showed that co-watching using an HMD at-a-distance was preferred over watching TV at-a-distance. The participants were co-located and could perceive each other through virtual representations. However, note that they watched a virtual “regular” TV set inside the virtual environment and not 360-films – which is the focus of this study. Therefore, they did not test the increased immersion that 360-films offers.

In a related study [21] on watching regular TV inside a virtual environment, the struggle to communicate while wearing a HMD and how it can create a social barrier was recognized. In the study, users could see each other in a 360-degree virtual space sitting around a table and was represented with 2D video streams in which they all wore HMDs as captured by the camera. The study found that the framework helped provide high immersion and co-presence, but it acknowledged that there is still a great deal left to work on. However, this approach may not be suitable for 360-films as the others representation would occlude the film.



Fig. 1. Example pictures from two screenings in which residents were watching synchronized 360-films.

3 Method

In order to study the experiences, challenges and practicalities around facilitating older people to co-watch 360-films for increased wellbeing, a study at two nursing homes was devised. The study consisted of five screenings (see Table 1 for group and resident coding and Figure 1 for context) with 19 residents in which they co-watched one to three 360-films using HMDs. Data was collected using non-participant observations [64], video, and semi-structured interviews [20]. This data was then thematically analyzed [7]. We also collected input from six nurses and four head of divisions through surveys and group discussions. Additionally, we interviewed a film consular involved

in the screenings and a playwright who had done 360-films screenings with about 50-70 nursing home residents. Finally, to determine the extent the 360-medium was used we analyzed residents head rotations.

The data was collected during what we refer to as *screenings* and consisted of a preliminary survey, screenings of the films, and interviews. Five screenings were arranged on three separate occasions at two different nursing homes during a one-month period. Different residents and nurses were involved in all screenings. One nursing home was located in the center of the town Norrtälje with a population of 22000. The other nursing home was in the small town Rimbo with a population of 5000. The size of the groups varied across the screenings (2-8 residents/screening). Prior to the VR-screenings, the residents filled out a short preliminary survey with background questions such as age, gender and information about their technological habits.



Fig. 1. The HMD Oculus Go. Multiple devices were used, and they were connected through the Showtime VR application, controlled by nurses using a tablet or smartphone.

Non-participant observation, video recordings and displayed 360-films. Non-participant observation [64] is a method where the object is to gather data without the observer participating in the activities being observed. This can be conducted with the observer either being present in the natural setting of the activity or not, in our study a researcher was present. The screenings were facilitated by trained nurses. This included fitting the headset onto the residents, getting the settings right, starting films, supporting, and engaging the residents throughout the screenings. The residents were seated during the screenings. Each screening was video recorded with consent.

The number of screened 360-films varied in the different screenings. The nurses were familiar with the films prior to the screenings. During the screenings the nurses could follow what the residents was seeing on a separate screen. All showed 360-videos were recorded in the local area and were filmed by Film Stockholm. The films used was a boat trip to Norrtälje archipelago (F1), lemurs at Skansen Zoo (F2), a guided tour at Sjaröfortet (F3, underground mountain fortress), an art exhibition/walk (F4), and a canoe ride on the Åkersberga canal (F5). Table 1 provide an overview of films screened in each screening along with resident codes and video lengths.

Oculus Go and Viewing Platform. The head mounted device (HMD) that was used in this study was the Oculus Go (see Figure 2). This HMD's is designed to be worn with glasses [41]. Focus adjustments is limited to moving the HMD itself for the best possible experience. However, it is possible to purchase tailored prescription lenses for Oculus Go, but this was not possible within this study as it requires prior knowledge about resident's visual defects. To be able to watch videos synchronized, the third-party application Showtime VR was used. Showtime VR allows a facilitator to control and start synchronized videos on multiple devices through either a tablet or smartphone.

Table 1. Resident coding (with gender and age), group composition and films watched

Group	Resident code (gender, age)	Films screened
G1	P1 (<i>M, 84</i>), P2 (<i>F, 77</i>), P3 (<i>M, 88</i>)	F1, F2
G2	P4 (<i>M, 93</i>), P6 (<i>F, 85</i>), P8 (<i>F, 90</i>)	F1, F2
G3	P9 (<i>F, 64</i>), P10 (<i>F, 82</i>), P11 (<i>F, 75</i>), P12 (<i>F, 87</i>), P13 (<i>F, 89</i>), P14 (<i>F, 89</i>), P15 (<i>F, 78</i>), P16 (<i>F, 84</i>)	F3, F4, F5
G4	P17 (<i>F, 55</i>), P18 (<i>F, 79</i>), P19 (<i>M, 81</i>)	F3, F4, F5
G5	P20 (<i>M, 78</i>), P21 (<i>M, 78</i>)	F1, F2

F1 – Boat trip (7:00 min), F2 – Lemurs at zoo (7:30 min), F3 – Guided tour at fortress (5:20 min), F4 – Art exhibition/walk (7:15 min), F5 – canoe ride (7:20 min)

Interviews. After the screening, semi-structured group interviews [20] was held to capture experiences and thoughts around co-watching 360-films. The questions were based on four aspects: feelings, group connection, technology and user experience.

Residents. In total 21 residents (P1-P21) took part in the study over five screenings. However, two residents (P5, P7) dropped out early so only 19 residents were included, 13 women and 6 men. The residents were aged between 55 to 93 years (average 81 years). In this paper we refer to our participants primarily as 'residents' of a nursing home or 'older people'. While these residents are typically aged over 65 and considered 'older adults', some of our residents – and other residents at nursing homes – are, due to medical conditions, aged under 65. Moreover, while our participants are predominantly aged over 65, they may not identify as 'old'. Twelve residents (63,2%) had owned a computer and six had owned a smartphone.

Thematic analysis. A thematic analysis [60] was used to get a direct understanding [64] of the residents experiences and the screenings in its natural element by identifying and analyzing patterns [7]. The second authors initially conducted a cursory analysis by listening to and transcribing the interviews. This was used to identify more prominent and recurrent themes. With preliminary themes identified, deeper analysis and validation was made independently by the first author. No other coders were involved.

Post-screening follow-ups with stakeholders. Several activities were performed to follow-up on the nurses, their head of divisions, one so called playmakers, and one film consular. All involved nurses (N=6) discussed their experience and thoughts in smaller

groups. The heads of division (N=4) answered a survey, and interviews was conducted with the Playmaker and film consular.

Post-analysis of HMD head rotations. To quantify how much residents looked around in the virtual environment we performed a video analysis of their head movements during the screenings. The purpose was to determine the degree the medium was used. If not actively used the added value of the medium could be questionable. The analysis was done by scrubbing the videos back and forth looking at each resident's HMD rotations. We marked each resident approximate total HMD rotation horizontally in degrees. All residents were classified as active, or passive, based on how much they looked around. Active classification was determined for frequent movements regardless of the magnitude of the rotation, this was obvious when scrubbing the film. Infrequent movements with long duration without movement was classified as passive.

4 Results

Here we summarize the findings from the study around five themes: general experiences and ideas expressed regarding 360-videos as a resource for enriching of everyday life, issues related specifically to the use of HMDs, participants sense of immersion and togetherness while co-watching, and finally, follow-up reflections by nurses, facilitators of the screenings as well as people involved in the technical production.

4.1 General Experiences

Before the experience no residents expressed having any prior expectations. The general interest was to explore something new. After the screenings were finished, many expressed positive experiences such as it being fantastic (P2, P6, P17), wonderful (P15), exciting (P18), happiness (P1). In fact, no one had any adverse comments. Overall, the experience was highlighted as captivating and more intense than simply watching a regular movie on a TV (P10, P15), comparable to IMAX but in a smaller size (P10).

For several residents, the experience prompted old memories that triggered feelings and even bodily sense perceptions. For instance, P17 could strongly recall the smell of a salt mine only by watching the film from the underground fortress (F3):

“when she walks into that mine you could actually smell it [...]. I haven't been to that mine, but what I could smell was like a salt mine [...] which I have been in many times. That smell is what I felt”

Another resident (P4) was familiar with the area in the boat trip film (F1), which led to reminiscing previous boat trips, places visited, and boats previously owned. Notably, the boat trip film was strongly emotional for group G5, so much that P20 cried after taking of the HMD in pure enjoyment over being able to revisit these waters he had visited earlier in his life. Both P20 and P21 was anglers. Post the screening P20 and P21 talked about (e.g.) where the best fishing waters were in the area and what fish

species most easily takes the bait, indicating a social value post the screening as it led to deeper conversations not covered but rather triggered by the 360-film.

Several residents expressed a desire for more videos and experiences. Their requests included previously visited areas and places. However, many rather desired to visit places that they never had the chance to see before, to go on new adventures. One example is how P1 wanted to visit particular Swedish mountains as his wife was born there and he had never been there. Another resident (P19) openly said that he really wanted to see things and places that he never had seen before, as if he was urging for new experiences and adventures, connotating possibilities no longer practically possible in real life at the nursing home. Other common suggestions circled around nature, and many residents were quite detailed and vivid in their suggestions, such as birds chirping (P13) and colorful forest sceneries with blueberries and lingonberries (P20).

One positive aspect of the experience was that it provided the opportunity to simply experience new technology. This was mentioned as technology that they have heard about on TV or in newspapers, but never had gotten access to. Residents highlighted that they are used to adopt new technology as they have experienced advances in technology throughout their entire life. However, recent developments had been difficult to catch up with. The value of this experience – in itself – was perhaps best expressed by P8, in which we could sense the excitement and curiosity:

“it’s that we’ve been following [technology] during our lifetime and a lot has happened. So, to get to experience something I’ve only heard about was fun!”

In our analysis, we also associated P8s statement with a sense of preserved dignity and the sense of staying relevant with present age. P4 was thinking in similar paths and implied that this type of expanding experience should be an everyday element to maintain well-being through smaller and reoccurring portions of new experiences:

“You, of course, get happier, that’s certain. A little while every morning”

4.2 Experiences and Issues Specific to the Head-Mounted Displays

Since the HMD was an integral part of the experience, one question asked to the residents after the screening was how it felt to wear it, and if they experienced any difficulties. The majority (14 out of 19) of the residents did not express any issues in comfort or otherwise felt that it affected their experience. However, five experienced some noteworthy problems. First, three residents (P9, P16, P18) expressed that they encountered visual problems during the screening and that the films looked blurry. Notably, all three were wearing glasses. For instance, P18 elaborated:

“I got used to it [...]. It was blurry, maybe it has something to do with my eyes or my glasses [...] but it always had that little tremble”

It is unclear exactly what P18 experienced and what she meant by “tremble”, but 360-videos often flickers a bit when moving the head fast or if the video quality is either low, or too high, for the HMD to handle. However, it is important to highlight that most residents wearing glasses did not explicitly state any visual problems or discomfort.

Another concern was for P3 who also expressed having severe problems seeing, saying: “*You could not see anything!*”. However, looking at the recorded video it was evident that the resident had trouble holding his head up, indicating that the HMD was too heavy. The result would be that P3 was looking down on the ground in the videos, where also a black circle was placed to mask the camera stand, and hence there was little to see. Despite this, P3 did not report any discomfort using the HMD. Similarly, P10 stated that the HMD was too heavy and P1 was observed to have difficulties with the weight of the HMD.

Another practical problem concerned how P1 found it weird that “*you could not blow your nose*” when being in the virtual environment. In the video material, it is also evident how P1 is trying to blow his nose but not managing to do so because of the HMD covering his nose.

4.3 Immersion and Togetherness while Co-Watching

As regards the social aspects of co-watching 360-videos in HMDs, almost all residents expressed paying no attention towards other residents in the room, indicating a low level of perceived virtual co-location and co-presence. Hence, a limited sense of a virtual co-watching experience. As regards to immersion, seven residents explicitly noted that they felt as if they really were in the 360-films being viewed, immersed and present in the virtual environment. The focus was clearly on digesting and experiencing the films as a strong medium which overshadowed the physical presence of others in the room. One illustrative example was expressed by P9:

“I was just looking at what was in front of me [in the HMD], not thinking too much about what was happening around me [in the physical room]” (P9)

On a group level, in the second group, G2, it could be seen that during that screening there was a lot of sounds and commotion around them, apart from the screening, but we observed no distractions or breaking of immersion. This could also be said for quieter groups, residents were focused during the screening and immersed in the virtual environment. The residents in G3 and G4 spent almost the whole screening being completely quiet, except for initial sporadic comments on how “*cool*” it was. From an observation point they all appeared to be inside their own little bubbles.

As regards being immersed in VR, some weird expressions of feelings were recorded. First, P10 explained how she felt a sudden urge to ask a question to the guide in the film but then “*realized that there was no [real] guide here!*”, indicating a high degree of presence and immersion in the film.

When asked if they thought it was better to watch together in a group or if it made any difference to the overall experience, the consensus during this first experience with VR was that it did not make much difference (all except P20 and P21). Three residents (P4, P17, P18) explicitly stated that they were so absorbed by the environment presented in the film that they forgot about the social surroundings in the physical room. For instance, a sense of being “*in the archipelago*” (P4), being “*in your own little world*” (P18) or being “*just me there*” (P17).

However, in post follow-up, it became apparent that these responses were affected by how well the residents knew each other. In groups where they knew each other (G1 and G5), they commented on the films and socialized more during the screening. This contrasted with the other groups (G2, G3 and G4) composed by people not knowing each other, in which remarkably less communication took place. Group G5, was also the only group that stated that the experience was better and more enjoyable when sitting in a group. These gentlemen knew each other well prior to the screening. Here expressed through a dialogue between two residents:

“you can actually talk about [what’s happening] and that does add something”. (P20)

“Yeah, I think that it’s good, it gets better by not sitting by yourself” (P21)

Not knowing what the other residents were looking at created a case in group G1 where P2 was trying to get P3 to look at a specific thing in the film. Calling out *“look over there”* while pointing. This created some confusion, as P3 had no idea where to look, as no virtual indicators were directing attention towards the object in question. While there was only one explicit instance of this, there were indications observed that this could have been a social hindrance for a common social experience also in other groups. For instance, we recorded several instances where dialogues caused other residents to look around as if searching for the objects or happening in question.

4.4 Video-analysis of HMD Movements

The Oculus Go have 101 degrees field of view (FOV). So, a resident turning 180 degrees takes advantage of approximately 280 degrees of the 360-film. In the study, 16 residents rotated their HMD 90 degrees or more, thus taking advantage of at least 190 degrees of the 360-film. One rotated the HMD 120 degrees (seeing 220 degrees), two rotated 135 degrees (seeing 235 degrees), five rotated 180 degrees (seeing 280 degrees), and one even 210 degrees (seeing 310 degrees). All these 16 residents were classified as actively looking around. Interestingly, the remaining three residents all rotated less than 90 degrees and were also classified as passive in their head movements, bordering to almost no head movements at all. Two rotated as little as 40 degrees (seeing 140 degrees) and one rotated 65 degrees with very few movements overall. These three (all older males) had severe mobility issues and were the only residents in wheelchairs.

4.5 Follow-up with Stakeholders

The nurses were positive to the whole intervention and stated that it was a good addition to otherwise more mundane activities. First, they highlighted positive aspects such as spontaneous movements, particularly among otherwise passive residents. Their impression was that the residents were strongly immersed and that the 360-films evoked many memories. Generally, they noticed a sense of pride among the residents having been invited to try VR for the first time. Regarding the films screened they highlighted that films should be short (maximum 5-10 minutes) and that more films are needed.

Suggestions was to add town walking tours, the main square, churches, seasonal happenings such as when cows are let out for summer bait, other specific local places, as well as films of elephants and lions. Furthermore, they noted some practical issue in managing the films on all the headsets, which required manual transfer to each headset. Therefore, they required that the tablet should be able to download new films and synchronize all headsets to reduce workload. Furthermore, they thought it would be good to be able to record their own films. They also reported some issues with the wi-fi connection in their facilities related to problems downloading films. Furthermore, as Showtime VR needed a little onboarding it would be good with a manual since it was not always straightforward to use.

The head of divisions confirmed much of the nurses' positive picture, and similar issues of using 360-films in nursing homes. Overall, either they wanted to borrow equipment again or purchase their own. In fact, three nursing homes had already purchased their own VR equipment and two others was considering purchasing to continue with screenings. Indicating both a perceived value to the care and the feasibility of distributed large scale VR screenings in these settings. Overall, all respondents leaned towards strongly recommending other nursing homes to test 360-films, simply because of the added value to their operations and the residents.

The playmakers' role was to engage residents through activities, his experiences was not concerned with co-watching experiences, rather individual viewings of 360-films. At the time of the interview, he estimated that he had screened 360-films for around 50-70 elderly (not the same as in this study) prior to the Covid-19 outbreak. Generally, he confirmed the strong immersive experience that 360-films provides for the residents compared to TV, as it situates them in a surrounding context. Some ethical considerations that he mentioned was the importance of dedicating time after screenings to discuss the experience, in particular for people with dementia, in order to manage any triggered negative emotions. He also highlighted that sometimes films need to be chosen together with caregivers or family as it sometimes can be difficult to tell what residents want to see, in particular when dementia is prevalent.

5 Discussion

The purpose of this work was to study how co-watching of 360-films can be experienced among elderly people in nursing homes, as well as practical aspects and the feasibility of such screenings. This is novel research as there is generally little research on experiences of 360-films viewed in HMDs, especially at nursing homes. Although some research has been done on co-watching regular films in VR on a virtual TV [35] [21], none of these studies have looked at 360-films, which is a very different media that covers the whole field of view in all directions, as if being in a real environment.

Overall, all 19 participating residents was strongly positive to the whole experience and expressed a wish to watch 360-videos on a regular basis. Thus, the results overall indicate that this was a pleasant and enjoyable experience that they would like to have recurringly. The majority actively used the medium to the fullest and utilized between 190 and 310 degrees of the 360-films. Regarding how the experience enriched their

life, they felt that it was an enriching experience that also made them reminisce and think of old memories that made them happy. The viewings spurred lots of discussions and suggestions for new experiences after the screenings, suggesting that the experience extended in a positive way also after the actual screening. Furthermore, nurses and other actors involved confirmed that it enriched their otherwise ordinary everyday life and led to conversations. Furthermore, they noticed a sense of pride about having gotten the opportunity to try new technology. During screenings nurses also noticed positive spontaneous movements and excitement, also among otherwise passive residents.

Who this experience is shared with also seemingly affects social interactions. The results indicate, overall, that in groups where the residents were familiar with one another there was more interaction, both during and after screenings. Being familiar with each other surely makes it easier to engage in conversations. However, it should be noted that this was a single event for the residents, recurring screenings with the same residents may have led to new bonds forming and increased social activity. This may also be the reason why all groups but one stated that they might as well have watched the movies alone, although they did not rule co-watching as negative. Those who knew each other beforehand was positive about co-watching and said it was better than watching alone. This indicates that co-watching may have positive sides not fully captured in this study due to social barriers caused by not knowing the others beforehand.

While high immersion is at the core of VR [35], little virtual co-presence was captured during the screenings. One reason may be that there were no signs of the others in the virtual environment. Although there was only one explicit, and a few more implicit instances of this, when residents were pointing at or talking about particular objects or happenings in the 360-videos, we believe it highlights that there are missing properties for social interactions to take place and let shared experiences unfold.

Looking at ideas [12, 21] that are available to improve co-watching, finding ways to somehow make it known where the others are present, or as with this current situation where they are looking or pointing, might be difficult to achieve while maintaining an immersive experience. One issue in the present study was that the users were not represented in the virtual environment, and while it could be sorted with a solution such as the one Gunkel et al. [21] have, the occlusion of the 360-video would likely lead to a less immersive experience. As a comparison, to have someone standing in front of the TV would occlude and disturb the watching experience. This is a clear trade-off and tension between immersion and co-presence somewhat unique to 360-films in which the films are visible in all directions leaving no free directions for additional add-ons. The question is how to unobtrusively make users aware of one another, without losing the level of immersion in the films and avoiding occlusion.

Concerning the residents who experienced difficulties with the HMD, some of the problems could be attributed to being unfamiliar with the device. The problems stated was visual blur and heavy HMD. The problem with the weight of the device is highly individual and a potential workaround is to support the device with their hands. However, HMDs for older people should clearly have less weight – or otherwise be more balanced in their weight not forcing the head forward – to be accessible technology. This is also supported by Hodge et al. [22]. As regards eyewear, according to the manufacturer [41], it should be possible to use glasses with this specific HMD and most

residents with glasses did not have any problems. It is possible that the blurry experiences recorded might be due to individual differences and eye conditions. The used HMD offers prescription lenses that would likely solve these issues. However, although this would be a good option for personal HMDs that option appears less appropriate within contexts such as nursing homes where HMDs are shared. Repeated use could potentially make using and adjusting the HMD correctly easier for the few who suffered from these problems. Although this was a marginal problem in the study, care should be taken to avoid social isolation for those who HMDs does not work for. The best option would be to design HMDs for this target group. However, other options may concern prescription lenses or testing other HMDs for specific individuals, and if this does not work, another possibility could be to participate using a tablet similarly to how the nurses followed the screening. Although the latter would take away much of the immersive 360-video experience, it would potentially lead to better social inclusion.

Another alternative to HMDs would be to use a large curved display. Although this could potentially work and also have co-watching benefits over individual HMDs, this option is not feasible in practice. Both because it would require large investments and it needs dedicated spaces for viewings at the nursing home. In our results we could also see that most of the residents with good mobility rotated their HMD to take advantage of between 190 to 310 degrees, which rather suggests a dome than a curved display, something that is even more unfeasible to host at a nursing home. Furthermore, portable solutions are beneficial for nursing homes as this allows for flexibility and sharing of equipment between different facilities and divisions. As we have seen, the nursing home have the economy and sees the added value to purchase HMDs, indicating that HMDs are indeed a good option despite some minor issues.

Regarding the extent the participants took advantage of the 360-films, our post analysis shows that the vast majority actively looked around. However, three residents were classified as passive and also rotated their heads less. Notably, these were the only residents sitting in wheelchairs and having more severe mobility issues. Although they were still positive to the experience and did indeed look around to some degree, this highlights that people with mobility issues may have more challenges in these contexts. On the other hand, albeit speculative, this medium could potentially also be used for training by naturally inviting to explore in the 360-films. There is research looking at how VR can be used for various types of rehabilitation [e.g. 10, 34], and having the technology already integrated at nursing homes may be an untapped opportunity.

The results indicate that watching these films created an immersive enough feeling that succeeded in shielding from outside disturbances. At least our residents explicitly ruled 360-films as more immersive than TV and sometimes the media blurred the boundary between real and virtual. For instance, when residents occasionally tried to ask questions to people in the 360-films.

The enrichment of the everyday life is a measurement that is, in nature, highly subjective. Subjective, in the sense that what one person found would make their everyday more enjoyable, might be something others liked less. All the residents in the present study expressed their experience to be positive, which could be considered to have made their everyday life better, at least for a moment. The scope of the study was not sufficient to conclude if their everyday life became better for long term. However, the

involved nurses noted positive effects and that it was a positive addition to the nursing home to activate and stimulate the residents. Moreover, loneliness and isolation are common within the older population [25, 44], e.g. by not being able to do the same things as before. After all, there is evidence [15] that VR experiences in groups can combat some of these problems. Although any type of new experience could be enriching, the quality and suitability of the experience should be considered [24].

For many of the residents the value of their first-time experience seemed to be in the actual content of the films, which for some brought back memories. Experiencing VR-technology enables people, who are no longer able to do things they would have been doing previously (e.g., traveling), to still be able to at least simulate experiencing them again, this time in a virtual environment. It is also a way to see places and happenings not seen before. This appears to be a sought-after value proposition for the residents in this study, as 360-videos may provide the opportunity to virtually experience places and happenings that no longer is practically possible in their life. This potentially offers opportunities to fill gaps and develop as a human in the autumn of their life. It is our impression that the value of this should not be understated. Another potential is to also offer films purposely made to be a catalyst for discussion and activation through intellectual or emotional stimulation.

In this study, the films used were from places in their vicinity that the majority was highly likely to have already seen, but even if not, the films are open enough to prompt memories. This openness was described by Gaver et al. [19] as an important factor in the design of the Photostroller. Overall, from what could be seen in the screenings, this connection to location seemed to have a positive effect, as it made them revisit memories and places they had not been to in a very long time. Therefore, this type of experiences, where the films have a geographical connection, becomes a way to continue to have a connection to another – or past – part of one's life. However, there is a risk that looking back at old memories could be seen as a loss of self or what has been lost, as described by Wallace et al. [62]. Therefore, it probably wise to also focus on the present and potential future. This could be done by having films that show new places and happenings, something that residents also asked for.

Besides this, results also suggests that the value of the experience is not entirely in the viewing itself, but in a bigger context. It is not only about viewing a film that might bring you back to old memories, but also about the discussion that occurs before, during and after watching. In many ways the experience became a “ticket-to-talk”. Similar effects have been reported for both television [56] and robots [28]. This supports the notion that VR experiences cannot replace social interaction [22], and should instead be used as a tool to engage the residents and through that enrich their lives. Additionally, in some way, it is also about keeping older people in the loop with technology and letting them experience it. Perhaps the conversations that came forth in the interviews are our best glimpse of how these 360-videos led to increased well-being since their responses and reactions was so overwhelmingly positive and rich in all its simplicity.

5.1 Reflection on Method

In hindsight, the varying groups sizes may have had an impact on the group interviews. In bigger groups it was hard to dig deeper as some residents tended to agree with more vocal residents. Although we wanted similarly sized groups this was not fully in our control as it was arranged by the nursing homes.

Some aspects in the study, perhaps particularly social aspects, may have benefited from several screenings with each group over a longer period to allow more time for social interactions to form. Preferably with the same facilitator and residents every time. Such study setup could potentially also measure long-term effects.

Another aspect was that the screenings did not allow the residents to freely choose films. This could have influenced the outcome since films might have resonated differently for different residents and thereby affect their experiences.

6 Implications for Design

These key design implications should be considered for co-watching 360-films screenings with elderly at nursing homes.

HMDs designed for social inclusion. Not all older people have the strength to use HMDs. In order to make HMDs accessible for this group this calls for efforts on reducing weight – and weight distribution – not to force the head forward. Furthermore, HMD designs for nursing homes should better account for a broader scope of visual problems. This is a matter of social inclusion.

Content is king. It is important to provide a rich and diverse set of films to allow screenings to be tailored to residents' personal interests, background and memories. This is also important to allow for reoccurring 360-video events in nursing homes. Examples of desired videos as expressed by the participants in this study includes known places, nature and new interesting places and experiences.

Increased virtual co-presence. Although functional, co-watching 360-videos in the form we have studied, lacks the co-presence component that makes the users aware of each other and what they are doing. This could potentially be helped with additional tools (e.g., to allow pointing and better virtual co-presence).

7 Future Work

On a general level, we need more research in the areas of 360-films to better understand the benefits of this medium. We also need follow-ups and long-term studies in nursing homes to better determine the long-term effects of using 360-films at nursing homes. Furthermore, since there was low virtual co-presence among our residents, we need more research on how to increase co-presence when co-watching 360-films and new studies on how that influences the perceived value of co-watching. Finding unobtrusive ways to 1) make it possible for users to know where others are, 2) what they are pointing at, and 3) what they are looking at, could be potential paths forward.

8 Conclusions

The aim of this work was to gain insight into how older residents at nursing homes experience co-watching 360-videos in HMD's by having them watch synchronized 360-videos in groups. But also, to investigate practical aspects for this target group, potential improvements and the feasibility of 360-video screenings in this setting. This study found that 360-videos was experienced positively by the residents and that 360-videos may be a good addition to increase – at least – short-term well-being in nursing homes through new experiences leading to new conversations. This general impression was also confirmed by the professionals working with the residents, who noticed excitement, pride to get to try new technology, and spontaneous movements. The feasibility was acknowledged as several nursing homes purchased own equipment and continues on their own. Showing that a self-going practice was established.

During the study we also captured weight and visual problems with the used HMDs that may lead to social isolation for individuals. This calls for designing better HMDs for older people in these settings, it may be particularly important with adjustable and weight balanced HMDs in settings where HMDs are shared among older people with a vast array of visual and mobility issues.

However, the intended social benefits from co-watching were not immediately obvious and the social interactions observed during screenings was limited, except for residents who knew each other beforehand. Overall, this indicates that other social aspects may strongly influence the perceived value of co-watching. But also, that the potential social value of watching together was hampered as there was little virtual co-presence. We believe that this is particularly challenging for 360-videos and suggest more research on pointing and perceiving the presence and gaze of others.

Finally, we conclude that it is largely the media content itself (the 360-videos) that creates valuable and enjoyable experiences. The films prompted different memories and discussions among the residents based on their previous experiences. We also noted a strong desire and opportunity for this user group to experience new places never experienced in their life. Because of their age and health, these may be out of reach in real life during their remaining time, but possible through this medium. Albeit difficult for young and healthy to imagine, it appears that such experiences could fill important gaps for people with more restricted life situations.

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