Playful Home-Based AR Applications: Increasing Physical Activity in the Elderly for Prevention and Rehabilitation K. Meyer, P. Rolfes-Gehrmann. *Gerontechnology* 25(s*)*

Purpose Digital therapy systems, including augmented reality (AR) and virtual reality (VR) applications, have been shown to benefit older adults with neurological or age-related functional limitations by supporting physical and cognitive training and enhancing engagement and motivation. Nevertheless, home-based rehabilitation systems require both adequate physical space and affordable system costs in order to be user-friendly [1]. In addition, VR-based applications can pose challenges, including motion sickness, balance issues, and visual fatigue, which may limit their acceptance and safe use in unsupervised settings [2]. This study aimed to design and develop an affordable, user-centered AR therapy application to support playful body and mind training for older adults in a home-based context. The project was conducted in collaboration with the “Leben im Alter” department of the city of Hamm to actively involve older adults in the design process and align the application with their needs and capabilities. **Method** Existing digital therapy systems available in the university’s digital therapy lab [3] were analyzed to identify functional limitations and barriers for home-based use. Based on these insights, an AR-based therapy concept was developed using Microsoft HoloLens 2 and Unity. AR technology was selected to integrate virtual elements into the real physical environment while maintaining user safety and minimizing adverse effects associated with VR. Two interactive games were designed to address physical coordination, arm and shoulder mobility, and cognitive engagement (Fig. 1). A preliminary usability study was conducted with seven older adults from the city of Hamm, who tested both applications in a short session. Following the gameplay, the participants completed a structured questionnaire using 5-point Likert scales and open-ended questions to assess usability, acceptance, perceived safety, physical activation of the hands and upper arms, and visual perception. **Results and Discussion** Both AR therapy games were successfully implemented and evaluated. The study sample comprised seven older adults with a mean age of 73 years (range: 68–84). Results indicate high usability and acceptance for both “Light Sphere Board” and “Bubbles”. Despite mild arm mobility limitations in one participant and functional monocular vision in another, upper-arm movements were reported as manageable, and the interaction with both games was described as intuitive and well suited for older adults. The perceived physical activation of the hands and upper arms was rated highly, indicating that the games effectively supported the intended movement goals. Despite the restricted peripheral field of view of the HoloLens 2, required head movement was largely accepted and often perceived as beneficial for encouraging additional movement. The overall system received a mean rating of 9.3 out of 10, and the majority of participants indicated that they would recommend the application to peers of the same age group. The study revealed no clear preference for one game over the other, suggesting that both interaction concepts are equally suitable for supporting playful physical training. In view of the limited sample size, the findings should be interpreted as exploratory. Nevertheless, the results underline the potential of affordable, AR-based therapy applications as a viable gerontechnological approach for safe, engaging, and user-centered physical training in home-based settings.

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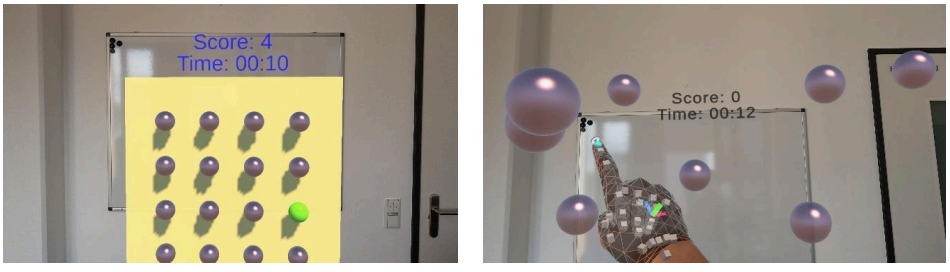

a) b)

Figure 1. *Gaming environment of the developed AR games for visual reaction training: a) “Light Sphere Board”, b) “Bubbles”*