

NOVEL THERAPY SETTING BY USING VIRTUAL AND AUGMENTED REALITY– A COMPARATIVE FEASIBILITY STUDY

Daniel Baumgartner (1), Andrea Kilchenmann (1), Dominik Textor (1), Jens Bansi (2)

1. Zurich University of Applied Sciences ZHAW, Winterthur, Switzerland

2. Kliniken Valens, Switzerland

Introduction

Immersive technologies such as Virtual or Augmented Reality (VR/AR) have gained substantial attention for therapeutic use. The virtual 3D-environment is already used for the treatment of pain or anxiety [1], but there is also potential for its use in physical rehabilitation. The VR lens provides a full virtual environment, whereas AR has the opportunity to place virtual obstacles on a transparent lens – where the background is still real. A combination of AR and VR technology (VAR) could be applied by using a so called “passthrough mode”. In this mode, the real background is captured by cameras of the lens and displayed virtually. This has the advantage of using the full spectrum of VR technology with a wide field of view.

The aim of the study was to perform a comparative usability study for the application of the three technologies VR, AR & VAR, with the background of suitability for a rehabilitation training with patients.

Methods

In a usability study with 20 healthy subjects, advantages, disadvantages and opportunities of the AR, VR and VAR technologies have been assessed. Participants were playing a grasping game on an AR and a VR headset. The game displayed moving apples in the 3D-environment at different distances/positions, which had to be captured by hand. The cameras of the AR/VR-lens were detecting the corresponding hand position therefore.

Parameters of interest were quality of the visual field of the lens, orientation in space, motivation, concentration, comfort and general usability of the devices. Feedback through an online survey has been performed (survey monkey). Rating has been done from 1=sceptical to 6=great. The game was played 3 minutes with each technology in standing position. Approval of the ethics commission of the Canton Zurich has been acquired.

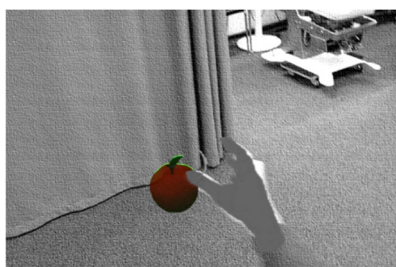


Figure 1: Field of view in passthrough mode with the real background virtually displayed (VAR) including obstacle.

Results

Participants were positively evaluating the use of virtual 3D-technologies with an average score of 5.4. Due to the extended visual field, VR and VAR technology were clearly preferred. For VAR, the real environment is virtually visible during the game, which improves orientation in space and provides an enhanced impression of balance & safety.

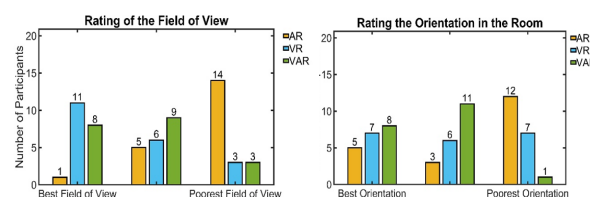


Fig 2: Rating of field of view/perception (left) and orientation in the room (right) for AR (yellow), VR (blue), VAR (green).

Discussion

The outcome suggests that VR and VAR technology were preferred compared to AR. In particular the large field of view and the good orientation in the room convinced the participants. With the VAR technology, not only the virtual hand was visible, but the entire arm compared to the VR technology. This can be beneficial for therapeutic purposes when proper execution of movement is a priority. With AR&VAR, a reference to the real environment all the time is provided. This can ensure a high level of safety for patients during the training. The advantage of VAR over AR is the significantly cheaper purchase price. This could make the use of VAR technologies accessible by more users.

Conclusions

All but two participants achieved higher motivation to grasp the fruits with the VR and VAR technology. This could be explained by the larger field of view and the condition that the fruits were found with smaller head movements.

A wider range of participants' age needs to be considered get a deeper insight into the differences, advantages and disadvantages of AR, VR and VAR technologies in the field of rehabilitation. Performing a study with neurological patients will be of high interest.

References

[1] Assaker R., Effectiveness of VR in reducing anxiety and pain during pediatric idiopathic scoliosis surgery, SFAR 2020

