Improved Takeover System: Enabling Single Actor Control for Multi-Avatar Populated Virtual Realities

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Abstract

Social virtual reality (SVR) has become more accessible to the general public. Just as in real life, users expect the possibility of engaging with many others within SVR. Creating open-ended, densely populated environments with highly interactive virtual human (VH) remains challenging. Despite the advances in artificial intelligence and language understanding, we still see the need for human intervention to control unanticipated scenarios or answer questions. Previous work has allowed a single actor to take over control of multiple virtual humans when interaction with the user was needed. However, those works focused only on non-verbal interaction. This paper proposes a system that supports full-body avatars with six-point tracking and a simpler take-over procedure. We demonstrate a scenario that enables both verbal and non-verbal interactions.

Figure 1: Screenshot of the user's view in VR (Left); Screenshot of the actor's view in VR (Middle and Right).

Experiment

The goal of the take-over system is to make the change in control of VHs imperceptible and to enhance co-presence with simulated VHs. To explore participants' reactions to multiple VHs being controlled by a single actor during interactions and to assess whether this method enhances social presence, we conducted an experiment with **two conditions**: interactions produced by an ***actor using our system***, and interactions based on pre-recorded responses with a ***Wizard-of-Oz setup***, where an experimenter triggered corresponding pre-recorded responses to answer back to the participants.

To ensure participants engaged in one-on-one conversations with various VHs, we created a museum with five unique VHs, as shown in Figure 2. Participants played the role of an **intern on their first working day**. A supervisor explained their task, which was collecting feedback from visitors and reporting it to a colleague.

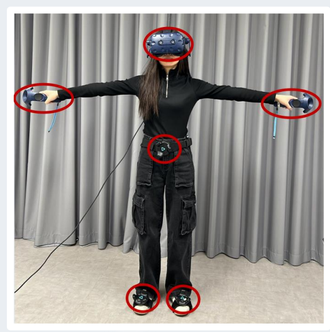
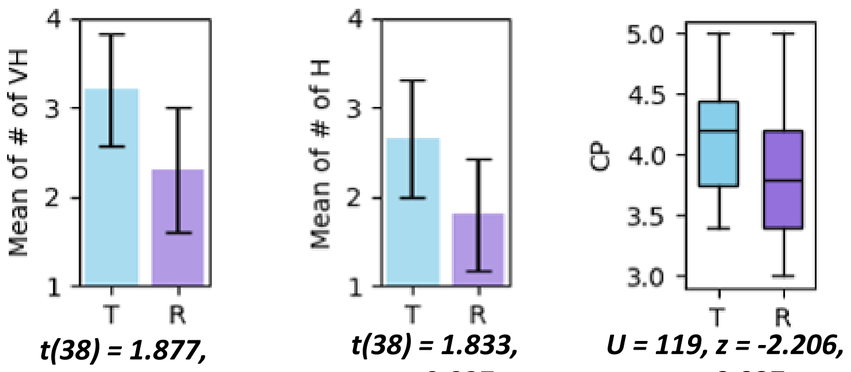


Figure 2: Placement of trackers, controllers, HMD for both the actor and the participants

Result



t(38) = 1.877, p = 0.034
a) # of human-controlled VHs

t(38) = 1.833, p = 0.037
b) # of humans perceived

U = 119, z = -2.206, p = 0.027
c) Co-presence

Figure 3: Plots for qualitative data; Error bars in bar plots display the 95% confidence interval; T: C-Takeover, R: C-Recorded

Figure 3: The experiment environment with VHs (model from [2]) in a virtual museum (model from [1]) The white dashed line is the route participants follow during the experiment.

System Design

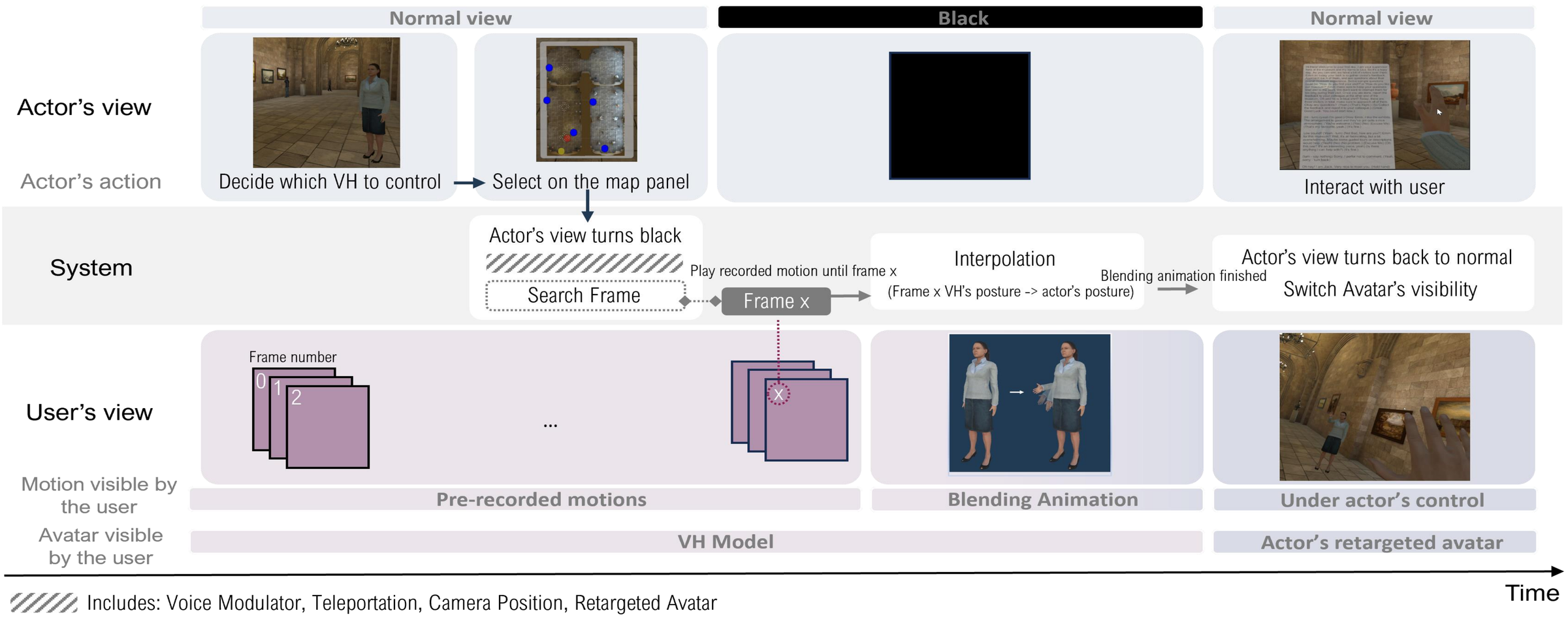


Figure 4: The procedure for an actor taking over control of a VH.

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[1] LaikaBossGames. Art gallery museum. Unity Asset Store, Release: Jan 2023, https://assetstore.unity.com/packages/ 3d/environments/art-gallery-museum-188756. 5
[2] M. Gonzalez-Franco, E. Ofek, Y. Pan, A. Antley, A. Steed, B. Spanlang, A. Maselli, D. Banakou, N. Pelechano, S. Orts-Escolano, V. Orvalho, L. Trutoiu, M. Wojcik, M. V. Sanchez-Vives, J. Bailenson, M. Slater, and J. Lanier. The rocketbox library and the utility of freely available rigged avatars. Frontiers in Virtual Reality, 1, 2020. doi: 10.3389/frvir.2020.561558 4