

Investigating Gesture-based Commands for First-Person Shooter Games in Virtual Reality

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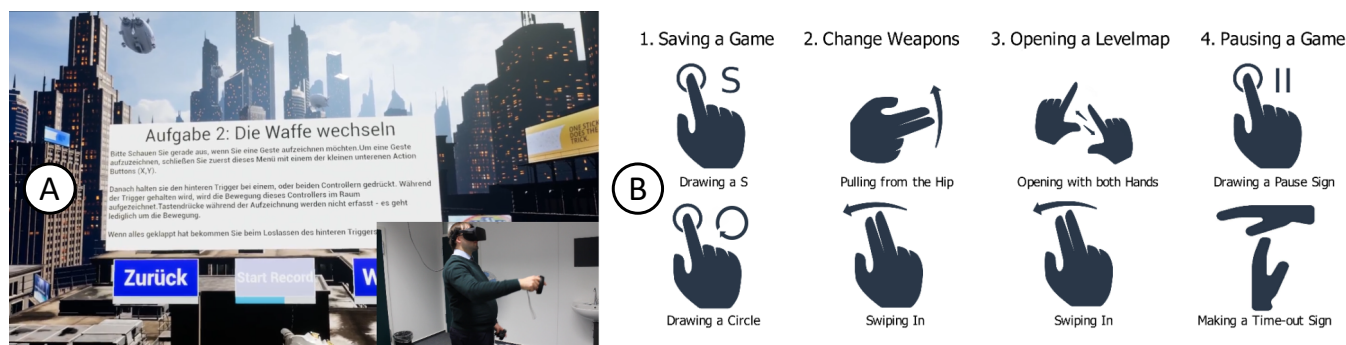


Figure 1: A) Example of a participant creating and recording gestures directly in VR for a VR First-Person Shooter (FPS) Game called *Robo Recall*. Interactive 3D menus (text in German) included the instructions for the game commands defining and recording gestures. Here, the user is required to define and record a gesture for the command: "Change The Weapon" and press "Start Recording" when ready or press to the "Next" button when satisfied with the created gesture. B) The summary of the two most frequently created types of gestures for the four game commands proposed. A video of the gestures produced by participants and their preliminary categorizations can be found online [here](#)

ABSTRACT

In this paper, we present the first results of a user-defined approach for designing gesture-driven commands for a first-person shooter (FPS) game in Virtual Reality (VR). We identified and categorized a set of common gestures for two in-game actions as well as two system control operations. We believe our preliminary results will interest VR game designers and researchers.

CCS CONCEPTS

• Human-centered computing → Virtual reality.

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KEYWORDS

Virtual Reality, Embodied Interaction, Gestures, Games

1 INTRODUCTION

In a Virtual Reality (VR) game players can embody their avatar and use gestures to trigger game commands instead of using gamepads or joysticks. Gesture-driven commands in VR games can be an interesting alternative to common control forms as embodied interactions could improve the overall VR gaming experience as well as increasing the appeal of VR games to unexperienced non-VR players. In particular, gestures exploiting the human body shape and utilize object affordances [5]. Even though, plenty of research pays attention to embodied interaction by gestures (see for a recent review [6]), designing a set of intuitive, comfortable and memorable gesture-driven commands remains a difficult endeavor. According to the literature, humans have difficulties to remember more than seven gestures [2]. However, Jeco et al. [1] observed that participant can remember dozens of gestures when creating them in VR and when they rely on everyday life gestures. Similarly, [3] found that user-defined

Dimension	Explanation	Gesture
Nature:		
Symbolic	Visually depicts a symbol	Drawing a S, Circle or Pause Sign, Making a Time-out Sign
Physical	Acts physically on objects	Pulling from the Hip
Metaphorical	Uses a metaphor	Opening (a book) with both hands
Abstract	Arbitrary gesture mapping	Swiping In
Binding:		
Object-centric	Space is relative to the object	<i>none</i>
World-dependent	Space is relative to the physical world	Pulling from the Hip
World-independent	Anywhere regardless to the world	Drawing a Circle, Pause Sign, S, Making a Time-out Sign, Opening (a book) with both hands, Swiping In,
Mixed dependencies	Involves multiple spaces	<i>none</i>

Table 1: User-defined gestures classified using the augmented reality taxonomy of [4]

gestures are easier to remember, both immediately after creation and on the next day. Therefore, this paper is proposing to identify and categorize a set of intuitive gestures for a VR FPS game by asking non-expert users to define them directly in VR after playing the game introductory tutorial.

2 EXPERIMENT

We asked participants to create, perform and evaluate their own gestures for four specific game commands in a VR FPS: i) *Saving a Game*, ii) *Changing Weapon*, iii) *Opening a level* and iv) *Pausing the game*. The participants were standing and wearing the *Oculus Rift* VR Headset with two *Oculus Touch* controllers within three *Oculus Cameras* for a Room-scale tracking. The gestures were recorded with a video camera while tracking data were recorded with the *Brekel OpenVR Recorder*. Participants were free to use any head and hand motions to define their own gesture-based commands. The participant played first the tutorial of the VR FPS *Robo Recall* from Epic Games (about 25 min). Afterward, the participants created their gestures while still immersed in the VR game (about 20 min). They followed textual instructions displayed on an interactive 3D menu (see figure 1-A).

42 students (21 male, 21 female) participated in the study. Their ages ranged from 18 to 33 ($M = 22.4$, $SD = 3.24$). Among all participants about 32% evaluated their VR expertise level as *intermediate*, 24% as *beginner* and 44% as *no expertise* at all. Only one participant had previous experience with the FPS VR Game. Many participants found similar gestures independently of their VR experience level. The figure 1-B summarizes the findings of the most preferred gestures: For the *Saving a Game*, the two most preferred gestures were "*Drawing a S*" (15%) and "*Drawing a Circle*" (15%) in the air. The *Changing Weapon* was commonly defined with a "*Pulling from the Hip*" gesture (17%) and "*Swiping In*" gestures (12%). The *Opening a Level* was often realized using a "*Opening gesture with both hands*" (22%) and "*Swiping In from*

the side" (17%). The *Pausing Game* was often performed by "*Drawing a Pause Sign*" (25%) and "*Making a Time-Out Sign*" (10%). A preliminary classification using the taxonomy of [4] shows that for the majority of the gestures are *Symbolic* and *World-independent* (see Table 1).

3 CONCLUSION

This paper presented the preliminary results of a study of user-defined gestures for an FPS VR game. Our first attempt to identify and categorize an appropriate pool of gesture shows, that some types of tasks are always bound with some specific dimensions. Our future work will focus on a deeper analysis of the recorded motion patterns, as well as evaluating the usability of the proposed gestures. We hope to provide further guidelines for embodied interactions in VR.

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