Off-The-Shelf: Exploring 3D Arrangements of See-Through Masks to Switch between Virtual Environments

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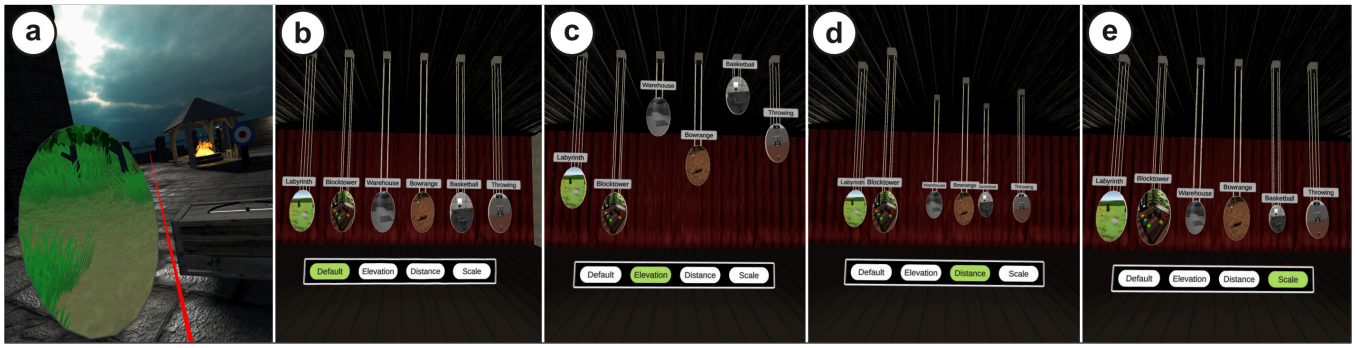

Figure 1: Off-The-Shelf offers (a) immersive see-through masks and explores their menu arrangements: Depending on the priority, masks (b) are aligned linear, (c) have different elevation level, (d) different distance to the user, or (e) different sizes revealing more environment context for higher priority.

ABSTRACT

This demo explores prioritization techniques to arrange see-through masks in virtual reality (VR). The oval masks show live previews of different virtual environments (VEs) and allow for seamless teleportation into a corresponding VE by putting the mask on the face. Each environment includes a mini-game (e.g., basketball and archery) in which the user has to perform a small task. The arrangement of the masks changes depending on a calculated rating, which considers the time since the game was last played and the game score. We envision this system to help users to multitask in VR. For example, to control multiple characters in VR games, to experience multi-strand (nonlinear) narratives, and to supervise semi-autonomous agents in different VEs.

KEYWORDS

Mask, Virtual Reality, Multiverse, Transitions

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1 INTRODUCTION

Users frequently encounter difficulties in transitioning between different virtual spaces and VR applications, which can hinder the fluidity and efficiency of their interactions [2, 5, 6]. Prior work [2, 5] introduced various methods, including visual transitions (e.g., cut, fade, dissolve, and morph). A permanent combination of VEs was investigated by Schjerlund et al., who layered four viewpoints of the same environment and made all but one translucent [8]. An alternative are localized portals that preview another VE and allow the user to step through them into the previewed space [3]. Pohl et al. [7] explore distant interaction through portals in a system called Poros, which uses spherical portals to interact with distant objects. Another way to reduce the necessary physical movement are mobile alternatives such as Orbs [4] and virtual headsets [6]. They can be moved to the user's head to switch the VE. Our work uses mobile masks that are inspired by the idea of orbs [4] and virtual headsets [6]. Masks combine the advantages of both by offering an orb-sized preview with a more familiar head-shaped appearance that invites users to place the mask on their faces.

Multiple masks can be used for switching between multiple VEs. In this work we explore dynamic app launcher menus for see-through masks. Besides traditional linear arrangements, we explore (literally) "off-the-shelf" arrangements, that place the masks outside of the typical app launcher shelf. Depending on a rating score, masks can change their distance to the user, elevation, and scale (see Figure 1). Based on the findings of Azai et al. [1], we use a horizontal menu arrangement that has been shown to be more efficient. Instead of using their proposed palm menu, we fully utilize the immersive 3D space offered by virtual reality, instead of confining the menu to a 2D interface. The menu is displayed inside the current VE and is always accessible by pressing a button.

2 CONCEPT AND IMPLEMENTATION

Our proposed system uses an overlay menu displayed above the current VE, akin to application launchers like that of SteamVR or Meta Quest 3. The menu contains oval masks that are 30 × 50 cm, each showing a live preview of a different VE. In our Unity implementation, for performance reasons, the preview initially shows a static image, which transitions to a live view once the mask is selected. The controller emits a visible ray that changes color when targeting a mask to indicate selection. Pulling the trigger confirms the selection and brings the mask to the user's hand. As the user moves the mask, the live image updates to show the corresponding portion of the environment. Bringing the mask closer reveals more until a full transition occurs when the mask is attached to the face, immersing the user in the new environment. This is implemented in Unity by mapping the controller's movements to a virtual camera. The mask menu can be reopened anytime in the new environment. The menu is always displayed on top of the environment, achieved by using two virtual cameras: one for the environment and another for the menu, ensuring the menu remains fully visible even if it spatially overlaps with objects in the VE.

A VE's priority can be defined in various ways: most recent interaction (similar to game launchers in Sony PlayStation or Nintendo Switch), least recent interaction (useful in productivity settings where users need to monitor all environments), or based on metrics like score or time spent in the environment. The calculated priority is presented to the user in multiple visual ways as visible in Figure 1:

(1) **Default** shows masks in a horizontal linear list.
(2) **Elevation** varies the masks' height with the highest priority mask being on eye-level and the lowest priority mask being 200 cm higher.
(3) **Distance** shows the highest ranked mask at 60 cm distance to the user and the lowest ranked mask at 200 cm distance.
(4) **Scale** varies the masks' sizes with the largest mask being 33% larger (40 × 66 cm) and the smallest mask being 33% smaller, making it 20 × 33 cm.

The mask corresponding to the currently active environment is not displayed in the menu to avoid redundancy.

3 DEMONSTRATION

In the mask menu, six masks are displayed, representing six environments, each containing a different mini game (see Figure 2):

(1) Archery in a medieval village,
(2) Basketball in an industrial area,
(3) Stacking game in a park,
(4) Coin search game in a maze,
(5) Mini-golf in a science-fiction setting, and
(6) Throwing game with moving obstacle ("goalkeeper").

When the user starts interacting in the environments, the menu visualization changes by adapting the VE's priorities. In our mini-game focused scenario, we prioritized environments with the most recent interaction, and with the game scores. The system is demonstrated using a standalone application on the Meta Quest 3.

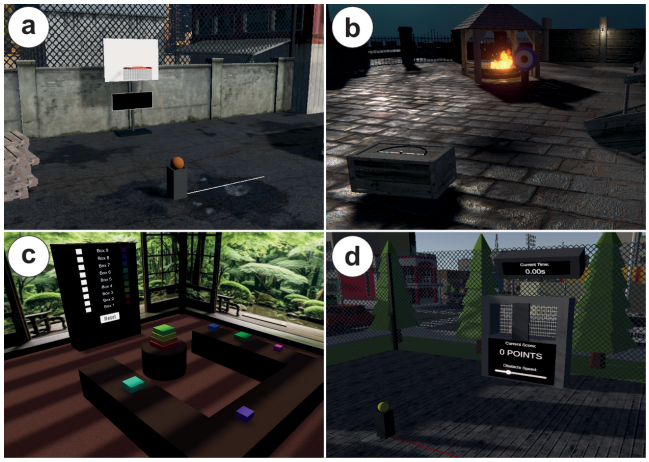

Figure 2: Four of the implemented mini-games: (a) basketball, (b) archery, (c) stacking game, and (d) throwing game.

4 CONCONCLUSION AND FUTURE WORK

We explore a novel mask-based menu system designed to facilitate intuitive decisions and implemented seamless transitions between virtual environments in VR. While traditional methods often disrupt immersion or require complex interactions, our system mitigates these issues, offering users a live preview before full immersion and simplifying navigation. Future work will focus on comparing the proposed visualization techniques and expand the range of interactions supported by the mask menu, incorporating user feedback to refine the experience. Our implementation in Unity with free assets and minigames has shown the system's versatility and practicality. We will showcase the demo as a standalone app on the Meta Quest 3. We hope the demo will spark interesting discussions on how to switch between VEs and how to improve multitasking in VR.

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