Workspace VR: A Social and Collaborative Telework Virtual Reality Application

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ABSTRACT

COVID-19 lockdowns accelerated user adoption of remote collaboration technologies such as Zoom and Microsoft Teams. Despite the challenges of working remotely, many knowledge workers still desire the flexibility of hybrid work and its personal benefits allowing for more productive individual work. However, return-to-office (RTO) mandates suggest an inclination that in-office work allows for more productive teamwork. To resolve these conflicting desires, Workspace VR was created. Unlike other social telework virtual reality (VR) applications, Workspace VR enables uncoordinated, social, collaborative, and productive individual work and teamwork via virtual avatars, workspaces, and integration with user computers. Designed for Meta Quest devices, users can feel like they are working together with others without constraints in Workspace VR.

CCS CONCEPTS

• **Human-centered computing** → **Computer supported cooperative work**; **Virtual reality**.

ACM Reference Format:
Jason A. Ortiz and Carolina Cruz-Neira. 2023. Workspace VR: A Social and Collaborative Telework Virtual Reality Application. In *Computer Supported Cooperative Work and Social Computing (CSCW '23 Companion), October 14–18, 2023, Minneapolis, MN, USA.* ACM, New York, NY, USA, 3 pages. https://doi.org/10.1145/3584931.3607502

1 INTRODUCTION

The COVID-19 pandemic and subsequent lockdowns forced companies and their employees, schools and their students, and other knowledge workers to begin "working from home." Also known as working remotely or teleworking, the shift from in-person work to isolated, out-of-office work simultaneously for so many people allowed them to find new perspectives on their approach to work and their intolerance for the annoyances of in-person work, such as commute times, office politics, or simply feeling comfortable as oneself around others. Once the ability to work in-person returned though, Microsoft shared survey results showing that 73% of workers wanted to keep flexible work options [1].

Despite that majority's desire for keeping flexible work options, another survey says 33% of bosses want their employees back in the office [2], and in another survey, 75% prefer some type of in-person work for their employees [6]. There are beliefs that employees work better when physically together. Microsoft research also suggested that firm-wide remote work caused stronger silos to form between teams, and they expect these silos to negatively impact the ability to innovate [13]. This may be caused by the lack of serendipitous encounters within interstitial spaces benefiting from physical proximity like hallway walk-bys, watercooler chats, and pre-and-post meeting conversations. Furthermore, today's technologies supporting remote work, such as teleconferencing software (e.g., Zoom, Microsoft Teams), asynchronous chat software (e.g., Slack, Discord), and traditional work software like email clients do not completely address or resolve the issues with remote collaboration and distributed work. For example, "Zoom fatigue" [10] from constantly sharing ones face via webcam, the lack of body language when communicating, or simply the state of unawareness of who is available when and where could be attributed to the inability of being together with others while remote.

To help remote, hybrid, and in-person workers be productive together while apart, Workspace VR was created. It is well understood that virtual reality (VR) users with avatar embodiments can feel more present in these virtual environments as well [11]. This VR application addresses the need for an interstitial space for users, particularly knowledge workers, to perform their work on their real computers within a social VR environment. They and their coworkers each have customizable avatars, and by using common VR head-mounted displays (HMDs) like the Meta Quest 2 or Meta Quest Pro, users can have their real hands tracked, virtually represented, and then seen by their coworkers, enabling more natural forms of body language communication. Workspace VR effectively empowers users to have intentional or serendipitous collaboration with their coworkers.

2 RELATED WORK

Some early research on using mixed reality for remote collaborative work includes that conducted by Raskar et al. on "The Office of the Future", which used stereoscopic projectors combined with glasses to show virtual content along with remote users [9]. Horizon Workrooms by Meta allows users to create avatars, host meetings, view their real keyboards, view their computer monitor in VR, work on shared whiteboards, and share content to a common screen;

CSCW '23 Companion, October 14–18, 2023, Minneapolis, MN, USA

ACM ISBN 979-8-4007-0129-0/23/10…$15.00
https://doi.org/10.1145/3584931.3607502

users can also teleport to different chairs within the virtual environments [7]. The Meta Quest Pro version of the application also allows for eye and face tracking, thus allowing for more natural facial expressions [8]. Immersed[1] is a VR application where some users work 40-50 hours a week completely in VR [12]. The application allows users to arrange and view multiple windows from their desktop or laptop computers completely within VR, along with customizable avatars, and the ability to meet with others in several virtual environments like coffee shops for example. Like Horizon Workrooms, Immersed lets users teleport to specific locations only. Many more VR productivity and collaboration[2] applications exist, such as Spatial[3] and Virtual Desktop[4].

3 DESIGN

Workspace VR is designed to combine the best parts of existing productivity and social VR applications while enabling more customizability, ownership, and freedom. Workspace VR is a social telework VR application that allows for users to work alone or with others in a virtual office environment. It has the following features:

(1) Explorable virtual environment with claimable virtual desks
(2) Full-hand tracking
(3) Unconstrained locomotion via hands or controllers
(4) Simple and intuitive computer duplication and control into the VR environment (see Figure 1)
(5) Simple and intuitive computer screen sharing
(6) Mixed reality view of the user's real desk
(7) Customizable user avatars
(8) Simple and intuitive "room" join system
(9) Voice chat support

By supporting these features, Workspace VR addresses users' needs for autonomy and agency yet minimizes obstacles to productive and collaborative work. For example, by supporting full-hand tracking and Meta Quest devices, users can view their tracked hands and fingers, eliminating the need for controllers, and thus more easily use their real computer keyboard and mouse via Passthrough MR. At minimum, a user is expected to be seated with access to a physical computer. With only their hands and existing computer peripheral devices, they can perform the work they normally do on their computers all while wearing a VR HMD. They can see other coworkers if and when present, talk with them, and to a more novel extent, view another user's computer screen if shared to enable those "over the shoulder" collaboration scenarios common in today's shared office workspaces (see Figure 2).

4 IMPLEMENTATION

4.1 Virtual Environment

The virtual office space is from Unity's SNAPS prototype package[5], which is no longer publicly distributed. Interactable buttons and menus come from the Oculus Interaction SDK and Ubiq, which are discussed in more detail in 4.3. Users can use "share" and "claim"

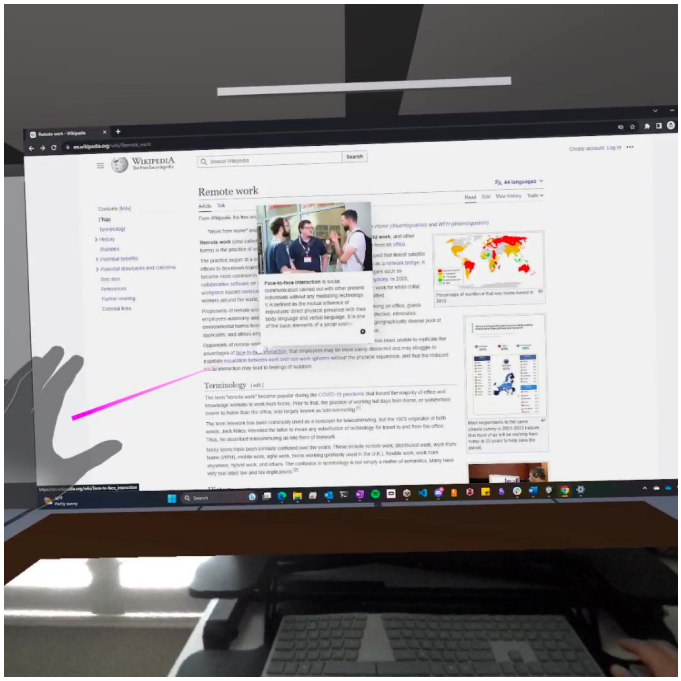

Figure 1: A user at their virtual desktop clicking on a website with hand-tracked pinch gestures

Figure 2: Two users viewing a shared computer screen

[1]https://immersed.com
[2]https://xrcollaboration.com/directory
[3]https://spatial.io
[4]https://vrdesktop.net
[5]https://blog.unity.com/games/customizing-snaps-prototype-assets-with-probuilder-2

buttons, which allow users to claim a desk, see their connected computer, view their real desk via Passthrough MR, and optionally share their computer with peers in the room.

4.2 Desktop Streaming

Frozen Mist's FMETP Stream 3.0 [4] with the FMETP Remote Desktop Add-On [3], both purchasable from the Unity Asset Store, enable desktop capture and Quest input capture to allow remote desktop control via virtual mouse and/or keyboard. To enable wireless desktop streaming, we host a Node.js Web Socket Server provided by Frozen Mist to connect desktop servers to VR clients over the public internet.

4.3 Interactions

4.3.1 Locomotion. The Oculus Interaction SDK provides prefabs to support teleportation and 45-degree snap-turn locomotion via tracked hands or controllers. Unique to Workspace VR is that users may teleport to both predefined spots at desks *or to any spot* on the ground in the environment. The Oculus Interaction SDK also provides a novel locomotion-activation gesture with visual cues that enable teleportation or snapping with simple pinch gestures.

4.3.2 Ubiq: Social Virtual Reality Framework. Workspace VR depends on the social VR Unity package Ubiq [5]. Ubiq provides Unity prefabs and a networking-agnostic implementation that supports both client-server application structures and/or peer-to-peer networks seamlessly. Implementers are allowed to host their own rendezvous servers to allow for room discovery and management, but they also provide a public server that is configured for use by default, thus enabling easy testing and support of up to 30 users [5]. Furthermore, Ubiq provides several features, including:

(1) WebRTC Voice-over-IP (VoIP) for inter-user voice communication
(2) Customizable avatars
(3) A menu system for avatar customization, name customization, and room management
(4) Networking C# scripts to enable networked Unity `GameObjects`

5 CSCW DEMO AND RELEVANCE

At CSCW 2023, attendees may join each other in the virtual office space via Meta Quest HMDs. They can access computers, view their real keyboard and mouse via Passthrough MR, personalize their avatars, chat with each other, and explore the virtual environment together. There will also be an optional crossword puzzle for them to complete with another user. User feedback will be obtained for further application development. We believe the CSCW community will find that Workspace VR combines simple yet novel interactions and tools that support many computer-supported cooperative work activities done by knowledge workers especially.

6 CONCLUSION

Workspace VR enables users to easily and casually telework with their fellow coworkers in virtual reality. Users can access their computers within the application, create and join networked rooms, customize their avatars, and intentionally or serendipitously collaborate with their colleagues. With the mission to enable successful remote, hybrid, distributed work between teams, Workspace VR is an effective proof-of-concept social VR application. Future work will focus on:

(1) Personalizable desks
(2) Customizable group workspaces
(3) Meetings rooms
(4) Full-bodied avatars (e.g., ReadyPlayerMe avatars[6])
(5) Improved multiple monitor experiences with window dragging and resizing.

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