

# Falling Asleep Together: What Makes Activities in Social Virtual Reality Meaningful to Users

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## ABSTRACT

The increasingly popular social virtual reality (VR) is dramatically transforming how people meet, interact, and socialize online. These immersive digital spaces blend aspects of the online and offline worlds, creating new opportunities for online interactivity. Yet, questions still remain about what individuals actually do in social VR and how they envision and reflect on the design of social VR technologies. In this paper, we report our findings of an interview study (N=30) that investigated what made activities on these platforms meaningful to users as well as users' recommendations for designing social VR to better support such activities. Our findings expand current literature on social dynamics and sociality in online digital spaces by focusing on social VR. We also inform future design directions to create more socially supportive and satisfying social VR space.

## CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in collaborative and social computing.**

## KEYWORDS

social dynamics, online social spaces, virtual worlds, social VR, interactivity, virtual reality

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## 1 INTRODUCTION

Exploring emerging social dynamics and sociality in digital social spaces such as massively multiplayer online games (MMORPGs) and open-ended 3D virtual worlds has been a long standing concern in HCI and CHI PLAY, bringing together concerns on nuanced group behaviors [14, 15, 35, 39], intimate experiences [18, 19, 21, 40], avatar presentation and customization [13, 25, 46], and cross-gender/queerness gameplay [18, 19, 25, 42]. Collectively, this body

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of work has highlighted diverse reasons why these activities are felt meaningful and valuable to online users, including experimenting with completely new identities or reaffirming existing identities, roleplaying fantasy-based and/or realistic adventures, and gaining social support and emotional connections via intimate online experiences.

Yet, to what degree can the constantly evolving online social spaces accommodate emerging social needs and further mediate, facilitate, and support more novel and nuanced social activities? One of the most recent and important cases is Social Virtual Reality (social VR), an emerging novel sociotechnical system that is dramatically transforming how people meet, interact, and socialize online.

Broadly defined, social VR refers to 3D virtual spaces where multiple users can interact with one another through VR head-mounted displays (HMDs) [36, 37]. In the past five years, various social VR applications such as Facebook Spaces, VR Chat, AltspaceVR, and Rec Room have rapidly grown in popularity. The success of commercial social VR applications has led to an emerging research agenda in HCI and gaming communities, drawing research attention to new research questions such as social VR design [26, 36, 51], communication and interaction modes in social VR [37, 38], and social interaction consequences [6, 55]. However, prior research reveal two main limitations. First, only a small body of work has explored new social practices and phenomena surrounding these emerging novel digital social spaces. Though modern day social VR draws similarities from traditional virtual environments, it affords a variety of nuanced activities, play, and entertainment that may offer unique experiences compared to traditional virtual environments. Therefore, more empirical work is needed to further investigate these emerging social platforms and the diverse activities that they may afford. Second, currently the majority of design recommendations for social VR were generated by researchers and designers. More input from actual social VR users regarding how they envision and reflect on the design of social VR technologies to better support their emerging social needs is needed.

In this paper, we endeavor to contribute towards addressing the above-mentioned limitations by exploring two research questions:

**RQ1:** What are the important and novel social activities across different social VR platforms according to users? And what makes these activities meaningful to them?

**RQ2:** What are the users' recommendations for designing social VR to better support such activities?

We thus make three interlinked contributions to HCI and CHI PLAY. First, we expand current literature on social dynamics and sociality in online digital spaces by focusing on social VR, an emerging novel sociotechnical system that has not been widely studied.

Second, we offer empirical evidence to unpack what users are actually doing in social VR. Our emphasis on why particular activities are perceived as subjectively meaningful, therefore, addresses gaps in existing literature on user behaviors in social VR and explores the transformation of “play” in the immersive virtual world and the many varieties of “play” beyond traditional gaming. Social VR affords an emerging form of embodied immersive “play”: activities of adventure, exploration, and socialization are intertwined with the play of having an avatar, participating in platform specific activities/games, and exploring through embodiment. Third, we contribute to design frameworks for social VR and inform future design directions to create more socially supportive and satisfying social VR spaces by introducing end users’ voices and insights.

## 2 RELATED WORK

### 2.1 Diverse Social Activities in Digital Social Spaces

Extensive HCI and game studies have investigated various important social behaviors mediated and supported by typical online social spaces such as MUDs, MMORPGs, and open-ended 3D virtual worlds. Among them, social activities in primitive virtual worlds and Collaborative Virtual Environments (CVEs), groups and intimate experiences, and experimenting through avatars have emerged as three key themes.

*2.1.1 Social Activities in Primitive Virtual Worlds and CVEs.* The earliest social activities in online spaces were conducted via rich text based interactions [4]. Through text, users immersed themselves in various activities such as role-playing, adventure quest, and reenacting famous scene from movies [24, 44]. In addition to these entertainment activities, text-based collaborative learning was also considered a significant activity in MUDs [8]. Such activities were even noted as a more efficient way of communication in workplace as they could maintain social relationships across different locations and schedules [10] and facilitate meaningful interactions, and activities because they were real time, archivable, unobtrusive, multiuser, and exclusive [17]. However, a major limitation of text-based social activities was the inability to convey and interpret rich social cues through posture, gestures, and voice intonation.

In addition, Collaborative Virtual Environments (CVEs) are considered important online digital places and spaces where people can be in touch, play together, and work together even when they are geographically apart [11]. Early work by Bailenson and colleagues on social dynamics in CVEs has demonstrated the nuances of CVEs compared to face-to-face interaction [1], including the use of nonverbal cues in a virtual environment [3] and the transformed interpersonal communication [2, 30]. These studies demonstrate the nuances of sociality in CVEs and highlight the potential future use of these online social environments. Yet they were mostly conducted in a controlled lab environment.

*2.1.2 Groups and Intimate Experiences.* Group activities and collaboration constitute essential social activities especially in Massively Multiplayer Online Games (MMORPG) [35]. In MMORPGs, groups can be short term or long term and can have diverse sizes ranging from 3 to several hundred. Very often, the size and goal of the group

can lead to different types of activities. For example, temporary groups (i.e., “parties”) tend to have short-term goals and focus on activities like completing quest or defending against another party rather than socialization [39]. In contrast, long-term groups such as guilds could be highly organized generate more dynamic and intimate relationships [14, 15]. Members of a guild were noted to share intimate details about family, significant others, and personal lives [39]. Therefore, in these groups, members also engage in social activities that are unrelated to the actual in-game tasks or goals, which may lead to more socially intimate experiences. For example, prior studies have highlighted that collaboration between two or more members whether in a group, guild, or dyad may create substantial emotional bonds of friendship, intimacy, affection, and online romance, which makes online activities meaningful and enjoyable to some users [19, 21, 40].

*2.1.3 Experimenting through Avatars.* Since most modern MMORPGs and virtual worlds are avatar-based systems, experimenting through avatars has become a significant part of users’ online experiences and activities. For these users, avatars are not only central to how they communicate and express themselves online but also afford novel activities to construct completely new identities or reaffirm existing identities [25, 46]. For example, Ducheneaut et al. found that users enjoyed the act of experimenting with a different digital body, leading to “creative freedom” [13]. Such a freedom also afforded cross gender/queerness gameplay via avatar customization [25, 42]. As Freeman et al. noted, users tended to use cross-gender play to escape from the stereotypes when playing games that mimic traditional offline gender roles [18, 19]. To many users, the act of presenting, creating, and customizing their avatars has become a key activity for them to socialize, explore, and experiment in an online social space.

In summary, prior work has highlighted that activities in online social spaces are often centered around the affordances of the specific system - either through the mode of communication, the support of group/collaborative behaviors, or the affordance of avatar creation and customization. These activities then lead to collaboration, competition, a sense of community, creative freedom, and intimate emotional connections, making online users consider them significant and meaningful to their online experiences. How, if at all, would emerging sociotechnical systems support even more novel and nuanced social activities? And how and why do people perceive these activities as meaningful and valuable? We now introduce social VR, a novel and increasingly popular digital social space.

### 2.2 Social Virtual Reality as Emerging Social Spaces

Over the past five years, social VR has risen as increasingly popular digital social spaces where people meet, interact, and socialize in new and more immersive ways. It refers to 3D virtual spaces where multiple users can interact with one another through VR head-mounted displays [36, 37] and can be traced back to concept of collaborative virtual environments (CVEs) [5]. Popular Social VR platforms include AltspaceVR, RecRoom, and VRchat. AltspaceVR is well known for the diverse events that it offers, ranging from open mic night, mediation classes, and programming classes. RecRoom

is considered most popular among minors, the main activities in RecRoom are centered around games (e.g., paintball and basketball). VRchat, among the three, affords minimal activities but features a broader range of customizable avatar representations. These platforms also offer varying degrees of tracked avatars ranging from full-body tracked avatars (trackers on users' elbows, feet, hips, head, and hands to fully rig the avatar) to head tracking only avatars.

Previous studies have identified three main technological features and experiential highlights of social VR. First, it affords full body movements and gestures in real time, high-fidelity 3D immersive virtual spaces with 360 degree content. Second, it supports vivid spatial and temporal experiences and a range of emotional states that is similar to face-to-face interaction. Third, it mediates both verbal and non-verbal communication as well as a wide variety of social activities through embodied social interaction [36–38, 51, 55]. Yet only a small body of work has explored new social practices and phenomena surrounding these emerging novel digital spaces. For example, Jonas et al. pointed out that social VR application design choices are significantly different from the design of any other 2D sociotechnical systems or non-immersive 3D virtual worlds [26] and McVeigh-Schultz et al. interviewed creators of various social VR platforms and proposed ten design considerations centered around aesthetics of the virtual environment, embodied affordances, social mechanisms, and cultivating positive social experiences [36]. Regarding social experiences in social VR, Blackwell et al. highlighted the negative aspect by discussing the commonality and evolution of harassment in these immersive environments [6]. However, this may not be true for all social VR platforms as Blackwell et al.'s work only reviewed Facebook Spaces. In contrast, Zamanifard and Freeman demonstrated that interactions in social VR could be quite positive and provided emotional satisfaction via the focus on embodied physical contacts, sense of co-presence, and the replication of real life activities [55].

This small body of work reveals two main limitations that motivate our work. First, social VR has potential to afford immersive and inherently natural social experiences compared to other online virtual environments. Understanding how people make sense of their activities in social VR is critical to explore how they perceive and approach this technology. Therefore, it is important to offer empirical evidence on what individuals are actually doing in social VR and what makes these activities meaningful to them. Second, despite the growing efforts to design more socially and emotionally satisfying social VR platforms, most existing design recommendations and frameworks were proposed by researchers and developers (e.g., [6, 26, 36]). More input from social VR users themselves regarding their actual demands and expectations for design features is urgently needed. These open spaces, therefore, lead to our research questions that focus on meaningful activities in social VR from users' perspectives (RQ1) and user-generated design recommendations for further supporting such activities (RQ2).

### 3 METHODOLOGY

This study was approved by the University's Institutional Review Board (IRB) for research ethics. To recruit participants, we posted a recruitment message on nine popular online forums for social

VR users (e.g., Reddit-Recroom, Reddit-AltSpaceVR VR, and Reddit-VRChat). We also directly recruited participants by entering popular social VR spaces (e.g., AltSpaceVR and VRchat). All participants who responded to our requests and agreed to participate were interviewed. As a result, 30 semi-structured in-depth interviews were conducted. Interviews were conducted via text or audio chat through Discord, Skype, or Google Hangouts based on participants' preferences from October 2019 to November 2019. The average length of interviews was 60 min and participants were given a \$20 gift card after they completed the interviews. Interviews started with questions about basic demographic information and devices and social VR applications that participants used most. The main interview questions were related to their social interactions and relationship building in social VR, important activities and social experiences they conduct in social VR, and their perceptions and understandings of social VR affordance. Example interview questions related to this study include "What do you usually do in social VR?" "what is your favorite activity in social VR and why?" "If you can change one social VR feature (technical or design features) to better serve your social needs, what would that be?", and so forth.

Among the 30 participants, 21 are cis male, five are cis female, and four are trans women. Of the 29 participants who shared their ethnicity, 20 are White, two are Black, five are Asian, and two are Hispanic. Participants aged from 18 to 65 (average age: 32.2) and with diverse experiences of social VR ranging from 5 months to 36 months (average: 18.7 months). Two participants (P26 and P27) self identified as disabled users. Participants also experienced a variety of popular social VR platforms including *Rec Room*, *VR Chat*, *AltSpaceVRVR*, *High Fidelity*, *Facebook Spaces*, *Vtime*, *Engage VR*, *Mozilla Hubs*, *Sonoroom*, *Pokerstar*, *Oculus Rooms*, *Sansar*, *Anyland*, and so forth.

We then used an empirical, in-depth qualitative analysis [52] of the collected data to explore what makes activities in social VR meaningful to users and their recommendations to improve the design of social VR to support such activities. Based on McDonald et al.' [34] guidelines for qualitative analysis in CSCW and HCI practice, we did not seek inter-rater reliability in our analysis but endeavored to identify recurring themes of interest, detect relationships among them, and organize them into clusters of more complex and broader themes.

Our coding and analytical procedures were: 1) both authors closely read through the collected data to acquire a sense of the whole picture as regards what activities that social VR users considered meaningful to them and why; and collectively identified thematic topics and common features in the data (e.g., activities, consequences, and recommendations) for further analysis; 2) both authors carefully examined and reviewed the thematic topics and developed sub-themes; and 3) both authors collaborated in an iterative process to discuss, combine, and refine themes and features to generate a rich description synthesizing users' perceptions of meaningful activities afforded by social VR and their design recommendations.

### 4 FINDINGS

In this section, using quotes from players' own accounts, we first present an in-depth investigation of five forms of social activities

that social VR users particularly found meaningful and valuable to them across various social VR platforms. We then identify three design recommendations that social VR users proposed to improve the design of future social VR systems to support meaningful social activities.

#### 4.1 Subjectively Meaningful Activities in Social VR

With the increasing popularity of commercial social VR applications, many technologists and practitioners envision that social VR would become "[the] premier place[s] to attend live shows, meetups, cool classes, and more with friendly people from around the world" (<https://altvr.com/>). However, what are users actually doing in social VR? And why are some activities in social VR feel more meaningful and valuable to them than others? In this section, we summarize five themes that made social activities in social VR subjectively meaningful to users: full body "mirroring" activities, mundane and essential everyday activities in new ways, activities for social and mental self-improvement, immersive cultural appreciation and educational activities, and engaging in immersive events.

**4.1.1 Full Body "Mirroring" Activities.** One significant and unique technological feature of social VR is full body tracking. According to our participants, having a full body tracked avatar meant using VR devices such as the HTC Vive (HMD), two controllers (sometimes including finger tracking vive knuckles), and trackers/pucks placed on their feet, hips, and elbows to fully rig the avatar. In this way, the avatar's body movement is consistent with the user's physical body movement. Our participants highly praised this feature and considered activities that experimented social VR's affordance of full body tracking one of the most meaningful and important to them. For them, such activities were valuable and meaningful because they allowed them to fully represent and express themselves in ways they could not have in other traditional virtual worlds.

A typical example is how participants enjoyed "dancing" in social VR. P3 (trans woman, white, 30), a professional dancer, explained, *"Full body tracking is a game changer really gets you immersed. As a dancer, this is going to be important to me. [In other virtual worlds], people do not have very expressive faces or very expressive hands. It just kind of feels like you're talking to really flat characters."*

According to P3, full body tracking was the very reason why she felt more "expressive" in social VR - as a dancer, the capability to mirror body movements within and outside social VR was crucial. This made activities in social VR more similar to those in offline world and people more open to each other. P3 continued to explain how she was more likely to disclose personal feelings and information in social VR: *"I think it's because of how the connection feels real. You're face to face with somebody even though it is virtual. I feel like that's probably the reason why we're likely to disclose things. Like usually I'll tell people Hey, I like you or I'm from Los Vegas, things like that. I pretty much share pretty openly."* In this sense, experimenting full-body tracking appears to be an important activity to bring people together and make the connection feel "real" (e.g., *"because you're face to face with somebody and even though it is virtual"*).

Others echoed this view. They commented that activities that involved full body mirroring dramatically promoted the feeling of social connection:

*"I prefer the full body avatars because they give you a more realistic sense of a presence there. They also help you to have a more natural interaction with others in social VR."* (P21, cis female, white, 45)

*"It's really just like the presence of another body right there. You have a full body, and others' bodies are also closer to you. It's much more intimate and makes you feel closely connected to other people."* (P23, trans woman, white, 21)

In both cases, experimenting full body mirroring made social activities in social VR more "realistic", "natural", and "intimate." For users such as P21 and P23, this was why they felt their engagement in social VR meaningful.

Such interpersonal connections did not stop within social VR. Participants also reported that experimenting with activities that involved full body mirroring not only helped them establish meaningful friendships within social VR but also led to more natural and less awkward offline meetings. In P3's (trans woman, white, 30) case, the ability to dance in social VR as in the offline world was essential to establish, maintain, and expand her social life. She noted,

*"I've met a lot of people who literally only just came up to me because they saw me dancing. They were intrigued and said that you're such a good dancer. And then people will ask me to teach them dance moves, and I'll try to give them basic introduction. So it has been a really good tool for me to connect with people and teach people."*

She also continued to explain that how such connections that started in social VR led to her first offline meeting with social VR friends:

*"We decided to meet at a musical festival. For some reasons, we never shared real life pictures until when we were looking for each other at the festival. But once we found each other, we just immediately started talking about the same things that we talked about before. It was like not meeting them for the first time because I already spent so much time with them in VR. I already know how they move, what their usual gestures are, etc. It was just a very natural meeting."*

As P3 described, experimenting full body mirroring became one of the most meaningful activities in social VR to many users because it significantly improved one's ability to express oneself as in face-to-face situations. Such heightened self-expression further promoted self-disclosure and social connections, which made valuable social interactions both in and out social VR possible.

**4.1.2 Mundane Everyday Activities in New Ways.** Another type of activities in social VR that most participants found meaningful to them were mundane and essential everyday activities. Participants highlighted that social VR allowed them to experience such activities in new ways that have never been done before in a virtual social setting, making them highly valuable.

One such activity that most participants highlighted was sleeping. They considered sleeping in social VR an important activity to them for three main reasons: (1) comfortability (2) part of an important social experience (3) a feeling of intimacy. For example, P17 (trans woman, white, 26) told us, *"I'll be honest. I fall asleep in social VR a lot. I'll generally be like lying in bed while doing VR. I have my VR setup in the living room because I live in the living room."*

*I have a futon bed that is just straight out in the living room. So I can just walk over to my futon while in VR, lay down, and keep talking to people until I just fall asleep. When I wake up, I'm often somewhere else in VR. This is quite exciting."*

In P17's account, rather than sitting in front of a computer as in a traditional on-screen virtual worlds, the immersion and ease use of social VR offered a feeling of comfortability to fall asleep in VR ("*just walk over to my futon while in VR, lay down*"). An additional appeal was the affordance of physically falling asleep while still be connected to the social world ("*keep talking to people until I just fall asleep*"), which differed from the mundane experience of sleeping in the offline world. In particular, P17 highlighted the novel experience of falling asleep in VR and waking up in a new virtual place somewhere else. While this may feel shocking or even scary in the offline world, it was exciting, playful, and enjoyable in social VR.

In fact, sleeping in social VR became such a popular activity for users that virtual places called "sleep worlds" were created. They were virtual places in social VR that were designed entirely for users to sleep, where dark lighting and a calm ambiance were provided. P7 (cis male, Asian, 18) explained how sleeping became part of an important social experience in social VR, even leading to communities of "sleepers" in "sleep worlds": "*In VR chat, there are Sleep Worlds. I would go any time when it is getting super late, either myself or with my friends. Someone would say, Okay, let's just go to a sleep world. And I'd be like, okay. Then we would all keep talking in the Sleep World. Eventually we'd also go to sleep one by one.*" (P7)

Interestingly, falling sleeping is often considered a solo personal experience in the offline world. Yet, these emerging communities of "sleepers" and "sleep worlds" reveal that a mundane activity such as sleeping can be experienced in new and more connected ways in social VR through which friends, or even strangers, could spend time and relax together.

Other participants also noted that falling sleeping in social VR was necessary to foster a feeling of intimacy for those in need (e.g., romantic partners). P3 (trans woman, white, 30) explained: "*It is like everybody who has a boyfriend or a girlfriend may fall asleep with them on the phone. And I've been able to do that in VR. We'll just be sitting and talking and after a while you know fall asleep. It's just part of our relationship, making us feel closer to each other.*"

For P3, who was in a long distance relationship, the fact that she and her partner could fall sleep together in social VR resulted in the vital feeling of intimacy and connectedness (e.g., "*making us feel closer to each other*").

However, some also described concerns about experiencing sleeping in new ways through social VR: "*I mean first I was scared to go to sleep here. So I always made sure to not sleep in VR because I was like, oh, what if it messes up my eyes are like what if like it burns something or whatever. But as time progressed, I just slowly stop caring.*" (P7, cis male, Asian, 18)

P7 admitted the novelty of sleeping in social VR. However, he was unsure about the potential risks associated with this new activity (e.g., messing up with eyes or accidents such as burning). Yet his account exemplifies that such fears may fade overtime. Though he did not continue to explain why, a potential reason may be that he became more familiar with the activity and observed how others did it. Another explanation could be that the appeal of sleeping in social

VR somehow outweighed the fear of potential physical/mental harm over time.

**4.1.3 Activities for Mental Self-improvement.** Participants also noted that social VR mediated activities that focused on self-improvement were of great significance to them. One reason is that social VR dramatically reduces personal cost (e.g., traveling, time, or monetary) to conduct such activities. Another reason is that participants felt more comfortable and confident to conduct and practice their skills in social VR with their anonymous and fully embodied avatars. In addition to practice and improve regular real world activities such as dancing and drawing, participants especially pointed out two unique areas of social VR mediated self-improvement: social skills and mental states.

Regarding improving social skills, participants mentioned that the combination of high level of immersion and high level of anonymity in social VR helped them better conduct interactive activities to practice social skills. They even considered such activities one of the most rewarding aspects of social VR, as P7 (cis male, Asian, 18) said, "*The best part of social VR I've seen so far is that I can practice my social skills.*" P23 (trans woman, white, 21) also added, "*Doing activities in social VR helped me become more confident and less socially anxious because i'm socially awkward. It's super similar to actually talking to people in the real life but the anonymity and the fact that you are talking with strangers whom you probably will never meet kind of takes away a lot of stakes. So, I feel more confident just by saying things I normally wouldn't. And it's a benefit.*"

P23's account is interesting because she felt that she could conduct activities in social VR that she "*normally wouldn't*" do, such as being confident to "*say things.*" For her, the immersion and anonymity of social VR calmed her down and provided her with a safe and comfortable environment to explore and experiment. This helped her improve her social skills with relatively low stress (e.g., "*takes away a lot of stakes*").

In particular, participants noted that conducting activities in social VR became a form of "empowerment" that improved their mental states (e.g., fighting with depression). P10 (cis male, white, 20) shared his story: "*Overall, social VR is the tool that allowed me to get into the virtual reality industry. It helped me get out of my depression because I can build authentic relationship and be empowered to do things that I would have not been able to do in the real life.*"

For P10, the significance of conducting activities in social VR to him lies in the opportunity to "*build authentic relationship*" and the sense of adventure ("*do things that I would have not been able to do*"). Through engaging in social VR, he not only felt "*empowered*" but also were able to improve his mental states ("*get out of my depression*").

**4.1.4 Immersive Cultural Appreciation and Educational Activities.** Another main theme emerging in our data is that participants appreciated how social VR afforded a series of cultural experiences and activities that helped them better understand each other and value diversity.

Compared to traditional forms of cultural education (e.g., images, videos, and books), social VR allows for a more engaging cultural experience by generating realistic cultural objects and mediating real time and multimodal social interactions. In this way, both users who are native to the culture and those who may not be familiar

with a certain culture can simultaneously engage in the cultural experience, which promotes mutual understanding, tolerance, and openness.

For example, P25 (cis female, Asian, 20) explained that social VR encouraged her to pursue an interest in art and other cultural understandings: *"Because I wanted to study art, I realized that social VR was such a great medium to interact with different people and different cultures that I had never met before. Being in Georgia, I was born and raised in the same area. So I knew the same people my entire life. It was just really refreshing to realize that I could just talk to so many different people and get to know their cultures through VR chat."*

As someone who were passionate about art, P25's pursuit seemed to be limited by where she lived and raised - her local community did not allow her to have sufficient exposure to the richness of cultural diversity as an artist would need. Instead, socializing with other users in social VR helped her conquer this geographic limitation, allowing her to *"interact with different people and different cultures"* that she had never met before. For P25, such an experience was *"really refreshing"* and helped her grow both as an artist and as a human being. Such an immersive cultural appreciation and education, therefore, made her activities in social VR meaningful and valuable.

Others highlighted that a friendly and supportive atmosphere in social VR also facilitated activities to build mutual understanding and mutual help between users from different cultures. P7 (cis male, Asian, 18) noted, *"I've helped people from different countries with their homework and they will help me with my homework. Some people came up to me and was like 'hey, I need help with my homework' and the other time I was like, 'could you help me out with my Japanese class.' People were just like 'yeah sure.' For example, I think I was helping some people with math and someone from Japan was helping me with my Japanese. I think this kinda helps me better understand other people and other cultures because we help each other."*

According to P7, encountering, interacting with, and helping people from different cultures in social VR seemed to be quite common and easy. Simply by asking, he was willing to help others and vice versa. For him, these activities further led to mutual understanding and better appreciation of each other's culture – *"because we help each other."*

P29 (cis female, Black, 21) further explained the importance of these cultural appreciation and educational activities in social VR: *"There are like educational worlds in VR chat with all the details you need to start learning a new language or a culture, such as artefacts. Or we can just go to a public world where you can find native speakers and learn or interact with them. For example, if you want to learn French or the French culture, you can go in and ask people from France questions."*

P29's account shows the appeal and value of learning about new and different cultures through social VR. With fewer requirements and limitations of the offline world (e.g., traveling, time, monetary) and more opportunities and accessibility to immerse oneself in a culture with natives and distinct artefacts, social VR seems to become an emerging cultural educational medium. It affords diverse activities for cultural appreciation, such as collaborative learning, Q&A with native speakers, and interacting with culturally specific artefacts.

**4.1.5 Engaging in Diverse Immersive Events.** From collaboration to role-playing, social VR provides a variety of immersive events ranging from concerts and political rallies to meditation. For our participants, engaging in these diverse events in a more immersive way constituted some of the most valuable and novel social activities in social VR. This is especially true for users who may lack mobility due to disability or financial or safety reasons (e.g., lack of transportation). For them, these events are appealing and valuable because social VR significantly eliminates many restrictions to attend these events, making them more accessible. For example, P27 (cis male, White, 45), who is physically impaired, mentioned: *"I'm usually stuck at home on the bed. So social VR has opened up a whole new world. I like that I get to go to real places. Instead of me physically going out and meeting up with people, I just kind of sit on my bed and meet people."*

Specifically, participants highlighted three ways through which attending events in social VR was subjectively meaningful to them: collaborative efforts for mental health, seeking feedback from the community, and professional development.

Earlier in our findings, we mentioned that participants used social VR to combat depression and social anxiety as individual efforts for social and mental self-improvement. Attending certain events also became an important activity for them to collaboratively and proactively advocate the importance of mental health. One such example is group meditation sessions. P10 (cis male, white, 20) described, *"I've attended guided group meditation sessions. It's nice to be there with others and make this a team thing. I ended up joining their team to host several of such sessions."*

In P10's account, a personal activity such as mediation could become an effective team effort through social VR. The presence of others in the same virtual space seemed to provide P10 with extra comfort (*"it's nice to there with others"*). Frequently engaging in such group events also fostered a sense of community and belongingness. In P10's case, he started as a mere participant but slowly mingled with the mediation team and became a host.

Others also highlighted the importance of seeking feedback from the community by engaging in diverse events in social VR. P24 (cis female, white, 27) shared, *"So usually what brings me to social VR is that there's some sort of events going on. For example on Monday nights, there's a creative writing workshop when there's an open mic. There's a UX meetup on Saturdays. That's what I do for a living. I'll usually go in and do some sort of like activity that they have planned. After it's done, I'll usually hang out for a little while and chat and socializing with people, giving feedback, or listen to others' suggestions for my work."*

According to P24, she enjoyed the wide range of activities that were offered on a regular basis in social VR. For her, these activities were efficient for fostering engagement and building a sense of community, which was a major reason why she continually involved in social VR. In particular, the ability to gain feedback on a piece of writing, or a performance with open mic night, and meeting up in social VR with colleagues in her career was what made these activities especially valuable to her.

P10 (cis male, white, 20) further added how he considered such professional development activities quite valuable to him: *"Some professional events are related to social VR, like the future of Social VR or the future of VR for education. But people also host different*

*professional events, like relating to social media, LinkedIn, Twitter and networking type of workshops. I do think they help me think more about my future career and understand different workplace cultures, etc."*

P10's account offers another example of the broad range of events in social VR from purely entertainment to a plethora of productive professional development opportunities. For P10, such opportunities not only helped him reflect on the future direction of his career but also made him learn how to behave professionally in a workplace. In this sense, social VR-mediated professional development events seem to emerge as promising collaboration and meeting spaces for the future of work.

## 4.2 User Recommendations for Supporting Meaningful Activities in Social VR

As our participants describe the above-mentioned social VR mediated activities as important and valuable to them, they did not consider that the current design of social VR systems fully supported such activities and their social needs. Rather, they expressed three main themes of design recommendations for better supporting novel social activities through social VR: 1) improving social connectivity by balancing, accessibility, and customization, 2) continued communication both in and out social VR, and 3) increasing realism and naturalness.

**4.2.1 Improving Social Connectivity by Balancing, Accessibility, and Customization.** Many participants expressed their expectations to further improve social connectivity in social VR. Specifically, they highlighted three potential strategies for designing future social VR platforms: a balance between the richness of interaction and the need to expand user population, increasing accessibility to better serve disabled users, and offering customized activities by categorizing users.

First, participants explained their frustrations about the explosion of growth on specific social VR platforms. They understood that the growth of these platforms were inevitable due to the increasing popularity of social VR. However, they noted that there was a lack of thoughtful design regarding how to sustain meaningful connections and interactions among social VR users within an increasingly crowded virtual space. In their opinion, the conversation, activities, and events were once more socially meaningful and significant. Yet recently, the richness of interactivity and the sense of connectedness had been diluted due to the overflow traffic on most of these platforms. For example, P12 (cis male, Asian, 49) described his hope to go back to an earlier version of Rec Room that was less crowded: *"If I can make Rec Room go back in time, that would be great. It was small with fewer people but felt more interactive and intimate. But I understand that they had to evolve their game in order to get more players."*

However, participants also acknowledged the need to expand user population to enrich and diversify the content and experience that social VR can provide. P6 (cis male, white, 29) explained this need: *"The biggest improvement to social VR would be to bring more people to it. I feel like the number of social VR users is still low. We should add more features to get more people in. For example, if there are incentives and goals to come in and play, that would bring up the community and that would improve everybody's experience."*

In P6's opinion, it was challenging for social VR platforms to offer rich and meaningful social activities with a relatively small user population. The reason was straightforward: users were both the consumer of content and the creator of content (e.g., by participating and interacting with others). Therefore, the design of social VR platforms should also focus on attracting and bringing new users on board, for example, through providing incentives and daily goals. For P6, such design features would be crucial to *"bring up the community."*

P3 (trans woman, white, 30) also added that a potential feature to connect with local users would help attract new users and improve social connectivity in social VR. She noted, *"To connect to people local to you would be fantastic. So if I want to go to a virtual gym or lobby full of people from Las Vegas, that would be a nice option. We can talk about things we all know about this area and even perhaps meet outside VR."*

According to P3, designing location-based virtual places in social VR seems to be valuable to gather users who share similar living experiences. Such a feature may also facilitate potential meet ups in the offline world. For social VR users such as P3, connecting with people who are nearby and potentially extending social activities from VR to the offline life would be an effective way to improve the sense of community and connectivity through social VR.

Second, participants highlighted the importance of increasing accessibility to better serve disabled users, so as to make social VR mediated activities more diverse, inclusive, and equitable. P27 (cis male, white, 45), a self-identified disabled user, revealed, *"Social VR needs to be more accessible to people with disabilities. There's a lot of VR stuff where a person has to physically turn around, and that's almost impossible for people with disabilities to do. Like if somebody who's talking behind me and they want my attention, but I just cannot turn around because I cannot easily move my body in the real life."*

For participants such as P27, the current lack of accessibility features in social VR prevented them from fully engaging and enjoying diverse activities in social VR. As most of our participants highly praised full body tracking in social VR, disabled users in fact complained about this feature and demanded for alternatives. In order to design more accessible social VR platforms, it seems to be valuable to allow certain users to control their avatars without physically "mirroring" their bodies in the offline world.

Third, other participants also noted the value of offering customized activities by categorizing users based on what type of activities they enjoyed most. P2 and P4 said,

*"I want to meet up with someone and not necessarily just playing Rec Room games. For example, I want to meet up with someone who can go play the unspoken or some other game together with me, or who can collaborate with me on some projects. It would be nice to have a mechanism to find such people in social VR."* (P2, cis male, white, 23)

*"I think it would be useful to create a social hierarchy with algorithms. Through the algorithms, a group of people who share similar interests can find each other, hang out, and do something together."* (P4, trans woman, white, 32)

Both P2 and P4 mentioned the demand to incorporate a ranking or recommendation system in social VR to help identify or "match" users who may share similar interests in certain type of activities. According to them, currently it was challenging to distinguish

users who were only interested in playing games from those who endeavored to find collaborators or companions for a workshop or an event. As such ranking/matching feature is already used by traditional online games, its addition to social VR platforms would allow for a more convenient and efficient way for users to find their "birds of a feather."

**4.2.2 Continued Communication Both In and Out VR.** Another potential feature that participants strongly recommended is the ability to leave a message for another social VR user even if that user is not currently in VR or on the device. This is a common feature on traditional social platforms and games but has not yet been adopted in social VR. Our participants expressed that their social VR activities/experiences could be seamlessly interwoven into their everyday lives through this feature.

For example, P9 (cis male, race unknown, 24) complained that he could not keep in touch with people whom he met in social VR. This contradicted the very essential purpose of socializing and connectivity of social VR platforms: *"I think the key of social VR is people's ability to connect with other people. For some reasons, VR chat devent does not have a function to, leave a message with friends, such as a message box or anything like that. If you want to do something outside VR but still want to know what's going on in social VR, there is no way to do this. It would be nice to leave a message to someone on the headset or computer. In order to make the best usage of social VR, we need to make it easier for users to actually connect with each other, both in and outside VR."*

Obviously, P9 considered that the current design of social VR platforms failed to help people *"actually connect with each other"* due to the inability to sustain continued communication both in and outside VR. For him, such features (e.g., leaving a message) would be essential to keep engaging in social VR while living a regular offline life. P24 (cis female, white, 27) shared similar ideas: *"What I want most is the ability to message and communicate when someone's not physically in VR. I think that would really facilitate a lot of continued conversation. Because as of right now, I basically I just meet new people every single day and I don't really have a sustained friendship."*

For P24, while she valued friendships emerging in social VR and would like to pursue such relationships, the inability to message and communicate with people outside VR made it challenging to fulfill this social need. This challenge also directly affected whether or not people could build sustainable and meaningful social interactions through VR. As P24 noted, the expectation was to *"have a sustained friendship"* rather than meeting *"new people every single day."*

In addition, though communication platforms such as Discord could facilitate chats among social VR users outside VR, participants still felt that it was insufficient to meet their needs for connectivity. P29 (cis female, Black, 21) highlighted, *"I would like to be able to text another user whom I met in social VR, like leave them a message. You don't really add all your friends from VR on Discord. Sometimes you just want to tell them something or they could leave you a note. I wish that was possible platforms such as VRchat."*

P29 clearly stated that social VR users preferred a platform-specific communication channel rather than depending on external standalone third-party communication applications such as Discord. There also seemed to be a need to distinguish friends whom they

met in social VR from other social networks (e.g., *"you don't really add all your friends from VR on Discord"*). Therefore, a built in messaging box that facilitates continued communication both in and out VR appears to be a much desired design feature for social VR platforms.

**4.2.3 Increasing Realism and Naturalness.** Participants were aware of the technical limitations of certain environmental and physical attributes in the current social VR platforms. They understood that social VR technology was still quite new and in a work-in-progress. However, they expressed expectations for attributes such as realistic physical environments and natural physical movements to design future social VR platforms. For example, P21 (cis female, white, 45) summarized,

*"I would like every social VR platform to be more realistic. I know that designers use specific assets to develop these VR worlds, but they could be more realistic. For example, AltspaceVR uses this poly type of environment. In fact, most of the environments in VR are using the poly type. They seem quite unnatural to me. I would prefer more realistic environments, like in a real cafe or a cozy place. I don't think that this exists in these platforms nowadays."*

According to P21, the demand for increasing realism for social VR did not only apply to the design of the virtual space but also referred to the dimensions of objects within the space as well as the social atmosphere of the space (e.g., *"a real cafe"* or *"a cozy place"*). Unfortunately, the current design of social VR spaces largely depended on *"the poly type"*, which limited users' experiences of realism and naturalness in social VR.

In addition, participants expressed desires for social interactions in more realistic manners through social VR. In particular, they highlighted the importance to heighten the role of hand gestures when designing social VR: *"I think I'm looking forward to more natural interactivity. For example, you can give someone an actual thumbs up and it's a real thumbs up. I hope there's just more personality when you're able to use your hands rather than just walking around like you almost have boxing gloves on. The same should apply to your legs, feet, face, etc"* (P22, cis male, white, 32).

In P22's view, more advanced hand tracking would allow for expressing more "personality" and subtle gestures when people interacted with each other (e.g., *"a real thumbs up"*), making social activities in social VR more realistic and natural. He also highlighted that such tracking technology should not be limited to hands but applied to other parts of body such as legs and face. In this sense, how to integrate and incorporate various types of tracking in different social VR mediated activities seems to point to a potential design direction for future social VR platforms.

## 5 DISCUSSION

To answer the two research questions that we proposed at the beginning of this paper, we have highlighted five forms of social activities in social VR that users find subjectively meaningful and valuable (RQ1): full body "mirroring," mundane and essential everyday activities in new ways, activities for social and mental self-improvement, immersive cultural appreciation and educational activities, and engaging in immersive events. We have also identified three user generated design recommendations for further supporting more novel and meaningful social activities in social VR (RQ2): 1) improving

social connectivity by balancing, accessibility, and customization, 2) continued communication both in and out social VR, and 3) increasing realism and naturalness. We now use our findings to discuss the implications of this work for extending our current understandings of new social practices and phenomena surrounding social VR as well as for informing potential directions for designing more socially supportive and satisfying VR platforms in the future.

## 5.1 Why Meaningful? Understanding Actual User Behavior in Social VR

As we described at the beginning of this paper, few empirical studies on social VR have explored what users are actually doing on these platforms and why they found such activities meaningful to them. Therefore, our findings provide valuable empirical evidence to better understand actual user behavior in social VR.

*5.1.1 The Nuance of Social VR Mediated Activities Compared to Traditional Virtual Worlds.* In this paper, we extend existing work on social dynamics and sociality in traditional 2D/3D virtual worlds by exploring the nuance of social activities that are mediated, facilitated, and supported by the emerging social VR platforms. In particular, our findings illustrate a number of similarities and differences between digital activities in traditional virtual worlds and in social VR.

One similarity is the broad range of educational, entertainment, and self-improvement activities across both traditional virtual worlds and social VR. For example, our findings are consistent with Bruckman's work [8] on educational activities in traditional virtual worlds. According to Bruckman, virtual worlds promote learning in four ways: 1) motivating users for learning; 2) providing emotional support; 3) offering technical support; 4) hosting appreciative audience to encourage learning [8]. In our work, we also found that social VR platforms motivated users to learn new languages and cultures in an immersive way. In addition, they encouraged users to learn new methods of self-improvement such as collaborative mediation. These new and immersive ways of learning then created deeper emotional support and led to a more meaningful learning experience where an appreciative audience were present. Another similarity is the wide range of technical attributes that both traditional virtual worlds and social VR employ to afford activities that were significant and valuable to users. Social VR is real time, unobtrusive, and can be multiuser or exclusive, which all are the attributes that Evard credited in facilitating meaningful interactions in traditional virtual worlds [17].

However, social VR also extends the capability of traditional virtual worlds as it affords the communication and interpretation of rich social cues through posture, gesture, and voice intonation. This facilitates more in-depth and immersive real time social experience. For example, our participants reported that social VR enabled them to engage in diverse immersive events including collaborative efforts for mental health, seeking feedback from the community, and professional development. They also noted that the richness of multi-modal communication in social VR helped users who may lack mobility better engage in these digital activities.

In addition, social VR affords a number of digital activities that are common in traditional virtual worlds such as paintball, yoga, dancing, meditation, experiencing aspects of a different culture,

or just casual socialization [24, 44]. However, social VR facilitates these activities in a more personal and immersive manner through its unique full body mirroring feature, which also attracts diverse sets of users. For example, dancing in social VR is much different from dancing in traditional virtual worlds. In traditional virtual worlds, dancing is usually induced through some forms of avatar body dancing through a non immersive interface [7, 9, 16]. In social VR, dancing is more immersive, embodied, and real time, which creates a more natural and engaging experience.

Our findings also demonstrate that full body mirroring in social VR allowed for mundane everyday activities that were rarely seen before in virtual worlds, such as sleeping. This finding is significantly different from prior literature on how players in traditional virtual worlds would forget to sleep, become addicted to the virtual world, or accidentally fall asleep while playing [23, 31, 54]. In our study, participants chose to intentionally fall sleep in social VR. For them, social VR seemed to create natural feelings of offline presence and let them feel comfortable and safe. This made falling sleep in social VR a meaningful and valuable activity that further blurred the boundaries between online and offline.

In summary, though traditional digital activities are also taking place in social VR, social VR both affords new and novel activities and offers more nuance ways to conduct and experience traditional digital activities.

*5.1.2 A Balance between Enhanced Social Connectivity and Self-Reflection.* Our findings show that social VR users seemed to be able to find a balance between social connectivity and self-reflection, which made their social VR mediated activities meaningful and valuable to them.

For example, our findings are consistent with Zamanifard and Freeman's work [55]: long distance couples did use social VR as a modality to stay connected. However, our findings also extend this work and highlight that intimate mundane behaviors such as falling asleep together in social VR was a novel way through which couples felt their time spent together in social VR more meaningful. Additionally, social VR is not only advantageous for those who are in long distance relationships but for those who are looking to develop new friendships, foster sense of belongingness, and engage in community building. These point to social VR's potential to afford a wide range of social connectivity and forms of interpersonal relationships beyond intimate romantic relationships.

In particular, an interesting finding is that though social VR is generally designed for social interactions and connectivity, one of the most important activities in social VR actually centers around experiencing, exploring, and improving one's self. This focus may result from the combination of *presence, immersion, and embodiment* in social VR. In VR, presence is known to influence the illusion of the virtual environment, and even the plausibility of the experience [48, 50]. Correspondingly, high presence often leads to stronger perceptions of immersion [47, 49] and connections within the environment. While senses of presence and immersion in social VR are both heightened due to full body tracking, *embodiment* is also further enhanced as users' bodies have become the sole interface for interacting with others. In this context, the mirroring of their physical body and virtual body not only communicates spatial behaviors [22] but also displays expression, social interaction, and

proximity [27, 32, 33, 53]. Such an interplay of enhanced *presence*, *immersion*, and *embodiment* may encourage users to pay more attention to their selves and reflect how they connect to their selves, the others, and the world.

## 5.2 Exploring Future Design Directions

Our findings also reveal three user-generated design implications for better supporting novel and meaningful activities in social VR. Our goal is to contribute to the current researcher and designer generated design frameworks for social VR (e.g., [29, 36, 45]) and inform future design directions to create more socially supportive and satisfying social VR spaces by introducing end users' voices and insights.

One interesting user-generated design recommendation is the ability to leave messages for other users through the headset or computer (e.g., a built-in in game voicemail system) rather than using any standalone external communication applications such as Discord. Asynchronous communication methods have been used in online games for a long time [43]. Yet, adding such features to social VR could allow voice mail messages in the form of textual, audible, or video messages, which would help social VR users balance their engagement in social VR and regular lives in the offline world. This suggestion aligns with one of McVeigh-Schultz et al's design considerations of "*consider[ing] the ways that your experience will bridge between VR and the outside world*" [36]. Yet our participants expected to *bridge* their experience, activities, and interactions with other users on the platform in addition to family and friends who are not associated with social VR. In this sense, asynchronous communication systems that mainly focus on building and maintaining connections between online strangers may need to be taken into account when designing future social VR platforms.

In addition, our participants' expectations of traditional aspects of realism holds true in social VR as they expect similar graphical fidelity compared to the physical world, but they also expect naturalness in interactions and experiences that resemble face-to-face interactions in the offline world. This is consistent with McVeigh-Schultz et al's another design consideration, which focuses on "*leveraging the familiar social context through the aesthetics of place and architecture*" [36]. Specifically, we found that to what degree realism and naturalness should be achieved is not an one-fit-all design principle. Currently, different social VR platforms such as RecRoom, VRchat, and AltspaceVR afford varying levels of realism. The expectations of the specific platform also seems to dictate the level of realism expected by the users. For example, RecRoom focuses on games and play, which may yield lower expectations of realism. In contrast, AltspaceVR, a platform to attend live shows, experience meetups, and take part in classes with other people, may yield higher expectations of realism because of the similarities to the offline activities. A better understanding of specific platforms' goals and main activities that they focus on seems to be necessary to determine the degree of realism and naturalness that users expect from a given platform. It should also be noted that our participants highlighted that social VR design should be more accessible for people with disabilities. Previous scholarship have demonstrated that traditional virtual worlds such as Second Life was beneficial for people with physical disabilities to experience self-discovery,

relaxation, and in-world equality [28]. However, how to make social VR more accessible to people with physical disabilities, hearing impairments, visual impairments, or mental impairments seems to be an understudied topic in current designer/researcher generated design frameworks.

After considering design frameworks and methodologies proposed in prior research [12, 36, 41], along with user-generated design recommendations emerging in our findings, we suggest the following potential practices for designing social VR for *accessibility* and *inclusion*:

*Participatory Design*: proactively involving people with various disabilities and marginalized communities in the process of designing social VR experiences and digital activities.

*Virtual Places for Social Support*: designing virtual places in social VR where marginalized and/or disabled users can share experiences, support one another, and combat harassment or negative social interactions collaboratively.

*Crafting An Onboarding Process to Explore Accessibility of the Platform*: in this process, users can experiment with the environment, features, and settings to identify and practice what interactions, if any, are accessible on the platform, without others being present.

## 5.3 Limitations

Our study has a few limitations. First, all participants were recruited from online forums, social media, and on social VR platforms. This sample mainly focuses on social VR users who actively use social media accounts. Another limitation is the lack of even distribution between participants and the platforms they use. Future investigation should aim at recruiting a broader participant pool with more diverse social VR platforms to capture a more comprehensive picture of social VR experiences and activities. In addition, we did not particularly discuss avatar creation as an activity in this paper because we focused on such activities in one of our prior work [20]. We also want to mention that we intentionally did not define what should be considered "meaningful" to give our participants flexibility to openly answer the interview questions and reflect on their subjective experiences. Future work can also be conducted to further investigate and differentiate how different types of social VR activities indicate various meanings, values, and significance to users.

## 6 CONCLUSIONS

Commercial social VR applications have emerged to be increasingly popular online digital spaces that afford real time multimodal interactions and a broad range of activities via full body tracking (play, meetings, social gatherings). Yet what makes activities on these novel platforms meaningful to users? Our investigation has identified five forms of activities that users find meaningful and valuable and three end user generated design recommendations for designing future social VR platforms to better support such activities. We believe that our focus on *meaningful* activities in social VR contributes towards addressing two main limitations in prior literature, namely, the lack of scholarship on actual activities in social VR and first hand accounts of end user generated design recommendations. We hope that our findings inform future directions

for designing more supportive, enjoyable, and satisfying social VR platforms.

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