

Meditating Together: Practices, Benefits and Challenges of Meditation on Social Virtual Reality

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Abstract

Meditation and mind-body practices offer many benefits for both mental and physical well-being. Recently, social virtual reality (VR) has emerged as a promising platform to support well-being activities. While Human-Computer Interaction (HCI) research has explored technologies for meditation, little is known about how users appropriate social VR for meditation, particularly group practice, and how it shapes their experiences. To bridge this gap, we interviewed 13 regular social VR meditators to explore their practices, perceived benefits, and challenges. We found that meditators utilized platform features to engage in community-driven group practices, manage session flow, employ avatars and body tracking for kinetic practices, and experiment with novel forms of meditation. Participants reported benefits and challenges related to the individual and social aspects of their meditation experiences. Based on these findings, we discuss the implications of using social VR for meditation, including how avatars and virtual others positively affect the practice, as well as emerging tensions and opportunities.

CCS Concepts

- Human-centered computing → Human computer interaction (HCI); Empirical studies in HCI.

Keywords

Virtual Reality; Meditation; Group meditation; Embodiment; Social VR; Mindfulness

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1 INTRODUCTION

Meditative and contemplative practices encompass various mental focus exercises and techniques, offering a range of well-being benefits including reduced stress and anxiety [50, 65, 108]. While often viewed as individual practices, group meditation has a long tradition in Buddhist *sangha* and is a common approach in mindfulness interventions. Group meditation fosters a sense of community, accountability, and peer support [64, 81], which can positively influence meditation outcomes. However, most meditation applications primarily adopt individualistic models rather than incorporating group practice [59, 126].

Digital technologies have expanded access to meditation through various platforms [30, 32, 35, 56, 78, 114, 120]. Meditators use video chat [38, 54], video conferencing [28], and more recently, live streaming [77] for online practices and community building. These platforms expand access to group practices, provide social support, and strengthen community connections. However, while effective for meetings and instruction, these tools fall short in creating a sense of physical co-presence. Limited modes of interaction and technical barriers can further undermine the meditation experience [54, 77]. More importantly, since these platforms were designed primarily for remote conferencing, they often lack adequate support for the embodied, group-based nature of online meditation.

Virtual Reality (VR) has begun to emerge as a novel platform for meditation. social VR, in particular, offers an immersive environment in social contexts for a variety of group activities, largely due to its ability to create a sense of “being together” or co-presence [45, 84, 86]. While research on social VR’s role in supporting well-being is still in its early stages, initial studies [45, 84, 86, 127] show that users engage in meaningful shared activities in social VR, such as dancing and sleeping, that foster comfort, social bonds, and intimacy [84]. In addition, the world-building tools offered by these platforms may lower technological barriers to creating immersive environments and high-quality interactive experiences tailored to their members, easing the complexity and effort involved in developing standalone applications to achieve the same goal.

Meditation communities have started to thrive on different social VR platforms, where users come together to participate in group practices. These organically formed communities of practitioners present opportunities to explore the meditator’s routine practices and identify key aspects that contribute to their positive or negative experiences in social VR. Gaining insights into current practices

within this space can inform the design of social VR meditation, VR-based meditation support, and perhaps suggest new models of technologically-mediated meditation. This exploration may also inform the broader social VR literature on meaningful activities.

This study explores these gaps by addressing the following research questions:

- **RQ1** How do active users in social VR meditation communities utilize social VR to structure their group sessions and support diverse meditation practices?
- **RQ2** What are the perceived benefits and challenges of using social VR for meditation among active users? Specifically, how do they perceive social VR as supporting or hindering the social and embodied aspects of group meditation?

To answer these questions, we conducted interviews with 13 meditators within the emerging social VR meditation communities. Using thematic analysis, we identified key themes related to their practices, experiences, and the perceived benefits and challenges they encounter. Our findings highlight factors that influence both individual and group meditation experiences, as well as tensions in the use of social VR for meditation. In addition, through the lens of embodied mindfulness, we examine how the sense of embodiment and self-representation influence the bodily aspects of mindfulness in social VR, and propose recommendations for designing VR meditation to support embodied mindfulness.

We contribute to HCI research on social VR and meditation in three key ways. First, we expand the growing body of work on the technology use for meditation by examining how meditators and online communities utilize social VR to enhance their practice and meditation capacity. This includes exploring meditators' perceptions of the benefits, challenges, and tensions associated with using this novel platform for meditation, as well as its impact on group dynamics, such as relationship-building with instructors and peers. Second, we contribute to social VR literature by identifying how current social VR platforms support community-driven well-being activities like meditation, while also highlighting the nuanced ways in which these platforms affect individuals and their communities. Lastly, we contribute to the HCI community by outlining principles for designing VR-based meditation support that fosters social presence and embodied mindfulness.

2 BACKGROUND AND RELATED WORK

2.1 Meditation and group meditation

Meditative and contemplative practices can broadly be defined as a family of techniques aimed at cultivating awareness and mental clarity to gain insight into consciousness, often with intermediate goals, such as enhancing mental well-being [122], or promoting “*human flourishing by training the mind*” [33]. Meditation may also involve self-exploration, such as the process of deconstruction and reconstruction through introspection and self-inquiry [14, 34], or cultivation of long-term traits and pro-social attitudes [33]. In the HCI literature, meditation is often examined as contemplative practices, mindfulness, or a spectrum of techniques like concentration, visualization and body scanning, tailored to goals such as stress reduction and emotional regulation [21, 69, 117].

Goleman and Davidson [52] describe meditation as a continuum from “*deep*”—rooted in traditional and spiritual contexts—to

“*wide*”—practical, secular adaptations shaped by science and technology. Our study on social VR for meditation aligns with the “*wide*” path, focusing on practices adapted for broader accessibility and distanced from their cultural or spiritual origins. We therefore adopt a practical perspective in this work, defining “meditation” as intentional practices or techniques that aimed to achieve a calm, mindful state, foster insight into mental processes and consciousness, and improve mental well-being [89].

Meditation and contemplative practices involve diverse techniques with distinct focuses and goals. Mindfulness, widely recognized in Western contexts, emphasizes present-moment awareness and attention-related processes [15, 33]. Loving-kindness meditation (LKM) cultivates compassion, open-heartedness, and kindness toward oneself and others [58, 67, 74]. Beyond seated meditation, movement-based practices like yoga and Tai Chi—also referred to as kinetic meditation [89], integrate physical movement and mindfulness, offering holistic benefits for mind and body [33, 89]. These practices have been shown to improve well-being, reducing depression and anxiety while enhancing attention, working memory, and cognitive function, even with short daily sessions [11, 70, 104].

Although often seen as an individual practice, meditation is frequently taught and practiced in group settings across both Western and Eastern traditions. In Buddhist traditions, group meditation is central to the concept of *sangha*—communities in which people meditate together [82, 119]. Through its connection to the teachings and lineage, the *sangha* nurtures a sense of belonging that brings accountability, support, and encouragement [81, 92, 119]. Outside of Buddhist traditions, group settings are commonly employed for mindfulness interventions, typically structured with experiential practice and a group discussion [64, 66]. Research highlights the benefits of group meditation, including instructor-student relationships, community support, and peer accountability [73]. Group dynamics, such as cohesion, have been linked to better outcomes, lower dropout rates, greater interpersonal support, and improved participation [59, 126].

2.2 Technology and VR-supported meditation

Digitally-mediated meditation occurs via a variety of technological platforms, including mobile apps [120], soundscape [30], wearables [56], tangible artifacts [35, 78], biofeedback devices [30] and digital games [32, 114]. Digital tools, mostly designed for solo meditation, often focus on promoting body awareness [35, 100] and mindful moments [4]. Technologies have been applied to everyday mindfulness [55] like mindful eating [68] and mindful walking [29], and to enhance compassion in empathy-focused meditation [120]. Technology-support group meditation has explored tools like video chat and video conferencing [38], and recently in live stream [77]. Although these platforms provide expanded access to meditation practice, social support and a sense of community, they often lack sufficient support for embodied social activity, particularly for group meditation. For instance, meditators report that they lack the “energy” or a feeling of interconnectedness—a collective experience crucial for group meditation [38, 77].

Virtual reality (VR) presents an alternative approach to meditation. Studies demonstrate VR’s feasibility, efficacy, and acceptability for mindfulness practices [24, 90, 110]. The multi-modal nature of

VR creates a sense of presence, enables virtual anchors to direct attention, and grants users the agency to explore [110]. Moreover, VR headsets can assist users in focusing by shielding external distractors [113]. Immersive virtual environments, in conjunction with audiovisual recordings, can promote relaxation or overcoming concerns [49]. When paired with body-based input like breath or EEG, VR can further induce awareness of the mind and body while promoting an attitude of acceptance [93, 103, 106, 121].

Literature has explored design guidelines for VR-supported meditation. Work has emerged in this area: Roo et al. [103] recommended a balance between distraction and guidance by challenging the user's focus and providing subtle navigational cues. Salehzadeh Niksirat et al. [105] suggest minimalism, non-judgment, and avoiding quantified performance metrics to promote acceptance and mindfulness. In an interview study with a mindfulness teacher, Lukoff et al. [82] suggest designing for constructive (prosocial qualities) and deconstructive paths (self-inquiry), along with designing for everyday mindfulness. In terms of frameworks, Döllinger et al. [41] built on the foundational work of Wienrich et al. [124] proposed a framework for designing and evaluating XR-based mindfulness support, highlighting four key elements of XR for meditation: virtual environments, virtual or augmented objects, virtual body and self-representation, and virtual others. While virtual environments and objects have been well-studied in XR meditation, how avatars, self-representations, and virtual others affect mindfulness and meditation practices are largely unknown [41]. Questions such as how self-presentation through avatars influences participants' sense of body awareness, or how VR supports positive group dynamics during meditation, are still unanswered.

2.3 Embodiment in meditation and VR literature

One of the important concepts to investigate in the study of social VR meditation is embodiment. While VR literature on the concept of embodiment often examines it in terms of body perception and sensation—such as the extent to which one feels present in and controls a virtual body [112] and in meditation emphasizes bodily awareness as a pathway to mindfulness [69], both recognize the critical role of bodily sensation or awareness in shaping how individuals interact with and experience the world. In VR literature, for example, Kiteni et al. [72] define *sense of embodiment* as the degree to which users perceive a virtual body as their own. Similarly, Peck et al. [98] examine how swapping embodied avatars affects users' perceptions and behaviors, highlighting how the degree of embodiment and avatar design influence the virtual experience.

In meditation, embodiment involves directing attention to bodily sensations to achieve present-moment awareness [69]. Both Buddhist and Western meditative traditions link body awareness to mindfulness, empathy, and well-being [13, 22, 92]. Khoury et al. [71] proposed the framework of *embodied mindfulness* to capture the complexity of embodiment in mindfulness, which encompasses five skills: detachment from automatic thinking, awareness of bodily sensations, sustaining connection with the body, fostering mind-body links, and accepting discomfort with a positive attitude [57]. This framework is particularly relevant to the exploration of social VR meditation, as it offers a structured approach to analyzing

how meditators use their bodies to cultivate mindfulness and offers guidance for designing social VR environments that support embodiment.

While embodiment has been extensively studied in both VR and meditation contexts, the intersection of these perspectives remains underexplored. Early studies suggest that embodying avatars in VR meditation influences users' bodily sensations [44, 106, 123]. Döllinger et al. [41] highlight the potential for XR meditation research to examine overlaps between avatar embodiment and embodied mindfulness. However, the impact of occupying a virtual body on cultivating mind-body connections or the potential barriers it may introduce remains insufficiently studied. Moreover, the presence of others' virtual bodies adds another dimension to consider. These gaps present opportunities to explore how social VR platforms can integrate VR embodiment with the embodied aspects of meditation.

2.4 Social VR for well-being activities

Social Virtual Reality (Social VR) has gained popularity in recent years. Commercial social VR applications like AltSpace [5], Rec Room [60], VRChat [61] and Meta Horizon [43] world not only provide users access to people from different countries and regions, but also serve as a platform for various social experiences. AltspaceVR and Rec Room use cartoonish avatars for simplified, game-like social interaction, while EngageVR and Meta Horizon Worlds blend realism for educational and mixed purposes. VRChat stands out for its user-customizable avatars reflecting various cultural, fandom, and personal influences.

Investigations into social VR are deeply informed by prior research on shared virtual environments (VEs) [8, 9, 12, 23, 27, 40, 62], ethnographic explorations of various virtual settings such as collaborative virtual environments (CVEs) [19, 20, 83, 91] and online game space [10, 18, 97]. Research on platforms like Second Life reveals how virtual worlds support meaningful practices beyond entertainment, as noted by Au [6]. Minocha et al. [88] further provide guidelines for conducting research in virtual environments, which are applicable to studies in social VR. These foundational works on early virtual worlds provide a historical and technological framework that situates and guides research into social VR.

Much of the current social VR research has centered on its technological capabilities, including full-body movements and gestures [9, 101], spatial and temporal experiences [5, 115], and verbal and non-verbal communication [86, 101, 102]. These studies emphasize social VR's ability to create immersive 3D environments that support emotional states and social activities comparable to face-to-face interactions. Recent work has also explored its affordances for collective learning [26, 39], meetings [2, 17, 94] and online events [42, 80, 84]. Several works provide guidelines for conducting research in social VR, including ethical considerations by Maloney et al. [85] and Deighan et al.'s [36] suggestion to develop empathy and insights into platform culture. Recent social VR studies [36, 84] suggests integrating observations to enrich the findings.

Research on social VR activities that promote well-being activities is still in its nascent stages. Foundational studies, such as those by Freeman and Maloney, demonstrate that social VR enables users to engage in everyday social activities like sleeping [84], dancing

[99] and drinking [25] in meaningful ways [46]. Users leverage social VR to practice social interaction [128], find support and community [80], and as a tool to reduce negative thoughts and social anxiety [36].

Preliminary studies have explored the use of multi-user VR to support compassion meditation in lab settings [53, 58]. However, the application of commercial social VR for meditation in real-world group contexts has not yet been investigated. Although group meditation and meditation communities have emerged in recent years within social VR, their practices, perceived benefits, challenges, and the specific aspects of meditation that VR supports remain largely unknown.

3 METHODOLOGY

To answer the research questions, we conducted semi-structured interviews with 13 meditators who regularly attended meditation sessions on social VR, aligning with prior research on social VR that employed semi-structured interviews [16, 45, 48, 80, 109]. Semi-structured interviews allowed us to ask follow-up and targeted questions tailored to participants' roles and practices, providing deeper and more nuanced insights than surveys or forum content analyses [25, 128], making it particularly suited for studying meditation in social VR. Guided by Maloney et al. [85], our study aligns with specific directions within this framework of social VR research, particularly those focusing on nuanced activities and engagement, design strategies, and the interplay of body, avatar, and user preference. These guidelines and frameworks shaped the development of our interview study.

3.1 Preparation Work

Before conducting interviews, the research team familiarized themselves with social VR meditation practices through YouTube videos and public meditation sessions across various commercial platforms.

Throughout the study period, researchers continued attending these public meditation sessions, gaining exposure to different practices, content, and features across multiple platforms. Between May 2022 and January 2024, the first and third authors attended twice-weekly sessions, lasting 30 to 60 minutes, on platforms like VRChat, Rec Room, Meta Horizon Worlds, and Engage VR. They also joined Discord channels for VR meditators to explore community values, feedback, and discussions. These informal observation sessions revealed how sessions were structured, how user-generated content emerged, and which features facilitated group meditation. Guided meditations were the most common, but sessions often included Dharma talks, Q&A discussions, social gatherings, and games.

Our preparatory work informed various aspects of the study design. First, it played a critical role in shaping our recruitment strategy. For example, attending the sessions helped us identify three participant roles: *attendees*, regular users joining sessions; *moderators*, community members managing or facilitating sessions; and *instructors*, experienced meditators leading or teaching the sessions. Without this preparation, we would not have identified the role of moderators, who, while also attendees during the session, take on additional responsibilities by actively managing and facilitating practices. We primarily focused on attendees as key

informants, a decision informed by their significant proportion and representation in the community, as well as the diverse perspectives they bring.

Second, our observations shaped the interview guidelines by complementing general questions with follow-ups based on community practices and platform features. Toward RQ1, we included follow-ups on scene elements, technology differences, and the flow of specific sessions, such as mindful eating. For example, we observed that attendees often used upper-body tracking with still postures, while instructors employed advanced setups like full-body tracking or projections, informing questions about how technologies supported embodied practices and adaptations to platform constraints. Observations of room layouts, functions of virtual objects, and session behaviors, such as walking during meditation, also guided questions about the role of virtual space and objects, session flows, and feelings about moderation. Toward RQ2, the follow-up questions explored which aspects of specific practices participants found valuable and why they held that view. These questions also helped us examine whether the challenges we identified aligned with participants' experiences and how they interpreted them. For example, participants practicing kinetic meditation, such as yoga or mindful movement, shared their perspectives on the platform's ability to support physical embodiment and how these experiences compare to the in-person or other virtual settings. Similarly, our experiences as newcomers attending sessions, sometimes unintentionally causing disruptions, shaped our questions about issues such as distractions, barriers to session management, platform-level support for social norms, and onboarding support for new users. Lastly, our preparatory work validated participants' concerns, such as the lack of platform-level moderation tools, which we corroborated through direct interface use and video recordings.

3.2 Recruitment

Meditators with experience attending group meditation sessions in social VR (described in Section 3.2) were recruited for this study. To identify VR meditators, we searched for VR meditation forums and communities in social VR, posted recruitment messages in related Discord communities, and used snowball sampling through participant referrals. Email and Discord were used to contact potential participants. Our study was approved by the university's Institutional Review Board (IRB), and interviews were conducted on Zoom after obtaining informed consent. These interview sessions lasted 48 to 110 minutes, averaging 69 minutes. All sessions were recorded and transcribed to maintain data integrity and facilitate analysis. Each participant was compensated with an Amazon gift card \$50 for their participation.

3.3 Participants and Procedure

We conducted semi-structured interviews with 13 participants from VR mediators. The inclusion criteria, inspired by previous studies [35, 79, 87, 99], were as follows: participants must be (1) at least 18 years old, and (2) have participated in group meditation in any social VR platforms. Participants were recruited as active members of the social VR meditation community, aligning with prior research that often focuses on active users to examine emerging practices and community dynamics in social VR (e.g., [7, 80]). These participants,

Table 1: Participant Demographics and Social VR Meditation Practices

ID	Gender	Age	Years with Meditation	Years in Social VR Meditation	Length and Frequency in Social VR	Platforms	Role
P1	Female	45	15	3	Daily, 2 hours (teaching)	AltSpace, VRChat, Engage	Instructor
P2	Male	62	40	1.5	3 times a week, 30 to 90 minutes	AltSpace, VRChat, Rec Room	Attendee
P3	Female	61	2	2	3 online sessions per week, 30-60 minutes each	AltSpace, VRChat	Attendee
P4	Male	53	30	4	4-5 days, 30-60 minutes each	AltSpace, VRChat, Horizon Worlds	Moderator
P5	Female	45	8.5	3	3-4 times a week, 30-60 minutes	AltSpace, VRChat	Attendee
P6	Male	70	5	2	3 or 4 times a week, 30 minutes	AltSpace, VRChat, Rec Room	Attendee
P7	Non-binary	40	3	2	Daily, 45-60 minutes	AltSpace, VRChat, Rec Room, Engage	Attendee
P8	Female	64	2	2	4-6 times, 30 to 45 minutes each	AltSpace, VRChat, Engage	Attendee
P9	Male	45	31	3	2-4 times per week, 30-60 minutes	AltSpace, Rec Room, VRChat	Moderator
P10	Female	63	2	1	Twice a day, 10 minutes to a half hour	AltSpace, VRChat	Attendee
P11	Male	45	15	2	Weekend, 20-30 minutes each session	AltSpace, VRChat	Attendee
P12	Female	39	3	3.5	At least 4 times a week, 60 minutes	AltSpace, VRChat, Rec Room	Attendee
P13	Female	46	4	3	5 to 7 nights a week either as the leader or one being led, 30-90 minutes each	AltSpace, VRChat, Rec Room, Engage, Horizon Worlds	Instructor

with sustained engagement in social VR meditation and related spaces like Discord servers, represent the current user base and provide detailed insights into the practice. Their reported challenges reflect both the barriers they faced when initially adopting the technology and those encountered during routine practice.

While no minimum experience was required, all participants had at least one year of VR meditation experience, with an average of 2.46 years ($SD = 0.85$). Compared to prior studies on social VR communities, our participants exhibited higher average experience levels in social VR. However, their regular weekly engagement patterns aligned with the “regular use” profiles identified in previous research, such as Li et al. [80], where LGBTQ+ participants spent 1 to 50 hours per week on social VR platforms, and Bagher [7], which examined regularly engaged VRChat dancers recruited from Discord. Social VR meditation, still in its infancy during the study, featured small, interconnected communities that shared members and resources, and in some cases, have merged. Despite this interconnectedness, participants represented a range of practices within social VR meditation, from platform-specific activities like VRChat

sessions to varied practices such as mindful movement, dancing, or Buddhist meditation.

Participants ranged in age from 35 to 70 years (average 51), with 11 years of average meditation experience. Among the 13 final participants (after screening out two users of non-synchronous apps like Tripp [118] or ZenVR[44], five identified as male, seven as female, and one as non-binary. Most meditated 3–7 times weekly, averaging 30–60 minutes per session. Platforms included AltspaceVR [5] (all participants), VRChat [61](12), Rec Room [60] (4), Engage VR [1](4) and Meta Horizon Worlds [43](3). The sample included 9 attendees, 2 moderators, and 2 instructors, reflecting the proportional composition and dynamics of the current community.

Each interview, lasting 60 to 75 minutes, was structured around four segments. The first two segments explored participants’ meditation backgrounds and use of other platforms like Zoom to provide context for motivations, expectations, and how prior practices influenced their adoption of social VR. Example questions explored participants’ backgrounds in meditation, their traditions or schools regarding group meditation, and their experiences with online

group meditation. The first two segments, while not directly addressing RQ1 or RQ2, provided contextual insights that informed interpretations of them. The third segment investigated participants' hands-on experiences with group meditation in social VR, covering session flow, group dynamics, and the perceived benefits and challenges of using VR for meditation (RQ1 and RQ2). Example questions explored participants' engagement with social VR meditation, including: What practices have you engaged in? How do sessions flow? What features are used for room management and teaching? Questions also addressed social interactions, such as: What kinds of interactions occur? How do others' avatars impact your meditation? In addition, participants were asked the following: What barriers or challenges have you faced? The fourth segment examined how social VR features influence meditation practices, interactions, and community building, identifying design opportunities (RQ2). For example, participants were asked: What features need improvement? How do you envision these improvements?

3.4 Data Analysis

Adopting an approach inspired by the grounded theory [31], we engaged in an interactive process of data collection and early-stage analysis, continuing to recruit and interview participants until reaching data saturation—when no further novel insights emerged. The interview analysis used the constant comparative method for thematic analysis [31]. To begin, two co-authors thoroughly reviewed the transcribed interview data. This step involved reading participants' narratives line by line, identifying and highlighting information relevant to the RQs, and taking notes to gain an overall understanding of how meditators use VR for meditation and their experience with VR and social VR.

After gaining familiarity with the data, the two authors initiated an iterative coding process. In this phase, the authors each open-coded the first 5 transcripts independently to develop a preliminary understanding of potential themes. The authors then compared and contrasted initial themes, combined the identified codes, eliminated redundancy, and developed categories that grouped similar themes in weekly data analysis meetings. For instance, ‘‘We don’t just meditate together. We do a lot of gaming together, some of us vacation together.’’ was coded as “extendable gathering” and “community activities” and then combined with “various events”. The two authors then systematically categorized the initial codes into thematic areas that corresponded with the study’s research objectives. Meanwhile, the authors continued to interview new participants. The emerging insights from data analysis were used to help shape subsequent interviews. As theoretical saturation was reached, the researchers began formal data analysis, in which a codebook was developed and the three transcripts were coded for each subgroup. After reaching a consensus on the codes and protocols, the remaining transcripts were coded using the codebook. The codes were reviewed to generate themes that emerged from the data or were merged with existing themes. The research team engaged in weekly discussions to integrate, refine, and streamline the identified themes and sub-themes to ensure that the emerging themes accurately represented the data in relation to the research objectives. All team members worked collaboratively to further refine the themes, assigning definitive names that encapsulated the essence of each thematic area.

Through iterative discussions, the team collated individual codes into provisional themes, which were further refined to produce 8 final themes and 160 codes. The final themes directly inform the subheadings in the Findings section, with each theme corresponding to a specific subheading. Finally, the research team focused on selecting compelling quotes to illustrate the themes and drafting the findings in a logically structured narrative.

4 Findings

Findings are presented in two broad categories: 1) how meditators utilize social VR for their group sessions and what their group meditation experiences with social VR were like (RQ1); 2) what are users perceived benefits and perceived challenges of using social VR for group meditation (RQ2). To support these findings, Table 2 mediators’ and community practices, Table 3 highlights the perceived benefits of social VR meditation, and Table 4 outlines the perceived challenges.

4.1 How do VR meditators utilize the affordances of social VR for group sessions

4.1.1 Leveraging world-building for community-driven meditation content. Social VR’s world-building tools enable custom-tailored experiences, which enhance traditional meditation practices and obviate the need for a standalone app. Community members create “rooms” or “worlds”—virtual environments with features designed for the live session (Fig. 1). Such rooms are deeply specific to the communities that create them; world builders carefully consider meditators’ preferences, instructor requests, and perceptions of community needs. Within these rooms, practices are varied (far beyond typical breath counting practices) and range from traditional sitting meditation to kinetic meditations such as yoga and mindful movement, as well as meditation aimed at evoking empathy, like Loving-Kindness meditation.

One way instructors demonstrated their use of world-building tools was by creating simulations of real-world scenarios, which served as a helpful practice to promote mindfulness techniques in everyday life. P9 described this: *“Session leaders can go in and spend hours in advance. They design these scenarios, and they would say: How should we be in those scenarios? What does mindfulness look like in a scenario?”* As P9’s quote illustrates, session leaders spent hours crafting scenarios to evoke specific responses and foster an understanding of mindfulness in context. One instructor, P1, shared their design of a “full moon meditation”, which uses a virtual moon (Fig.2a) as the anchor to keep participants *“in the moment”*.

“There’s a full moon above us... and we’re all physically there looking at the moon, doing this full moon meditation... So the moon is actually going to be a subconscious reminder of what we have meditated on.”

World builders shape session experiences around community members’ preferences and feedback. P4 emphasized the role of world-builders, who not only reflect aesthetic preferences but also consider the needs of everyone involved in meditation: *“It depends on the world builder to be mindful of this when they’re actually creating an environment...he always takes into account what we want in the environment that’s going to benefit meditation.”*



Figure 1: Meditation worlds on social VR

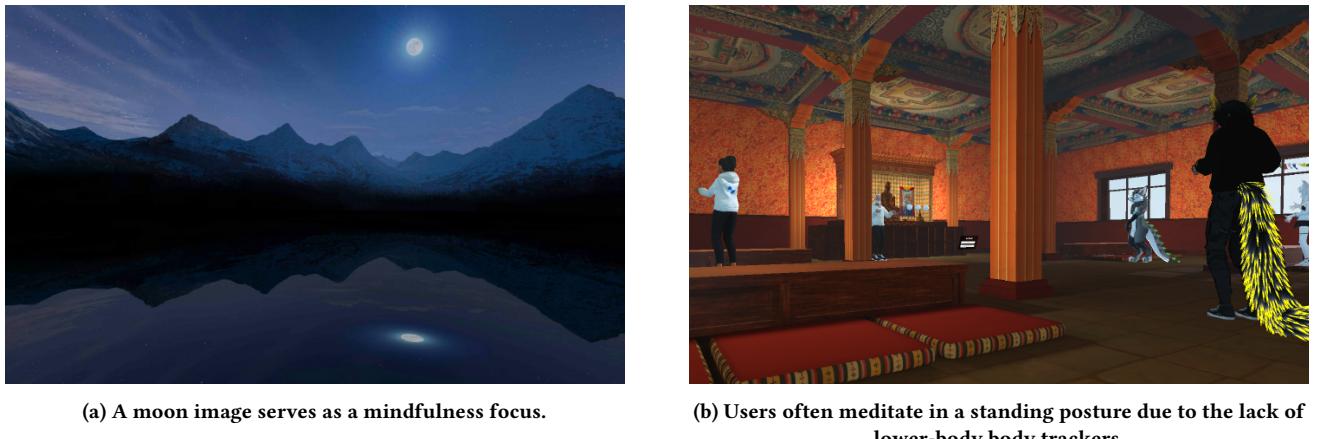


Figure 2: Examples of virtual objects and a group of avatars meditating in VRChat.

Community members contribute to the meditation experience through collective activities and creative input. User-generated content is directly integrated into the meditation process, as highlighted by P7: “*We’ll do what we call the Gathering... it’s building something like abstract art. And then, that became the object of meditation a couple of months back.*” Ultimately, the world-building capabilities of social VR support instructors, world-builders, and communities to collaboratively create a wide range of meditation experiences that are tailored to the unique preferences and needs of the community.

4.1.2 Manage session flow through different phases of live sessions. Social VR supports multiple phases of group meditation sessions, including onboarding, instruction, group practice, post-practice sharing and reflection. Users design “worlds” or “rooms” to make users feel calm and comfortable. To create a smooth transition into the meditation space, many worlds include a preparation or transitional area. For example, in an outdoor meditation world, users walk a quiet path before arriving at the public gathering area. P3 described this experience, stating: “*In the preparation for the meditation, you can be in an area conducive to relaxation.*”

The on-boarding stage enables participants to create personal connections and prepare themselves for the following practice. For participants who used this time as a “social moment” to greet others, the name tags above each avatar and voice chat facilitated getting

to know one another, helping to build rapport through personal interactions. This feature also enabled instructors to structure the onboarding process effectively. P1 spoke as an instructor, describing how instructors in their community structured the onboarding: “*And so how I structured my particular class... as people walk in, like the first 5 min, I would always greet them by their name.*”

Meditation sessions in social VR often feature quietness and stillness, with most users appearing in a standing posture due to the lack of extra body trackers, even though in real life they are sitting (Fig.2b). To ensure these norms of quietness and stillness are maintained, instructors often use moderation tools to maintain this norm within the meditation space. As P1 explained, “*After 5 min, I would mute the whole room, except for myself, and lead a guided meditation. We’re silent for a particular amount of time*” P4 noted that at this stage, social VR helped facilitate the transition from quiet settings to more social settings required by different meditation practices, stating, “*During the intervals when we move from sitting meditation to walking meditation, there’s usually some very brief interaction possible, but it’s usually not that much until it comes time for the discussion groups.*”

Following the meditation practice, participants regathered for group discussion or “inquiry”, a key component in group meditation that allows participants to share their individual experiences of the practice, and is largely absent in stand-alone, single-user meditation apps [65, 111]. In social VR, a range of features facilitate group

Table 2: Findings for RQ1: How meditators utilize social VR for their group sessions.

Themes	Sub-themes	Description
World-building for community-driven content	Tools for user-generated content	Social VR's world-building tools enable the creation of tailored virtual environments ("rooms") designed to support various meditation practices.
	Community-driven content creation	Instructors, world builders, and community members work together to shape the rooms and the meditation experiences.
Managing session flow in social VR	Onboarding and rapport-building	Instructors greet participants and structure onboarding activities. Features like name tags and voice chat are found particularly useful for onboarding and preparing participants for the practice.
	Moderation and social norms	Instructors and moderators use tools to mute participants and maintain quietness, ensuring alignment with meditation norms.
	Post-practice sharing and reflection	Features like embodied avatars, virtual microphones, and emojis enable participants to share and reflect on their experiences and emotions.
Embodiment	Avatars and body-tracking support kinetic meditation	Avatars and body-tracking support embodied practices and kinetic meditation, making it easier to demonstrate, learn, and engage in these practices compared to traditional or video-based methods.
	Hybrid virtual-physical movement	Movements in social VR blend a sense of virtual and physical, allowing participants to engage in bodily practices with a sense of freedom while maintaining an awareness of others in a virtual world.
Innovating meditation in social VR	Inventing social VR-based meditation practices	Social VR enables the creation of entirely new meditation practices, such as VR mindful gaming.
	Creative adaptations of everyday meditation	Traditional practices, such as mindful eating, are creatively adapted in VR to enhance awareness, accountability, and the transfer of mindfulness skills to daily life.
	Visual and spatial enhancements for empathy	Immersive meditations, such as loving-kindness sessions, use symbolic imagery and spatial elements to evoke strong prosocial emotions and deepen connections between participants.

discussion, with avatars and non-verbal communication—such as raising hands and passing a virtual microphone—playing a crucial role in facilitating participation. P13 shared how the function of “microphone” encourages social sharing in an intuitive way: “*When we are [in] AltSpace, the microphone could just be passed. I think more people would check in just to say: ‘hey, thanks for the great meditation.’*” In addition to embodied avatars, emojis were frequently used during prosocial meditations to convey empathy, express support, and show agreement. As P8 described: “*While they’re talking, you just send up whatever emoji like laughter or sad faces... So it’s like this mutual way of letting each other know that you’re there without a word.*”

4.1.3 Avatars and body-tracking creating kinetic meditation. Instructors highlighted how social VR enhanced their ability to lead embodied mindful practices, such as mindful dancing, movement, and yoga, as shown in Fig. 3a. Because social VR enabled instructors to track and project their bodily movements in a 3D virtual space, they could explore new exercises not possible with media like video conferencing. As P13, an instructor who taught mindful movement and yoga in social VR described: “*They’ll see my hands, and then they’ll see my head and my abdomen. They can tell if I lean to the*

side, or if I put my arms up, but if I do anything with my legs or my feet they can’t see that. So I find that when I lead my sessions in VR. I’m very specific with my directions. I make sure that I give lots of detail and also give them lots of options.”

Participants appreciated the opportunity to engage in body-mind exercises within Social VR (Fig. 3b), finding the sessions effective, enriching, and safe to explore. P13, for example, noted how participants in mindful movement classes, particularly younger users, gained greater body awareness through these exercises and felt the impact of the practice: “*About two weeks ago I was in VRChat, we were doing a lot of bodywork and a lot of stuff with the breath. The energy was amazing. I had to catch my breath a couple of times during the practice... I will say that it was a really powerful meditation.*” Similarly, P5 shared feelings in the mindful dancing sessions: “*It was a lot of fun, because I feel like I was revisiting that sort of new meditation. Your mind is doing dance meditation.*”

Movements in social VR are a hybrid between virtual and real, which requires an awareness of others while also creating feelings of freedom and safety. P5 described the need to balance a sense of freedom with the awareness of others’ physical proximity in the virtual space: “*You know we were encouraged to be wild and free, and you did have to pay attention to other people’s location a bit more. But*



(a) An instructor leading meditation with an embodied avatar and a projected hologram.



(b) A kinetic group meditation session (Yoga).

Figure 3: Meditation with embodied avatar and hologram projection in AltSpace.

You weren't necessarily dancing with someone... we were just really focusing on being in our bodies and that experience." Some participants (P13, P5) found that the avatars' inability to perfectly mirror physical movements was beneficial in encouraging engagement. This disconnect helped reduce self-consciousness, making it easier to participate in kinetic meditations. P5, for instance, noted how this limitation of the avatar allowed them to feel more comfortable during mindful dancing: "*I definitely feel more safe dancing in VR [...] We were all dancing and following the choreography moves, and we all looked ridiculous. But because you know that the avatars don't fully reflect the body, you kind of feel like you can be a little more carefree and not worry about it. And you know you're not conscious of how my body looks right now...Because it's not my body.*" This sense of detachment from the physical body provided participants with the freedom to engage in bodily movement without the usual self-awareness or anxiety that might arise in physical settings.

4.1.4 An experimental ground for novel forms of technology-mediated meditation. Social VR's interactive modules and customizable environments enabled users to explore new mindful activities. Instructors primarily leveraged VR as an extension of their real-world teaching methods, using virtual objects to anchor meditative practices in ways that mirrored traditional approaches. Community members demonstrated a greater interest in experimenting with novel forms of meditation unique to the VR medium.

One such innovation was VR mindful gaming, invented by the community. This practice integrates mindfulness meditation with a body-based VR game by encouraging participants to engage in aggressive or competitive games while maintaining a controlled, mindful perspective. P9 further clarified the goal and tasks involved in playing aggressive games during these meditation sessions, emphasizing that the objective is to provoke negative emotions as a way to practice techniques like emotional regulation and to prompt self-inquiry. They explained the purpose of using an aggressive game to induce negative feelings and elicit self-inquiry: "*It's a kind of experimental gaming meditation where you try to play an aggressive video game from the standpoint of knowing that at the end you're trying to stay mindful throughout this.*"

Many participants felt that because VR could trigger emotional responses, it could be used creatively to create novel forms of meditation aiming to evoke specific feelings. The community actively experimented with features to support daily informal practice in creative ways. One example is mindful eating, which focuses on cultivating presence and awareness by deliberately paying attention to the act of eating, often at a slow pace. Although mindful eating wasn't originally designed for VR, participants adapted the practice by having their avatars "eat" virtual food while they themselves ate real food outside VR. They used communal spaces for group eating events, incorporating features like spawning virtual foods to heighten awareness of eating habits, with the goal of transferring these skills to everyday life outside VR. P2 described their mindful eating sessions in which they shared the sounds of eating through microphones: "*We move to a mindful snack, and during that time, it's a silent snack... You can have your microphone on if you want, so that people can hear you eating.*" P9 shared their session in Rec Room with a virtual food spawned in the center of the room to raise their awareness: "*In mindful eating, so in Rec Room we could spawn a pizza, or something like that, and try to get the kids to eat it slowly.*" Here, representations provided reminders to one another—a form of accountability—on their practice.

Participants valued empathy-related practices, such as loving-kindness and compassion (Fig. 4) meditation in social VR. When combined with visuals and co-presence, these experiences were particularly intense for participants and evoked strong pro-social feelings. P6 described a loving-kindness session in which the instructor guided participants through an immersive journey to different locations on Earth to trigger emotional responses and empathy for others:

"The room's walls dissolved, and we found ourselves floating above the city. After a while, he had us close our eyes, then reopen them to find ourselves on top of the Himalayas, surrounded by snow and mountains. We meditated there, watched the sun rise over the mountains, and then transitioned to space, looking back at Earth. There was a talk about loving-kindness and leaving the world a better place. We meditated on that, and at the end, there was a rain of goodwill and peace and the meditation ended."

By incorporating visual and spatial elements, such as floating above cities, meditating on mountain peaks, or viewing the Earth from space, social VR provided a collective experience that resonated emotionally and spiritually with participants. The symbolic imagery (like “the rain of goodwill and love”) used in the experience deepened the practice’s impact by linking visual metaphors to prosocial emotions.

4.2 Perceived benefits and challenges

Understanding users’ motivations for engaging in social VR meditation provides context for interpreting their experiences and the perceived benefits or challenges of this practice. A key motivation was the desire for connection and community, which was often intertwined with the need for well-being support. Participants frequently sought to counteract loneliness and stress, particularly during the isolation of the COVID-19 pandemic, when physical constraints limited access to in-person groups or nature. This dual need for social connection and emotional support drove many to VR meditation as a way to re-establish community while managing stress and anxiety. Others were motivated to deepen their practice within a supportive group, share experiences, or seek guidance from instructors. Life changes, such as becoming parents or losing access to regular meditation spaces, further highlighted the importance of both connection and well-being. Peer influence also encouraged participation, with some joining through friends’ recommendations.

These motivations closely align with the benefits participants experienced, including a sense of interconnectedness, emotional support, and accessibility. In the following section, we explore these perceived benefits in detail, demonstrating how social VR meets users’ needs and enhances their meditation practices.

4.2.1 Benefit: interconnectedness intensify presence. A major perceived benefit of social VR for meditation is the unique way it fosters a sense of interconnectedness during practice—the strong feeling of meditating *with* others. While group meditation in any setting can create a shared experience, participants noted that social VR enhances this interconnectedness through a distinct sense of physical-virtual co-presence, which traditional video conferencing platforms often lack. Specifically, seeing avatars, embodying an avatar, sharing a spatial environment, and engaging in subtle non-verbal social cues helped them feel a strong sense of “being together” during group meditation. They reported that this heightened co-presence improved their focus on the present moment and deepened their concentration during meditation.

Interpersonal connection is both a desired part of meditation, and an end in and of itself with group mediation. Participants shared that the live sessions in social VR fostered a strong sense of co-presence and interconnectedness, despite not being physically together. Live social VR sessions retained the same “vibe” or shared “energy” they experienced during in-person sessions, which they found lacking in traditional video conferencing platforms. For example, P13 described how simply standing next to someone in a shared room created a connection: “*Social VR meditation is just something that has the potential to heal so many just by connecting, and letting people know that they’re not alone. So many things that they come to us for, someone else that’s standing right near them in this virtual space is or did experience the same thing.*” P1 emphasized

the feeling of shared energy during the practice: “*In VR, I feel you still share your energy with each other. And so when you’re sharing your energy, your spirit with me, and the same, and even over miles apart. Like sometimes I meditate with the group, and like we’re thousands of miles from each other, and I still feel that connectedness.*”

Feeling connected to others intensified the meditation experience for many. As P9 described: “*So I just think it makes the meditation more intense, you know, more solidified. And when you’re around a whole bunch of other people that are calm, it’s easier for me to be calm as well, because it’s creating that environment with energy in the room.*” P1 added that being with others helped them stay present: “*I’m with people, interacting, it just keeps me in that moment more.*” Observing others experiencing challenges, particularly through their bodies, validated participants’ experiences and encouraged them to persist in their practice [51]. For instance, P5 reflected that seeing others wiggle during meditation helped normalize the difficulty of maintaining stillness: “*Just see the imperfections of other people, and not as a flaw. But as: I’m doing okay, everybody wiggles a little bit. Everybody struggles with this, and that’s a good thing to see, in a way.*”



Figure 4: A live session on VRChat: a compassion meditation to connect meditators with the planet Earth and others.

4.2.2 Benefit: Social Relationships to Promote Meditative Practices. Participants valued how social VR fosters personal relationships, openness, and community accountability, all of which enhance meditation practices. Like in-person group meditation, social VR supports personal connections with instructors, an aspect not well-supported by traditional online conferencing tools. At the same time, avatar embodiment and anonymity in social VR encourage openness, lowering barriers to engagement with both instructors and peers. In addition, social VR combines the accessibility of an online platform with key benefits of in-person meditation, such as a shared sense of presence and accountability within a diverse meditation community that supports long-term growth. Instructors compared social VR to Zoom in their capabilities to engage large groups, and notice the bodily feedback.

Social VR facilitated the development of personal relationships between instructors and attendees, which many participants found helpful for learning and crucial for the continuity of their practice. As P8 reflected: “*My favorite part is that I’d like to do it for longer and do it with my session leaders more frequently... Meditation for me. It’s finding somebody that I can relate to. I’m also a person, the*

Table 3: Findings for RQ2 (a): Users perceived benefits of using social VR for group meditation

Themes	Sub-themes	Description
Interconnectedness	Interconnectedness intensifies the experience	Social VR fosters a sense of co-presence during meditation, allowing participants to feel connected with others despite physical distance. This interconnectedness enhances focus, intensifies the meditation experience, and helps participants stay present in the moment.
	Validation	Observing others' challenges, such as fidgeting or struggling to stay still, normalized participants' own difficulties and encouraged persistence.
Social Relationships	Feeling personal	Social VR fosters personal connections between participants and instructors, which helps build rapport and aids learning.
	Safe to be vulnerable	Anonymity and physical separation in social VR reduce self-consciousness, making participants more open to sharing and reflection.
	Higher engagement than video conferencing	Social VR enables instructors to engage participants more personally and notice real-time feedback through avatars, which is less feasible in video conferencing platforms.
	Access to a community for accountability and growth	The sense of community in social VR motivates participants to show up, engage, and grow in their practice, fostering accountability and belonging.

hearing part of it, and they [instructor] have to have a voice that I feel the loving kindness, the caring.”

The *anonymity* of social VR, and *safety* of being in different physical spaces led to productive relationships for many participants. P12 described how digital co-presence, anonymity, and physical safety combine to make people feel comfortable being vulnerable: “*You feel physically present with the other people in the room, and there’s a little touch of anonymity to the avatar, which means that people are much more comfortable being vulnerable in VR...that combination of the physical proximity and the avatar. It definitely makes people feel safer.*” Participants also noted that social VR reduces *self-consciousness*, which encourages openness. As P13 commented: “*A lot of them come to us because they have social anxiety. When they can only see this avatar on the screen, I find that people are more willing to be open, more willing to be vulnerable, more willing to share.*”

Instructors also felt a high level of engagement in social VR, which they compared to video conferencing, primarily due to the more direct and personal interactions it enabled. They could approach participants for conversations and observe their engagement through body language, such as nodding. P1 shared the benefits of using both verbal and non-verbal communication when managing a yoga class, explaining: “*I tried to teach Yoga on Zoom, and I don’t feel like the engagement is the same, especially when you have a larger group setting. In VR, I can go up to you, we can have a conversation. Or I can really control the whole panel a little bit easier because we’re still moving our arms, and you can see people are checked in if they’re nodding their heads. And in Zoom, I don’t feel that connection is the same.*” P13 emphasized how the embodied avatars in social VR make it easier to notice when participants are struggling, allowing instructors to adjust their teaching in real-time: “*You can tell when*

someone has opened the menu, because it shows it right up in front of their face. So I can tell if someone’s having trouble focusing, or if they’re having trouble sitting still.” Recognizing struggles in real time enables instructors to offer prompt feedback, which helps participants maintain focus and improve their meditation skills. P10 added that instructors would engage with gestures and make eye contact, creating a personal connection: “*So the session leader is mindful enough to be looking over here. Look here like you look to an audience. It’s more personal.*”

Participants reported that the *community* was essential to their growth with meditation practices. Many participants, including P2, P4, P5, and P6, highlighted validation and accountability as key advantages of live sessions in social VR. P2, for instance, contrasted their experience of mindful eating in Rec Room with practicing alone, stating: “*I sometimes try to practice mindful eating on my own, but it takes more effort, and my mind is more often willing to run off in some of the different directions and get lost. I feel much more accountable to me into the people in the group to be able to do it properly. So it feels more easier to do in a more rigorous way in a group than it would on my own.*” Similarly, P13 noted how social VR provided “*a sense of wanting to show up, wanting to be there for the community, and wanting to feel that energy in that connection with other people*”, particularly for those less experienced with the practice.

4.2.3 Challenge: Disruptions from trolls and newcomers unfamiliar with the social norms in meditation spaces.

Social VR platforms were originally designed for gaming and social events, which focused on interaction and engagement, which presented challenges. During silent meditation, social norms prioritize stillness and quietness. Common social behaviors, such as walking, talking, or asking questions - which might seem obviously disruptive in physical space

– occurred with some frequency in social VR. P1 explains, “*The distractions would be where people come in, and they don’t know it’s a meditation spot. They don’t know what’s going on here. And I’ve had times where people come in and like, hey? What’s everyone doing? Why is no one talking? And then they [community moderator] would have to come in and speak to them, and that’s the big disruption.*” Unlike other social VR settings where interaction and spontaneity are expected, meditation spaces require a strict sense of mindfulness and stillness. When newcomers or trolls enter the space unaware of the ongoing meditation, even a well-meaning inquiry can cause a significant interruption. P11 added that these disruptions were often caused by users unaware of the meditation context: “*It’s hard there because they come in and they’re not coming into the events specifically for meditation.*” P8 further commented on how the platform-level design can exacerbate this issue, with sounds and visual effects triggered when new users enter: “*There are certain platforms where, when people come into the room, it makes a noise, and bright-colored beams come down. They can’t control that, and it’s very distracting.*” These automatic features, suitable for social activities, conflict with the stillness meditation requires.

Participants wanted better moderation tools to control their space. The importance of effective moderation was stressed by P9, who volunteered in Rec Room to manage disruptive behavior: “*So I’ve actually volunteered as a moderator in Rec Room quite a lot, because that’s where it’s necessary, we would have to kick out the ones that were clearly there just to cause problems for the people taking it seriously.*” Similarly, instructor P1 noted the challenge of leading large groups in VRChat due to the lack of moderation tools: “*I’m not sure how many people can be in VRChat, because it seems like it can be a lot of people. But we have a lot less tools to moderate, and moderation is a huge thing when you’re trying to lead a session.*”

Some participants eschewed moderation tools and advocated for community-driven approaches that provide *guidance* to both disruptive presences (especially children) and those disrupted by them. As P7 described, community involvement can turn disruptors into active participants, noting how younger users went from being distractions to helping enforce group norms: “*They’ve become regulars to the group. And now they transition from the disruptors to telling [others] that they can’t move.*” Some experienced meditators viewed distractions as opportunities to deepen their mindfulness practice, as noted by P9: “*If something like that distracts you, how can you bring your thoughts back to the meditation? That’s something to look at as an opportunity to learn.*”

4.2.4 Challenge: Avatar representation and technical limitations interfere with meditation. Participants identified technical limitations and the prevalence of avatars reflecting harmful body ideals as key challenges. Specifically, instructors faced difficulties monitoring participants’ physical alignment and safety during embodied practices due to limited tracking and high technical demands. Attendees noted accessibility issues with full-body tracking, the inability to support longer sessions, and the discomfort caused by avatars reflecting unhealthy, thin body ideals.

While some participants appreciated avatars for reducing self-consciousness, the prevalence of idealized, thin avatars created new difficulties, especially for those dealing with body image issues. This issue was highlighted in sessions like mindful eating and

mindful dancing, where the goal is to reduce body-related concerns. P2, for example, expressed dissatisfaction with the default avatar choices: “*Now they assume you want an avatar that is thin. We all have very thin bodies. Avatars, I think, would be more empowering to people who are dealing with body image issues. Especially the meals group, representation matters in cases.*” P5 echoed this, emphasizing that overly idealized avatars could undermine the purpose of these meditative practices: “*But it should not be like, just like a model. I would honestly do an intervention on my avatar if it was a real person...I would also love avatars that can be more representative of who we are as people.*”

This same pseudonymity, which created a sense of trust, could also create alienation. Some users used inconsistent avatars, even within the same session, which disrupted a sense of connection for some. P8 emphasized that maintaining the same avatar outfit helped build familiarity: “*Once you get a set out for a set look. Then they know you by sight without having to see your name tag. You also prefer your friends to have the same avatar rather than change their appearance very often.*” P9 echoed this sentiment, expressing frustration with frequent avatar changes in VRChat, which undermined a sense of continuity and connection: “*In VR chat, the people change their avatars every 5 minutes, that really destroys any sense of a connection that you might feel.*”

Participants also faced technical limitations related to safety concerns and full-body tracking, which posed challenges for body-mind exercises like yoga and mindful movement. P13 highlighted this issue for instructors: “*In a headset, they’re not seeing their physical body, and so you’re not quite sure if they’re doing it safely or correctly.*” P2 echoed this concern: “*But the VR does not support tracking the movements of your lower body. There are leg sweeps, and other moves, but if you’re looking at another avatar that’s doing those movements, you can’t see if they’re doing anything correctly.*” The performance requirements for advanced avatars with full-body tracking further limited the inclusivity of such experiences (P5). The complexity and technical demands of significant bandwidth and specialized equipment like extra trackers, further complicated the use of holograms in meditation sessions. Participants (P1, P2, P3) also noted that extended VR meditation sessions posed challenges due to physical discomfort and sensory overload, contrasting with real-life retreats where extended periods of stillness, silence, and solitude—essential to practices like Buddhist meditation—are difficult to replicate in VR.

5 DISCUSSION

Social VR has emerged as a promising alternative for group meditation sessions when in-person practice is not available. Through interviews with active members of social VR meditation communities, we explored how these groups creatively utilized the platform, including leveraging world-building features to produce community-driven meditation experiences, employing platform tools for seamless transitions between different phases of live sessions, and incorporating avatars and body-tracking for kinetic meditation exercises. Participants also experimented with novel forms of technology-mediated meditation and frequently compared social VR to both traditional video conferencing and in-person group meditation sessions. These findings indicate that social VR meditation merges

Table 4: Findings for RQ2 (b): Users perceived challenges of using social VR for group meditation.

Themes	Sub-themes	Description
Disruptions	Lack of awareness of meditation norms	Social VR platforms, originally designed for gaming and social activities, create challenges when newcomers disrupt silent meditation sessions due to being unaware of the social norms of mindfulness spaces.
	Limited moderation tools	Instructors and participants highlighted the lack of effective moderation tools to control distractions during meditation sessions.
	Using disruptions as mindfulness opportunities	Seasoned participants framed disruptions as opportunities to deepen their mindfulness practice.
Avatar, Self-representation, and Technical Limitations	Unrealistic and unhealthy body aesthetics	Avatars often reflect real-world ideals of thinness, which conflict with body-positive meditation practices, such as mindful eating or dancing, exacerbating body image concerns.
	Full-body tracking barriers	Limitations in full-body tracking restrict the effectiveness of embodied practices like yoga and mindful movement, posing safety concerns when participants' movements cannot be fully verified.
	Physical discomfort and sensory overload	Extended VR sessions caused physical discomfort (e.g., headset fatigue) and sensory overload, limiting the duration and replicability of traditional meditation retreats.

immersive, experiential practices with virtual-physical co-presence, creating a context capable of eliciting emotional responses while enabling remote participants to share a collective experience. Moreover, compared to designer-driven standalone meditation apps, this approach lowers the technical barriers for meditation communities to engage in content generation. Members in various roles can focus on co-creating meditation experiences and content that meet the broader community's needs, without the burden of developing an entirely new application.

Our participants' adoption of social VR highlights a broader need for both meditative and social benefits of group practice, especially for older adults lacking access to in-person sessions. Many turned to social VR during the COVID-19 pandemic, when isolation, grief, and mental stress disrupted traditional practices. Older individuals, often living in isolation, found social VR meditation a way to combat loneliness and reconnect with a community while maintaining their practice. Unlike younger populations, who may turn to other social or entertainment activities, our participants saw social VR as a means to recreate the communal dynamics of in-person meditation. Their motivations and perceived benefits indicate that Social VR offered advantages over tools like Zoom by fostering a sense of shared spatial presence, physical proximity, and embodiment—key to creating a tangible social connection. Participants found these elements lacking in Zoom. Additionally, social VR provided a more inclusive option for those with concerns about real-life appearance or identity, making it easier to engage in group meditation. However, barriers remain for its broader adoption as a tool for introducing meditation to a wider audience.

We discuss the implications of these findings from three perspectives. First, we identify how virtual others and group dynamics affect the collective meditation experience on social VR, and how social VR supports these dynamics. Second, we explore the role of

avatars and self-representation, particularly their impact on embodied mindfulness. Finally, we address underlying tensions, implications, and opportunities of how HCI can better support meditation and, more broadly, community-driven group well-being activities.

5.1 Virtual others facilitate embodied mindfulness in a supportive social context

Aligning with literature on XR meditation, our findings highlight the role of natural, relaxing environments [41, 103] and virtual objects [110] in facilitating mindfulness and enriching participants' meditation experiences. However, what distinguishes social VR meditation from other technology-supported practices is the two key aspects: the integration of group dynamics into the meditation process and body-based experiences. In the following sections, we examine how virtual others and avatars shape the social and embodied meditation experience in social VR.

5.1.1 Impacts of virtual others: community, enhanced focus and compassion. The exploration of virtual others in VR-based meditation remains in its early stages, particularly regarding how their presence contributes to practice and in what form. Our findings confirm and extend prior research, showing that social VR fosters stronger connections, provides access to a supportive community, and makes participants feel safer and more comfortable being vulnerable. [36, 80, 84, 99]. While the ability of social VR to facilitate close and personal relationships has been observed in other contexts[36, 79, 84], this effect was particularly pronounced in social VR meditation. Participants emphasized the importance of feeling safe to be vulnerable, especially during inward-focused practices such as meditating with closed eyes or sharing personal experiences in group discussions.

Beyond these parallels with prior research, our findings reveal four distinct ways in which virtual others, particularly human avatars, uniquely influence an individual's social VR meditation experience and capacity.

Virtual others set a conducive environment for an intensified presence. One notable finding is that the presence of others, even with minimal interaction, can deepen an individual's meditation. Participants reported an "intensified" experience, citing improved focus, motivation, and a sense of shared energy absent in platforms like Zoom or live streams [37, 77]. Literature on intensified experiences in social VR is limited. One related study by Piitulainen et al. [99] found that dancing in social VR fostered intense enjoyment. Our study, however, highlights different mechanisms for meditation. The heightened experience stemmed from a profound sense of interconnectedness—an awareness of meditating alongside trusted others in a safe, conducive environment. This aligns with Lukoff et al.'s [82] "container" concept, which emphasizes a co-created environment with safety, relaxation, focus, and social support. Contrary to the findings of previous research on the co-presence of virtual agents [44] and non-embodied avatars [63], our findings suggest that interconnectedness depends on perceiving others as "real" through verbal and non-verbal communication in virtual spaces.

This interconnectedness also relates to the concept of "collective solitude [95]" in meditation, where self-awareness is balanced with an awareness of others' co-presence. While typically absent in tools like Zoom, participants in our study experienced this dynamic through avatars and body tracking. Observing others' physical struggles normalized their own, reinforcing the shared nature of challenges. This supports Wyatt and Harper's [125] findings on the value of shared struggles in group meditation, confirming this dynamic extends to virtual settings through body tracking and avatar use.

Virtual others deepens emotional connection. In compassion or loving-kindness meditation, where users experience greater empathy and gratitude, having a target imagining sending love and sharing enhances the emotional connection with others. This feeling was further enhanced by interactive elements like sending hearts or immersive features like a shared virtual journey. The combination of embodied others and interactive modalities provides unique opportunities for strengthening empathy and prosocial emotion in social VR compared to other technologies. Future research should explore whether embodied avatars evoke stronger empathetic responses than non-embodied avatars or virtual agents.

Virtual others as attention-orient anchors. Virtual others also enhance meditation stamina by acting as anchors for attention and focus. Observing others engaged in the same practice serves as a powerful reminder to remain focused and still. In addition, seeing other avatars struggle also helped normalize the challenges of meditation. This visibility helps reduce feelings of isolation or self-criticism and fosters persistence. Notably, the avatar of another participant serves as an "anchor" to redirect the wandering mind, thus practicing with others may improve their attention and focus over time.

Teachers as embodied guides. The teacher-student dynamics in social VR environments allow for personal and immediate teaching experiences. Although close connections between users

have been observed across various social VR activities [36, 76, 84], instructors who lead the session build relationships with attendees in four ways: creating a welcoming environment, embodying the teaching, providing real-time feedback, and facilitating discussions after practice sessions. In kinetic meditation particularly, instructors can physically approach participants in the 3D space, closely observe their movements, and offer personalized guidance based on their bodily feedback. This approach not only strengthens the teaching process but also strengthens the personal, close feeling with attendees.

Our contribution lies in demonstrating a naturally occurring proof of concept for mediated co-presence in VR-based meditation, filling a gap in the literature where meditation practices have traditionally focused on solitary or controlled environments. In addition, the findings of this study offer implications for HCI research and design, particularly for supporting group meditation in VR. The role of virtual others—enhancing meditation through emotional connection, attentional focus, and vulnerability-sharing—points to potential design strategies for integrating these social mechanisms. Effective design must consider nuanced embodied cues from avatars and the specific social norm bound in VR meditation space (such as quietness and stillness). Moreover, the demographics of our participants, including older adults who adopt social VR for meaningful social engagement and long-term well-being rather than novelty, suggest that the audience for social VR meditation extends beyond younger populations, such as those studied in Bagher [7]. Designing meditation content for these users may require more careful consideration of factors such as accessibility and safety support than for general social VR audiences or activities like gaming, entertainment, or dancing.

5.1.2 Recommendations for designing embodied mindfulness in VR.

Another key theme that emerged from our data is the interplay between the mind, body, and avatar, which is closely linked to the concept of embodiment. While our findings did not reveal a direct effect of avatars on mindfulness or other states, they suggest that embodying an avatar influences one's willingness to engage. Opportunities exist for social VR and VR-based meditation to design body-based practices, techniques, and skills. Khoury et al.'s [71] framework provides a structured approach to embodied mindfulness, comprising five successive skills focused on the bodily aspects of mindfulness. Using this framework, we discuss how HCI can design avatars, self-representation, and embodiment to cultivate these skills.

Our findings suggest that embodying an avatar allows users to feel more carefree and less self-conscious about their physical bodies, reconnecting them with their bodies and sensations. Moreover, the perception that "*the avatar body is not my body*" suggests that embodying a form distinct from one's own can help users detach from automatic, negative feelings. **Design for the detachment of automatic thoughts** could utilize the sense of embodiment to reduce effortless thought[71]and encourage reflection from new perspectives. Designers could explore the effects of embodying diverse forms, like non-humanoid avatars [96, 116].

Beyond simply occupying another body, incorporating movements aligned with users' physical actions and breathing can increase awareness of the body and its sensations. Participants noted

that even without full-body tracking, moving freely felt mindful. **Design for bodily awareness and body sensation** could build on this by directing attention to the body through virtual embodiment. Designers in this direction could explore various bodily excise and kinetic meditation like Tai Chi. Designers could explore bodily exercises and kinetic meditations like Tai Chi. Seeing one's avatar in a mirror or alongside others may further strengthen the connection to the body by reinforcing ownership and agency [72]. Everyday activities like walking could also create meaningful experiences that translate from VR to real life.

Design for the mind-body connection emphasizes the body's role in bridging the virtual and real worlds. Mindful eating, for instance, exemplifies how synchronizing physical and virtual experiences—like eating, tasting, and smelling—can create profound bodily awareness and meaningful experiences. During such practices, users regulate themselves, reinforcing the link between mind and body. This suggests VR meditation can support a range of everyday and tangible mindfulness practices through virtual embodiment.

Design for acceptance, the most challenging skill to foster, requires mastery of other skills first. Acceptance moves beyond avoidance strategies, such as believing "*the avatar body is not my body*"—a strategy that may benefit beginners but hinder deeper growth. Designing for acceptance intentionally introduces discomfort and interruptions. Experiences tailored to users' skill levels, supported by scaffolding, could aid novice meditators[82]. Additionally, inspired by disruptions in social VR, designers could also incorporate virtual others to allow users to practice mindfulness techniques in a safe, controlled environment.

5.2 Tensions and opportunities of using social VR for meditation

Social VR presents promising opportunities for meditation but also poses challenges that complicate its ability to fully support meditative practices. Our findings show that social VR facilitates embodied mindfulness, fosters positive group dynamics, and enables collaborative meditation environments. However, these benefits come with tensions related to technological limitations, social dynamics, and meditation-specific needs. Key challenges include balancing moderation with mindfulness acceptance, addressing self-representation, a healthier body relationship, and managing dependence on technology. These tensions reveal both the limitations and opportunities for social VR in meditation, calling for further reflection on how to improve support for mindfulness practices.

5.2.1 Managing disruptions: moderation vs. acceptance. Disruptions, including harassment, pose significant challenges in social VR meditation due to the platform's inherently playful and social nature[48]. While not unique to meditation, such disruptions are particularly impactful here, where quietness and focus are central to the practice. Even minor interruptions can destabilize group dynamics due to the heightened sensitivity of meditators [59]. Participants frequently reported trolls or younger users disrupting sessions, with research showing that harassment feels more intense in social VR due to the heightened sense of presence and embodiment [16, 48, 109]. Social VR's broad audience, including younger users, can further exacerbate the challenges in meditative environments [48].

Although the broader social VR ecosystem faces similar challenges, the social norm of meditation demands a heightened level of quietness and focus, making such disruptions more disruptive than they might be in other contexts. Some participants called for better moderation tools, especially moderators frustrated by limited options for muting or removing disruptive users. This aligns with broader calls in social VR research for stronger moderation controls [48]. However, others suggested focusing on community norms and guidance rather than strict moderation. P7, for example, emphasized that disruptions often arise from a lack of understanding of social norms in meditation spaces, advocating for cultivating shared norms and fostering respect through community involvement. Research supports this, noting that many disruptive behaviors in social VR are unintentional and can be addressed through clearer guidance [16, 48]. Experienced meditators viewed disruptions in social VR as opportunities for meditators to practice accepting by integrating challenges into their practice. This echoes literature suggesting technology should promote acceptance over control [103, 117], and support a deconstructive path [33] to elicit self-inquiry and insights [82]. However, implementing this approach effectively may require nuanced community mechanisms to guide newcomers [48]. A balanced strategy blending moderation tools with community-driven governance could offer flexibility, supporting stricter controls and guidance for newcomers while fostering resilience and mindfulness for seasoned practitioners.

The tension between moderation and acceptance carries significant implications for HCI design in social VR meditation. While stronger moderation tools are necessary to maintain a focused, peaceful environment, especially for novice meditators, social VR must also uphold mindfulness principles. Facilitating meditation-specific social norms is equally crucial. Future research should explore how to balance prosocial behavior, control, and acceptance, creating tools that honor meditation norms and promote inclusivity in social VR environments.

5.2.2 Acceptance for a healthier body relationship. While avatars that deviate from one's real-life appearance can boost confidence and reduce self-consciousness, these benefits come with trade-offs. As discussed earlier, the limited body type options and societal ideals represented by avatars, such as the "thin" body type, raise important questions about how self-representation can either enhance or hinder the cultivation of body acceptance during meditation. Therefore, there exists a tension between encouraging social participation and supporting the development of body acceptance. As Khoury et al. [71] suggest, acceptance builds upon foundational practices like connecting with bodily sensations. Since acceptance is one of the most difficult mindfulness skills to cultivate, understanding this sequential development can help researchers and designers balance promoting social interaction with supporting deeper mindfulness skills. Previous research has explored how technology supports acceptance and other aspects of embodied mindfulness [103], however, how social VR achieves this balance remains largely unknown.

The negative effects of avatars in social VR are an emerging concern. Freeman and Maloney [47] found that avatar aesthetics influence social interactions: visually attractive avatars are associated with more positive perceptions and increased social behavior,

while less attractive avatars have the opposite effect. Additionally, age presentation can influence the willingness to interact [47]. Piitulainen et al. [99] preliminarily discuss users' concerns about body image in social VR, particularly for children. Our study extends this research by examining the negative effects of "visually idealized" or societal norm-conforming avatars in meditation. In such settings, socially idealized avatars can hinder the cultivation of acceptance, especially during embodied practices like mindful eating or dancing, where building a positive and mindful connection with one's physical body is essential.

Our findings suggest broader implications for social VR. The tension between promoting social behavior and supporting well-being reflects a larger challenge for social VR platforms: how to balance the creation of visually appealing and engaging avatars with the need for inclusivity and emotional well-being. For social VR design, our findings point to the importance of offering diverse, customizable avatar options that allow users to engage in meaningful self-representation and activities.

5.2.3 Dependence on social VR. While social VR has been embraced by many as a convenient platform for meditation, our findings reveal tensions around technological dependence and its integration with everyday mindfulness. Many participants used the platform regularly for meditation, raising concerns about over-reliance, particularly among novice meditators. Supporting and extending previous studies [79, 87], these findings warn of the potential difficulty in transferring mindfulness skills from structured, technology-assisted sessions to informal, everyday practices. Two participants exclusively meditated in social VR, potentially limiting their ability to practice mindfulness outside this structured environment, showing a particular risk for novice meditators [82, 87]. Our data provides limited evidence that social VR helped users cultivate mindfulness in everyday life. Instead, participants appeared to rely on visual stimuli to induce a meditative state and on the sense of embodiment to establish a mind-body connection, raising questions about the long-term implications of such reliance on technology.

Although some community practices, such as mindful eating groups, have aimed to bridge the gap between VR and real-life mindfulness, social VR still lacks built-in features to support this transition. The responsibility largely falls on instructors and community members to guide users in transferring these skills to real-life contexts. Moreover, social VR platforms may inadvertently encourage avoidance behaviors, as users may come to rely on VR to support their social and emotional well-being, potentially at the expense of engaging with the physical world. As noted by Deighan et al.[36] and Piitulainen et al. [99], this escapism can negatively impact mental and physical well-being.

These findings highlight important considerations for HCI design and the broader role of social VR in supporting mindfulness. Lukoff et al. [82] advocate for designs that reduce users' dependency on technology over time by gradually removing scaffolding and transferring mindfulness skills into everyday life. Similarly, Li et al. [75] suggest using everyday tangible objects to facilitate mindfulness. Designers have an opportunity to incorporate features that promote healthy disengagement from the platform, such as encouraging reflection or offering suggestions for continuing mindfulness practices outside VR. Such features would bridge the gap

between technology-assisted meditation and real-world mindfulness, aligning with broader calls for technology designs that foster mindful disengagement rather than dependency [117].

6 LIMITATIONS AND FUTURE WORK

This study serves as a first step toward understanding the potential and challenges of using social VR for group meditation. Below, we discuss the study's limitations and outline directions for future research.

The first limitation concerns our participant sample. While this study focuses on active social VR meditation users, it does not include groups with more diverse experiences, such as novice meditators, new users, those who discontinued its use, or meditation experts without VR experience. Including these groups in future research could provide a more comprehensive understanding of how social VR supports meditation and social connection across different levels of expertise. For instance, novice meditators may face challenges in adopting social VR as an entry point to traditional practices like mindfulness and bodily awareness, raising questions such as: Can social VR effectively convey these practices and values, and how does it compare to platforms like Zoom? Experienced meditators, on the other hand, might view VR as supplementary or unnecessary, reflecting reluctance toward high-reliance technologies noted in previous studies [3, 4, 79, 107]. New users could reveal insights into adapting to virtual spaces, including comfort with avatars, voice chat, and social norms, as well as navigating the learning curve and their tolerance for initial discomfort. Additionally, studying users who discontinue social VR meditation could highlight barriers such as usability issues, misalignment with practice values, or technological constraints, revealing where current tools fail to meet practitioners' needs [28, 38]. Finally, perspectives from psychologists prescribing therapies like Mindfulness-Based Cognitive Therapy (MBCT) or Mindfulness-Based Stress Reduction (MBSR) could uncover the therapeutic potential of social VR for group-based therapy, broadening its applications beyond meditation communities.

The demographics of our participants, primarily older adults seeking meaningful social engagement and well-being rather than novelty, reflect the current social VR meditation community. Their needs—such as combating loneliness and reconnecting with a community—highlight the unique role of social VR in addressing isolation. However, this focus limits our understanding of younger audiences, who often view social VR as a platform for gaming, socializing, or creative expression. Younger users might see social VR meditation as a novelty rather than a sustained practice; or, alternatively, embrace it when content creative integrates with activities they already enjoy. Future research should explore younger users' motivations, favored practices, and perceptions of social VR to inform strategies for sustained engagement, cross-generational appeal, and interest-driven activities.

The second limitation concerns recruitment. Our snowball sampling method drew participants primarily from an interconnected VR meditation community. This approach reflected the small and emerging nature of these communities at the time, where overlapping memberships and shared practices constrained the diversity of perspectives. Since then, social VR meditation has expanded

with platforms like VRChat hosting new and diverse communities. These emerging groups exhibit varied atmospheres and practices, including traditional Buddhist meditation in temple-like settings with cross-legged avatars, dance-based activities such as mindful dancing in mirror-equipped studios, and wellness-focused groups offering gym-like live sessions. Exploring these evolving communities could reveal how different virtual atmospheres, levels of embodiment, and group structures shape meditation experiences and inform designs that cater to diverse user needs and preferences.

Third, our findings are mostly based on interviews and informal observations from a limited number of public VR meditation sessions. This approach may miss the broader range of meditation practices, group dynamics, and long-term effects of social VR on well-being. Future studies should incorporate quantitative measures and ethnographic research across different meditation settings to gain a more comprehensive understanding.

Lastly, the study reflects the state of technology as of April to January 2024. As social VR technology evolves, user practices and perspectives may change. Additionally, varying levels of platform support add complexity. Future research should explore how advances like full-body tracking and platform-specific features influence social VR meditation practices and user experiences.

7 Conclusion

Our interviews with VR meditators provide insights into various aspects of group meditation activities in social VR. Participants described leveraging world-building tools to create community-driven meditation spaces, managing session flow through different phases of live sessions, utilizing avatars and body-tracking for embodied meditation, and experimenting with novel forms of technology-mediated meditation. The study highlights the perceived benefits of using VR for group meditation, including enhanced meditation experiences and increased meditation capacity through group dynamics. However, several challenges were identified: disruptions from trolls and newcomers, self-representation issues that hindered practice, and technical limitations related to avatars and full-body tracking. Social VR shows promise in directing bodily awareness and enhancing body-mind connection, however, its design, such as avatar representation and platform-level social norm, tends to promote avoidance rather than fostering acceptance and a positive relationship with the body. These tensions highlight design opportunities to bridge the gap between social VR as a platform for social and gaming events and social VR meditation as a structured activity, guided by specific social norms within the meditation space, and centered around well-being.

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