Drifting Off in Paradise: Why People Sleep in Virtual Reality

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ABSTRACT

Sleep is important for humans, and past research has considered methods of improving sleep through technologies such as virtual reality (VR). However, there has been limited research on how such VR technology may affect the experiential and practical aspects of sleep, especially outside of a clinical lab setting. We consider this research gap through the lens of individuals that voluntarily engage in the practice of sleeping in VR. Semi-structured interviews with 14 participants that have slept in VR reveal insights regarding the motivations, actions, and experiential factors that uniquely define this practice. We find that participant motives can be largely categorized through either the experiential or social affordances of VR. We tie these motives into findings regarding the unique customs of sleeping in VR, involving set-up both within the physical and virtual space. Finally, we identify current and future challenges for sleeping in VR, and propose prospective design directions.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**.

KEYWORDS

sleep, social VR, VRChat

1 INTRODUCTION

Sleep is a universal human behaviour. Getting a good night's sleep is imperative for humans - aspects of sleep duration and sleep quality are correlated to physical and mental wellbeing [47, 53, 54, 62] and can influence behavioural aspects such as learning and memory [6]. However, sleep-related risks, caused from lowered sleep duration and poor sleep quality, are becoming increasingly widespread among modern society [4, 22]. This motivates the importance of developing regulation and understanding the patterns and experience of human sleep, spawning of a wealth of studies regarding 1) extending present understanding on the mechanisms of sleep and

2) developing technological tools to support sleep. For example, a number of sleep trackers, mobile applications, and wearables have emerged in both research and market to address the "crisis of sleep" [3, 57, 66]. In this study, we focus on one modern technology in particular that is undergoing an exploratory phase as a clinical solution towards aiding sleep - virtual reality [35, 55].

Virtual reality (VR) as a technology has extended the ways in which humans can immerse themselves in virtual worlds in unparalleled new manners. VR allows for feelings of presence and interactivity that allow users to immerse themselves in virtual worlds [50, 51]; worlds that can both recreate and enhance aspects of the physical world [75]. These unique characteristics of virtual reality have inspired its application to several different fields, including entertainment, education, and health [27, 60, 64]. However, virtual reality need not be limited to a single-user experience - one aspect of virtual reality that has drawn significant study is the novel social interactions that occur and the communities that form within multi-person worlds [38]. Such systems, coined as "social VR", represent increasingly popular, complex, and meaningful online spaces where users can interact with each other through their head-mounted displays in real-time while being spatially independent, potentially half the world apart [40].

Combining modern VR technology with sleep has been done in past clinical experiments in order to address aspects of sleep quality [35], but what of the other experiential factors regarding sleeping in VR? In particular, how do the affordances of VR create opportunities that may induce the voluntary practice of sleeping in VR? In this study, we explore this question through considering the individuals who sleep in VR as part of their regular lives, rather than for any specific clinical experiment. This emergent practice ties in a rather small and niche community; however, it is an important community to study to better understand the experiential effects and culture revolving around sleeping in VR. The scarcity of past research in this area is evident as well - only one major past research work has ever considered this community; however, their work had been contextualized around a broader study around social VR [38].

In this study, we aim to perform a deeper exploration into the motivations and experience behind the practice of sleeping in VR. To do so, we performed semi-structured interviews with 14 participants who indicated that they had experience with sleeping in VR. During the interviews, we considered why people sleep in VR, and what does sleeping in VR offer them that sleeping outside of VR does not. We additionally ask participants to identify areas of challenge in regards to the present experience, and ask them to ponder upon the future of the practice in such a rapidly shifting VR landscape. We find that most motivations relate to gratifications regarding sociality - of wanting to fall asleep with friends, or aspects of the environment - of wanting to sleep in a virtual world of their

choosing. We find that these motivations respectively tie into desires regarding intimacy and desires regarding escape. In addition, we find that many of the challenges of the present experience relate to limitations of the VR hardware in general - with the bulk of the headset being the most common complaint in regards to sleeping.

Ultimately, our main contribution in this study is in developing an empirical understanding of the rationale that people have for sleeping in VR and the experiential factors of the practice. Our main research questions ask 1) "Why may people choose to sleep in VR?", and 2) "How do people sleep in VR?". Many of the respondents intertwine their motivations with the social affordance of VR, and thus, we also make findings that impact the current literature regarding community and social interactions within VR settings.

2 RELATED WORKS

In order to contextualize this study, we first consider past research regarding sleep as a whole, as well as the ways in which technology has increasingly been used to develop tools in order to enhance the sleep experience. We also consider the recent use of virtual reality as a sleep aid. We then consider virtual reality from a more general level, understanding the benefits it affords and the motivations that people have for using it, as well as some of its present challenges. Finally, we explore a specific facet of virtual reality - social VR. We explore past work into user experience and the social interactions within the online VR community, tying into the past research work on social sleeping in VR.

2.1 Sleep and Technology

Sleep, being an important human behaviour that correlates strongly with physical and mental wellbeing, has no shortage of health and technology related literature that centres around it [25, 34]. State-of-the-art accuracy for sleep tracking, e.g. using polysomnography (PSG) can be obtrusive and difficult to perform within regular settings [44]. As such, various, more-lightweight tools have been developed with the goals of either monitoring sleep patterns. For example, Nochino et. al. developed a camera-based system for sleep stage (i.e. wake, light, deep, REM) estimation focussed on the movement of the body extracted from a web camera [52]. To summarize such applications, Matar et. al. developed a review of research literature regarding sleep tracking using less intrusive assessments, primarily focussing on cardiac, breathing, and movement activities [44]. Similarly, Scott et. al. conducted a systematic review of the various existing devices for measuring sleep onset, an important period of the sleep cycle for behaviour treatments [70]. These are just a few examples of the wealth of prior review-based research into this area [13, 16, 32]. Extending onto this abundance of research development, several sleep tracking tools have been made commercially available as well, such as through consumer wearable devices like Fitbits [36].

Building upon the ideas of monitoring and tracking sleep, technological tools have been developed with the goal of improving sleep as well. Kalaiselvan et. al. developed a mobile application that blends a virtual pet with sleep tracking, using a virtual pet as a medium for regulating sleep [28]. Low et. al. considered the role of mindfulness-based therapy as an alleviation for insomnia, using Headspace, a mindfulness smartphone application, in order to improve sleep [37]. Chen et. al. proposed a dynamic sleep lighting fixture that adjusts the emission of mobile devices in order to improve sleep quality [11]. In regards to hardware developments, devices such as noise-masking earbuds [19], snore aids [46], and eye-masks [1] have also been investigated in regards to their effects on sleep. Environmental fixtures, such as artificial lighting [12], bedtime music [26], and white noise [63] have also been explored as possible sleep interventions.

The use of virtual reality is a much more recent advancement in sleep technology. Such systems involve both a hardware component and a software application to create immersive virtual experiences to possibly facilitate sleep. De Zambotti et. al. were early to propose the use of this technology to facilitate sleep [15]. Lee and Kang expanded on this through experimentation with the use of virtual reality meditation in addressing sleep quality of intensive care unit patients, finding a self-reported higher sleep quality for the experimental group [35]. Pai et. al. developed NapWell, a sleep assistant that uses VR to decrease sleep onset by providing a realistic virtual environment prior to sleep [55]. Despite such studies, there has been much less done on the experiential effect of sleeping in VR - what is sleeping in VR like? In this study, we draw insights from people who voluntarily choose this method of sleeping outside of clinical environments, focussing on the motivations and experiences of this overlooked community.

2.2 The Affordances of Virtual Reality

Virtual reality provides the opportunity for users to be transported to and explore virtual worlds in ways that they could not in the real world. Two defining features of virtual worlds in general are embodiment - feeling connected to the virtual avatar in the world, and presence - feeling as though they exist within the virtual setting [29, 69]. Much research has been conducted on these affordances and their application within virtual reality [2, 49, 68], and researchers have used these qualities to apply virtual reality towards pain relief [43], therapeutic systems [77], or entertainment mediums [56]. These concepts are often further tied with the aspects of immersion, based on the sensory fidelity that the system provides [7]. Overall, Slater states that this forms the "real power" of virtual reality - the provision of an illusory setting which influences the user's response and perception derived from a belief of being present [73].

These specific features and affordances of VR have seen it implemented for a wide range of applications. For example, Guttentag considered the use of VR for tourism, expanding upon the physical immersion and presence that the technology affords [24]. Slater considered the use of immersive VR for implicit learning [72], and Yao and Kim considered it in the use of a cycling exergame [78]. Despite the many studies which investigate how VR can enhance present experiences, there has been a scarcity focusing on the experience of sleeping - it is not well understood how such affordances of VR may affect sleeping in VR. This study addresses this gap by looking into how specific features of VR relating to presence, immersion, and embodiment (tying into its ability to immerse users in new environments) may impact user desire and experience when sleeping in such systems.

2.3 Social VR

Social VR refers to the large-scale VR platform and environments that support the online gathering of people - multi-user virtual worlds that allow people to interact freely while being physically apart through the medium of head-mounted displays (HMDs) [45, 58]. Social VR is a relatively recent phenomenon, but has elicited a plethora of research into the area. Social VR can serve as a comparable simulacrum of real-life interaction, with past research indicating transferability in terms of social connectedness [14] as well as affective states and group dynamics [48]. Freeman and Maloney found that social VR have motivators relate to identity and self-presentation, as it allows users to experience themselves in novel manners, tying deeply into discussions on self-representation and body ownership [23]. Latoschik et. al. found that the existence of other avatars in a world can furthermore stimulate presence and interest [33].

Despite its comparable traits towards real-life interaction, social VR also has unique idiosyncrasies that differ from traditional human interactions. For example, aspects of communication have been deeply studied by both Maloney et. al. [41] and Tanenbaum et. al [76]. The affordances and limitations of present VR technology, tied with the unique embodiment aspect of VR, creates a unique set of non-verbal communication tools and gestural interactions. Aspects of privacy and information sharing have also been studied in regards to social VR, with some people cherishing the anonymity that such systems provide them, while others are more open to sharing details about their personal lives [42]. Social VR is not without its challenges as well, including issues regarding virtual harassment (e.g. unsolicited touching and grabbing) [5] and undesirable tensions between different user bases, such as children and adults [39]. Past research has considered specific examples of activities that people do in social VR such as dancing, learning, and sleeping [38, 59]. As the foundation for this study, the work of Maloney et. al. in particular highlights the motivation and experience of engaging in virtual activities in social VR settings, including the desire for immersive social-connectedness and companionship [38]. One activity that the researchers highlighted was that of sleeping in VR, which participants indicated transformed a regular, mundane activity into a novel social experience. In this study, we largely expand on Maloney et. al.'s initial findings regarding sleeping in social VR, by highlighting the complex social dynamics that motivate the practice, the routine and experience of its practitioners, and its present limitations and shortcomings. Ultimately, we consider how an activity oft regarded as a private, personal exercise may extend towards being something people can share and experience in a socially-connected setting.

3 METHODS

We conducted semi-structured interviews with participants that reported that they had previously slept in VR. As this practice was initially rather foreign to the researchers, an initial set of questions was drafted out that focussed on the basic set of motivations, practices, and challenges; however, questions constantly evolved as we learned more about each participant and the activity as a whole. The overarching goal of the interviews were to develop deeper insights into the research questions - mainly aiming to understand why and how people sleep in VR, as well as highlight ways in which it could be improved. This qualitative study was approved by the institute's research ethics board.

3.1 Participant Recruitment

In this study, we aimed to recruit participants that had voluntary experience with sleeping in VR (that were additionally age 18 or older). Initial participants were recruited from a mix of personal recruitment (a single connection of the researcher that was an active participant in the practice) and online recruitment through Reddit and online posting boards. In particular, a call for participation was posted on the researchers' institute's paid study posting board, as well as VR-related subreddits upon moderator approval (/r/vrchat, /r/oculus, and /r/virtualreality). To further disseminate the study, snowball sampling was used. During recruitment, participants were asked to fill out an initial screening questionnaire asking about the frequency and duration of their general VR experience, as well as their experience with sleeping in VR. Participants were additionally screened, either through additional screening questions or through email conversation, to validate the legitimacy of their intentions. Post hoc screening of participants was also performed through matching interview responses to the screening questionnaire. In the end, 3 participants' data was unused post hoc because their reported experience was less than what had been stated on the questionnaire and the inclusion criteria.

In the end, we completed with a sample of 14 participant interviews, ending recruitment when we found that the information gain from additional interviews was increasingly minimal. This sample of participants allowed us to reach saturation in terms of information gain - i.e. data saturation [67]. Our participant sample represented a diverse range of practices involving sleeping in VR - from those who sleep in VR nearly every day to those who do it as a more infrequent activity. The age of the participants ranged from 18 to 30, with a mean age of 23. 8 of the participants were reported as male, 2 as female, 1 as non-binary, 1 self-reported as genderfluid (born male) and 2 preferred not to report. A more detailed representation of the participants can be found in Table 1, including their intentional frequency of sleeping. In terms of the software used for sleeping in VR, the majority of the participants indicated that VRChat was the platform of choice that they used while sleeping.

3.2 Interview Protocol

Semi-structured interviews were conducted with the final pool of 14 participants over remote video or voice calls. Prior to the study, participants were asked to review and sign a study consent form outlining data collection and usage; audio recording was collected when consent was provided. The interview questions revolved around the participant's history and past involvements with sleeping in VR, their motivations for engaging in the practice, the ways they prepare for sleep (both in real-life and within VR), and their overall sleep experience. Participants were asked to compare sleeping in VR to sleeping outside of VR, indicating areas in which one was preferred over the other. Participants were also asked about the challenges of sleeping in VR, possible improvements they might suggest to enhance the experience, and what they thought about the future of the practice. Some sample examples of questions that

Table 1: Summary of Interview Participants

Participant ID	Age	Gender	Experience (Using VR)	Frequency (Using VR)	Experience (Sleeping in VR)	Frequency (Sleeping in VR)
P1	20	Male	6-12 months	5+ times a week	4-6 months	3-4 times a week
P2	20	Non-binary	1-2 years	5+ times a week	4-6 months	3-4 times a week
P3	28	Prefer not to report	2+ years	1-2 times a week	Under a month	Less than once a week
P4	21	Male	2+ years	3-4 times a week	Under a month	Less than once a week
P5	25	Prefer not to report	1-2 years	5+ times a week	1-2 years	3-4 times a week
P6	21	Male	2+ years	5+ times a week	1-2 years	3-4 times a week
P7	22	Gender-fluid (Born Male)	2+ years	5+ times a week	2+ years	5+ times a week
P8	18	Male	6-12 months	5+ times a week	1-3 months	Less than once a week
P9	24	Male	2+ years	5+ times a week	2+ years	5+ times a week
P10	21	Male	2+ years	5+ times a week	1-2 years	Less than once a week
P11	24	Female	2+ years	5+ times a week	2+ years	1-2 times a week
P12	23	Male	2+ years	3-4 times a week	1-2 years	1-2 times a week
P13	30	Male	2+ years	3-4 times a week	1-2 years	1-2 times a week
P14	25	Female	2+ years	5+ times a week	2+ years	3-4 times a week

were asked were "What does the experience of sleeping in VR provide that regular sleep does not?" (and vice-versa) and "How do you get prepared in real-life to sleep in VR?"; a more detailed interview protocol can be found in the work's supplemental material. As sleeping in VR was a practice that the researchers did not have much experience in, initial exploratory questions were more open-ended questions, but through repeated interviews and the gathering of information, the interviews became increasingly refined and more specific, detailed, and targeted questions were able to be asked. The knowledge and analysis derived from each individual interview was thus used to expand the range of and inform possible follow-up questions for subsequent interviews. Interviews lasted on average approximately 40 minutes, and participants were compensated $10 CAD for their time (1 participant refused payment, indicating they

had been participating out of interest). After the interviews, the primary researcher transcribed the recordings into text in preparation for data analysis.

3.3 Data Analysis

The cleaned textual data was qualitatively analyzed through inductive thematic analysis [8]. With minimal prior background knowledge into the area, we avoided making assumptions about the shape of the data. The primary researcher first re-read the interview transcripts, reflecting upon and familiarizing themselves with the data. From this, research codes were then developed and used to codify the transcription data. These codes represented the base content of the spoken data, examples being "escapism", "intimacy", "brightness", etc. Codes were then grouped and clustered into a hierarchical

system of categories, which then evolved into the specific themes that motivate our subsequent findings.

4 FINDINGS

4.1 Motivations for Sleeping in VR

To preface this section, we first start by mentioning that not every instance of sleeping in VR mentioned is necessarily fully intentional. Users described a number of times in which they may accidentally fall asleep, simply due to tiredness or exhaustion. For example, *"sometimes you're just chatting with your friends, and you just accidentally fall asleep"* (P2) and *"I started just doing it out of nowhere. I would be in VR for hours, and I would just get tired and fall asleep right there"* (P11). In these cases, sleep is an unintended consequence of simply using VR for extended periods of time.

Between unintentionally falling asleep and having full intention to fall asleep in VR, there exists a level of purposefulness that exists somewhere in-between, which P4 describes as the "quasi-intentional" factors for sleeping in VR, i.e. *"the sort of the quasi-intentional of like, it's the weekend and then just getting on VR and then like drinking a bit until I pass out"*. In this case, sleeping in VR is something that the participant is aware of that may happen as a result of their actions, but not something that they necessarily want to do anything about. As another example, P10 describes that sometimes they make the conscious decision to not exit VR because they are already tired and in a relaxed position - e.g. *"If I decide I want to fall asleep in VR usually it'll be because I know I already feel a bit tired, I don't feel like getting up, or I'm with friends and they're already relaxing. And I figured I might as well just stay there and just sleep"* (P10). In this case, P10 makes the conscious decision to stay in VR despite being tired, knowing that this may lead to them sleeping with the headset on.

Despite the fact that sleeping may sometimes be a consequence rather than the main goal, there still exists an opportunity cost - people can easily take their headsets off and exit VR before they go to sleep. Thus, this leads us to investigate the intentional factors that envelop sleeping in VR in the next sections - the advantages of VR that make people want to stay in their headsets while nodding off. We find that, for all our participants, intentional motivators for sleeping in VR were almost perfectly divided into two categories. These categories are experiential factors - relating to the aspect of being in a new, often relaxing environment, and social factors - relating to being in an environment with the presence of people. Some participants were only motivated by one or the other, whereas others were motivated by a mix of both.

4.1.1 Experiential Factors. The first subset of motivators in regards to sleeping in VR relate to the affordance of the technology in providing an immersive, novel environment, e.g. *"I just felt like I'm in another environment"* (P12). Participants expressed contentment in regards to having the ability to sleep in places that differ from their typical space, e.g. *"The biggest motivation for me is the new environments, being able to sleep in different environments every other day"* (P1) and *"it really matters to me where I sleep, and VRChat literally opened up endless possibilities of where you could go to sleep and where you could wake up"* (P6). P2 contrasts the possible visuals in VR - *"you can see the sky, you can see the stars up there"* against

the typical, more boring views outside of VR - *"normally you just see your ceiling or your walls"*. The ability for users to sleep in different environments provided them with feelings of relaxation and peace, e.g. *"[I] try to get a place that would make me feel relaxed"* (P1). Past research has suggested that the presence afforded by VR further strengthens the elicitations of such emotional reactions [18], which could further extend upon the feelings and emotions felt by the participants. The favoured worlds by participants varied from person-to-person, ranging from outer space to a skyscraper on a rainy day; however, many preferred worlds that generally felt more *"cozy"* and *"peaceful"*.

The immersive ability for virtual reality to transport its users into a different world also offers a form of escape, as indicated by several participants. The concept of **escapism** from the real-world can manifests as escape from physical factors, e.g. isolating oneself from noisy physical environments - *"you can't see anything, you can't hear anything outside of this world, which is nice if you live in a busy, noisy, bright environment like say, a major metropolitan area"* (P3), adding that with VR, they can instantly be transported to *"rural Japan with your own private lake and some beer that magically appears"* (P3). The concept of escapism is also demonstrated from a more mental viewpoint, such as isolating from reality or society - *"If say, your living situation isn't ideal. If you just don't want to deal with something. If you just don't want to be where you are. And not everyone can afford a plane ticket"* (P3) or isolating from one's own thoughts - *"The reason I sleep in VR sometimes is sometimes I'm laying in my bed and my brain is still too active and I'm thinking about situations - I'm overthinking ... I cannot overthink in VRChat, even when I'm lying alone"* (P8). Thus, sleeping in VR allows users to address some sort of discontentment that they may have with present reality, an idea that has previously been suggested in relation to general VR usage [71] as well as broader virtual environments as a whole [10].

Overall, these environmental facets have led a number of participants to imply that VR can sometimes aid in helping with falling asleep, e.g. *"I'm just going to sleep but for the first five hours I just could not sleep, it was weird. But just said f*** it, just put my VR on like, oh well, this is nice."* (P7). A few participants stated that they had known personally people who had treated their insomnia with VR, e.g. *"I have some friends that will sleep in VR but they have insomnia so they'll just go to a peaceful world and fall asleep"* (P5) and *"people treated their insomnia with VRchat, and it worked ... I've known people for multiple years that I very much believe"* (P6). The frequency of such similar claims lent some anecdotal credence to it, and some research has begun to explore this area [15]; however, this still requires much more further clinical research.

4.1.2 Social Factors. The other main subset of motivators for sleeping in VR revolved around the social aspect of the practice. Almost all of the participants indicated that they typically used a social VR application when going to sleep in VR, with the most frequently cited being VRChat. Sleeping is not frequently considered a social activity, but many participants indicated that sleeping in social VR settings allows for it to gain the qualities of one. For instance, several participants indicated that sleeping in VR made them feel as though they had company while sleeping, and that was their primary motivation for engaging in the practice - e.g. *"It's like, it*

feels like you're not alone in a way, because it kind of, there's this immersive feeling that somebody is with you or there are people around you" (P11), *"There's that feeling that I'm just not alone."* (P6), and *"my purpose of sleeping in VR is to be with someone"* (P5). Several participants made comparisons between sleeping in VR and sleepovers - the ability to stay over, talk late, and fall asleep with others was described as comforting (P11) and relaxing (P1). The company that people kept while sleeping could be strangers (e.g. by sleeping in public sleeping worlds), but was more commonly friends that the participants had met in VRChat before.

This ability to sleep with others was discussed in detail during the interviews, especially in relation to the bonds that sleeping may incur. For example, P11 described how having a friend around while they sleep can feel very comforting - *"It can feel really good to have them as company while you sleep. And despite the fact that you know that you and that person are probably really far away, I don't know, it just feels like you know they're right next to you. That's very comforting."* (P11). From an even more deeper perspective, P4 discusses how sleep can relate to aspects of *"intimacy"* - stating that people within their friend group can sleep together in VR because *"they're fairly intimate"*. P7 states that *"People want intimacy from it… They certainly crave that but no one's going out right say it typically"*. This aspect of intimacy further extends towards gestural communication and presence with other avatars, for example, cuddling while sleeping was a common theme across several participants. P5 discusses how such gestures entice their feelings of phantom touch, and that they can feel where other avatars may touch them - e.g. *"I can get tingling sensations where I kind of feel the [touch] ... It's very fulfilling and it feels really nice to me."*

The deeper intimacy provided in social VR settings was discussed in detail by several participants, and when comparing to real-life, P6 stated that similar practices might feel strange - *"if it would be in real life and the random friend asked me like a can we cuddle and fall asleep next to each other, it would feel weird, but [in VRChat] it just doesn't"*. This relates to several statements made regarding how VRChat has a different set of customs compared to real-life, e.g. *"VRChat has a lot of social norms that are quite different from regular real life just in general. The social norms there just feel kind of more intimate, I guess, like physical contact feels like a more sort of accepted thing over there"* (P10). Our findings regarding feelings of intimacy and presence support prior studies on social VR, which drew similar outcomes [38]. Overall, the practice of sleeping in social VR transforms this oft private activity into a social one, as it is able to take on qualities of social experiences that are afforded through social virtual reality.

4.2 Practices and Experiences of Sleeping in VR

4.2.1 Setting-Up for Sleep - Getting Comfortable in the Real World and the Virtual World. As one may imagine, it may sometimes be difficult to adjust to sleep with a headset on one's face, as well as cables connecting to the computer. Many participants indicated several accommodating actions they might take to improve the experience for themselves in this regard; usually having certain setups that differ from their regular way of sleeping. For example, P5 described a fairly specialized setup, in which they have specific headphones, pillows, and mattresses that help with supporting

sleeping - *"If you position your pillow correctly then you have a nice fluffy pillow… I use an air mattress because my VR space is beside my computer"*, etc. On the other hand, more simplified described setups involved simply sleeping on a chair, e.g. *"I'll usually bring my office chair over to where I usually play, like sit down … in general it's easier for me to just sort of lean back and just close my eyes and fall asleep. It just sort of felt like I don't know natural I guess"* (P10). In general, participants indicated that the physical space in regards to sleeping in VR could require a dedicated form of setup.

One main issue with setup for sleeping in VR was the use of laser-based full-body tracking. Laser-based tracking was a challenge as it performs poorly under occlusion, which often arises during sleep in the form of blankets. As such, some people did not use tracking for sleeping (e.g. *"I don't use the full body tracking with sleeping, because the way I used the tracker on the hip I could only lie on one side … that's just uncomfortable so normally even if I'm dead tired I turn them off and take them off before I go to sleep."* (P9), some people slept without blankets (e.g. *"I wouldn't be able to really put blankets on or anything because it would stop my trackers from tracking."* (P11)), and one participant indicated a solution that involved placing holes in their blankets to maintain tracking.

In addition to the physical hardware adjustments, participants indicated a number of steps that would typically be done within the VR software as well in order to set-up in preparation for sleep (as P8 states, *"it's like a checklist"*). Firstly, participants would look for a specific world to sleep in. Sometimes these worlds would be where their friends were already, and sometimes these would be public sleep worlds (worlds in which strangers congregate with the purpose of sleeping in a social manner). The social aspects of sleeping are discussed in the following section, but participants indicated that, from an environmental standpoint, they had subjective preferences for specific worlds over others. For example, P5 indicated a preference for "rain-based worlds", and P6 expressed a bias towards outer-space type worlds (*"space, everything that has like this space-kind of look"*). In general, P4 mentions that *"if you look at the design of worlds made for sleeping, they always have the ability to turn down the lighting, way down or have very sort of soft lighting and usually have ambient music or soft rain type noises"*, indicating that most of them have are very "comfy" environments to hang out in.

Once settled in a world and prepared for sleep, several participants emphasized the importance of having their avatar to mimic their pose - putting their avatar in the correct position to sleep as well. For example, P8 mentions that *"When I fall asleep I look at my avatar. So if I'm laying down in a weird position or a position that I'm not laying in … It just feels weird, like I'm not connected. Like I just feel separated from VR, it breaks immersion"*. In a less extreme example, P9 mentions that *"The only thing I do is activate the emote so the eyes are closed"*. As such, preparing their avatar for sleep and indicating to both the user themselves as well as others is another aspect that falls under the checklist of preparing to sleep in VR.

Typically, while sleeping in VR, the headset was indicated to be left on (i.e. on whatever world the participant fell asleep in, in the case of VRChat). VR in its current form typically can stimulate vision and hearing - to set up these senses for sleeping, participants mentioned that they typically must dim the brightness as well as lower the volume before they are prepared to sleep.

4.2.2 The Virtual World - Social Interactions and Experiences in VR Before, During, and After Sleep. Many participants indicated that social interactions and experiences play a major role in sleeping in VR - prior to, during, and even after sleeping. Sleeping in VR was mentioned by many to be a social activity - something they can share and partake in with other users. Relating back to the motivation for sleeping and the desire for intimacy, the manner in which this manifests is through both forms of communication (both verbal and nonverbal), as well as emotions and relationships formed through sleeping alongside others. In many cases these "others" were typically friends that the participants were familiar with, but could sometimes be strangers e.g. in public sleep worlds.

Communication, especially in nonverbal and gestural forms, plays a large part in social VR as a whole [41] - we find that this holds when discussing sleeping in VR as well. In regards to sleeping, several participants indicated that the intimacy of sleeping could manifest in virtual physical contact, e.g. *"there's always those little gestures comforting each other, giving a hug, giving head pets"* (P6). In particular, the act of "cuddling" was brought up often as an act preceding and during sleep, e.g. *"I play pretty late so you end up like there's a lot of like cuddling"* (P5), *"I do that a lot just gotta like just cuddle"* (P8). We find such acts are able to trigger certain "phantom touch" responses in various participants, which allow them to "feel" the virtual physical contact without it existing in real life. Although the act of sleeping while hugging seems romantic, several participants stated that it's more normative in VR as *"People are a lot more touchy in VR"* (P4), and *"It doesn't really have to get sexual"* (P8), in regards to these aspects of physical intimacy.

We find that aspects of physical contact combined with the practice of sleeping together had emotional effects on certain participants. For instance, P4 indicated that sleeping together with their friends *"makes [them] feel more emotionally attached and intimate towards [their friends]"* (P4). Similarly, P7 states that sleeping together with someone they've known for a long time stimulates their sense of "compassion" towards them, and when hugging their friend *"I feel warmth from that, that warmth is like enough to put me to sleep"* (P7). Several participants indicated that during this practice (and within broader social VR as a whole), they would feel more deeply connected to the person rather than the avatar, especially if the person is a friend they had known for a while (*"I tend to show more of a connection to the person themselves behind the avatar"* (P11)). However, for some people, the avatar did play into their emotional preferences, e.g. *"[I prefer] an avatar that is bigger than my avatar. So I can, I don't know, just feel small, safe, protected, that's definitely a plus for me"* (P8). Ultimately, we find that sleeping, which often evokes an intimate connotation, forms a unique set of communicative and emotional aspects in the context of social VR.

4.2.3 Post-Sleeping in VR. In this section, we reflect upon the actions and feelings of participants upon waking up, i.e. the hypnopompic experience. We note that for certain participants, sleeping in VR is more a precursor for a deeper sleep - i.e. they would first sleep in VR for a few hours, before taking the headset off and going to a regular sleep, e.g. *"I know in about three hours, two hours I will just wake up naturally because something's happened or my brain has decided to turn on randomly. Then I take off the headset. And then … I*

think most of the time I can get another good five to six hours of sleep." (P8). However, other participants indicated they typically spend the entire sleeping time under VR, e.g. *"I'll sleep like 6, 7, 8 hours"* (P11), *"You get to the point where you can sleep for like 6, 7, 8 hours without waking up just like you would like a normal sleep. So you get used to it eventually."* (P5). Thus, we find that some participants, upon waking up, simply go back to sleep after removing their headset, whereas for other participants, waking up in VR harks the beginning of their day.

An interesting topic discussed during the interviews was in regards to the instantaneous moment of waking up - what do people feel in the instant directly after waking up in VR? Past studies have looked into the instant of transition from virtual to real environments in a conscious state [30], but waking up in VR involves the unique transition from unconscious to conscious state in a virtual environment. Several participants indicated that at this moment, especially when they first started engaging in the practice, they may feel slightly disoriented or confused, but they quickly get used to it, e.g. *"Maybe the first couple times I woke up when I was in VR I was maybe a bit confused, but like now I'm familiar with the concept enough"* (P10) and *"I've had like sort of momentary confusion… but I've never had a moment where it's sort of like, like I didn't sort of immediately understand that I was in VR"* (P4). P3 mentions that *"[if] your brain in your first early morning moments your brain is not seeing you, but seeing the avatar you chose for you"*, it creates a disconnection (relating to the Proteus effect - the phenomenon for people to be affected by their avatarized representations [23]).

An occurrence that was more disorienting to participants was when they woke up in a world different from the one they fell asleep in, something that typically never happens in real-life. Participants indicated that this might happen if they get moved together with a friend, or if they get kicked from a world, or if they disconnect. When this happened, participants expressed that *"[it]'s really disorientating. The first time I woke up in another world I was actually really scared because I didn't know where I was. And then I didn't even know that I was in VR… I needed to process like, how did I end up here."* (P8) and *"It is pretty weird. You're like, you kind of wake up and you're like what the f***. So, the first few times that it happens it kind of is very confusing and you're like, you're more focused on what happened."* (P11) Nevertheless, participants indicated that they eventually become increasingly accustomed to these occurrences and their initial surprise dissipates as they experience them more and more times. This was a common sentiment in regards to many aspects of sleeping in VR in general - that you eventually get used to things that may be difficult or surprising at the start. Overall, we find that although waking up in VR can generate feelings of momentary confusion and disorientation at the start, these feelings tend to disperse over time through repetition.

4.2.4 Reflecting on Self-Reported Sleep Quality. During the interviews, some participants made comments about how sleeping in VR affected their self-reported quality of sleep. Some participants expressed that sleeping in VR would be less comfortable and result in a lower quality of sleep simply because of the setup and hardware required to participate in such a practice, e.g. *"I feel like either way if I fall asleep in the chair I'm just not going to get the same quality of sleep as I would in a bed."* (P10). P10 also expressed

that having a light (even a dim one) constantly in their eyes may also affect their sleep, e.g. *"having screens shining in your eyes can kind of affect it, even if it's dim"*. However, several participants indicated that sleeping in VR nowadays does not affect their sleep quality too much, e.g. *"I don't really have anything that concerns me about sleeping in VR. I don't worry about the quality of my sleep too much"* (P10), and *"normally the sleep is just OK"* (P1). A few participants indicated that sleeping with a VR headset allowed them to fall asleep faster, which may help with feeling more rested when waking up - *"Generally I feel just as rested as if I had slept outside of VR, sometimes even more so because when I sleep in VR sometimes I'll fall asleep like significantly faster than I would if I wasn't in VR."* (P5), and *"Now that I've done it so often my brain associates putting on the headset, especially in the evening, with going to sleep so I feel I fall asleep much faster than without VR."* (P9). Several participants indicated that sleeping in VR could potentially have therapeutic effects, especially for those who have trouble sleeping; however, more research would need to be done in this area.

4.3 Challenges and Suggested Improvements for the Practice

4.3.1 Hardware-Related. Despite the fact that participants made certain adjustments towards making the practice of sleeping in VR more comfortable, many still implied that the bulk and clunkiness of the hardware set-up was a main challenge that could be improved on. Present VR hardware does not necessarily support the experience, nor do we assume is it designed with sleeping in mind. Thus, firstly, the weight of the headset and the feeling of having something on your face was something that participants brought up as something that could be initially uncomfortable, especially to people new to the practice, e.g. *"The biggest thing is just getting used to having something on your face. That's the big thing and I'm one of those people that can just fall the f*** asleep anywhere"* (P3) and *"The biggest one is I think just the weight of the headset itself. I said I've gotten more comfortable with it but it is definitely still a factor"* (P10). P14 mentioned that an improvement would be to have the sleep experience *"without a headset"*, but speculated on whether such an improvement may ever be possible. However, P10 did note that they expect smaller form-factor VR headsets to release in the future, a direction currently explored by present research and development as well [31]. Nonetheless, as previously mentioned, the issue of discomfort drawn from weight becomes less prevalent as time passes and people get used to it.

In addition to the overall discomfort of having a device weighing on one's face, the way one adjusts it on one's head could lead to health issues if not done correctly, for example, P6 - *"And so it was sitting very tightly on my face when I fell asleep. And it was pushing down my nose and this was a big mistake … almost to a point where I could just not breathe because it was just shaking so much"* and P11 - *"Part of the headset would push against my nose, and so it made breathing through my nose really difficult in my sleep… I ended up getting sick that way"* both recount instances in which they had suffered undetected breathing issues from wearing the headset, presumably from wearing the headset too tightly or incorrectly.

Another major challenge related to the concept of full-body tracking. As stated prior, laser-based full-body tracking is difficult under occlusion - *"You can't really keep tracking with the trackers and have a blanket over you."* (P4). Accuracy in full-body tracking is highly desired, relating to the inclination to maintain a consistent matching between a person's real-body movements and their avatar's movements (e.g. *"I find it really, really, really disjarring to wake up, and then not be able to like move a limb [in VR]"* (P5)). As such, this creates a challenge in regards to sleeping in a way that allows for tracking to be maintained. In response to this, participants discussed present workarounds (*"You could cut holes in your blankets to put your trackers through, so that your trackers aren't blocked but you still have blankets"* (P5)) as well as possible designs that could be pursued in the future (*"somehow we could have full-body tracking that didn't need something like base stations to find it. a tracking that could go through blankets"* (P11)). P5 proposed the use of IMU-based tracking as an alternative (e.g. SlimeVR [74]), however, noted that presently available ones currently come at the expense of decreased accuracy.

Other miscellaneous physical-based suggestions related to having a more comfortable set-up, e.g. the development of a pillow to support people sleeping in VR (P8) or a more-ventilated headset with some airflow (P3). Overall, we find that present hardware-related challenges relate to developing methods of supporting user comfort, convenience, and safety before and during the experience, all the while allowing people to continue engaging themselves within the practice of sleeping in VR.

4.3.2 Software/Application-Related. Participants also listed a number of present challenges and suggested improvements that could be made in terms of the VR application and software when using it to sleep. During sleep, the typical behaviour of the headset is to stay on, meaning that the user stays in the same environment that they fell asleep in. However, this means that visuals and audio are maintained while sleeping, unless the user manually changes these (e.g. a small number participants indicated that the headset sometimes automatically turns off). This can be an issue, for example, P8 mentions that they think the blue light of the VR screen can be harmful - *"When I woke up, because I fell asleep with the blue light my eyes were burning"*. As such, several listed challenges and suggestions relate to adjustments in regards to such sensory stimulation. In regards to visual stimulation, for example, P1 indicates that during sleep, it's common for *"some people [to] have trouble with lights"*, and P9 indicates that in the past, *"the brightness would kick my brain back in and wake me up"*.

One possible improvement that was suggested was a global dimming functionality, to allow users to dim the environment for themselves in any world (a functionality that currently is dependent on how the world is built out). For example, *"Some worlds don't have a brightness or bloom slider. Why not just put it into VR software?"* (P8), and *"[An improvement would be to] change the way our environment looks if we want everything to dim in any world. I think that would be goated [awesome] as f*** because I could go to any world I want to"* (P11). Another improvement that was suggested in order to alleviate the issue of brightness were to have methods that automatically turn off the display once the user has fallen asleep, e.g. *"find a way for the VR headset to detect that you're sleeping and maybe turn off the display completely"* (P8) or *"a timer that you can set for when your screen turns off, so if you don't move for certain*

amount of time it's a screen to black" (P9). Such improvements may help with addressing related concerns in regards to sleeping near small screens [20].

Auditory stimuli was the other main sensory artifact that participants indicated that they would like control over. P6 indicated that in public sleeping worlds, there may be people (trolls) that come in and make loud noises - *"they would use soundboards with very loud music or they would just actually scream"*. The only preventative measure for this is to mute everyone, but as P6 says, this is not ideal because *"there's also some people that you just want to maybe interact with once you wake up"*. One proposed solution would be to have a filter-based mute, e.g. *"if [a sound] reaches a certain amount of decibels you could just mute. That would be a really nice addition, so you don't have to worry about somebody forcibly waking you up."* (P6). P7 indicated that methods to address sensory stimuli while sleeping could be done in a singular, customizable, "Do Not Disturb"-type setting, which would both shield the user from unwanted stimuli while also letting others around know that the user is sleeping.

Overall, we find that software-related challenges and improvements - leading to future design directions - could ultimately revolve around the application behaviour before and during user sleep, relating to the desire to have a comfortable, undisturbed sleep in their desired environment.

5 DISCUSSION

5.1 Sleeping in VR and Motivations

One research question that we were aiming to investigate in this study was in regards to the motivational factors that underlie people's desire to sleep in VR. Throughout the study, we find that sleeping in VR belies a deeper motivation - the desire to extend upon the mundane activity of real-life sleep. We find that the main motivations for sleeping in VR are not necessarily to improve the quality of sleep with the purpose of tying this back to physical and mental wellbeing, but for the purpose of transforming sleep into a new experience - one that allows for customization and sociability - aspects that typically are lacking in present sleep experiences. The technology to induce this transformation, namely VR, provides the specific affordances that allow for this extension. However, because we find that the core motivations lie within the experience, interactions, and relationships, we believe that the actual VR aspect of the practice (i.e. the actual use of a VR hardware) is not as important in regards to motivations as the experience it allows for. In short, we find that people sleep in VR because VR allows them to extend the social and experiential nature of sleeping, however, this comes at the sacrifice of certain challenges associated with using VR to sleep - namely, aspects relating to comfort, the weight of the headset, the constant light while sleeping, etc. This relates back to the challenges and improvements discussed - how can we develop ways to continue to support the **experience** while eliminating restrictions and limitations based on the **VR hardware**.

We consider the motivations for sleeping in VR under prior motivational theories. In particular, we look at self-determination theory, an empirically derived theory for human motivation and personality [17], which has been previously applied in a variety of fields, such as within education [61] and video games [65]. In regards to the latter - the overlap between (social) virtual reality and games

(i.e. VRChat can often be referred to as a game) provide motivation for us to apply a similar theory within our study. Self-determination theory argues that the three primary needs that underlie human motivation are competence (demonstrating personal skill), autonomy (affording freedom and control), and relatedness (supporting social connectedness). We find that sleeping in VR affords autonomy for all users - it provides them the freedom to control how and where they can go to sleep. As indicated in the findings, this largely ties into the experiential motivations - the idea that people can feel free to *"sleep in environments that aren't my bedroom"* (P10). Users in VR are able to fine-tune the world they sleep in, what they hear, who can join, etc. - allowing a precise level of control over their sleep environment; this greatly diverges from the real-world. This reveals a motivation that highly corroborates Maloney's prior study [38] - that sleeping in VR allows users to experience a daily, mundane activity in a manner that is completely novel.

For many participants, the motivational pull of relatedness also applies - this relates to the social motivations of sleeping in VR. Participants indicate that sleeping with others allows them to generate feelings of closeness and intimacy with others, which may be lacking from their normal sleep experiences. For example, in regards to the present form of the experience, P4 states that *"sleeping in VR is always just like a simulacra of real life - it will never be perfect. So sort of it's always sort of like it's more of a sort of chasing a feeling of intimacy that you'd much rather have in your life"*. This desire for increased levels of social connectedness could potentially be addressed with suggested recommendations outlined by prior work [38], namely continued communication outside of VR (to transform VR connections into sustained relationships), as well as potentially increased realism and naturalness in terms of social interactions. Nonetheless, findings from our interviews demonstrate that sleeping in VR allows for a unique form of social connectedness, in which physical intimacy may not always represent romantic intention, and which you can feel a sense of connection to someone thousands of kilometers away. The ability to communicate with others (either strangers or friends) before and during sleeping, via both gestural and verbal communication, has drawn comparisons to simulating the experience of a sleepover without the need to travel. As such, sleeping in VR allows users to generate these feelings of social connectedness and relatedness through an experience not often thought of as being social. As sleeping in VR typically follows from regular social VR use, this practice creates a constant, uninterrupted stream of such connectedness within the virtual world.

Next, we investigate the motivations for sleeping in VR within the research of broader social VR. Past research has investigated how features of social VR can allow for meaningful shared activities - having mirrored activities that people can immerse themselves, engage, and share with others. For example, the findings in this paper expand on prior findings relating to sleeping in VR, in that such a practice can offer a social, intimate experience that could facilitate the development of entire worlds dedicated to it [38]. However, aspects of comfort were more split in our study compared to the prior, with many discussing the challenges of sleeping with specific hardware, especially the weight of the headset. Issues with full-body tracking hardware when sleeping arose as a challenge as well, which challenges the motivation of having a full body mirroring of activities [38]. The discussion of hardware also elicited similar

concerns regarding potential health risks (e.g. eye-related risks). Similar to prior studies [38], the rapid growth on VR platforms and the changing nature of demographics within social VR served as an additional frustration, especially with a practice as intimate as sleeping together, but also an important aspect to consider in regards to future development in the area.

One aspect we considered uniquely in the study was the embodiment of an avatar in social VR - and how such factors affect the specific practice of sleeping in VR. We found that certain participants had preferences for sleeping with specific avatars, e.g. P5 stated that there was a type of avatar they would not sleep with because they did not feel comfortable with it. However, we noted that several participants indicated that they felt more closely connected to the person behind the avatar rather than the avatar themselves. P11 states that an avatar in social VR acts *"as a means of some kind of like self-expression"* - demonstrating that the avatar is more a medium for communication and representation of identity rather than a representation of the physical person. This generally aligns with prior research on avatarized social interactions [23]. However, as we find, intimacy with such specific representations may still be subject to one's own preferences - aspects of both the person behind the avatar as well as the avatar itself may play a role in affecting a user's desire to sleep (or be intimate) with another in social VR.

Ultimately, throughout our findings, we find that sleeping in VR fills a motivational niche that people desire for an experience that can be mundane and repetitive. We dig deep into user specific motivations, and aim to better understand the experience from even prior to the moment of sleep until the after the user wakes up. In this study, we link practice to motivation in order to illustrate the entire extent of the experience from even prior to sleeping to after the user awakes in VR. As such, this study helps serves as guidance towards understanding how people both currently engage as well as may engage with such a practice in the future, as discussed in the next section.

5.2 The Future of the Practice

Throughout the interviews, we asked participants whether they considered that the practice of sleeping in VR, a currently niche practice, would be something that may become more commonplace in the future. In response to this, most participants were optimistic. Many stated that they believed that the benefits of sleeping in VR - namely, having customizable environments and engaging in a social experience - would be something they could see people wanting in the future. However, several presented qualifying cautionary arguments that may inhibit the practice's growth. Several participants indicated that, in the present form, the VR technology and its comfort may be a limitation, and that many people may not easily adapt to sleeping with a headset on. Such challenges and suggested improvements have been discussed prior in this study.

From a less technological, more social standpoint, several participants indicated challenges in regards to the shifting demographics of social VR. One particular trend that was brought up was that of increased children - *"the biggest demographic shift that has been created … [is] a bunch of kids start getting on VR chat"* (P4). Several of the participants indicated distaste towards this demographic

shift, with many stereotyping them as screamers and trolls (e.g. describing worlds inundated with kids as a *"hellish daycare"* (P4)). From a sleep quality standpoint, participants indicated issues with having unregulated children in their rooms, e.g. *"I feel like 70% of the kids are the trolling screamers that are trying to wake you up"* (P6). However, the inter-relationship between adults and children forms a complex problem in broader social VR in general [39, 40], especially since the typical indications of a child (e.g. height, appearance) are not always apparent on virtual platforms. As such, participants indicated that even talking to a person might not always provide knowledge that that person is a child, unless explicitly stated. This creates issues when adult-specific content is presented in front of children [39, 40], e.g. one participant brought up ERP (erotic roleplay) as an example. Sleeping, which constitutes an intimate action in social VR, has a similar problem - how can one ensure that the avatar someone is sleeping with belongs to someone age-appropriate? This serves as a question to consider in future development of the area - safety implications must be considered for minors to coexist with adults in virtual areas in which intimate behaviour may occur.

Lastly, the increased mainstream nature of VR also serves as an important dynamic to consider in regards to sleeping in VR, as well as social VR in general. With companies like Meta aiming to make VR more accessible towards a general public, participants wondered how interactions and relationships in social VR as a whole might shift. For example, one participant drew parallels with "Eternal September" - when Usenet became widely available to home users, harking a cultural change in the modern Internet. Many participants indicated how VRChat has a unique culture and set of norms, and wondered whether these norms might change to appeal to a broader audience or if other mainstream social VR platforms may develop in parallel but never intersect. Throughout our study, we find that sleeping in VR relates to the normative intimacy and physical affection that is present in social VR; however, how such practices may expand and be affected (or perhaps affect) mainstream social VR is still to be seen - whether sleeping in VR continues to be a niche practice, or whether it beckons towards a broader shift towards living in virtual worlds. Nonetheless, the benefits of sleeping in VR are difficult to deny, and we believe that this developing practice may eventually become more popular as technology becomes more refined and more users are willing to engage in the practice.

6 LIMITATIONS

We identify several limitations that continue to exist within the scope of our study, some of which relate to participant recruitment. Although the pool of participants was relatively small, the exploratory nature of the study, its level of data saturation, and its fit within past local standards [9] allowed us to judge the sample size appropriate for this study. However, we note that the novel nature of the practice outlined in this study does not necessarily mean that our participant sample captures the full experiences of all possible participants in the practice. In terms of the recruited participant pool for the interviews, we found that the demographic of the interviewees skewed towards young male adults. This may create some bias in the responses, especially since past research has

outlined differences regarding social interactions and virtual perception among the genders [5, 21]. Future research could be done in order to expand upon this initial participant pool and possibly understand the impact of gender on the practice of sleeping in VR. In addition, due to the methods of recruitment, we find that the participants may skew towards people who deeply relate to sleep as a social VR activity. More could be done in order to expand the search towards people who relate to sleeping in VR as a therapeutic exercise.

Most interview participants had fairly extensive experience with VR in general - all but four participants indicated that their frequency of VR use exceeded or was equal to 5 times a week. These participants were thus both physically accustomed to the hardware as well as likely familiar with people and friends within the social VR community. As such, the results of this study may lean towards VR "experts", and thus, the experience may not be generalizable towards people who are new to VR. However, many outlined that the experience changed as they become more accustomed to it; thus, it would be an extension to the present study to consider people who are more novice in the practice. Thus, one possible future research proposal may be to conduct an experiment with users unfamiliar with the practice - to have them sleep in VR in a controlled setting and discuss their overall experience to understand both the physical experience and social relationships that they develop as someone new to the community.

7 CONCLUSION

In this study, we considered the practice of voluntarily sleeping in VR, looking to investigate the motivations and experiences that underlie this niche practice. We conducted semi-structured interviews with participants that have experience with the practice with the purpose of developing findings to address the research questions of why and how people engage in this practice. We discover that participants engage in sleeping in VR for two broad motivational categories - 1) experiential motivations - the motivation of sleeping in a world of their own desire separate from the difficulties of reality and 2) social motivations - the motivation of being able to sleep with others and share the experience via gestural forms of communication. We find that the experience of sleeping in VR involves setup in both the physical and virtual world, and relating to this, we identify the challenges that underlie sleeping in VR, which often relate to the limitations of the VR hardware and software itself. We furthermore suggest improvements to ameliorate the experience for its practitioners. Lastly, we discuss the motivational pulls that sleeping in VR offers to its current and prospective participants, and speculate on its future within the context of the shifting nature of social VR.

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