Disembodied, Asocial, and Unreal: How Users (Re)Interpret Designed Affordances of Social VR

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ABSTRACT

Although Social Virtual Reality (SVR) affordances are designed to enable embodied social activities and interactions within virtual environments, the ways that users perceive and interpret these affordances can shape how SVR platforms are used and experienced. In this study, we examined the design and use of SVR affordances based on qualitative survey data from 100 SVR users. We observed that user practices diverge in important ways from intended designs, adding complexity to conventional interpretations of SVR platforms as embodied social environments. This research highlights dynamic user behaviour in which users interpret and reconfigure the affordances of SVR platforms, ranging from asocial use cases to actions that reflect the current limits of embodied communication. We contribute findings that may improve SVR design by revealing opportunities to foreground user needs and expectations, leveraging both the designed possibilities of SVR and the interpretations of those possibilities.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**; **Virtual reality**; *Collaborative interaction.*

KEYWORDS

Social VR, affordances, embodiment, non-verbal communication

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1 INTRODUCTION

Social virtual reality (SVR) encompasses a range of platforms that provide multi-user digital social interactions and communications to a growing user base [23]. Like other interactive systems, SVR platforms inherently present specific interaction mechanisms, or affordances, that enable the platform's available functions. As these platforms' major design patterns, practices, and features become more apparent, there is a need to better understand the possible activities, functions, and use habits within SVR. Recent scholarship underscores the importance of a nuanced understanding of SVR use, especially given that users navigate these virtual worlds without clearly established social norms or practices [38]. Theories of affordances within interactive media suggest that with an expanding range of applications, users have increasing liberty to interpret and adopt functions or affordances according to their own preferences [45]. These theoretical perspectives also imply that there may be discrepancies between the anticipated functions designed by developers and designers, and the practices implemented by actual users. This signals a need for a comprehensive exploration of the SVR landscape with a specific focus on how affordances are perceived and interpreted.

Given the increasing prevalence, flexibility, and customizability of SVR platforms, this paper analyzes the links between platform design elements and use practices in these virtual environments. Previous SVR research has emphasized the value of linking technological affordances to habits of use [37, 38] and has provided initial findings via taxonomies [23], topographies [40] or inventories of affordances [55], or interviews with designers [27, 36] and research professionals [49]. Previous studies have also explored the possibilities of interactions through avatars [14], social space design, personal space regulation, onboarding, navigation and social mechanics [36, 38]. Other relevant research has begun to show the variety of ways that SVR users interpret these platforms and experiences. For example, some SVR studies have highlighted the importance of facilitating discussions about what is appropriate in SVR and what users appreciate or dislike in these platforms [15], focusing on social rituals [35] or specific demographic groups, such as teenagers [31] or older adults [2]. Based on this prior work, there is an opportunity to bridge research examining SVR design with

SVR use practices, contributing to an improved understanding of how users interpret the design in the context of their actions, needs, and expectations within SVR applications.

To address the need for deeper insight into how SVR users respond to, interpret, and/or adapt to the perceived affordances of SVR platforms, we conducted a survey collecting structured qualitative data [29]. In the end, we analyze data from 100 participants. Foregrounding features that distinguish SVR from other VR experiences, we focused primarily on affordances related to embodied communication [30], self-expression [31], and social connections [28, 38], highlighting users' meaning making and experiences to better incorporate end users' voices and insights into design analysis [30]. Our results demonstrate that although the social [50] and embodied [1] affordances of SVR are essential design features, they are not necessarily interpreted or adopted by users as designers intend. For instance, our participants often avoided using SVR with other users, which represented a 'hidden' affordance of SVR. At the same time, embodied communication was not as frequent and diverse as design applications and guidelines recommend, which we discuss as a 'false' affordance of SVR. These results highlight how affordances can shape user interactions but can also be reinterpreted [45]. Therefore, individuals can use this technology uniquely or ascribe non-normative meanings to the technology and the actions within them, thereby transforming the technology's impact. Based on these observations, our study raises questions about how SVR design might better respond to both the positive opportunities that current users are identifying, as well as the negative effects of how current affordances are used, where extreme behaviours can become normalized and influence users' social environments and practices.

Our research emphasizes how users participate in shaping SVR-related practices and aims to provide an analytical basis to optimize SVR platforms for an approach that recognizes users' diverse needs, preferences, and interpretations. We suggest that this includes increased attention to the range of social and asocial experiences that are possible within these platforms, as well as increased attention to the lack of uniformity across experiences, due in part to differences in hardware, individual applications, poorly regulated social norms, and individual expectations. These findings also stress the need to avoid a technologically deterministic approach when describing how individuals may use SVR, especially as users actively reconfigure and reinterpret available affordances. Ultimately, our work contributes to future design and policy guidelines that strive to construct socially beneficial and user-centric SVR platforms.

2 RELATED WORK

2.1 Affordances and their interpretations

More than four decades ago, Gibson [20] introduced the concept of affordances as the qualities of objects and environments that define and inform perceived functions and potential interactions. Although affordances are generally understood as action possibilities [42], there are important nuances across the definitions, conceptualizations, and approaches that constitute the study of affordances. For example, Gaver [17] argued that affordances encompass properties of the environment that facilitate interactions, noting that mistakes can appear due to false and hidden affordances. For Gaver, hidden affordances remain unapparent, whereas false affordances appear perceptible but do not facilitate the interactions they suggest. Alternatively, Stoffregen [47] argued that affordance is not a property of the environment but rather a product of interaction or perception of it; they conceptualized affordance as a higher-order property arising from the human-environment system, where the system holds the affordance, with neither the human nor the environment individually possessing it.

For Nagy and Neff [39], technologies and media are themselves adaptive, learning, responsive, and changing along with the users. Affordances can be affected by the ways that users are imagined by designers, and by the uses that are imagined within the contexts of a technological system. If the perception of affordances is based on relationships made possible by broader socio-historical understandings [42], the interpretation of affordances also becomes more dynamic and contextual. Technologies and environments can "demand, allow, encourage, discourage, and refuse interactions," with affordances defined by perceptual, physical, cultural and institutional expectations Davis and Chouinard [10]. Affordances can also reveal power and resistance, as Shaw [45] suggests when adapting Stuart Hall's encoding/decoding model [22] for interactive media technologies. This additional layer of analysis suggests that interactions that technologies afford are not neutral in their design, i.e., designs and technologies do not tell us what to think or do, but they do shape what we think with. Shaw [45] argues for the need to differentiate how media technologies are designed, used, and interpreted, as decoding technology implies both implementation and interpretation practices. For Shaw, encoded media (messages) can be decoded in dominant (as it was designed), negotiated (rethinking the design), or oppositional ways (going against the design).

Based on Shaw's [45] proposed framework (which in turn extends conceptualizations like those by Gaver [17] and Nagy and Neff [39]), three broad categories of affordances can be distinguished for SVR. Perceptible affordances are similar to the designed affordances, with dominant interpretations representing the intended use practices. Hidden affordances are not intended but are possible based on the design, which opens opportunities for users to negotiate new uses or act in opposition to the design (e.g., video game modding that reinterprets, exposes, or changes the ideological contours of the original game, or deliberate acts of passivity when the technology demands an unwanted action [45]). Finally, false affordances pertain to those design elements that are perceived to be usable, but for various reasons, did not achieve their expected purpose. For instance, in SVR, it could pertain to a virtual drawer that does not open, or to instances where users ignore, reinterpret or misapply certain features of the platform, or an "incorrect" utilization of the platform — a usage not intended by the designers. Again, users may exploit a false affordance for an oppositional reading of the design.

2.2 Social VR affordances

SVR is designed as an immersive communication tool within the broader realm of virtual reality (VR) technology [28], providing users with 3D virtual collaborative environments (VEs) facilitated by head-mounted displays (HMDs) and avatars [14]. Users engage in diverse activities within VEs, such as socializing, remote work,

event organization, or learning [13, 28, 37]. This is similar to previous collaborative virtual environments, such as Second Life [25, 56] but with new affordances made possible by modern HMDs. The design of contemporary SVR is well described in recent research via a taxonomy of SVR platforms [23], a topography of communication affordances [40] and an inventory of possible non-verbal acts [55], that demonstrate intended, or designed, structures of SVR use. More specifically, SVR platforms afford social participation and activities through the act of embodying a digital avatar whose head and hand movements correspond to those of the user through the HMD and controllers [14], increasing the complexity of people's self-presentation within broader sociotechnical ecosystems. As a result, SVR encourages users [10] to practice embodiment [27]. Thus, embodiment (in its practical form) is among the core features of SVR applications that differentiate them from other online social platforms. In other words, with its focus on avatar-based communication and (partial) body-tracking, SVR is designed to provide embodied experiences to users [1].

Activities in SVR can be supported through verbal and non-verbal communication and other functions [33]. Non-verbal communication features in SVR [33] include proximity regulation, attention indicated by eye gaze, nodding, applauding (for approval), pointing to direct attention, waving for greeting, and so forth. Gestures are important communication features of SVR as they aid communication by supporting effective collaboration and exchange of information through visualization (e.g., drawing in air and emojis to show agreement) or by indicating thoughts and emotions. Many non-verbal aspects of SVR are designed to replicate the real world, for example, with audio cues that aid the perception of distance among users [57] or through the possibility of moving around to "organically break off into small groups." [28, p. 2]. In addition, embodied avatars are supposed to stimulate turn-taking during virtual conversations [44]. Previous collaborative virtual environments, such as Second Life, were also expected to stimulate certain aspects of non-verbal communication [16], however, proposed improvements required additional hardware like haptic technologies [41], which were not part of the original design.

As with any VR system and the sense of presence that it targets [9], (perceived) realism is an essential part of SVR [46] as it replicates many aspects of social reality. This involves social expectations and norms from real life [37]. For instance, RecRoom emulates real-life community centers by including features that strive for family-friendly environments with bright colours, an auditorium with seating, and campfires or beach resorts. SVR applications can also simulate specific forms of social interaction, such as hugging, handshakes, gaze, and other body movements that represent real-life movements. Finally, the realism of avatars is said to affect communication [43], and physical similarity with an avatar is said to be an important part of embodiment [3]. However, as researchers [18, 19] have pointed out, there are important limitations to these forms of embodied communication, as the expected interactions also pose many challenges for people with disabilities, often normalizing able-bodied conceptualizations of appropriate actions within virtual spaces.

Clearly, SVR is designed to be social [28, 38], and in some cases it is a relatively safe space for self-disclosure to achieve self-expression, relationship development, social validation or identity clarification [53]. Spaces in SVR are often designed to promote or encourage [10] conversations at circular table spots or campfire settings [37] and facilitate virtual meetings [36] via features for turn-taking or visualizing data. Avatars also play a role in communication and identity signalling [27]. For example, in some platforms, it is possible to become friends through a handshake feature, invite to events through fist bump, choose emotion expressions in a menu, pat other users' head as a sign of appreciation, and so forth.

While SVR research reveals a variety of possible social and embodied interactions, theories of affordances and emerging scholarship about novel uses for SVR are a reminder that any designed affordances must also be considered alongside user perceptions and interpretations. As a space of social transformation and adaptation, SVR also has its own evolving practices [35]. New social rituals and norms that are emerging in VR differ from the offline world. For example, there is evidence that users utilize existing features to create their own embodied practices, for example, "mirror cuddling" and "social sleeping" [30]. Examples such as these show that affordances can be reinterpreted and practiced in other ways than intended by SVR designers. Although our broader goal is to uncover the potentials of SVR for social connections and initiate a discussion about how we might enable more user-centric design practices in SVR, we begin by examining how SVR users perceive SVR affordances and how they describe their interactions with SVR systems. We therefore propose the following research question:

RQ: How do participants interpret (or reinterpret) the basic affordances of SVR? How are current actions and/or understandings of SVR shaped by these affordances?

3 METHODS

This study is part of a larger project (similar to Freeman et al. [15]) focused on SVR experiences and possibilities. After receiving ethics clearance from our university, we gathered data through a survey conducted on Qualtrics[1], using Prolific[2] to recruit participants. To refine the survey questions, we used two pilot tests (n=15 each) resulting in adjustments to wording and question sequences, including the addition of new questions. Following the third pilot test (n=15, included in the analysis), the main survey was administered for two days. The sampling process was not geographically limited but rather determined by the sampling time period in specific time zones.

3.1 Sampling

We collected data from 120 participants (similar to Sykownik et al. [53]), encompassing a varied array of ethnic backgrounds and gender identities, which prior work has identified as a methodological gap in the recent studies on SVR [15, 57]. Only participants over 18 years old who reported ownership of a VR headset were included in the study, M_{age} = 28.6, SD_{age} = 7.46. This initial dataset included 54 female, 60 male, and six non-binary participants. After screening the responses, 20 participants' responses were eliminated from further analysis because they were empty, in a different language (one participant), or their responses were either copied from public

[1] Qualtrics.com
[2] Prolific.co

sources or fully AI-generated (as identified by AI-detecting software, such as GPTZero). In the end, the analysis included 100 participants, which included 41 female, 54 male, and five non-binary participants; among them, there were 45 White, 25 Black, 18 Hispanic, six Asian, four mixed-race individuals, and two Latina/Latino.

In our sample, the representation of SVR platforms was similar to previous research, which identified the following platforms as the most popular: VRChat, AltSpace (which has since shut down), Meta Horizon Worlds, RecRoom, Neos, and Bigscreen [51]. In our sample, 48 participants identified VRChat as the primary platform they use, 28 Meta Horizon Worlds, 11 BigScreen, 6 RecRoom, and the rest used other platforms, such as Neos VR, Pavlov VR, Bean VR, or AltspaceVR. Only 31 participants used a single platform (which was either VRChat or Meta Horizon Worlds).

3.2 Survey design and questions

Our investigation was not limited to specific platforms. Including platforms that support both large-scale public social experiences (e.g., VRChat) and those that focus on small-scale private social experiences (e.g., BigScreen) contributed to a more comprehensive understanding of SVR users' engagement across a broader spectrum of platforms, resulting in richer evidence. Participants were asked to identify the platform they used most frequently, along with other platforms they used, and were encouraged to reflect on their experiences across these platforms.

The Qualtrics survey comprised demographic inquiries, questions about the frequency of platform usage, headset preferences, preferred platforms, and a set of open-ended queries crafted to capture participants' insights and perceptions about their use of Social VR. Collecting structured qualitative data via open-ended questions in a survey resulted in extensive data with both depth and variety, and it provided the benefits of comparability between studies [29]. In other words, open-ended questions allowed participants to express their own interpretations of SVR use rather than respond to predetermined characteristics and features. More specifically, employing open-ended inquiries as a bottom-up approach, we gathered information on attitudes and self-reported behaviors from SVR users to investigate naturally emerging interpretations [11]. This was fundamentally a qualitative exploration, aiming to capture the nuanced experiences and perspectives of participants, however we include quantitative findings when it is possible based on our analysis.

The questions were designed to stimulate responses on how people use SVR in different circumstances, situations, and for different purposes. Questions about users' understanding of SVR and its perceived affordances were based on the analysis of the designed SVR affordances via existing taxonomies [23], reports [38], and personal experiences of SVR use. These affordances included matters of avatar creation, locomotion, practices/norms, personal space regulation [38], and basic conversation. We also aimed to capture how participants communicated non-verbally in SVR, including attention to, when possible, any references that participants made to kinesics (body and eye movements), vocalics (voice manipulation), haptics (touching), physical appearance [6], and emotional expressions as a distinct element of kinesics [26]. However, we acknowledge that a more detailed understanding of these facets would require additional measures beyond our survey.

The survey began with background questions, including opportunities for participants to describe their perceptions of the intended purpose of SVR. Then, participants were asked about their use practices in terms of gestures, ability to express emotions, conversations (e.g., how they start them, how they attract attention, how they walk and talk at the same time, or communicate at a distance, and take turns speaking), and whether they used these platforms with or without other people. We also examined how they used different safety features, such as mute functions or defining personal spaces. Finally, we asked participants to compare their SVR experiences and conversations with those in real-life or video-conferencing platforms (e.g., Zoom) to highlight their preferences in technology use. The average completion time for the survey was 55 minutes. Each participant's responses were pseudonymized with alphanumeric codes (e.g., svr1, svr2, etc.)

3.3 Analytical approach

In this study, we based our analytical approach on Reflexive Thematic Analysis, or RTA [4] to provide a detailed analysis of the collected data on affordances and users' perceptions of them relying on existing research, the understanding of SVR systems and taxonomies, theoretical frameworks, and researchers' experiences. Based on RTA, coders were consistently involved in the analytic process, and reporting the results as the coding process required continual questioning of assumptions made in interpreting and coding the data [4]. To ensure triangulation of the data assessment (along with a diversity of perspectives), the analysis involved four coders [8, 24].

The analysis commenced by familiarizing ourselves with the data through an initial reading [4, 5, 7]. The primary researcher read the data to understand the full picture and identified preliminary codes for analysis and discussed them with other team members (similar to Maloney et al. [32]). The codes were based on the characterizations of users' behaviors (e.g., whether the behavior was non-verbal or verbal) or the direct reflections of their behaviors (e.g., what emotions or gestures participants stated they expressed or used or how they used SVR in general). This guided the analysis based on the existing and emerging questions as topics of the analysis [5, 7].

We drew an initial dataset from a subsample of 20 randomized participants, which the four coders then tagged. The coded data and corresponding codes were reviewed to maintain consistency among all four coders. Following this, we created a second set of codes using the new tags and codes generated from the initial 20-participant dataset. With this second set of codes, the four coders, who represented different expertise in SVR and HCI, independently analyzed the data. Thus, we divided the data into six equal and manageable sections, ensuring a more focused approach to coding and interpretation. At all times during the analysis, two independent coders were assigned to each data section, promoting rigorous scrutiny and diverse perspectives. Our analysis consisted of two training sessions and six coding sessions, each lasting one hour or more. This approach ensured consistent, dedicated attention to the data across all sessions.

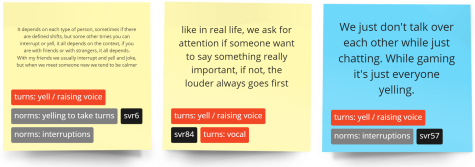

Figure 1: Example of a cluster of codes (and data units) in the Miro Board

Following the conclusion of the coding sessions, a research team meeting was held to oversee the review, discussion, and eventual finalization of the identified codes and its clusters (see Figure 1 for an example of coded data) into initial themes compiled into a shared Miro Board. This process was undertaken to ensure cohesion and consensus within the research team. In cases where discrepancies emerged between two coders, resolution was sought through the expertise and relevant knowledge of the primary researcher, as these may reflect key aspects when analyzing data [34] and making sense of it [4, 5, 7]. We approached the identified themes as "interpretive stories about the data" Braun and Clarke [4, p. 594] produced by researchers based on their expertise and theoretical assumptions. The final themes were discussed, interpreted, and co-related with each other to describe their meanings more accurately and to present a comprehensive narrative of the study.

4 RESULTS

In the beginning of the survey, we asked participants to describe the overarching design goal of SVR platforms. Some (n=6) suggested that SVR was created to replicate life: "To replicate the real-life digitally and allow people to have immersive experiences at home" (svr52). Many others (n=20) stated that SVR is supposed to provide new experiences or forms of escapism, offering the following descriptions: to create "that special out of this world feeling" (svr30); to take a break from a real-world (svr84); to be someone else or "to be whoever you want online, picking the avatar you want to be but don't have the courage or is not socially acceptable to do it in the real world" (svr73); and to provide space for self-expression, where "nobody can be judged for their looks so the 'first impression' we get relies on their behaviour" (svr98). Around a quarter of our participants (n=28) suggested that SVR was designed for specific activities, such as exercise (svr90), travelling (svr101), world creation (svr59), attending events (svr67), or playing games and having fun (svr62).

Most of the participants (n=86) thought SVR was designed for social interaction, including chatting with friends (svr41) or meeting new people around the world in a relatively safe space for socializing (svr63). SVR in these cases was expected to connect like-minded people and lonely people (svr31), but on a more intimate level than chat rooms (svr83), because it simulates embodied interaction:

> "It was designed for social purposes mostly in terms of connecting people all over the world who share an interest in virtual reality beyond just chatting, which other social platforms offer. Allowing them to do a lot more without feeling like the Internet or lack of physical contact is a true barrier." (svr109)

While each of these responses reflects and/or relates to available affordances in SVR platforms, which can promote various forms of embodied communication, social connection, or self-expression, a closer analysis of participants' responses suggests a variety of breakdowns, challenges, and reinterpretations of available affordances. In this section, we describe how participants interpreted and responded to these challenges. We begin with the most direct example of reinterpretation: although SVR consists of a set of platforms ostensibly designed to foster social experiences, many participants would sometimes use SVR entirely alone, not seeking to engage with anyone else.

4.1 Asocial SVR, or asocial use as a hidden affordance

More than a third of the participants (n=37) expressed at least one way they used SVR without other people. Although it might be expected that these instances came from participants using BigScreen, which is less focused on social interaction [55], asocial use was more present in VRChat and Meta Horizon Worlds. Participants reported to use SVR by themselves to play games (n=10), because they "don't need any other person to enjoy the experience" (svr12), stream videos (svr13), or to watch movies in VRChat (svr102) or in Bigscreen "to feel like I was getting a cinema experience" (svr48). Sometimes they would use it for other activities like making art (svr102), or immersive dwelling [58], e.g., "I like customizing characters on VRChat so this is the main reason I sometimes use that platform without other people" (svr71).

Most of the participants who engaged in asocial use (n=19) reported using it by themselves for travel in virtual lobbies or worlds: "VRchat 'world hopping' exploring new worlds was always fun to me, so I, from time to time, did went in alone without friends and just explored new places and worlds" (svr41). Or, as another participant said: "It's a lot of fun to find new places and undiscovered gems, as well as to chill out and take a (virtual) breather through these environments" (svr67). Participants often virtually traveled between various spaces specifically to find a relaxing place to quiet down: "Sometimes I'll find a relaxing world to lay down in and just feel calm, a personal favorite is a beach on the moon overlooking earth" (svr32). Participants often used VRChat for these asocial activities, as in the following case: "Sometimes, when I use VRChat by myself I search for peaceful, meditative worlds where I can relax and enjoy the tranquility and visuals surrounding me" (svr102).

Some participants saw their asocial activities as a break from more active social environments (svr47, 57, 61, 77). SVR, in general, often lacks social norms regulating communication between users, even though it is a space in which new norms can emerge [35]. Social interactions are often unregulated and anyone can jump into the conversation or interrupt other users. As many participants reported, "it is always chaos and interruptions," (svr73) "everyone just kind of talks" (svr70) or "it is a mess, we talk over the top of each other all the time." (svr69) At the same time, to attract attention, they sometimes have to yell or be "loud and obnoxious" (svr92) or "everyone is just yelling" while playing games (svr57). Within these contexts, personal space features were interpreted as ideal for asocial use: "I have my own 'home' space, which I am customizing

to my taste. It's also good for me to take a break from people (just like in real life!), as I tend to function better alone" (svr65).

While SVR afforded various ways to interact with other users, participants reported that they often found comfort in these asocial experiences. For some, it was a reprieve from the often chaotic and interruptive social interactions in SVR, where social norms are still evolving. Such emerging and unstable social practices also may affect how and when SVR users apply non-verbal tools in their interactions with each other.

4.2 Disembodied SVR, or navigating the false affordances of embodied communication

SVR is often described in research as embodied based on the ways users communicate, express themselves, coordinate behavior, or share their feelings [27, 30]. However, our data indicated important limitations to these forms of embodied communication in SVR.

4.2.1 Vocal, loud, and poorly regulated communication. There are many possibilities for non-verbal communication in SVR even without special equipment [55], but, as reported by our participants, conversations are dominantly vocal. When asked to describe how they start conversations with strangers, a majority of participants (87%) reported that they do it exclusively in a vocal manner. Participants who did use non-verbal communication described various strategies. Svr19 described an approach that combined physical proximity of avatars, a wave, and observing whether the other user's microphone was active before initiating vocal conversation: "I get very close to that person and wave at them. If they have a microphone, I then say hi and just ask general questions," or as svr16 stated, "I just wave my hand to them and ask where they are from." One person offered a fist bump (svr8), and another a handshake while interpreting the other user's receptiveness to the gesture: "I would usually introduce myself with my name, and depending on the reaction, either wave if they seem a little timid or offer a handshake if their reaction to me seems positive." (svr45)

Even though none of the participants were required to use their bodies to greet others, the limitations of embodied communication in SVR [52] led to specific adaptations that leveraged embodied affordances. For instance, taking turns in SVR is poorly regulated in general, which corresponds with the previous theme. Despite non-specific gestures or non-verbal cues, some participants (n=8) reported raising a hand to take turns, or a few people (n=4) reported using a person to regulate the conversation, i.e., "by designating a person to speak, making them take a turn" (svr115). A couple of participants said they would nod (svr13) or pass an object to indicate whose turn it was to speak:

> "It totally depends on the world and the group you're with. One time I was sitting in a circle with a few others, and we were passing a pen between us whenever someone wanted to talk, which is probably the most 'explicit' example of taking turns. Typically the conversations I take part in are quite informal, so it's just a case of making yourself heard and *trying* not to be rude." (svr67)

As participants described, when they took turns in their conversations, even though avatar embodiment is supposed to foster discussions [44], taking turns was done mostly in a vocal manner (70%), which was not always easy: "sometimes with a bit of difficulty. I guess this is a little similar to Zoom. You have to wait for someone to stop talking as depending on the platform depends on how good sound works" (svr47). One exception was described by svr98, who is neurodivergent and who found that practices like pointing to indicate speaking turn order was as effective in SVR as in offline settings. More often, however, participants stated that they had to yell to be heard, i.e., "the louder always goes first" (svr84). It takes an extra effort for SVR users not to be loud in SVR, especially when it comes to communication with strangers because among friends they are used to yelling and interruptions (svr6). One danger is that such behavior and attitudes can become normalized, with a socially required acceptance and reproduction of such practices and their interpretations. Svr77 specifically justified such an atmosphere in SVR based on the stage of technological development of SVR:

> "Well, it's chaotic most of the times, tbh. But it's normal I guess, we are in the early days of VR 'age' sort of speaking. But I guess it is no different to normal conversations as you just try to wait till the other person ends their speech or whatever." (svr77)

Participants noted that smaller groups are more manageable in terms of virtual conversations, but "if there is too many people, it becomes a bit of a problem though." (svr91) SVR does not seem to be suited for group discussions. Even though many participants expressed that Zoom 'feels less natural' for communication, in the end, although social gatherings of multiple people is an affordance of SVR, communication affordances in those instances are poor: "There is a fair amount of talk-over that goes on in SVR, though, it can be somewhat annoying when multiple people are all trying to speak at once." (svr79)

There is also a fundamental issue with combining two of the most basic social and physical affordances in SVR, i.e., talking and walking simultaneously. The embodied practice of movement, or a change of a physical location, is also said to be fundamental to VR experiences [21] but it is not always easily incorporated into social interactions given the technological challenge of aligning any physical movement and physical bodies (of real people) with simulated movement in artificial environments [12]. Sometimes, during simultaneous walking and talking, it can be hard for users to focus on the conversation, as described by this participant: "Orientation can be a tricky thing, having to navigate virtually, and literally can be hard to focus on simultaneously" (svr69). Similarly, there are issues due to the simulative nature the SVR spaces: "if the person isn't facing you, you won be able to hear them all the way or if you are talking and walking they can run into a different place mid convo" (svr100). Many times, "there's no expectation of eye contact or personal space whatsoever while talking" (svr60), thus "it can be a little odd trying to face some people or the eyes don't always want to look at each other and it can sometimes seem like the person isn't looking at you and thus isn't interested" (svr45). In other words, the combination of affordances relating to movement and communication can have unintended interpersonal effects.

Overall, these examples suggest that the breakdowns in attempting to use embodied communication affordances led participants to either avoid those actions and gestures, suggesting that, for many,

embodied communication constituted a false affordance of SVR. Those who were able to use embodied gestures and actions displayed a negotiated reading of those affordances [45], deciding how and when embodied actions might be relevant or useful depending on the specific social scenario. For the most part, working around the limitations of embodied actions in SVR caused many participants to rely on using the platforms primarily for simplified forms of action and communication.

4.2.2 Exaggerated, simplistic, and limited non-verbal expressions. The spectrum of gestures that *can* be expressed in SVR is wide [33], but the spectrum that is expressed in practice is not. When asked directly or through a contextual question, half of the participants reported employing at least one non-verbal act with their head or a hand. In general, however, these gestures were often generic and simple. This included waving (n=40), raising a hand (n=12), nodding and shaking a head (n=21), pointing (n=10), and visualizing a sign with hands (n=5), such as a thumbs up (svr40). Many stated they would use several of these gestures in the course of a conversation: "I use my hands to wave to show that I'm greeting the people I'm in communication with and my head to show that I can hear them and I agree. I also raise my hand if I have an opinion" (svr111). However, other users claimed they rarely used non-verbal gestures, like svr58: "I sometimes wave at people to be polite. Other than that, I don't use my head and hands that often" (svr58).Although one of the key patterns that describes the non-verbal gestures that participants used is how broad and simplistic they are, despite their simplicity they would often also be exaggerated, as described by svr85: "mainly to wave or point, I use them as I do in real life, but with more exaggerated motions I guess" (svr85).

The same patterns of limited embodiment in the communicative process are reflected in situations when users need to attract attention to themselves. The exaggeration here applies to vocal communication as well. 63 participants reported attracting attention to themselves using primarily vocal means. For example, svr36 would get attention "by waiting for a pause in the conversation and then talking. I don't wave my hands or anything." (svr36) A third of the participants reported acting more disturbingly, i.e., they often yelled and raised their voices to attract attention, as in "I yell and become super annoying acting with my avatar." (svr119) Others would "talk louder and make exaggerated movements with hands" (svr84), "start speaking louder or physically put [themselves] in front of others" (svr33), or "raise voice a little, make strange noises, or ask an uncomfortable or interesting question" (svr6).

Some participants said they would wave (n=12) or raise a hand (n=21) to attract attention. Usually, it would still include yelling: "Sometimes waving my hands as if I'm greeting a friend I saw across the street. In some occasions, walking to someone and talk louder and, if necessary, scream to draw attention" (svr73). The remaining participants would perform some exaggerated atypical movements (n=7), as in "I draw attention to myself by moving around a lot, doing funny or weird voices and dancing or singing" (svr102). Others would look for additional ways to draw attention to their avatar (n=7), as in "I can stand on top of a table or shout something out loud or move around the spaces creates and also the clothes of fashion I wear" (svr13).

Another situation in which participants could have communicated via embodied tools was when they were far away from someone who could still see them. Participants described three practices in these cases: vocal/textual (n=50), non-verbal (mostly waving, n=50), and/or approaching others (n=43). Most of the time, they reported a combination of these practices: "I'll be screaming or doing hand gestures until they notice me. Sometimes, this leads to some funny situations" (svr73), or "I can wave at them, call them over with hand gestures or I can shout to them or walk closer to them" (svr32). Three participants would also throw virtual objects at other users. According to svr67, "usually, this is enough to get someone to come closer and see what I have to say."

4.2.3 Simplistic and vocalized emotional expressions. Emotional expressions are limited in SVR. In many cases, they are specifically designed to be positive. For example, in RecRoom, facial expressions are limited to express happiness so that everyone looks friendly [37], which can be problematic when it comes to accurate expressions for emotional states that are not always positive. In general, because non-verbal communication is less accurate in SVR, emotional expressions can lead to misinterpretations due to the technological limitations of SVR [55].

Overall, joy and excitement were the most widespread emotions that participants reported they could express or understand. The other two reported emotions were sadness and anger. Even when participants said they could express "all emotions," they would refer to basic emotional categories: "you can express everything, laugh, anger, sadness, and that's why I really like spending time in VR" (svr6). Participants primarily described and identified emotional expression based on vocal (rather than embodied) affordances, noting "basic emotions that can be inferred from someone's voice, like laughter, joy, anger" (svr12). While participants said that vocal communication can express any emotions, they would still acknowledge the limitations: "Of course, it's hard to express emotions through facial expressions due to technological limitations, but speech can also express most, if not all, emotions" (svr25). However, as svr83 pointed out, happiness/excitement and anger are the most obvious emotions in the tone of the voice and in the intensity of the avatar movement. While participants often refrained from expressing more complex or unrecognizable emotions, the capacity or effectiveness of the available affordances to express excitement and anger could be linked to how often those emotions were expressed.

Our participants also described the limits of body language and avatars (svr119), describing how their modes of expression were limited in regards to presentable emotions: "emotions that I can express with my voice but surely not emotions I can express with my face or my body" (svr71). Participants reported being able to use their hands for self-expression, but also in a simplistic manner: "Only really what you can convey through voice acting and vocal expression. The arms can wave a little or express shock by covering the mouth perhaps" (svr51). Overall, while it is obvious that SVR does not replicate all possible forms of human communication, the available affordances would shape how participants used SVR to communicate and express themselves, prioritizing certain forms of communication and limiting the range of their emotional expression.

4.3 Unreal SVR, or negotiating reality boundaries

Even though SVR users often look for "realistic" experiences, SVR also can be a space for an escape, experiments, or a moment in a quiet or controlled space. Sometimes, participants would indicate that it is the whole purpose of SVR: "everything feels unrealistic, I guess that's why I like it" (svr82) or "some extreme worlds are clearly unrealistic, but that's part of the fun of being in VR" (svr32). For our participants, the unreal and simulated nature of SVR helps people to escape reality (svr1), to feel like they can be anywhere with people around the world without existing physical limitations (svr72).

In these cases, participants saw opportunities to leverage the affordances to control their environment to suit their needs, which including having control over social situations, which is not applicable to in-person meetings in which individuals share spaces both socially and physically. Specifically, they referred to the ability to mute others: "virtual conversations are very different, especially when you have the ability to mute people or kick them out of chat rooms." (svr57). Some participants (n=4) also appreciated the ability to leave the conversation at any time, because "you can leave the conversation whenever you like without fear of being rude. It's a completely different experience, less hindered by the conventions of typical conversation" (svr58). For some, like svr63, this affordance has a calming effect:

> "I find it more comfortable. I have anxiety, so not actually physically being there, I find a sense of safety [...] as I'm still where I feel comfortable yet still present, also the fact that you can leave if you feel necessary without the uncomfortable sense of people seeing you leave, or asking why you are leaving." (svr63)

This level of control extended to identity expression via avatars and/or choosing which aspects of their identity they chose to reveal. Some participants (n=8) indicated that in cases where real-world settings do not allow for identity expression, avatars provide an alternative (svr103). This was the case for svr67, who was a part of the furry community, and who used SVR to create their virtual bodies. They also appreciated the level of privacy that SVR platforms, such as VRChat, can provide in a private closed environment that felt much more welcoming than public spaces.

About a third of the participants (n=34) reported that SVR allowed them to be more social or more honest with others due to the relative anonymity (svr98) and corresponding self-disinhibition [48]. Some women felt that it was comforting to be less visible through the use of an avatar, as they did not feel that they were being watched or judged (svr21). As svr83 noted, "I don't have to worry about my appearance and instead, people can judge me on my characters and what I say" (svr83). For some, a feeling of distance from reality is a part of the energetic atmosphere in SVR, where "virtual interactions are way more over the top, fun and extroverted" (svr102). At the same time, this distance may mean for some people that ordinary social norms do not apply to the emerging virtual circumstances:

> "People in the real world need to follow the rule of society and so on, but in a virtual world, you can blur those rules and have more freedom. I guess the freedom is a big part of why people like VR." (svr77)

5 DISCUSSION

SVR platforms, by design, encourage social connection [28, 38], conversation [36] via non-verbal tools [33] and other embodied practices [27]. However, SVR affordances, being a product of interactions between SVR users and platforms [47] are dynamic because of the ways that users imagine and interpret those affordances [39], and because the major affordances interact with each other [42] encouraging the emergence of newly defined affordances and ways to use SVR. These factors highlight a complex interplay between technology and human agency, where users reshape and redefine the boundaries of what technology can offer, potentially challenging or responding to existing norms [45]. As a result, it is necessary to question the direct or indirect impact of the technology on its users, whether it is a promotion of social connections [28] or a sense of embodiment [21].

Our results show that SVR, as a social platform, is a product of interpretation and use practices. Users' interpretations, preferences, and creative impulses influence how technology is employed, sometimes leading to unexpected and unconventional uses [45]. Designed affordances, as a dominant construct, do not always correspond with users' immediate practices. Given that users are *always* interpreting technology, users can rethink or reinterpret the design, uncovering hidden or unapparent ways to use SVR affordances. As Shaw [45] suggests, there are many ways that participants can oppose the dominant design, discover hidden or false affordances, or negotiate new uses for SVR beyond the designers' original intentions.

Such dynamics open doors to innovative and unanticipated applications of SVR. In the following subsections, we present a few such dynamics based on our analysis. First, we found that the hidden affordances of SVR lead to asocial use, complicating the emphasis on social experiences in SVR platforms. Second, our analysis offers an insight into what can be interpreted as a false affordance of SVR, embodied communication, which is not only limited by current hardware and software but also increases the importance of vocal communication that can contribute to asocial use. Third, we describe increased control over SVR environments as an 'unreal' affordance that users contrasted with offline spaces. Finally, we present the potential impacts of the imbalance between SVR affordances and users' behavior.

5.1 Issues with social connection and asocial use as a hidden affordance

While SVR platforms are inherently social, users can reinterpret this fundamental assumption and find value in the non-social aspects of the technology. For various reasons, some users either prefer or need to be alone within a platform's ecosystem. For instance, as seen in the Subsection 4.1, SVR can sometimes be overwhelming, especially in VRChat [37], causing individuals to seek quiet spaces relying on SVR's non-social features. This phenomenon reflects the dynamic and natural ways of technology adoption, where users actively shape their interactions with technology based on their contexts and needs.

The emergence of asocial use patterns in SVR is a reflection of evolving practices in digital spaces. These asocial uses may foster the development of new practices as these individuals explore SVR's capabilities in isolation, such as immersive dwelling, which is a process of playing and experimenting with avatars in front of a virtual mirror [58]. Such actions reflect ways that users' interpretations of SVR affordances can produce meaningful and personalized practices. This evolution highlights the adaptability of technology in accommodating diverse user needs and preferences, showcasing the platform's potential to transcend its original social-focused design and offer multifaceted experiences similar to real-world social environments. Future work could examine asocial use in more detail, for instance, by analyzing users' motives, forms of asocial engagement, emotional reactions, or their impact on the overall social landscape in SVR. At the same time, these experiences raise questions about how *social* SVR truly is, especially when considering these findings alongside the limited and simplified scope of embodied communication.

5.2 Embodied communication as a false affordance of SVR

SVR, by its design, presents a promising platform for embodied communication, as evidenced by prior research [33]. However, based on our findings, it appears that users do not (or cannot) fully make use of these opportunities, and there are discernible limitations of non-verbal communication within SVR. The gestures and emotions conveyed in these virtual spaces tend to be simplistic and broad [37], heavily relying on vocal expression. Our participants' responses demonstrate that vocal communication dominates the SVR landscape. Non-verbal acts or gestures, besides basic ones like waving or whole-body movements for locomotion, did not naturally find their place in SVR interactions. Furthermore, issues with the accuracy of embodied communication led to potential misinterpretations of cues and misuse of features [58]. Consequently, our participants either did not employ a variety of opportunities for embodied communication or engaged with those modalities in a simplified manner, resulting in a lack of diversity in their communicative experiences.

False affordances can lead to errors and confusion [17]. While SVR encourages simplified communication, it can inadvertently lead users to adopt loud and, at times, obnoxious behaviors to ensure their visibility and audibility in the virtual environment. Some (like svr9) stated that they usually would not attract attention to themselves in SVR (or generally), but felt the need to do so loudly. Alternatively, users can push others to get attention (svr86) or crash at walls (svr37) to be noticed. Although the goal of these practices can be to compensate for the limited communication capabilities in SVR, such behavior may potentially contribute to an atmosphere that is loud, obtrusive, and feels unsafe or unpleasant to some users (including the ones who perform such behavior). This phenomenon underscores the delicate balance that SVR designers must strike between encouraging user engagement and maintaining an environment of meaningful, safe, and wholesome interactions. As a result, it may be necessary to limit interaction features that do not yet accurately represent users' communicative intentions. The most popular SVR applications (observed in the present study) fail to adequately afford group conversations, which can lead to obstructive behavioral patterns, such as interruptions and yelling. The more SVR users reproduce such behavior, the sooner it may become the norm in SVR.

5.3 'Unreal' control as desired or necessary affordance

The lack of social norms and coherency in embodied social communication of SVR may encourage participants to seek ways to exploit the simulative nature of SVR by having increased control over their environment, including social situations. This control is demonstrated through features like muting others, the ability to leave conversations at any time without fear of being rude, and the calming effect of having the option to remain present in social virtual spaces while still feeling physically comfortable. This also pertains to identity expression through avatars, as users control which aspects of their identity to reveal. Some participants, particularly those facing limitations in real-world settings, found avatars to be an alternative means of expressing themselves. Privacy is also valued, with closed virtual environments providing a more welcoming space than public ones. Some individuals, especially women in our sample, appreciate the freedom from being visibly judged and find comfort in being evaluated based on their personality and words rather than appearance. All these considerations may be necessary for SVR users to adapt to the unwelcoming circumstances and extreme interactions with other users.

As a result, a negotiated reading or reinterpretation of SVR's social qualities can also be applied to common conceptualizations of SVR as offering something that is impossible in reality, including the argument that "technology is at its best when it scaffolds us in ways that supplement and even transcend what we can do in physical reality" [36, p. 449]. On one hand, our participants offered examples of appreciating experiences that they interpreted as impossible in real-world spaces and/or features that do not represent real-life capabilities, such as the ability to leave a conversation instantly at any point in time or mute others. However, future work might also examine when such behavior represents an effective use of the controlled VR context, or when it represents a byproduct of social irregularities, miscommunications due to the limitations of the available forms of expression, or even deliberate misuse of current affordances. For example, prior work has shown that some of the safety features in SVR can be exploited to harass individuals [58].

5.4 The imbalance between SVR use and designed affordances

Technological or designed affordances affect the use practices of embodied communication, self-expression, and social connection. For example, VRChat promotes creative tools for playing with one's visible identity through avatar customization whereas Meta's Horizon Worlds or BigscreenVR focus on the quality of social activities rather than identity expression [14, 54]. Each of the SVR applications that our participants used provides structures that strive to provide the foundations for virtual cultures, norms, and behaviors to evolve. As we demonstrated, however, there is a disconnect between the actions that users take to express themselves and be heard and seen, and the affordances that are designed to allow them to do so.

SVR's functions for communication may not always be appreciated by users, as they primarily facilitate broad and exaggerated expressions of basic emotions, such as joy or anger. In essence, SVR applications are currently tuned for extremes; for instance, conveying happiness often requires exaggerated actions like jumping around or breaking things. These extremes can result in obnoxious behaviors and discomfort, potentially leading users to avoid social contact and spend time alone. Alternatively, extreme behaviors can be normalized and become a part of SVR's social practices because users get used to them, for example, because they often perform them with friends. Future work could examine how communication in SVR might more effectively incorporate the nuance of real-world interactions. This is especially needed as misread cues, such as an enthusiastic greeting, could be misunderstood as an insult [58] or efforts to seek attention can include harassing behavior, whether or not this is the intention. To understand the attitude and emotions of other users, our participants described relying on the tone of others' voices, with affordances for embodied or gestural communication often avoided or used only in their most simplified forms.

5.5 Future work

For SVR designers, technical limitations are part of the problem in regards to the accuracy of communication, which is not as precise and representative of the real-world communication standards that users might expect. While it is necessary to improve technological applications, it is important for SVR designers to identify which reinterpretations are desirable or reasonable reactions to the contexts, and which should be avoided. For instance, SVR designers should recognize that some users may prefer or require individualized engagement, so they need to provide options for users to customize their social experience, including the ability to find quiet spaces within the platform. However, it is necessary to understand the motives and forms of asocial engagement in SVR and its underlying problems. This could involve analyzing users' behaviors, emotional reactions, and the impact of asocial use on the overall social landscape.

Improvement of non-verbal communication in SVR may include enhancing the accuracy and diversity of gestures and emotions conveyed in virtual spaces. However, because this can be limited by the technology that is available, SVR designers should encourage a balance between vocal and non-verbal communication within SVR interactions. While the design of such systems, like SVR, is based on a set of related suggestions or assumptions, if such suggestions are not followed, the system may fail, unless it is adaptable to account for the deviations. That said, it would also be useful to educate users about the capabilities and limitations of embodied communication in SVR. This would help users understand how to utilize non-verbal communication tools to enhance their communicative experiences effectively. Finally, highlighting user control and opportunities for adaptation in any situation may empower users even more.

5.6 Limitations

A significant limitation of the study arose from the survey format employed for data collection. The main issue was the constrained control over participants' responses, occasionally leading to situations where researchers could not clarify or understand certain responses, resulting in data gaps. To mitigate this challenge, the research team sometimes had to infer or reconstruct the intended meaning of participants by considering their other responses that were not directly related to the topic in question. For instance, if participants stated that they did not use gestures when asked directly, but described performing non-verbal communication in another response, we relied on the latter data unit.

Another limitation is that our sampling was limited to a specific time period of data collection, primarily collecting data from certain world regions. We also acknowledge that our results can only be interpreted in the context of the current SVR landscape, which includes perceptions and interpretations based on the novelty of VR technologies and environments. In that sense, some findings may not be valid after significant changes are implemented or users have adapted to new emerging practices. We hope that our findings will lead to technological developments and communication-related affordances in SVR applications will evolve to reflect safer and more wholesome user experiences.

Another limitation that we acknowledge is the limited generalizability of our assumptions and conclusions. Specifically, we understand that participants may not have remembered the type, frequency, or contexts of the gestures they performed. Overall, any self-reported data regarding individual experiences is always likely to be affected by the participants' recall.

6 CONCLUSION

This research describes the dynamic and often unforeseen ways in which users engage with SVR, challenging established boundaries of technology use and human-computer interaction. Recent scholarship underscores the importance of a nuanced understanding of SVR user practices. Given the significant divergence of these practices from the intended affordances of SVR, it becomes crucial to apply this understanding to the analysis of SVR experiences. While SVR is designed to facilitate social interactions, the absence of established norms and the quality of communication between users raise questions about its social characteristics and application. Additionally, technological constraints, functions, or specificities in terms of embodied self-expression further influence this dynamic. As users continue to reshape SVR's potential, future research should delve deeper into these effects and their implications for the development of virtual norms and practices within SVR.

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