Hugging from A Distance: Building Interpersonal Relationships in Social Virtual Reality

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ABSTRACT

This paper focuses on how the emerging social VR systems, as new and unique social interaction spaces that afford high-fidelity and multidimensional physical presence, may support building interpersonal relationships in a more nuanced, immersive, and embodied way. Based on 30 interviews, our investigation focuses on 1) the main reasons why people build and foster interpersonal relationships in social VR; 2) various novel activities through which users can foster relationships in social VR; and 3) the complicated influences of social VR mediated relationships on users' online and offline social lives. We contribute to better understanding mediated interactive experiences by shedding light on the novel role of social VR in transforming how people meet, interact, and establish connections with others compared to other forms of media. We also provide potential directions to inform the design of future social VR systems to better afford healthy, fulfilling, and supportive interpersonal relationships.

CCS CONCEPTS

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

KEYWORDS

computer-mediated communication, online relationships, online interaction, social virtual reality

1 INTRODUCTION

Social Virtual Reality (VR) refers to 3D virtual spaces where multiple users can interact with one another through VR head-mounted displays (HDMs) [36, 37] and can be traced back to the concept of collaborative virtual environments (CVEs) [5]. Over the past five years, social VR applications, such as VR Chat, AltspaceVR, and Rec

Room, have emerged as the next generation of VR and afforded digital social space where people meet, interact, and socialize in new and more immersive ways. The increasing popularity of social VR has also led to an emerging research agenda to further investigate the mediated interactive experiences in these novel digital social spaces, including design strategies [23, 36, 43], communication modes and interactive activities [28, 33, 37, 38], long distance couples' and children's engagement [30, 31, 48], and self-presentation and avatars [3, 16, 18]. Still, little is known regarding how engaging with social VR may affect some of the deepest and most meaningful aspects of human experiences: building, developing, and maintaining interpersonal connections and social relationships. Establishing such connections and relationships is not only the most important psychological and behavioral dynamic of knowing, loving, and caring for a person [22] but also directly affects how people work, live, and interact in various forms of collective lives such as groups, organizations, and communities [1].

Therefore, using 30 interviews of users of different social VR platforms, in this paper we investigate the nuanced dynamics of developing interpersonal relationships emerging in social VR. Inspired by social scientific literature on human communication and relationships, we define a relationship in the context of social VR as a strong, deep, or close association/acquaintance between two or more social VR users (e.g., friendship or romance). Specifically, we explore the following research questions:

RQ1: *What motivate people to build and develop relationships (e.g., friendships) in social VR?*

RQ2: *How do people foster interpersonal relationships in social VR?*

RQ3: *How do these social VR mediated relationships affect users' online/offline social lives?*

We thus make several interlinked contributions to better understanding mediated interactive experiences. First, our study provides empirical evidence of nuanced relationship building dynamics in social VR, an emerging interactive digital social space. This sheds light on the novel role of social VR in transforming how people meet, interact, and establish connections with others compared to other forms of media (e.g., social media and online gaming). Second, we highlight the focus on *embodied interactions and experiences* and *replicating mundane everyday activities* in forming and fostering social VR mediated relationships. This points to the need to take embodiment, realism, and naturalness into account when (re)conceptualizing computer-mediated interpersonal relationships. Third, we also provide potential directions to inform the design of future social VR systems to better afford healthy, fulfilling, and supportive interpersonal relationships.

2 RELATED WORKS

2.1 Computer-Mediated Interpersonal Relationships

Hassenzahl et al. [21] suggested that the Beatles' song "All You Need is Love" summarizes typical psychological studies of human needs for relationships in the past 60 years: the general feeling of being related to others, in other words, establishing interpersonal relationships, is crucial to people's life satisfaction and happiness. Most traditional social science studies appear to agree that an interpersonal relationship refers to a strong, deep, or close association/acquaintance between two or more people, involving experiences that range from the mundane to the aesthetic [42], and as a specific sort of knowing, loving, and caring for a person [22]. Such relationships are demonstrated as various forms such as friendship (a freely chosen association), family (which establishes roles and identities), and romance (based on passion, intimacy, and commitment).

The question, then, is how much of these relationships carry over into digital interactions and how do computing technologies affect them? Existing studies in HCI and CSCW have pointed to the significance to investigate various types of interpersonal relationships (e.g., workplace, friendship, romance, and regular domestic behaviors) as they are formed, maintained, or fade in diverse online social spaces such as social networking sites [9, 10, 25], online dating sites and applications [45, 49], and forums (e.g., [12, 41]). They have highlighted: 1) in contrast to relationship building in the offline world, online users are more sensitive to their own internal states (e.g., emotions, feelings, attitudes, and values), showing an "enhanced private self-awareness" [11]; 2) the text becomes a vehicle for relationship building because the "process of creation of a mutual narrative biography" [20]; and 3) the developmental sequence of technology-supported relationship building is similar to that of offline relationships: starting with an initial encounter; a growing stage of sharing minds, which may generate the feeling of connectedness; and a "virtual mirror" [2] stage of mutual optimization and idealization. In this process, selective self-presentation may happen because of the lack of social contextual cues [46] and the relative anonymity of digital interactions.

In particular, a body of research has investigated interpersonal relationships in multi-user virtual environments such as online gaming and 3D virtual worlds (e.g., [13, 14, 17]). Many studies have underscored the importance of collaboration to relationship building in these environments. Instead of merely playing alone or observing others' behavior via public communication channels, collaboration provides online users with both social support (e.g., mutual trust among multiple players) and strategic/instrumental support (e.g., knowledge gathering and sharing, player decision-making, leadership, failure) (e.g., [4, 47]). It offers a more intimate forum for game play, allowing players to attach themselves to a group, to automatically follow and better understand one another, to naturally compete with other groups, and to show how they react in tense, risky, and unclear situations [39]. However, prior research reveals two limitations in using technology to foster and support interpersonal relationships. First, technology design for supporting interpersonal relationships tends to emphasize communication affordances, which may neglect many other crucial experiential

qualities such as embodiment or shared memories for relationship building. Second, few existing technologies can offer embodied and immersive experiences that seamlessly replicate people's everyday activities, which play a significant role in forming and maintaining interpersonal relationships. To address these limitations, in this paper we focus on how the emerging social VR systems, as new and unique social interaction spaces that afford high-fidelity and multi-dimensional physical presence, may support building interpersonal relationships in a more nuanced, immersive, and embodied way.

2.2 Social VR as Emerging Social Spaces

Social VR refers to 3D virtual spaces where multiple users can interact with one another through VR head-mounted displays [36, 37]. In Social VR, users can create, craft, and customize their avatars to enter the virtual spaces and interact with others. Their avatars support full body tracking (i.e., one's avatar body actions correspond to his/her physical body actions in real time) rather than merely being controlled by mouse, keyboard, or joystick on a computer screen. Using such avatars, social VR users can conduct and enjoy real life social activities such as walking in public space, playing a game, watching a movie, participating in a concert, and having a party in a highly realistic simulated 3D virtual environment. Examples of popular social VR platforms include AltspaceVR, VR Chat, Rec Room, Facebook Spaces (discontinued in 2019), High Fidelity VR, and so forth.

The booming commercial social VR applications have led to an emerging research agenda on social VR as novel social spaces for mediated interactive experiences. Prior studies on social VR have focused on design strategies [23, 36, 43], communication and interaction modes [3, 29, 33, 37, 38], long-distance couples' and children's experiences [30, 32, 48], and harassment and privacy concerns [7, 34]. They have also highlighted three unique technological affordances of social VR. First, it affords full-body movements and gestures in real time, high-fidelity 3D immersive virtual spaces with 360 degree content. Second, it supports vivid spatial and temporal experiences and a range of emotional states that is similar to face-to-face interaction. Third, it mediates both verbal and non-verbal communication as well as a wide variety of social activities through embodied social interaction [36–38, 43, 48].

These characteristics seem to introduce more immerse, real-time, and embodied interaction practices and experiences. Yet, still little is known regarding how these unique technological affordances, such as the direct relationship between social VR users' physical body and avatar body and the immersive experiences, may affect social VR users' experiences of meeting, knowing, and caring for others through technology. This open space, therefore, leads to our focus on social VR mediated interpersonal relationships. Our investigation has three emphases: motivations to build interpersonal relationships (RQ1), specific activities and experiences to foster such relationships (RQ2), and influences of such relationships on people's online/offline social lives (RQ3).

3 METHODOLOGY

Data Collection. This study was part of a broader research project on social experiences in social VR. It was approved by the University's Institutional Review Board (IRB) for research ethics. We

posted a recruitment message on nine popular online forums for social VR users (e.g., Reddit-RecRoom, Reddit-Altspace VR, and Reddit-VRChat) to recruit participants who were willing to be interviewed. We also directly recruited participants by entering popular social VR spaces (e.g., AltSpace and VRChat) and asking random users whether they would be interested in participating. All participants who responded to our requests and agreed to participate were interviewed. As a result, 30 semi-structured in-depth interviews were conducted. Interviews were conducted via text or audio chat through Discord, Skype, or Google Hangouts based on participants' preferences from October 2019 to November 2019. The average length of interviews was 60 minutes and participants were given a $20 gift card after they completed the interviews. Interviews started with questions about basic demographic information and devices and social VR applications that participants use most. Interview questions were designed based on our extensive prior work on social relationships in online gaming [14, 15, 17, 19] and a preliminary study on long distance couples' experiences of social VR [48]. The main interview questions were related to participants' avatars, important interactive activities and social experiences they had in social VR, how they met and developed relationships (such as friendships or romance) with others in social VR, and their perceptions and understandings of social VR affordance. Example interview questions related to this research include: *"Have you ever used social VR as a way to seek friends, romance or any type of close interpersonal relationship? If so, how?"; "Have you ever used social VR as a way to maintain existing relationships?"; "Do you feel engaging in social VR help you make new friends/find significant others?"; "How do you maintain connection with people you met in social VR?"*

Participants. Among the 30 participants, 21 are cis male, five are cis female, and four are trans women. Of the 29 participants who shared their ethnicity, 20 are White, two are Black, five are Asian, and two are Hispanic. Two participants (P26 and P27) self identified as persons with disabilities. Participants aged from 18 to 65 (average age: 32.2) and with diverse experiences of social VR ranging from 5 months to 36 months (average: 18.7 months; SD=10.7). They also spent 5 to 80 hours on these platforms per week (average: 16.3; SD=17.9). Participants had experienced a variety of popular social VR platforms. 3 participants only exclusively used VR Chat and 27 participants were frequent users of more than one social VR platforms. Such platforms included Rec Room (N=27), VR Chat (N=27), AltspaceVR (N=17), High Fidelity (N=5), Facebook Spaces (N=1), Vtime (N=1), Engagae VR (N=1), Mozilla Hubs (N=1), Sonoroom (N=1), Pokerstar (N=1), Oculus Rooms (N=2), Sansar (N=1), Anyland (N=2), Echo Arena (N=1), and so forth.

Data Analysis. Using a Grounded Theory Approach [44], we used an empirical, in-depth qualitative analysis of the collected data to explore how people build and develop interpersonal relationships in social VR. We did not seek inter-rater reliability in our analysis but endeavored to identify recurring themes of interest, detect relationships among them, and organize them into clusters of more complex and broader themes [35]. In doing so, both authors first closely read through the collected data to acquire a sense of the whole picture as regards how people sought, built, and developed interpersonal relationships such as friendships in social VR. Second, both authors highlighted interview questions that were relevant to each RQ and used thematic analysis [8] to identify a set

of initial thematic topics and sub-themes (e.g., motivations, experiences, activities, and outcomes) emerging in participants' answers to these interview questions. Third, a shared spreadsheet was used to document, combine, and refine these themes and sub-themes per research question by color coding. Fourth, both authors collaborated in an iterative process using the shared spreadsheet to discuss, combine, and refine themes and features to generate a rich description synthesizing participants' perceptions and experiences of relationship building dynamics in social VR.

4 FINDINGS

We present our findings in three parts: main motivations that drove participants to build and develop interpersonal relationships in social VR (RQ1); important activities and experiences through which social VR users fostered various interpersonal relationships (RQ2); and influences of these emerging relationships on social VR users' online and offline social lives (RQ3).

4.1 Motivations for Building Relationships in Social VR

All 30 participants in our study reported that they had developed certain types of interpersonal relationships (e.g., friendship or romance) with people they met and interacted with in social VR. 28 participants highlighted that they mainly used social VR to meet and build relationships with online strangers rather than maintaining relationships with people they already knew (e.g., existing friends, romantic partners, or family members). In particular, three themes emerge in our data concerning why participants would build and develop relationships in social VR: relationships were not sought out but naturally emerged; endeavoring to meeting and learning from people beyond geographic limitations in a more realistic manner; and practicing how to use social VR to maintain existing relationships in the future.

4.1.1 Relationships Were Not Sought Out But Naturally Emerged. 15 participants never had the intention to build friendships or meet a romantic partner through social VR. For them, the main goal of engaging in social VR was to explore and experience this novel technology. However, all 30 participants developed certain types of close relationships with people they met in social VR over time. In this sense, their close relationships with others were not sought out but naturally emerged. P21 (cis female, 45, White) explained, "*When I started using the platform, it was not for social purposes or getting to know people. I wanted to get to know the technology, the device, and how to do specific tricks. You can actually throw the ball when playing basketball in social VR, which for me was very new. However, over time I gained a sense of how to meet people in VR, and I started to actually want to meet new people through VR.*" Clearly, building social connections was not a pre-existing goal for social VR users such as P21. She was motivated to engage in social VR only to explore the technology itself and engage in the novel embodied experiences afforded by such technology. Gradually, however, her subjective experiences diverged from her original motivations as she engaged in social VR over time, making her "*actually want to meet new people through VR.*"

This natural and gradual process was considered an organic way to develop relationships with other social VR users. P12 (cis

male, 49, Asian) and P10 (cis male, 20, Asian) summarized their experiences, "*The social aspect is not something I actively seek out [in social VR]. Usually it just happens organically, and I think that's a good thing*" (P12) and "*For the most part, most of the people that I have met in social VR and formed these kinds of friendships have all been just like accidental . That's also the best part of the social VR experiences because it's so natural*" (P10). Neither P12 nor P10 actively made efforts toward building any social relationships with others when engaging in social VR. P10 even called the emergence of friendships in social VR as unplanned thus "*accidental.*" Such relationships just naturally emerged after spending time in social VR. This naturalness thus made their relationships with others "*organic*" and "*the best part of the social VR experiences.*"

Participants themselves were even surprised at this gradual change, as P5 (cis male, 29, White) explained, "*I don't seek out interpersonal relationships, romance, or anything like that. I have the real world to do that if that's what I want to actually do. So I'm surprised I actually made some friends in social VR over time.*" P5 in fact initially rejected the idea of VR-mediated relationships and considered that connections and attachments to others should only happen in the offline world. He seemed not to see social VR as a platform that fostered and supported such relationships, especially at a deep and personal level. Therefore, he was surprised by his subtle and natural transition from social VR as a technology for fun to social VR as a space for emerging friendships.

In all these examples, participants were motivated to engage in social VR for experiencing the novel technology itself rather than any pre-existing social purposes. However, despite being unplanned and unexpected, they gradually forged friendships with others by spending time together in social VR. For them, such relationships were not sought out but naturally emerged, which was considered a significant part of their online social experiences.

4.1.2 Meeting People beyond Geographic Limitations in A Realistic Manner. The other 15 participants acknowledged that they had intentionally used social VR as a way to seek close interpersonal relationships such as friendships and romance. They highlighted that they were mainly motivated to do so because they endeavored to meet and learn from people beyond geographic limitations. Though they may also be able to meet and interact with people from all over the world in other online social spaces (e.g., social media or traditional online gaming/virtual worlds), they especially noted that social VR afforded such opportunities in a more realistic manner. This uniquely motivated them to meet, interact, and build interpersonal relationships with others in social VR. For example, P10 (cis male, 20, Asian) revealed, "*I built some friendships in social VR because it feels more and more just like attending meetup events face to face, except I don't have the physical constraint of geographic location. And I actually feel like I'm talking with other people in real life.*" P10 compared his social VR engagement to "*attending meetup events face to face*" without any physical constraint. For him, what social VR attracted him most was not only how he could connect and hang out with others regardless of geographic limitations but also the feeling and experience of "*talking with other people in real life.*" In this sense, how he interacted with others in social VR was identical to face-to-face interactions in the offline world. This realism, therefore, motivated him to seek and develop friendships.

P21 (cis female, 45, White) further added how realistic such interactions could be in social VR compared to other media such as video conferencing and gaming: "*It's kinda like Zoom or Skype, but you have that personal [presence], like using an avatar sitting next to you and talking to you. But it is also different from having an avatar in a game or a 3D virtual world because it feels as if you're in the same place, and this is much better. I think it makes it more realistic that you are meeting with the other person. This makes me want to build relationships with them.*" According to P21, the ability to feel that he and other people were actually "*there*" together motivated her to seek and build relationships in social VR. For her, this experience was different from video conferencing due to the enhanced sense of presence (e.g., with an avatar). It was also unique from traditional gaming or virtual worlds because of more embodied avatars (e.g., full-body tracked avatars).

How would this happen? Participants attributed such realism to the fact that they felt more engaging, intimate, and personal with their avatars in social VR than traditional virtual worlds and online games. As P22 (cis male, 32, White) explained, he felt that his avatar in social VR was "*truly an extension of himself*": "*With RecRoom, when you're creating the avatar, you're actually looking at it, and you can move around and turn around. It's truly an extension of you. If it's in a normal game, it's not as engaged. I'll just find the first thing that's kind of okay and go with it.*" According to P22, avatars in games were simply characters, while in social VR, they became "*real life.*" P7 (cis male, 18, Asian) also considered that such a realistic experience (e.g., the ability to actually touch someone's shoulder) often facilitated the feeling of support, attachment, and care, which drove him to crave friendships and emotional connections in social VR: "*On days that are just long or when I am having a bad day, social VR is just so much more immersive because someone can actually reach out and touch your shoulder. So you know they have your back.*"

Therefore, more than half participants considered social VR a compelling and immersive virtual space to meet and connect with others who were similar to themselves or learn from others who had different experiences. P25 (cis female, 20, Asian) highlighted, "*Because I wanted to study art, I realized that social VR was such a great medium to interact with different people and different cultures that I had never met before. Being in Georgia (United States), I was born and raised in the same area. So I knew the same people my entire life. It was just really refreshing to realize that I could just talk to so many different people and get to know their cultures through VR chat. We could just hang out like in real life.*" For P25, she was motivated to seek close relationships in social VR because she could find and connect with people who also engaged in art, learn more about other cultures, and perhaps also challenge her own perspectives. Developing relationships with other social VR users thus provided her with a valuable opportunity to understand what was "*out there*" that she would not have known from where she lived. More importantly, she could connect with and learn from others in a manner similar to face-to-face interaction, which was a significant eye-opening experience.

4.1.3 Practicing Maintaining Existing Relationships through Social VR. Most participants (N=28) mainly using social VR to meet and build new connections with strangers. Yet, they also mentioned

that they were motivated to do so because they wanted to practice how to use social VR to maintain relationships with people whom they already knew (e.g., existing friends, romantic partners, or family members) in the future. For example, P14 (cis male, 32, Hispanic) explained, "*After messing around and building some kind of interaction and relationships with other people, I got to know how this thing worked, and it was really fun and gratifying. So I want to eventually use it to connect with people I know in real life. I think that'll be one of the real benefits of social VR.*" P14 was motivated to "*play*" with the technology and learn how to actually interact with others through social VR. In this process, he built "*fun*" and "*gratifying*" relationships with others. This became a valuable learning experience for him, making him more confident in the potential of using social VR with existing friends to strengthen their friendship when possible.

Others also expressed similar expectations for using social VR for maintaining romantic or family relationships. For example, "*I'm hoping to get my long-distance girlfriend a VR device so that we can meet and hang out in social VR. Now I'm experiencing it myself and making some friends there, so we know how it works*" (P11, cis male, 21, white); "*I will definitely go into VRchat together with my kids. I'm playing with VRchat and interacting with people so I can make sure it's the right space for my kids*" (P28, cis male, 48, white); "*I want to see who are out there in social VR first and if it's OK for my parents to go there, I wish my mom and dad had a headset and would once a week hop in and play a game of ping pong with me in RecRoom*" (P26, cis male, 30 white). All three participants highlighted their hope to leverage social VR's novelty to enhance their existing relationships, such as experiencing social VR with their romantic partners, children, or parents. However, they also revealed two main barriers for them to do so: the access to VR devices required for using social VR and the uncertainty of whom their romantic partners or family members would interact within social VR and how. Therefore, they were motivated to explore social VR themselves and experiment with interacting and building relationships with others. This helped them better understand the technological affordance of social VR and the typical social interaction dynamics in such spaces. With such knowledge, they would then feel more comfortable and encouraged to use social VR to maintain and strengthen their existing friendships, romance, and family relationships.

4.2 Novel Activities to Foster Relationships in Social VR

Regardless of whether interpersonal relationships were actively sought out or naturally happen in social VR, participants collectively pointed out novel activities that supported and fostered the emergence of such relationships. Such activities included engaging in shared activities in an embodied way, experiencing mundane activities in new ways, participating in immersive events, and actively extending relationships beyond social VR.

4.2.1 Engaging in Shared Activities in An Embodied Way. In social VR, users can engage in diverse shared activities together ranging from browsing the Internet, watching videos, playing games, exploring different worlds, to building digital artifacts. In particular, participants highlighted that engaging in these shared activities in social VR played a unique role in fostering their relationships with

others over time due to the direct relationship between their physical body and avatar body. P2 (cis male, 23, White) mentioned, "*In VR chat, you can have things that track your leg and parts of your body. You can even do finger tracking. So whatever you do in social VR is basically a one-to-one recreation, or 'mirroring' of you and what you do in real life. This makes doing things with others such as dancing, building, and playing games together super fun and real.*" For him, conducting activities with others in social VR was a "*one-to-one recreation*" of doing the same activities in the offline world due to the coordination between his avatar and his physical body. This "mirroring" dynamic thus made such shared activities similar to those conducted in the offline world ("*fun and real*"), which helped him build relationships with others.

P5 (cis male, 29, White) also shared similar experiences: "*I have made friends in Rec Room by playing games together. There's one person. I'm not sure if he actually is mute, or he just prefers not to talk. But we just communicated through body movements when playing games. The fact that we can use body language to communicate and play games together is really fascinating and helps us become friends.*" In P5's example, despite voice chat being the primary communication method in social VR, he could still communicate and play games with someone who did not talk via body language. For him, this was "fascinating" because they not only engaged in shared activities in a novel way (e.g., through the body-avatar connection) but also built friendships that they might not have been able to make in other platforms (e.g., where they could not use body movements). For these participants, the more they engaged in shared activities in social VR, the closer they felt towards others – not only because of the significant time they spent with others but also due to the feeling that they were conducting such activities in a face-to-face manner.

4.2.2 Experiencing Mundane Everyday Activities in New Ways. Another critical way to foster interpersonal relationships in social VR is to experience mundane and essential everyday activities in new ways that have never been done before in a virtual social setting. One such activity that 6 participants highlighted was sleeping. In fact, sleeping in social VR became such a popular activity that virtual places called "sleep worlds" were even created. They were virtual places where users could chat, relax, and fall asleep together with dark lighting and a calm ambiance. P7 (cis male, 18, Asian) explained how sleeping became an important way to connect social VR users by fostering communities of "sleepers" in "sleep worlds": "*In VR chat, there are Sleep Worlds. I would go any time when it is getting super late, either myself or with my friends. Someone would say, Okay, let's just go to a sleep world. And I'd be like, okay. Then we would all keep talking in the Sleep World. Eventually, we'd also go to sleep one by one.*" Other participants also noted that falling asleep in social VR was necessary to foster a feeling of intimacy for those in need (e.g., romantic partners). P3 (trans woman, 30, white) explained: *"It is like everybody who has a boyfriend, or a girlfriend may fall asleep with them on the phone. And I've been able to do that in VR. We'll just be sitting and talking and after a while, you know, fall asleep. It's just part of our relationship, making us feel closer to each other."* P3 was in a long-distance relationship with someone she met in social VR. The fact that she and her partner could fall

asleep together in social VR resulted in the vital feeling of intimacy and connectedness (e.g., *"making us feel closer to each other"*).

In addition to sleeping, participants highlighted other everyday activities afforded and simulated in social VR that helped them build relationships with others, including going to virtual bars, watching movies, dancing, and doing homework. For example, P3 (trans woman, 30, White) described her weekly routine to conduct such activities with people he met in social VR, "*Monday nights we watch movies inside VR. Then, Tuesday through Thursday, we just hang out in general. Usually Friday nights, we have some sort of party. I do a lot of dancing and stuff like that at the parties, and then, Saturdays are just usually us hanging out again.*" P6 (cis male, 29, White) also mentioned going to a bar world in social VR and met people, "*There is often some sort of cool setting like a bar in social VR. They are cool places to meet people. I go to a new bar, and there'll be groups of people in the bar, and I'll walk by them, and then I'll go upstairs, and there'll be another group talking up there. And then you go up another floor, and you find more people talking. So it's really just me walking around and listening in on a group and then slowly, you know, introducing myself into it, but in a less awkward way compared to real life.*" According to these participants, such activities were close simulations of what people would do in the offline world to meet and connect with others (e.g., going to a bar or a party to meet people and watching movies). This familiarity thus helped them quickly "fit in" seemingly foreign spaces in social VR. Yet, meeting new people for the first time and starting a conversation with strangers can be awkward in the offline world. In contrast, in P6's example, he seemed to feel more comfortable and less uncomfortable introducing himself to online strangers and engaging in conversations through social VR.

P3 (trans woman, 30, White) especially noted that the ability to dance in social VR as in the offline world was essential to establish, maintain, and expand her social life. She revealed, "*I've met a lot of people who literally only just came up to me because they saw me dancing. They were intrigued and said that you're such a good dancer. And then people will ask me to teach them dance moves, and I'll try to give them a basic introduction. So it has been a really good tool for me to connect with people and teach people.*" As P3 described, the ability to perform dancing in social VR using full-body tracked avatars significantly improved her ability to express herself in face-to-face situations. It also served as a catalyst to bridge her with others: people interested in dancing were attracted to interact with her and she started to make new friends and connections through teaching and discussing dancing in social VR.

Eight participants even used social VR as a platform to study with others and ended up making friends by asking for help with their homework. For example, P7 (cis male, 18, Asian) highlighted the importance of collaborative studying and mutual help for building new friendships: "*I've helped people from different countries with their homework, and they will help me with my homework. [...] I was helping some people with math, and someone from Japan was helping me with my Japanese. I think this helps me better understand other people and other cultures because we help each other. We then became friends after studying together for a while.*" For P7, studying with others in social VR was a win-win strategy: such activities effectively helped them learn their subject matters and built a mutual understanding and better appreciation of each other's culture,

which nurtured their emerging friendships. In particular, P7 pointed out asking for help and helping others in social VR seemed to be quite common and easy, "*I just go to a world and say, 'Hey, I need help with my homework.' Some people came up to me and helped. Other times I was like, 'I knew this person was taking this class.' So I asked them, 'Hey, I know you're taking this class. Could you help me out?'*" Simply by asking, he was willing to help others and vice versa. In this sense, social VR seems to afford a friendly and supportive atmosphere, facilitating users' everyday activities to build mutual understanding and mutual help.

4.2.3 Engaging in Immersive Events. Social VR provides various immersive events ranging from concerts, talk shows, and meetups for specific groups (e.g., LGBTQ+ and mute users) to professional development workshops such as coding, creative writing, and VR education. For our participants, engaging in these events in an immersive way constituted some of the most novel social activities in social VR, which provided them with significant opportunities to meet, interact, and build relationships with others. This is especially true for users who may lack mobility due to disability or financial/safety reasons (e.g., lack of transportation). Social VR eliminates many restrictions to attend various events for these participants, making socialization and networking more accessible to them. For example, P27 (cis male, 45, White), who is physically impaired, mentioned: "*I'm usually stuck at home on the bed. So social VR has opened up a whole new world. I like that I get to go to real places. Instead of me physically going out and meeting up with people, I just kind of sit on my bed and meet people.*" Such events also appear to have recurring audiences. This helps attendees build a reputation and foster stable interpersonal relationships, as they often engage in these events with the same group of users regularly. P19 (cis male, 43, Asian) explained this dynamic: "*When I run into somebody, they would recognize me, and I would recognize their avatar and name. So we sort of became friends. I think the seven or eight friends who I have in RecRoom were from a period of time when I was just jumping and playing with the same people again and again. It then got to the point where we were getting friendly with each other.*" For him, there was a clear transition from merely hanging out with random people in social VR to establishing familiarity and connections with a stable group of friends. The key to such transition was to regularly meet and interact with the same people by attending the same events.

Participants also reported that they became friends with those who hosted such events. P10 (cis male, 20, White) revealed, "*I basically formed friendships with several people who hosted events that I attended. For example, one person hosted those social events and networking type of workshops in AltspaceVR. I've attended a lot of her events, and we became friends. I think it's common for the hosts to become friends with people who come in regularly. I've attended guided group meditation sessions. It's nice to be there with others and make this a team thing. I ended up joining their group to host several of such sessions.*" According to P10, it was not surprising that event hosts often form certain types of close relationships with regular attendees of their events – their common interests brought them together, and frequent interactions through such events helped them further build familiarity and mutual understanding. In P10's case, frequently engaging in these events fostered a sense of community and belongingness. He started as a mere participant but

slowly mingled with the meditation group and even became a host himself.

4.2.4 Actively Extending Relationships Beyond Social VR. Our participants also actively fostered and extended their relationships outside social VR, for example, by using third-party applications to stay connected and planning in-person meetings. About half of the participants mentioned that the main challenge to maintain emerging relationships in social VR was to stay in touch with their VR friends outside the social VR platforms. P7 (cis male, 18, Asian) noted, "*It's hard to communicate with people because there is no messaging system in social VR. If they don't come to the platform, there is no way to contact them.*" With the fear of losing connections, many participants used various third-party applications to connect with people they met in social VR, including Discord and social media platforms. P3 (trans woman, 30, White) and P25 (cis female, 20, Asian) shared, "*Some friends I met on VR Chat follow me on Instagram. Occasionally, they will comment on my posts or even message me on Instagram. For the most part, 95% of our communication is just about random things in our lives and has nothing to do with what we do in VR chat*" (P3) and "*I've added people I met in social VR on Discord, Snapchat, and Instagram. So there are different ways through which we can talk, but not always necessarily in VR. They'll just send me a call or send me an audio message on Snapchat, but for the most part, it is over text*" (P25). According to them, the ability to sustain their interaction beyond social VR was crucial to maintain their relationships. Such interactions significantly expanded how they could communicate and what they could communicate about. In both cases, in addition to voice chat and avatar-mediated communication in social VR, P3 and P25 were able to stay in touch with their VR friends through commenting on posts and sending audio or text messages outside VR. P3 also highlighted that instead of VR-related topics, she and her friends could chat about their daily lives beyond VR, potentially bringing them emotionally closer.

Nine participants even went out their way to plan in-person meetings with their social VR friends. P3 (trans woman, white, 30) provided an example: "*I've built several great friendships with some people. We decided to meet at a musical festival. For some reason, we never shared real-life pictures until we were looking for each other at the festival. But once we found each other, we immediately started talking about the same things we talked about before. It was like not meeting them for the first time because I already spent so much time with them in VR. I already know how they move, what their usual gestures are, etc. It was just a very natural meeting.*" For P3, her connections that started in social VR led to her first offline meeting with social VR friends. As she described, such an endeavor to extend VR friendships to offline was "*natural,*" which also strengthened their relationships by further confirming the familiarity and mutual understanding.

Similarly, P10 (cis male, 20, Asian) described becoming close to someone whom he met in social VR, leading to voluntary self-disclosure and then to offline meet-up, "*Social VR has often led me to become closer friends with someone, and then we start sharing more details about who we are real life, then we start sharing our social media. And in several interesting situations, I've now met people first in social VR, and then I met them in real life.*" P7 (cis male, 18, Asian) also mentioned such meetups as pleasant surprises, "*One day a*

person I met in VR Chat was like, 'Hey, I have a layover in your city. You want to come buy me lunch?' and I was like, 'Sure.' We got lunch, and it was very cool." For these participants, meeting with their VR friends in the offline world was mostly positive and fun, making them willing to continue such connections both in and out of social VR.

4.3 Influences of VR Relationships on Online/Offline Social Lives

Participants highlighted three ways through which their VR relationships affected them both online and offline, including enriched online and offline social lives, new understandings of self, and tensions between online relationships and offline social circles.

4.3.1 Enriched Online and Offline Social Lives. 20 participants considered building relationships with others in social VR enriched their social lives both online and offline. For example, P17 (trans woman, 26, White) described, "*I have built many strong friendships through VR, specifically through VR chat. I think I expanded my discord platform. There are so many people I've met. I love meeting them and like having experiences with them. I have an entire album of pictures that I've taken with people. They're all wonderful memories that I've made with people I've met.*" P17 cherished all the new friends she made through VR Chat. She described those friendships as "strong" and considered them highly valuable for her social life – without social VR, she would not have met this many people and built friendships. For her, experiencing social VR with these new friends and making memories together (e.g., as photo albums) may be one of the most significant outcomes of engaging in social VR.

P25 (cis female, 20, Asian) also shared a somewhat unexpected outcome of engaging in social VR for him: reconnecting with people whom he already knew in new, and perhaps, better ways: "*I had run into an old high school friend on VR chat, but we had met through my friend in the Middle East. So, we had no idea it was one another. In high school, we were in the same academy archery team. We had mutual friends, but I never directly spoke to him in high school until VR chat, and after playing VR chat with him for a while, we decided just to meet up and catch up. It was really refreshing because suddenly, we are closer friends in three months through VR chat than we've ever been in three years in real life. It wasn't uncomfortable. It wasn't awkward; it was pretty natural.*" P25's story is interesting at multiple levels. First, her social VR friend from another part of the world reconnected her with someone whom she knew in the offline world but never comprehensively interacted with each other. Second, social VR seemed to help them interact better than in the offline world - less uncomfortable and awkward but more natural. Third, social VR effectively facilitated the process of building their relationships: they felt closer to each other after engaging in social VR for three months than attending the same school/team for three years in the offline world. In this sense, social VR positively affected several aspects of her interpersonal relationships, including the connection methods, quality of the relationship, and efficiency of relationship building.

Five participants further highlighted how their emerging relationships in social VR might even lead to real life changes. P17 (trans woman, 26, White) recalled, "*Three weeks ago, I went on vacation for the first time in my life because I never had money. But*

finally, I was motivated enough to save some money for traveling because I wanted to meet with someone I met in VR Chat that I was romantically interested. I spent a few days there, and it was a really great time. I learned that we weren't really going to be compatible long term, but we still had a great time. This travel and adventure would never have happened if we didn't develop such connections on VR chat." In P17's case, her VR relationship encouraged her to pursue changes and adventures in the offline world, such as traveling for the first time in her life. Though such an endeavor did not lead to an offline romantic relationship, she still considered it a precious life experience, which she would not have had without social VR.

4.3.2 New Understandings of Self. Participants also noted that fostering and building relationships through social VR affected how they understood and improved themselves, such as learning about their gender identity, developing a better mental state, and practicing social skills. For example, P17 (trans woman, 26, White), mentioned, "*I made a lot of friends in social VR. I talked to them every day, even when I'm not on VR because we're just close friends. One of these friends even inspired me to think more about my identity and take a bit more action in transitioning. I became really good friends with her. She and I just spoke earlier today about some surgery and medical stuff.*" P17's VR friendships were important and inspiring social support sources. Such support was so powerful that it helped her better understand her gender identity and motivated her to pursue transgender procedures in the physical world.

12 participants added that their relationships in social VR facilitated their recovery from depression and made them more confident. P10 (cis male, 20, White) and P3 (trans woman, 30, White) shared their experiences: "*Social VR helped me get out of my depression because I can build authentic relationships and be empowered to do things that I would not have been able to do in real life. I am fascinated by the fact that social VR can bridge geographic distances*" (P10) and "*Social VR not only made me more confident there but more confident in real life. I was a prop dancer, but I had never done traditional dance before until social VR . Since I have practiced traditional dance so much in social VR with people, now I am comfortable with doing that in front of people in real life*" (P3). For both P10 and P3, interacting and building relationships with others in social VR improved their mental state. In P10's case, the ability to foster meaningful and genuine relationships beyond geographic limitations empowered him to combat depression. In P3's case, her friendships with others emerged in a highly immersive and realistic virtual environment. This mitigated her fear of doing a dance style that she was inexperienced in front of an audience. Such confidence was also transformative, which made her more comfortable when dancing in the offline world.

Further, building relationships in social VR helped users practice social skills and later apply them in their offline social lives. P29 (cis female, 21, black) explained her struggle, "*I'm always afraid that other people would talk about me or make fun of me behind my back, like bullying. This makes it difficult for me to make friends in real life. But after I started talking to strangers and making friends in VR, which is something I wouldn't do in real life, I've changed this attitude. Now whenever someone tries to talk to me in VR or real life, I make an effort to talk to them back and not run away.*" In this quote, P29 revealed the long-term stigma that prevented her from building

offline relationships. However, the combination of a high level of immersion and anonymity in social VR seemed to help her better conduct interactive activities, which effectively improved her social skills. As a result, she became more comfortable with socializing and could use such skills to make friends offline.

4.3.3 Tensions between VR Relationships and Offline Social Circle. Though 20 participants perceived their relationships in social VR as positive and beneficial, 10 participants highlighted several tensions between VR relationships and their offline social circle. One concern is the complication of building two separate social lives. P7 (cis male, 18, Asian) mentioned, "*Engaging in Social VR has definitely made me a bit more outgoing and a bit more nonchalant about a lot of things. But I feel like it's not healthy to engage in two different social lives. It's different for me because I'm a completely different person online. Also, a lot of people don't value online friends as much as real-life friends. So sometimes your efforts to make friends in VR feel wasted.*" P7's description raises an interesting question about how social VR users perceive and approach their VR relationships compared to offline relationships. In P7's opinion, there was a fine line between social life in social VR and offline social life. For him, these two types of social lives seemed to operate on different levels. Therefore, for users like P7, fostering and developing relationships in social VR may become a burden rather than a benefit. P10 (cis male, 20, Asian) shared a similar experience, "*There was one point in time where I knew more people in social VR than the classmates I knew at my college. I also knew my social VR friends better than my actual classmates. I think I spent too much time in VR, so I didn't really have time to know my classmates.*" Social life in social VR and offline social life became an either-or choice for P10. They also contradicted each other: making an effort to foster relationships in social VR meant insufficient time and energy left to build an offline social circle.

Even for participants who endeavored to blend these two types of social lives, tensions remain. P14 (cis male, 32, Hispanic) warned, "*In social VR, you create kind of fake memories, like beautiful memories that do exist but not in the same way that real memories exist. This can make interpersonal relationships in social VR quite complicated when people meet in real life.*" P14's account highlighted the possibility of over-idealization in social VR. As an emerging novel technology, social VR affords unique and immersive activities that users may not have experienced in the offline world. While such experiences and memories could be quite realistic, P14 argued that they still did not happen in the offline world. It was then unclear how the difference between realistic virtual experiences and offline experiences could affect the transition from a VR relationship to an offline relationship.

In addition, P8 (cis female, 27, White) expressed concerns about the incompatibility between interactions in social VR and those in the offline world: "*when people meet offline, sometimes they still behaved like they were in social VR. For example, they would be overly intimate and want to cuddle or snuggle. It makes me really uncomfortable. It also feels very strange to me. It's not how you treat someone in real life.*" According to P8, the norms to interact with people in social VR seemed to be distinct from those in the offline world. While it was completely normal and acceptable to show physical closeness (e.g., cuddling) to one's VR friends using full-body tracked avatars, the same behaviors made P8 feel "*uncomfortable*"

and "*strange*" in the offline world. For these users, immersive and embodied interactions in social VR were still fundamentally different from face-to-face interactions. They thus rejected the idea of applying social norms for fostering and maintaining VR relationships to offline relationships.

5 DISCUSSION

To answer our research questions, we have highlighted three main reasons why users built relationships with others in social VR: they did not actively seek out interpersonal relationships but such connections just naturally emerged; they endeavored to meet and learn from people beyond geographic limitations in a more realistic manner; and they used such interactions as learning experiences in hopes of maintaining their existing offline relationships through social VR in the future (RQ1). We have also described novel activities through which users can foster their relationships emerging in social VR, including engaging in shared activities in an embodied way, experiencing mundane activities in new ways, participating in immersive events, and actively extending relationships beyond social VR (RQ2). Lastly, we pointed out the mixed influences of social VR mediated relationships, such as enriched online and offline social lives, new understandings of self, and tensions between online relationships and offline social circles (RQ3). We now discuss the implications of this work for better understanding computer-mediated interpersonal relationships and for informing potential directions for designing more socially supportive and satisfying VR platforms in the future.

5.1 Nuances of Social VR Mediated Interpersonal Relationships

Existing literature has proved that specific technological affordances can influence the strength and nature of the mediated interpersonal relationships, such as how the presence of a visual avatar can increase interpersonal trust [6], and that being able to perform shared actions together in a virtual space enhances the experience of online dating [49]. In this study, our findings still reveal several similarities between social VR mediated relationships and interpersonal relationships formed and developed in other online social spaces such as social networking sites [9, 10, 25], online dating sites and applications [45, 49], forums (e.g., [12, 41]), and online gaming and 3D virtual worlds (e.g., [13, 14, 17]). First, like any other computer-mediated relationships, our participants were sensitive to their own internal states [11]when building relationships with others in social VR. For example, they clearly reflected on how such relationships may affect their understanding of self. Second, selective self-presentation [46] still plays a role in developing interpersonal relationships in social VR: some social VR users showed a strong preference that there should be a fine line between social life in social VR and their offline social life. As a result, they would present themselves and behave differently in social VR and offline. Third, collaborative activities are still important dynamics to foster and strengthen emotional connections and relationships in social VR as in online gaming and 3D virtual worlds [4, 14, 27, 40, 47]. In our study, participants considered engaging in shared activities and attending events together important ways to build familiarity, trust, and attachment to others.

However, our findings highlight two significant nuances of social VR mediated interpersonal relationships. The first is the focus on *embodied interactions and experiences* rather than text-based Computer-Mediated Communication (CMC) for relationship building. Previous literature has emphasized the role of textual communication in shaping interpersonal relationships in other online social spaces, such as by supporting selective self-presentation and idealization of perception [46] and by creating a mutual narrative biography [20]. In contrast, in social VR, how a user gets to know, interact with, and care for others is mainly achieved by embodied interactions and experiences – since textual chat is inefficient and not everyone is willing or able to use voice chat.

In VR, the sense of embodiment often refers to the three senses about one's virtual body – ownership, agency, and self-location [24, 26]. In social VR, all three senses are further magnified compared to traditional gaming or 3D virtual worlds, which significantly affect how interpersonal relationships are formed, experienced, and perceived. For example, one's sense of being physically immersed in the virtual environment is significantly enhanced in social VR due to the fact that avatar behavior in social VR corresponds to the ways bodies are used in the offline world. This may lead to a higher awareness of body ownership and more physical and transformative interactive experiences (e.g., hugging someone in social VR requires making a "hug" movement in the offline world), which strengthens the emotional engagement in relationship building. Second, the level of joint involvement and user connectedness is also enhanced due to the broad spectrum of verbal (e.g., voice) and non-verbal (e.g., body language) communication modalities in social VR. This heightens one's agency of his/her virtual body and arguments potential methods to build and foster relationships with others through such a body. Lastly, social VR avatars are the sole interface between the users and their digital identity. This allows users to explore the virtual environment in a more straightforward and immersive way, which creates a strong sense of self-location and awareness of co-presence. Therefore, social VR seems to offer a new way to mediate and support interpersonal relationships – it leverages both the anonymity and flexibility of virtual spaces and the physical and bodily experiences in offline face-to-face interactions, making the development of such relationships more immersive and realistic. As we have shown, our participants especially valued the fact that they were able to meet people with an enhanced sense of embodiment in social VR, which made such relationships novel and more satisfactory.

Another uniqueness of social VR mediated interpersonal relationships lies in the emphasis of *replicating mundane everyday activities*. Our participants especially appreciated how social VR allowed them to conduct mundane everyday activities, such as sleeping, dancing, and studying. For them, the ability to engage in such activities with others directly led to their sense of intimacy, closeness, and connectedness. For example, falling asleep together in social VR helped users to form communities where people built close connections. It was also a crucial way for romantic partners to build stronger emotional connections. In this sense, social VR seems to mediate interpersonal relationships in a more natural way: users develop and foster connections and attachments simply by conducting their regular everyday activities rather than being driven (or forced) to

accomplish tasks and shared goals with others (e.g., as in online gaming).

Collectively, these nuances indicate that forming and fostering social VR mediated relationships is similar to building social connections in the offline world – such relationships are natural, immersive, and realistic; they also require bodily experiences and are closely related to mundane everyday activities. However, some participants in our study still regarded social VR relationships and offline relationships as two separate levels of social lives with distinct social norms. For them, the enhanced embodiment and realism in social VR did not benefit how they connected with others but undermined the overall quality of their social lives to some degree by creating unnecessary challenges and confusions. As online social spaces evolve towards more natural embodied interaction, these contradicting views, therefore, lead to important questions about the increasingly complex role of embodiment, realism, and naturalness in perceiving, experiencing, and (re)conceptualizing computer-mediated interpersonal relationships and how they may create growing new tensions between online and offline social lives.

5.2 Designing for Supporting Relationship Building in Social VR

Grounded in our findings, we identify three potential design implications for mediating and fostering healthy, fulfilling, and supportive interpersonal relationships in social VR. These implications are neither complete or exhaustive as they are mainly directions based on our participants' accounts. Yet, we consider that they highlight input from actual social VR users and may benefit developers and designers who endeavor to improve and advance nuanced social dynamics in VR.

Stay Connected and Informed Both In and Out of Social VR. A significant barrier for our participants to develop and maintain connections with people whom they met in social VR was the lack of methods to stay connected and informed when they were not in VR. There was also no means to leave a message to someone's friends through VR or contact them when they were not currently in VR. Therefore, many had to resort to third party applications to stay connected outside VR, which was considered ineffective and time consuming (e.g., need to manage multiple accounts and applications). To address this challenge, asynchronous communication systems that mainly focus on building and maintaining connections between online strangers may need to be taken into account when designing future social VR platforms. One example is the ability to leave messages for other users through the head-set or computer (e.g., a built-in in game voicemail system) rather than using any standalone external communication applications such as Discord. Adding such features to social VR could allow messages in textual, audio, or video formats. This would help social VR users have a consistent way to continue their social interactions even if they are not engaging in VR in-the-moment.

Simulating More Everyday Activities. Another important highlight in our findings is the importance of engaging in mundane everyday activities for fostering interpersonal relationships. For many social VR users, their close relationships with other users are not built upon intensive collaborative activities (e.g., teamwork in gaming) or a sense of accomplishment (e.g., achieving a shared

goal). Rather, such connections emerge in simply conducting regular everyday activities in social VR over time. They even consider it a more organic, natural, and realistic way to build and strengthen their interpersonal relationships. Therefore, it seems to be valuable for future social VR platforms to provide more activities and events that people would normally conduct with others in their offline everyday lives, such as cooking, gardening, and exercising. The ability of conducting such activities in an embodied way seems to be effective to help online strangers build familiarity and attachment.

Better Catering to Family Relationships. Though many of our participants mainly met and built relationships with online strangers, they expressed the hope to eventually use social VR to maintain their existing relationships, such as connecting with long distance romantic partners and family members. As the current global COVID-19 pandemic enforces travel restrictions and stay-at-home orders, such demands may continue to grow. In this sense, it would be beneficial to design future social VR as more family friendly space – e.g., providing more activities that support family relationships (e.g., family movie watching events); offering private customized venues for dating, wedding, or celebrating anniversaries; and adding features that can capture and document valuable memories of such virtual family lives.

5.3 Limitations

A few limitations of this study should be noted. All interview participants were recruited from online forums or social media. There is a potential bias towards social VR users who maintain an active social media account. Another limitation is the lack of even distribution between participants and the platforms they use. While our participants reported their use of diverse social VR platforms, they mainly focused on mainstream commercial platforms including Rec Room, VR Chat, and AltspaceVR. It is also challenging to systematically measure user personalities in an interview study as interviews focus on rich and in-depth personal experiences. Future work should aim to recruit a broader participant pool with more diverse social VR platforms to capture a more comprehensive picture of technology-mediated relationship building afforded by specific social VR platform. Future work will also measure personality traits and psychological status and how they affect relationship building in a follow-up large scale survey.

6 CONCLUSIONS

In this paper, we have focused on nuanced relationship building dynamics emerging in social VR. Our investigation has revealed 1) the main reasons why people build and foster interpersonal relationships in social VR; 2) various novel activities through which users can foster such relationships; and 3) the complicated influences of social VR mediated relationships on users' online and offline social lives. We have further highlighted the complex role of embodiment, realism, and naturalness in perceiving, experiencing, and (re)conceptualizing computer-mediated interpersonal relationships and identified three potential design implications for mediating and fostering healthy, fulfilling, and supportive such relationships in social VR. As global events (e.g., COVID-19) have placed more focus on understanding and re-imagining online interactions and virtual

experiences, we hope that these findings contribute to better under-standing new and more nuanced mediated interactive experiences afforded by novel technologies and informing the design of future online social spaces for interacting, networking, and emotionally bonding.

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