The Dating Metaverse: Why We Need to Design for Consent in Social VR

Douglas Zytko and Jonathan Chan

Abstract—This paper presents a participatory design study about how consent to interaction and observation of other users can be supported in social VR. We use emerging VR dating applications, colloquially called the dating metaverse, as context for study of harm-mitigative design structures in social VR given the evidence of harms that occur through dating apps and general social VR applications individually, and the harms that may occur through their convergence. Through design workshops with potential dating metaverse users in the Midwest United States (n=18) we elucidate nonconsensual experiences that should be prevented and participant-created designs for informing and exchanging consent in VR. We position consent as a valuable lens for which to design preventative solutions to harm in social VR by reframing harm as unwanted experiences that happen because of the absence of mechanics to support users in giving and denying agreement to a virtual experience before it occurs.

Index Terms—Consent, dating, social VR, social virtual reality, metaverse, harm, harassment, participatory design

1 Introduction

Social VR applications, which enable users to freely interact with others in 3D virtual spaces, have gained in popularity as a research topic [32, 38–40, 63] and in public use, prompting claims that it could be the "most social platform ever" [62]. The possibility of social VR to support a specific use case such as dating (finding partners for romantic and sexual interactions) has been envisioned in the literature for some time [6, 23, 67, 70], yet only recently have VR dating applications become publicly available to consumers [55]. For instance, popular dating app companies Tinder and Bumble have discussed plans for a dating metaverse [5, 14, 17] and entirely new VR dating applications have emerged such as Planet Theta [66] and Flirtual [33]. These applications serve either as virtual dating environments for interaction and assessment of compatibility with potential romantic partners who live nearby, or as standalone mobile apps that connect social VR users interested in dating who can then migrate to a third-party social VR application such as Rec Room [53] or AltspaceVR [3] for virtual dates.

Given the realized benefits of social VR for augmenting social life for children [36], older adults [7], and marginalized groups [20] one may assume that VR dating will revolutionize how people establish romantic and sexual relationships for the better. However, traditional non-VR dating apps are well documented as facilitators of sexual harm across online and offline modalities [1, 15, 25, 26, 51, 54, 56, 71], and evidence of harassment in social VR is growing [10, 13, 22, 47, 57]. In this light the dating metaverse is poised to expose users to harms typical of both social VR and online dating if not effectively designed for harm mitigation.

While VR dating is still in fledgling stages there has been little consideration for safety within VR dating environments—attention has instead been placed on benefits for physical safety by way of reducing the need for face-to-face dates [67]. We consider it important to inform safety-conscious design for VR dating environments now before a broader userbase is unwittingly exposed to the convergence of online dating and social VR harm. In this paper we focus on how social VR environments intended for dating should be designed for safety and prevention of harm. The research questions guiding our work are:

RQ1. *How should social VR environments for dating be designed? What activities or behaviors should be supported?*

RQ2. *What harms should be anticipated and prevented in social VR environments for dating?*

RQ3. *How can social VR environments for dating be designed to prevent such harms while supporting anticipated uses?*

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Towards answering these questions we present a participatory design study with prospective VR dating users in the Midwest United States (n=18) to collectively envision harm-mitigative designs for VR dating environments. The study is situated in a broader initiative to incorporate young adults in the design of contemporary technologies such as XR and social robotics for sexual wellness and sexual violence mitigation.

Participants envisioned VR dating environments as socially sexualized places for discovering, interacting with, and bonding with other daters while also exploring one's own sexuality. This can be likened to bars and night clubs in the physical world where sexually charged dialogue and interaction is allowed and expected to an extent.

An overarching theme in data analysis behind anticipated harms and proposed harm-mitigative designs for this vision of a sexually-explorative dating metaverse was *consent*: agreement to interactions that one engages in or observes in social VR. Under this conceptualization the notion of objectively harmful behavior is rejected, with harm instead being qualified on a user-by-user basis as unwanted interaction and experience. Participant-created designs for harm mitigation thus sought to provide dedicated mechanics to users for giving consent to interaction and observation of other users' interactions in social VR, as well as mechanics for informing users' decisions to give consent.

The study highlights a conspicuous absence of consent as a lens for researching and designing social VR, despite increasing popularity of applying consent to the study and design of other technologies including video games [45], social robots and conversational UIs [60], mobile dating apps [24, 71], and social media apps [30, 34, 69], as well as related interests in VR regarding body sovereignty [16]. This paper's primary contribution is the elucidation of consent as a valuable, stakeholder-advocated direction for which to design preventative solutions to harm in social VR—beyond the relatively narrow use case of dating—by reframing harm as experiences that occur because of the scarcity of mechanics for explicitly giving and receiving consent to an experience. We use our study's findings to advocate for consent as a long-term agenda for designing and assessing safety features in social VR.

The rest of the paper is structured as follows. First we review prior work into harms that occur in social VR and online dating as separate technologies, along with an introduction to the dating metaverse and associated research. The participatory design study of VR dating environments for safety is then presented, followed by a reflection on the specific designs proposed by participants with mind to potentially adverse effects on user experience. We connect our study to research of consent within other contemporary technologies to pose opportunities for future research and design of consent mechanics in social VR.

2 Background

The dating metaverse represents a convergence of social VR and dating applications, as well as the harms that users are exposed to in these

respective technologies. In this section we first review social VR, including the harms that occur in these virtual spaces and social VR application design for addressing such harms. We then similarly review research into online dating that identifies the prevalence of sexual harm between online daters that occurs across online and face-to-face boundaries and the state of dating app design for safety. We explore research that has envisioned a dating-oriented metaverse through the years, concluding with the current state of dating metaverse technologies.

2.1 Harm in Social VR

Social VR applications intend to support social interaction in 3D virtual space with VR headsets [39,40]. Several publicly available social VR applications have emerged in recent years due to access and affordability of commercial VR technologies [49], including AltspaceVR [3], Rec Room [53], and VRChat [65] among others. Users are represented with avatars that can take on human and non-human forms, and which are situated in public virtual areas for impromptu interaction amongst a massive number of virtually collocated users through voice, text, and avatar movements [31].

Public use of social VR is still relatively new, yet reports of online harm and harassment have propagated through popular media and research [10, 22, 47, 57], particularly towards women and ethnic minorities [20]. Harm in social VR takes various forms like verbal harassment, sexual touching of avatars, and displaying obscene content in the virtual environment [13]. Furthermore, Maloney and colleagues found an alarming lack of barriers around child-adult interactions [37], which can render children susceptible to sexual predators and exposure to adult content.

Social VR applications offer some features for addressing harm such as blocking, muting, and personal space bubbles (a circular area around the user that renders any avatars invisible that enter the personal space). However researchers and developers wish to improve these existing features for accessibility and efficacy [22, 61]. For example, Sun and colleagues suggest having varying sizes of personal space bubbles in relation to how familiar two users are to one another [61]. Morrow and colleagues [42] mention updating applications with more accessible ways to mute and block users, specifying that these features should be easy to use and quick to take action.

2.2 Harm in Online Dating

Modern online dating applications are mobile apps that utilize GPS to recommend users to geographically nearby daters for increasingly rapid face-to-face encounters [12]. Popular examples include Tinder, Bumble, Hinge, and Grindr. Users are represented through profiles that consist of pictures of one's physical appearance along with sparce text content such as age and a short bio. Interaction between users occurs through private messaging, typically after they have expressed interest in each other's profile.

While the benefits of using dating apps for social goals such as romance, casual sex, and friendship are now clear, so are the harms that dating app users are exposed to. Sexual harassment and hostility through private messaging is common, particularly against marginalized groups such as LGBTQ users [4, 19] and disabled users [50]. Online dating-facilitated harms are not relegated strictly to the online modality. Sexual violence in the physical world, or nonconsensual sexual activity such as rape and unwanted touching of the body [9], is a particularly devastating harm perpetuated through dating apps [1, 15, 25, 26, 51, 54, 56, 71] with victims predominantly being women. Research has found online daters to be victims of sexual violence more so than non-users [15] and rates of online dating-facilitated sexual assault are on the rise [1]. In one study in Australia, over 10% of all sexual assaults in their sample were attributed to online dating [54].

Dating apps do not simply connect victims with perpetrators intent on causing harm. Zytko and colleagues discovered that use of dating apps can predispose users to becoming perpetrators and victims of sexual violence without their realization due to misinterpreted signals of consent to sex inferred through the dating app interface [71]. Relatedly, other work has discovered sexual scripts unique to dating apps [35], or socially constructed understanding of appropriate sexual behavior in online dating, that can lead users to understanding sexual dialogue and interaction to be expected purposes of dating app-use.

Current dating app designs to address sexual harm are rather sparce and have incurred calls in the literature for improvement [2, 72]. Such features are typically reactive—rather than preventative—including user blocking, muting, and reporting features, as well as panic buttons to alert authorities of harm that is occurring.

2.3 The Dating Metaverse

Research has considered the possibility of dating in VR for over a decade. Yet prevention of harm that could occur during VR dates has not been explored to our knowledge, although implications on safety during face-to-face dates have been noted. Specifically, users may reduce risk of physical harm through improved capabilities for intimacy and evaluation of romantic compatibility online "without requiring awkward or unsafe in-person meetings" [67]. Relatedly, in 2008 Frost and colleagues [23] tested a VR dating application in a lab study to improve online daters' capabilities to form impressions of romantic compatibility [18]; concepts for further improving compatibility assessment through extended reality (XR) were proposed in [70]. Other work has anticipated how advances in haptic technologies could enable immersive sexual experiences in VR dating [6]. Existing use of social VR and other virtual worlds for tangential purposes suggests that sexual experience and intimate moments in VR dating are more than plausible, emphasizing the need for more attention to risk of sexual harm within VR dating environments. For example, social VR platforms are already being used by long distance romantic couples to maintain and enrich their relationships [68] and the HBO Documentary *"We Met in Virtual Reality"* [28] demonstrates that such relationships can originate in VR as well. Virtual worlds such as Second Life have also been used to live out BDSM sex fetishes [8].

Industry has made progress towards publicly available dating metaverse technologies, although these initiatives seem more focused on capitalizing on increased access to consumer VR devices rather than making online dating safer. Tinder and Bumble have publicized their intent to "enter the metaverse" [11]. Tinder announced plans for the "Tinderverse" that utilizes XR technologies for "blurring the boundaries between offline and online" [52]. Their parent company, the Match Group, has released a "dating metaverse" application called Single Town in Korea [11]. Entirely new companies built around VR dating have also emerged such as Planet Theta [66], Flirtual [33], and Nevermet [46].

Commercialized dating metaverse technologies can be divided into two categories: virtual dating environments through which users discover and interact with geographically nearby daters all within a virtual environment, and supplementary applications for mobile devices and web browsers used for discovery of social VR users interested in dating, after which matched users segue their interaction to a third-party social VR environment such as Rec Room [53] or VRChat [65] for a virtual date. Users of virtual dating environments discover potential daters in a public virtual space and if two users wish to have a virtual date they can transfer to a private interaction. For instance, Planet Theta provides functionality for "micro-dating" – a private environment designed for speed dating in which users are given conversation prompts for assessing compatibility and can "rate" their dating partner afterwards.

3 Method

This study is part of a larger initiative to involve young adults (ages 18-29) in the design of contemporary and emerging technologies for sexual wellness and sexual violence prevention. We focus on this demographic because it aligns with the age range most affected by sexual violence [58] and because social technologies have become a normalized component of their romantic and sexual exploration. Most importantly, social technologies serve as scalable influences on socially constructed perceptions of appropriate sexual behavior for this age group, often in inadvertent and negative ways (e.g., [71]). We frame the dating metaverse as a particularly potent opportunity to intentionally foster healthy social dynamics in light of the increasing adoption of social VR amongst younger adults.

Table 1: Participant demographics.

P#	Gender	Ethnicity	Social VR Experience
1	male	White	10+ hours
2	male	White	4-6 hours
3	male	White	1-3 hours
4	female	Black	1-3 hours
5	non-binary	White	4-6 hours
6	male	White	4-6 hours
7	male	White	10+ hours
8	female	Asian	4-6 hours
9	male	Asian	none
10	female	Asian	1-3 hours
11	female	Black	none
12	male	White	none
13	female	Middle Eastern	none
14	female	Asian	none
15	female	Asian	none
16	female	Hispanic	4-6 hours
17	male	White	1-3 hours
18	male	White	none

To explore our research questions germane to the dating metaverse (see first page) we conducted a series of participatory design workshops with prospective VR dating users in the Midwest United States (n=18) to produce safety-conscious design concepts for the dating metaverse. The study was approved by our institution's institutional review board (IRB). Participatory design [44] entails anticipated users and other applicable stakeholders of a new technology engaging as designers themselves alongside professional developers and researchers to ensure their values, perspectives, and priorities are incorporated as they intend. Participatory design contrasts with more traditional user-centered design approaches in that participants are not merely reacting to, or providing feedback on, designs created by researchers (e.g., usability testing), but rather proactively producing their own designs. Researchers in this context serve as facilitators who support participating stakeholders through the design process (see example in [27]).

3.1 Participants

We sought participation of stakeholders in the 18-29 age range who have previously experienced online harm and who have used, or are interested in using, VR for social interaction and dating. We opted for stakeholders with prior experience with online harm so that their lived experiences could help them anticipate harms in the dating metaverse that we as researchers may overlook. We did not require participants to disclose the nature of their online harm after consultation with a certified sexual assault nurse examiner, IRB personnel, and university staff about Title IX regulations. Recruitment materials were also informed by these consultations. In particular, recruitment materials clarified the purpose of the study as co-designing VR dating environments to prevent harm and foster positive romantic and sexual experiences. We were explicit about notions of harm and sex in our ads so as to help prospective participants anticipate discomfort they may experience. Recruitment involved an online advertisement disseminated over social media and mailing lists to groups, clubs, and organizations in the geographic area surrounding our university and the university itself that provide social support to the community and/or cater to demographics most at risk of sexual harm. They were encouraged to share the ad with applicable parties. Physical posters were also posted on campus.

Participants identified their genders as female (8), male (9), and non-binary (1). They identified their ethnicities as White (9), Asian (5), Black (2), Middle Eastern (1), and Hispanic (1). Ages ranged from 18 to 26, with an average age of 21. Eleven participants indicated having 1 to 10+ hours of prior experience with social VR, while 7 had not experienced VR prior to the study. All participants either used dating apps before and/or indicated intent towards online dating in the future. See Table 1 for demographic information.

3.2 Data Collection and Analysis

Participants were split across three participatory design workshops based on prescheduled workshop attendance options in the recruitment survey. Sessions lasted 2-3 hours and occurred in-person in a private meeting space on our university's campus. Options were afforded in the recruitment survey for one-on-one design workshops for participants hesitant to discuss this study's sensitive subject matter in a group setting, however all participants opted for group participation—several acknowledged in the sessions this was for mutual social support.

The session protocol began with collection of informed consent forms from participants and a hands-on demo of popular social VR applications including VRChat [65], Rec Room [53], and AltspaceVR [3] with an Oculus Rift VR headset to provide participants with general familiarity of the technology. Participants were encouraged, although not required, to personally wear a headset and navigate the virtual world or otherwise observe other participants in the virtual world through a separate 2D computer screen.

We then gave a short presentation of common social VR harms identified in prior work [13] and an introduction to the current state of VR dating applications through walkthroughs and screenshots taken by the researchers from publicly available portions of the applications (most were in various stages of beta or private release at the time of study) as well as news articles and websites about emerging designs. Throughout the presentations participants were encouraged to ask questions, provide comments, and openly relate presentation content to their personal dating and social computing experiences. Participants were then prompted to discuss anticipated uses of VR dating environments and harms that they anticipated occurring through VR dating.

After the group discussion had exhausted itself participants were asked to design VR dating features or environments to prevent the previously discussed harms. Three reflection prompts given to participants to inspire design included 1) envisioning enjoyable interaction with other users in a VR dating environment, 2) forecasting harms that VR dating environments should seek to prevent, and 3) envisioning a safe VR dating experience. Design patterns from Jonas and colleagues' taxonomy of social VR design choices [31] were provided to participants in the form of "mechanic cards" (slides summarizing common social VR features along with a visual depiction) to help brainstorming. Specifically, participants were encouraged to consider design of the self (avatars), interaction with other users, and the environment(s) through which interaction occurs. We offered participants various tools for producing and logging their design ideas including post-it notes and arts-and-crafts materials for rapid prototyping such as Lego sets, construction paper, markers, and clay. Participants were encouraged to openly discuss their designs with the researchers or other stakeholders as they were producing them and when they concluded their designs so that visual artifacts could be supplemented with ample audio data describing the design and the motivations behind them.

All design sessions were audio recorded and transcribed. Two researchers collectively analyzed the transcripts and visual artifacts with an open coding process inspired by Strauss and Corbin [59]. Researchers used Dedoose for line-by-line coding of quotes and visual artifacts followed by code organization in Miro [41] to produce themes. The overarching code emerging from analysis was "consent/agreement" with subcategories of codes pertaining to different types of consent mechanics: structures for clarifying, informing, and conveying agreement to partaking in particular social VR experiences. Additional codes from analysis, such as how participants perceived the purpose of VR dating environments, are also noted in the findings.

4 Findings

Regarding anticipated uses of VR dating environments (RQ1), participants envisioned the dating metaverse as a socially sexualized environment for discovering, interacting with, and bonding with other daters while also exploring one's own sexuality. Participants sometimes drew comparisons to bars and night clubs in the physical world where sexual behavior is allowable and expected—to an extent—such as kissing, touching of the body, and sexually charged verbal dialogue. VR capabilities referenced in support of a sexually-explorative dating

metaverse were avatar design that could be erotic and sexually suggestive as well as manipulation of avatars and haptic feedback capabilities to afford simulated sexual acts. Participants also discussed use of the virtual environment to augment exploration of sexual identity and sexual topics, such as construction of virtual objects and structures as a form of collaborative activity with potential romantic or sexual partners. Ultimately, participants approached sexually-charged interaction not as inherently indecent, but as potentially valuable to assessment of one's own romantic and sexual proclivities as well as romantic/sexual compatibility with dating partners in ways not possible or condoned in physical world locations.

Due to the potential for socially sexualized experience, anticipated VR dating harms mainly pertained to a *"gray"* area of VR behavior: interactions that some daters may consider harmful and inappropriate and that others may consider desirable and important to assessing compatibility before a face-to-face date. As P15 (female) explained through a bar analogy:

"Absolutely, you can't expect that everything's gonna be peachy when you walk into a new place, you know, like if you walk into a regular bar; same thing might happen like you don't know. You can't just assume that it's always gonna be a safe space [for you], which is of course unfortunate."

Participants resisted the notion of objectively harmful behavior, or interactions that should be universally prevented in VR dating environments. Instead they qualified harm subjectively, on the basis of whether an interaction or observation of interaction amongst others is personally wanted or unwanted by a respective user. The primary code in data analysis that comprised VR dating harms (RQ2) was the absence of consent: unwanted experience that one was not able to agree to or decline before the experience occurred. Examples often pertained to nonconsensual interactions with other users such as unwanted sexualized verbal dialogue or simulated bodily movements directed towards one's avatar, as well as nonconsensual observation of interactions between other users in a VR dating environment (e.g., the unexpected viewing of two avatars in an intimate embrace). Some participants also brought up examples of virtual interactions that may be agreed to under misinformed pretenses, and that would be nonconsensual in retrospect, such as sexually charged interaction with an under-age user who one believed was over the age of 18.

Proposed designs for harm mitigation (RQ3) sometimes involved preventing perpetrators of harm from rejoining a VR dating environment, such as through IP address banning, or from disclosing one's personal information (doxing) through AI. Yet most designs comprised what we call **consent mechanics**: features intended to clarify and ensure users' agreement before they engage in interaction with another user or witness interaction amongst other users. Three categories of consent mechanics pertain to the following (see Table 2 for summary of participant-generated designs):

- Mechanics for giving and denying consent to interaction with another user (section 4.1)
- Mechanics for informing consent to interaction (section 4.2)
- Mechanics for informing consent to observation of potentially intimate interactions between other users (section 4.3)

4.1 Mechanics for Giving and Denying Consent to Interaction with Another User

Participants anticipated that sexualized interactions (e.g., public displays of affection between dater avatars, sexually charged verbal content, and simulated sexual acts) would likely become a normalized step in the progression towards face-to-face meetings between VR daters as a way to assess compatibility and foresee risk of physical sexual harm. They considered a key differentiator between desirable and harmful interaction in VR dating to be prior permission or agreement to the experience—what P16 (female) called *"consensual"* experience. Proposed designs illustrate a two-layer approach to consensual interaction in social VR. First are mechanics to explicate agreement to interaction with another user, independent of the nature of that interaction. Second are mechanics for giving and denying consent to particular dialogue or actions during an interaction.

Table 2: Summary of consent mechanic designs.

Consent Mechanic Type	Goal	Example Designs From Participants
Giving consent to interaction	Ensure consent to interaction with another user before it occurs	-Multi-stage consent bubbles -Pre-consent through social settings
Informing consent to interaction	Provide information that affects decision to give consent to interact with user	-Limited avatar choices to prevent deception -Identity verification -Risk flags
Informing consent to observation of other users	Provide information that affect's decision to enter a virtual environment	-Public worlds with behavior rules -Environment tags to anticipate possible behavior

The most popular design proposed by participants for the first layer was a repurposing of the personal space bubble as commonly seen in general social VR applications such as VRChat. As currently designed, personal space bubbles allow users to designate a circle around them and when other users attempt to enter that space their avatar disappears. As P17 (male) described it: *"There is a setting in VRChat called personal space, where if you were relatively close to a person's avatar, I don't know if there's just a specific body part or like, the model itself has to be close, but they would have vanished in front of your eyes."*

We used the code "consent bubble" in our analysis to collectively describe participants' visions for modifying the personal space bubble design to require users to consciously accept another VR dater into their personal space—a way of explicitly providing permission to interaction with another user. *"Comfort zone"* was another term used by participants. See Figure 1 for visual artifacts produced by participants.

Some participants further proposed the ability to modify the size of their consent bubble to avoid the realization of an attempt to commit a nonconsensual act. A critique offered for currently designed space bubbles is that they do not actually prevent nonconsensual acts against one's avatar (e.g., groping) but rather the visibility of the nonconsensual behavior. From P17 (male) again describing how a user would visually disappear if they attempt to grope one's avatar in current social VR applications: *"So realistically speaking, you won't be able to see them, but you'll still be able to, or you would still know that they could be doing this to you."* The realization that a user is attempting nonconsensual acts can be as traumatizing as visually witnessing the act, and participants suggested that expanding the size of one's consent bubble could limit awareness of another user's desire to perform a nonconsensual act and related attempts at provocation.

Relatedly, participants proposed a multi-stage consent bubble—or bubbles layered on top of each other with increasing radius—to allow a gradual consenting of more intimate interaction near one's avatar. This design would allow users to consent to verbal or otherwise visual interaction without necessarily exposing oneself to physical, embodied interaction between avatars. For example, a user could set up two consent bubbles, the first of which has a larger radius and would allow a user to interact with them while their avatars are still fairly spaced apart, and the second consent bubble would allow the partner to bring their avatar closer and potentially touch one's avatar with their own. P14 (female) imagined a situation in which a woman who has previously experienced sexual harm in VR wants to gradually start interacting in a VR dating environment again with consent bubbles:

"I think it would be a good idea to implement, like different, you could make larger safety zones. So like, say [a woman] just wanted to come and [...] be safe. Like this is after she's been scarred by this dude [who has sexually assaulted her avatar before]. She's like, I just want to be safe, don't want anyone coming [too close]."

Of course, after a user is accepted into one's consent bubble they may

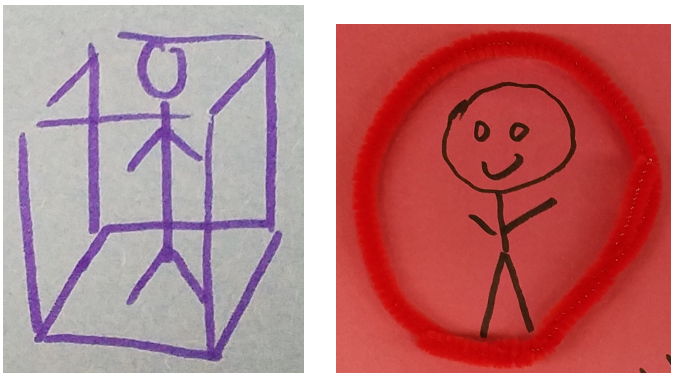
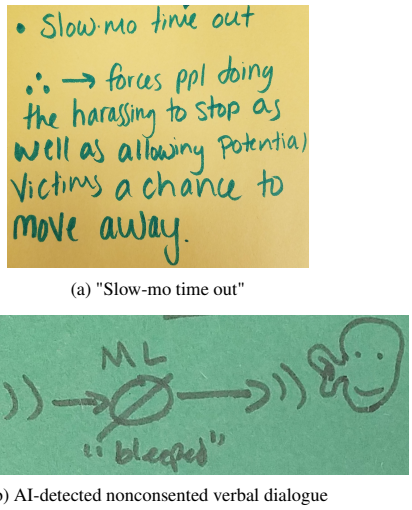


Fig. 1: Participants suggested repurposing personal space bubbles as a consent mechanic in dating VR environments. This would require a user to explicitly give consent or agreement to interaction by consciously allowing a partner to enter one's bubble.



(a) "Slow-mo time out"

(b) AI-detected nonconsented verbal dialogue

Fig. 2: Second-layer interaction consent mechanics involved users pre-designating dialogue and behaviors that they consent to or deny consent to. AI would be used to block nonconsented behavior during interaction.

still attempt a nonconsensual act either deliberately or inadvertently, hence the need for a second layer of interaction consent mechanics. No participant proposed an action-by-action consent process, which may seem the most obvious design choice, likely because it would quickly become untenable and unrealistic for a free-flowing conversation. Instead, some participants considered ways that users could predesignate consent (or lack thereof) to particular types of verbal dialogue and behaviors between avatars (see Figure 2). One idea was a *"social settings"* page during user onboarding where a user could designate the types of behaviors and dialogue they would be comfortable with, and those that they definitely would not want to experience. Participants typically referenced AI being used to detect and censor nonconsented verbal dialogue and behavior (behavior deviating from one's social settings) before it is heard or observed by the recipient. For nonconsented physical actions against one's avatar, P4 (female) imagined *"slow-mo timeout"*—the perpetrator's behavior being slowed down so that a potential victim can move their avatar and avoid the harmful action. P6 (male) envisioned nonconsented verbal dialogue being *"bleeped"* out like in movies and TV shows.

While consent bubbles were consistently desired amongst participants, there was some pushback to AI-driven censoring of nonconsented interaction on the grounds of feasibility and privacy. Some did not think it was practical for a user to pre-provide a complete list of behaviors they consent and do not consent to; these decisions may change with each partner that one interacts with. They also were not confident that AI could reliably detect all attempts at nonconsented behavior and censor them in time. Others were concerned by the prospect of their intimate interactions being constantly observed by the VR dating application: *"that also comes with the whole privacy complaint of like, now they're recording every single conversation you have."* An alternative design approach was proposed that involved mechanics to inform users' decisions to engage in interaction with a given user in the first place (the first layer of interaction consent). These are discussed next.

4.2 Mechanics for Informing Consent to Interaction

Participants debated affordances for self-presentation in VR dating environments, particularly avatar design, and their implications for consent to interaction. Avatar design in social VR can vary significantly, as evidenced in today's general-purpose social VR applications in which users can adopt non-human avatars such as animals and pop culture characters.

Several participants pondered whether creativity in avatar construction may obfuscate users' abilities to make informed decisions about whom to interact with. Most examples offered by participants described avatars being used for intentional attempts to mislead users into consenting to interactions that they may otherwise not have agreed to if they had additional, or more accurate, information. For instance, male-identifying participants were concerned about underage users creating avatars to mislead other daters into thinking they are over 18, which can result in users inadvertently *"committing [. . .] crime"* such as exposing children to inappropriate content or engaging in sexually inappropriate interactions in VR—in this sense, becoming perpetrators of nonconsensual acts themselves. Other participants were concerned with emotional manipulation for financial scams (an already-widespread harm in dating apps) or coercion into sexualized interactions by partners who intentionally misrepresent expectations for their physical world selves; for instance, a much older user adopting an avatar of a younger person. P5 (non-binary) captured both of these concerns:

"That would be the, that would be probably the biggest one that I would imagine if you, you know, meet someone, someone's misrepresenting themselves as being younger than they are and like [asking] them to show them or have them do something inappropriate."

Regarding financial scams: *". . . extorting money out of someone or something like that. [There is] a Netflix show where they'd be like, you know, I need money for this. And someone sends them money. Because they like, think it's someone that they have like a strong emotional connection with that they like really care about or like, I need money to come meet you somewhere."*

In response to the potential to manipulate decisions to consent to interaction through avatar design a few participants believed that VR dating environments should only allow realistic avatar creation that matches one's physical appearance as closely as possible, such as with whole-body scanning technology. Most other participants still supported creative avatar construction however, in recognition of its importance for users with nonbinary gender identity or who may want to intentionally mask personal physical details for safety.

To prevent misinformed consent through creative avatar construction there were two proposed design concepts: supplementing user avatars with risk *"flags"* to inform other daters' decisions to interact with them, and private identity verification with the VR dating application. Identity verification would operate similarly to mobile dating apps, in which proof of identity (e.g., a driver's license) is sent privately to the VR dating application. There was no shortage of privacy concerns voiced by participants though, and several did not consider the tradeoff of privacy for identity verification to be worthwhile. According to P2 (male): *"Like, how can you make sure like, is this information going to be encrypted? Is it going to be shared with anybody? Are they going to use it, as you know, is the application going to sell your information to companies? So many questions that get raised with it."*

The more popular design concept—especially for women in the study—was risk flags, which refer to crowdsourced indicators of past nonconsensual acts inflicted by a user that would be visible to prospec-

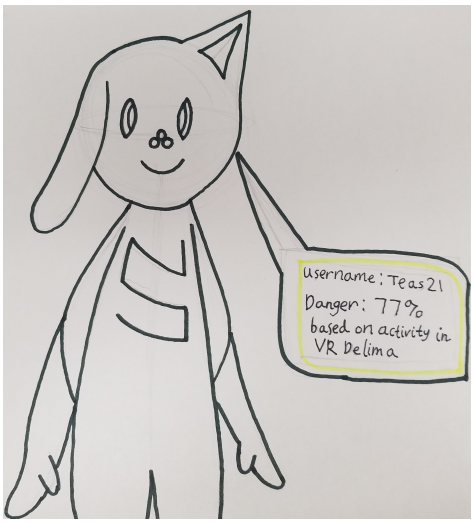


Fig. 3: A popular, although controversial, design for informing consent to interaction was a risk or *"danger"* indicator associated with a potential interaction partner.

tive daters that they encounter in VR (see Figure 3). This was also referred to as *"peer reviews"* and a *"danger"* percentage by some participants. As P10 (female) described during conversation with other participants in her design session:

"So if there's someone who frequents these dating rooms, and they keep—going back to your review system—they keep getting negative reviews. Like, 'hey, this person was saying crass comments to me' or, 'hey, this person opened [with] a one liner about how big my boobs are on my avatar' or whatnot. Like, just constantly doing that, it's like, okay, flag this user, give them a warning, be like, 'hey, you're making people uncomfortable.' We're trying to- it's one thing to come on here and date. It's another thing to come out here and harass people."

Women in the study did acknowledge risk flags as a rather extreme design for informing consent decisions, and one that could potentially be manipulated. P13 (female) called it *"exploitable"* because users can have their friends give positive ratings or reviews, while risk flags could be erroneously assigned in retaliation for a failed romantic connection. While participants openly acknowledged flaws in a literal implementation of the risk flag idea, they stressed the value of content that may help women inform decisions to consent to interaction and avoid harm that could subsequently occur. For instance, P11 (female) imagined still possibly consenting to interaction with a VR dater who exhibited an elevated danger percentage to assess if they had learned from prior harm they may have inadvertently caused to other users:

"[. . .] if somebody has a flagged profile and you go up to them and they're like, oh hey you're really hitting it off, it'd be like, well, 'why is your profile flagged?' And they're like, they can either answer honestly or they can be like, 'Oh, it was just me and this one girl had like a misunderstanding.' It's like, 'Well, what was the misunderstanding about?' It's like, 'oh, I, I just, I made a joke. And she didn't like it. I don't know.' What's the joke about? and then and you know, that- then people can kind of use common sense to be like, okay, this guy is not, this guy makes sexist jokes and stuff."

4.3 Mechanics for Informing Consent to Observing Interaction Amongst Other VR Daters

"So I've always been a more kind of, I'll go out and meet people. And that's how I'll try and date and it's, it's worked. [. . .] If you are more comfortable with [swiping on] dating apps as your main form of dating, yeah, it's gonna be uncomfortable. If you're more social, I feel like the VR dating is a happy medium between the two." – P6 (Male)

Participants were intrigued by the more *"social"* opportunities for discovering dating partners in VR relative to impersonal profile-based discovery in mobile dating apps. Several of their design ideas implied that VR daters would discover romantic and sexual partners through public environments—or *"worlds"*—that are geographically bound to ensure that users can eventually meet face-to-face with partners they discover in VR. One participant described this open-world discovery of potential romantic partners to be like *"walk[ing] into a regular bar,"* drawing attention to the varying levels of normativity around public displays of affection and sexual behavior within these physical world establishments.

Likewise in VR dating, participants acknowledged the possibility of bystanders observing sexualized interaction and content in virtual spaces that may be discomforting and subjectively harmful. Participants thus extended the notion of consent or agreement not only to interactions that a user directly engages in, but interactions that they may observe in a virtual dating environment. It would be impossible to design consent mechanics that secure consent to observing each interaction occurring in a public VR environment, and so participants instead proposed designs for informing users' consent to entering public VR environments. There were two popular consent mechanic approaches for informing decisions to enter VR dating environments: 1) a simple distinction between public and private VR dating environments in which public environments have predetermined rules around acceptable behavior whereas private environments do not, and 2) multiple public virtual environments with varying levels of normativity around sexualized interaction that users choose to enter based on pre-entry descriptors of ongoing interactions.

Regarding the public versus private world distinction (the first design approach), private worlds would have no application-wide rules around acceptable behavior, and users would be expected to negotiate behavioral expectations before consenting to enter a private world with a given partner. These private spaces could be used for assessment of romantic compatibility through one-on-one dates in an intimate setting, and also for more explicitly sexual interactions or simulated sexual acts afforded through advanced haptic feedback technologies (as envisioned in [6]). Public spaces, on the other hand, would have stringent rules around interaction and content so as to avoid unexpected observation of content that would make a user uncomfortable. The public spaces would primarily be used to discover geographically nearby daters and have introductory conversations with them before consenting to escalating interaction towards a virtual *"date"* in a private environment.

Some participants were adamant that public spaces should not allow interactions that are explicitly romantic or intimate because those spaces are essential for discovering potential dating partners and therefore any content that causes a user to avoid such spaces would preclude them from the most basic functionality of the VR dating environment. P4 (female) described this from the perspective of a user unwittingly observing other daters engage in an intimate interaction: *"You're making, like, that person feel uncomfortable to the point where they feel like they aren't welcome in these public spaces."* P5 (non-binary) described how expectations for acceptable behavior in public worlds would alleviate uncertainty around decisions to enter them:

"The whole thing with public rooms is it's supposed to be an environment for everybody. [...] But, you know, if you're joining a public room, you shouldn't have to expect to experience like porn or harassment, y'know that shouldn't be something that is a normal thing."

The other design approach involved a more nuanced system of tagging public worlds based on the type of content or interaction currently occurring, enabling users to anticipate interactions that they may observe within them before consenting to enter. This idea was borne out of a concession that it may be unrealistic to expect VR daters to engage strictly in platonic interaction simply because of posted rules. Some participants described public world tags as *"warnings"* that would give indication of *"18 plus content"* that one may see in the given world such as public displays of affection. These tags would also pertain to sexual explicitness in users' avatars, recognizing the possibility of users crafting partially naked or sexually suggestive avatars for the purpose of sexualized interaction.

There were some concerns over how tags would be applied. A few participants expected that tags would be applied and updated by users who had recently entered the respective virtual world (see Figure

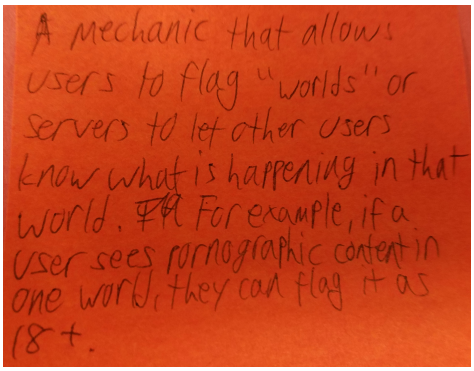


Fig. 4: P12 suggested a user-generated tagging system to inform users' consent to entering a public VR dating environment.

4). However this design opens the possibility of inaccuracy or even intentional attempts to mislead others about the interactions occuring. Per P1 (male):

"Of course, there could always be people that put up misleading tags just because they feel like it; they think it's funny, and then there's gonna be people that actually use them correctly, but you don't know what situation you're going into, you know?"

Towards ideas for a more accurate tagging system, a few participants suggested AI-driven tagging that is responsive to content and interaction currently occurring in a given world. P18 (male) imagined AI-driven tagging helping them make an informed decision to avoid particular worlds: *"If it was like machine learning generating those tags [. . .] and then you see this one where it's like [sexually suggestive] imagery because somebody's playing a video or whatever, and be like, alright, I'm gonna go to this [other] one instead."*

5 Discussion

Motivated by the emergence of VR dating applications, and the convergence of online dating and social VR harms that users will be exposed to, we conducted a participatory design study with prospective young adult users in the Midwest United States to consider how safety could be foregrounded in the design of VR dating environments. Consent was the predominant theme behind participants' proposed designs, referring to mechanics for giving agreement to interaction with other users as well as observation of interactions occurring in one's virtual dating environment.

Consent can serve as a valuable lens for preventing harm in VR dating environments, and more general social VR contexts, because it targets an antecedent of interpersonal harm: the absence of (opportunities to give) explicit agreement to an experience occurring. Social VR is a technology especially conducive to consent mechanics because the entirety of the user experience can be designed, including the user's representation, their interaction capabilities with other users, and the surrounding environment in which interaction takes place.

While participants posed myriad designs pursuant to consent, the primary contribution of this work is the identification of computer-mediated consent as a new conceptual direction or lens for which to design safety-oriented features in social VR—marking a departure from traditional reactive features and designs that necessitate universal understanding of what qualifies as harm. There are surely a wide range of possible consent mechanic amalgamations that could be developed and assessed quantitatively or otherwise in future user studies. These necessary steps must stem from an initial conceptual idea for consent mechanics in social VR, which our study provides through the stakeholders that we seek to protect through design.

In this section we first critically reflect on participant-proposed consent mechanics, including potentially adverse effects that should discourage adoption of some design concepts. We then plot future directions for design and research of consent mechanics in social VR.

5.1 Reflections on Participant-Generated Designs for Social VR Consent Mechanics

The study elucidates three categories of consent mechanics worthy of further attention: mechanics for giving/denying consent to interaction, mechanics for informing decisions to give consent to interaction, and mechanics for informing consent to entering public VR environments. We consider the participant-proposed designs in these three areas as a starting point for imagining consent mechanics in social VR, rather than prescriptive direction on how exactly they should be designed.

Participants themselves identified weaknesses in some of their design suggestions which should discourage their precise adoption while still motivating future design through the underlying intent of the ideas. One was pre-consent social settings, in which AI was envisioned to automatically detect and block attempted dialogue and behavior that a user has not pre-provided consent to through a settings page for demarcating behaviors they are willing and unwilling to be recipient to. Participants recognized that users may struggle to pre-identify the range of behaviors they would deem acceptable and unacceptable, and they also doubted the technical feasibility of just-in-time prevention of nonconsented acts. Despite these issues, the underlying idea of a multi-layered process of consent to interaction should be further considered, meaning the incorporation of consent mechanics at multiple stages before and during interaction.

Towards this idea, we would first recommend a social settings page that enables users to establish baseline and simplistic pre-consented situations such as types of people that can interact with them (e.g., only friends) and how that interaction can happen (e.g., only voice or voice and avatar-to-avatar touch). In-the-moment consent mechanics can support consent exchange to social situations that occur beyond those baseline settings, such as allowing strangers into one's personal space. The flexible consent bubble proposed by participants seems particularly feasible for this given the existence of personal space bubbles already in social VR applications.

The design ideas that sparked the most disagreement and criticism in design sessions were those for informing decisions to consent to interaction. Participants were uneasy about restricting avatar creation possibilities because of adverse impacts on marginalized groups who rely on avatar construction for safety and identity exploration (further supported in [21]). "Risk flags" to help users anticipate potential harm in otherwise consented interaction also drew concern, although women in our study who promoted the idea emphasized the importance—if not necessity—of offering some information to users beyond avatars to determine if consenting to interaction is a wise choice. One way to inform consent decisions without relying on subjective and potentially biased indicators is through track records of consent mechanic-use. If formal consent mechanics for engaging in interaction were established, such as those for users to explicitly give or deny agreement to someone entering their personal space and starting a conversation, usage of such features could contribute to records of one's consensual behavior that can inform future decisions by others to interact with them. For example, if a user always uses a consent mechanic to explicitly ask for permission to start an interaction with strangers in a public virtual space, future users may see an indicator of that track record which can make them more willing to interact with them as well.

5.2 Future Directions for Consent Mechanics in Social VR

While we have offered design directions for consent mechanics based on participants' ideas, here we identify three additional directions for future work: 1) scaffolding consent mechanic design with widely advocated consent models from public health, 2) generation of new consent mechanic ideas through synthesis with literature on consent in other social technologies, and 3) diversifying stakeholder populations represented in consent mechanic design and methods used in consent mechanic research.

5.2.1 Drawing Inspiration from Consent Mechanics in Adjacent Social Technologies

Consent has not been closely considered in the social VR literature, although we note overlapping topics of body sovereignty in VR [16]

and consent to *research* occurring in VR [48]). Nonetheless, consent has gained popularity as a lens for designing other social technologies such as social robots and conversational agents [60], video games [45], social media applications [30] (including consent to research participation through such platforms [69]), and mobile dating apps [71]. This prior work with adjacent technologies offers consent mechanic ideas from researchers, whereas our study is one of the first to present computer-mediated consent mechanics proposed by stakeholders/users. Nonetheless, consent mechanics proposed by researchers for other technologies could also be sources of inspiration in social VR design.

For instance, Nguyen and Ruberg [45] discovered "aftercare" phases of consent in romance-themed video games in which a sexual experience is discussed with partners after its completion to inform alterations to one's behavior in future interactions. This could be applied in social VR as well, potentially as a distinct phase at the end of one-one-one virtual dates or interactions in private virtual environments. Private feedback and reflection on one's consent practices—particularly how they are respecting consent decisions of their interaction partners—could be more instructive to future behavior than public user assessments that are critiqued in the previous subsection.

How consent is given and received in the midst of social VR interaction could also be informed by ideas rooted in adjacent technologies. Strengers and colleagues [60] proposed the idea of a "traffic light" system of visualizing consent (or lack thereof) from a social robot, which also lends itself to virtual environments by having users express their ongoing consent visually. Visual consent indicators could be an unobtrusive way for users to convey changes in their consent decisions and comfort levels without having to awkwardly interrupt conversation.

5.2.2 Scaffolding Design with a Consent Model

How should consent mechanics seek to augment the practices of giving and receiving consent to interpersonal behavior? The sexual violence literature has contended with this question for decades in light of empirical evidence of inconsistency in publicly adopted sexual consent practices [43], some of which are susceptible to misinterpretation and inadvertent harm (e.g., interpreting consent through nonverbal cues).

Likewise, computer-mediated consent mechanics proposed by researchers for other social technologies often adopt an established framework for consent from public health that is intended to prevent such misinterpretation and harm. The most notable is affirmative consent [64], a widely advocated model for consent to sex intended to prevent sexual violence by putting the onus on initiators of a (sexual) interaction to receive overt agreement, rather than on recipients to overtly refuse. Under this model consent must be voluntary, informed, revertible, specific, and unburdensome [30, 60].

Prior work has applied these affirmative consent tenets to propose consent mechanics in social technologies for purposes beyond sex. Im and colleagues used affirmative consent to generate design concepts for consensual interaction in social media platforms [30], and other work has applied it to speculate on human interactions with embodied technologies [60]. Affirmative consent has also been applied to analysis of human-computer interactions in contexts as diverse as video games [45] and online dating [71] to identify problematic influences of technology on consent practices and to inspire future consent mechanics.

We encourage adoption of affirmative consent as a framework for consent mechanics in social VR because it offers a set of heuristics for evaluating newly proposed consent mechanics. Specifically, they must support revertible consent, they must support consent to specific acts in order to reduce misinterpretation over what is consented to, they must help inform users' decisions to give consent, and they should reduce burdens to consent exchange. Some of our participants' designs are pursuant to affirmative consent, which is an indicator that users would be receptive to affirmative consent mechanics. For example, virtual world tagging supports *informed* consent to entering particular virtual spaces. Pre-consenting to particular interactions in a social settings page would be another example of *specific* consent.

5.2.3 Diversifying Design Participation and Methods

We must reiterate that the consent mechanic ideas produced in our study are reflective of a Midwest United States demographic. It is unknown if participants' motivations, priorities, and concerns would generalize to other populations of current and future social VR users. For future design of consent mechanics there is a clear need to diversify design participation to more populations given evidence that perceptions and practices of consent vary across cultures [29].

Populations that future research may prioritize for inclusion would be those at disproportionate risk of harm and marginalization. Examples include women and LGBTQ+ populations given elevated rates of sexual violence victimization, racial and ethnic minorities, users with disabilities, and non-Western demographics. Future work should also involve more experienced social VR users, who can report on their personal experiences with consent exchange in social VR and inform ways to incorporate new consent mechanics into existing social VR application designs.

Lastly, our study employed a qualitative, participatory approach that traded a larger sample size for the capacity to foreground an in-depth understanding of the perspectives of anticipated users in the design of safety-oriented features for VR dating. We would advocate that future work employ a wide range of methods to explore three research areas pertaining to consent in social VR: 1) exploring how users currently engage with existing social VR structures to augment consent exchange, 2) ideation of more consent mechanic ideas with larger and more diverse samples, and 3) development and assessment of consent mechanics in their capacity to maintain safety without disrupting social interaction.

To the first, semi-structured interviewing and focus groups would seem the most appropriate methods. To the second, participatory design methods could be applied to more diverse demographics as mentioned earlier, along with unmoderated methods such as surveys to collect perspectives of a larger sample of stakeholders on emerging design ideas. A mixed methods approach would be most effective for the latter. Given advances to rapid prototyping capabilities for VR, stakeholders could be included in iterative testing of prototypical consent mechanics to assess if they work as anticipated or pose inadvertent barriers to the user experience. Quantitative methods could be employed as well for analysis of behavioral data and to broaden sample sizes and perspectives of different user groups.

6 Conclusion

Social VR and dating applications individually expose users to significant harms, and the emergence of VR dating applications emphasize the urgency of improving social VR design for safety. Towards informing harm mitigative designs for VR dating environments, and social VR more broadly, we conducted a participatory design study with young adults in the Midwest United States (n=18).

Anticipated harms and proposed designs for harm mitigation revolved around the concept of *consent*. Under this lens, harm in social VR is inherently subjective, comprising experiences that are unwanted by the respective user. Designs for harm mitigation took the form of *consent mechanics* that explicitly support users in giving or denying agreement to interaction and observation of other users' interactions in social VR.

In light of the increasing popularity of consent as a research and design lens for other contemporary social technologies, consent mechanics would seem an opportune approach to harm mitigation in VR dating, if not social VR more broadly, because of the unique affordances to users in VR for controlling their self-presentation, their interaction capabilities with other users, and the surrounding environment. While the study elucidates myriad stakeholder-produced consent mechanic ideas, the overarching contribution of the paper is in proposing consent as a novel conceptual lens or roadmap for informing and assessing design for safety in social VR. Directions for future work include expanding stakeholder involvement to demographics beyond the Midwest United States given evidence of cultural variation in how consent is understood and practiced. Additional quantitative and qualitative methods can also be employed to assess the efficacy of proposed consent mechanics on safety without jeopardizing user autonomy and privacy.

Acknowledgments

The authors wish to thank Jesse Brown and Rachel Yang for their contributions to data collection. This work is partially supported by the U.S. National Science Foundation under Grant No. IIS-2211896.

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