Beyond Affirmative Consent: Creating Alternative Models for Consent to Computer-Mediated Sexual Activity through Social VR for Online Dating

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Despite the pervasiveness of computer mediation in nonconsensual sexual activity, there is an absence of consent models that explicitly prescribe how consent to sex should be asked for, given, and denied when mediated by technology. HCI literature has advocated for the adoption of affirmative consent ("yes means yes"); however, this model was created in 1991 without consideration for computers and has been historically underutilized. Through a speculative study of VR dating with 16 women and LGBTQIA+ stakeholders, we contribute archetypes of four new computer-mediated consent models for sexual activity. These include 1) visual consent through AR/VR rather than verbal dialogue, 2) agent-mediated consent where AI agents communicate consent on behalf of sexual partners, 3) a two-layer consent process called consent-to-stimulus, and 4) environmental consent where virtual environments scaffold behaviors that can(not) be consented to. We conclude by reflecting on which models could potentially supplant affirmative consent to better mitigate computer-mediated sexual violence and enrich sexual experience. ***Content warning: This paper discusses forms of sexual violence including rape.***

CCS Concepts: • **Human-centered computing** → **Collaborative and social computing theory, concepts and paradigms**; **Participatory design**; **Mixed / augmented reality**; **Virtual reality**.

Additional Key Words and Phrases: consent, online dating, social VR, affirmative consent, sexual violence, AI, abuse, harassment

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1 Introduction

In 1996, Oliver Jovanovic and Jamie Rzucek met online and exchanged messages before arranging their first face-to-face date. Jovanovic was subsequently sentenced to 15 years to life in prison for the violent rape of Rzucek during their first face-to-face encounter; however, the sentence was later overturned when the appellate court ruled that messages Rzucek had sent online about her

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sexual interests, including sadomasochism, were evidence that *"she consented to the [...] sexual abuse"* that later occurred [1, 22].

More than 25 years later there remains no clarity around the role that technology could or should play in how people give and receive consent to sex, despite growing evidence of nonconsensual acts through online dating [38, 60, 127, 136] and other social platforms [6, 55, 74, 117]. One may argue that computer mediation of consent would do little to deter a bad actor intent on causing harm, yet this ignores years of evidence in public health that sexual harm can occur without conscious intent by the perpetrator [33, 48, 97, 150]. Perpetuation of these inadvertent harms is due to problematic and unreliable consent practices [71, 77, 80, 85] that lead a person to misinterpret or incorrectly assume consent (e.g., reliance on body language) [14, 110]. Similarly, HCI research with findings related to consent in computer-mediated environments [96, 129, 143, 175] has shown that harm can be facilitated by technology through inadvertent scaffolding of problematic consent practices and beliefs. For instance, dating app users have misinterpreted signals like a bikini profile photo or "winky face" emoji *as* consent to sex, thus bypassing the perceived need to ask for permission before sexual contact [175].

Clearly, research is needed into how technology can intentionally scaffold sexual consent exchange to mitigate inadvertent harm. An essential prerequisite to such "consent technology" is a consent model: rules that prescribe exactly how consent should—and should not—be exchanged between people. Formative HCI research on computer-mediated consent to interpersonal behavior has advocated for affirmative consent ("yes means yes") [81, 92, 114, 148, 173, 174] as a basis or gold standard. Affirmative consent has laudable qualities that can reduce misunderstandings of consent, such as putting responsibility on the initiator of a sexual act to explicitly ask for and receive consent rather than on their partner to overtly refuse [83]. Nonetheless, affirmative consent has been extensively critiqued by the public and scholars alike for being unrealistic [59, 68]; an assertion backed up by evidence that affirmative consent has been historically under-adopted during sexual encounters [110, 128, 165]. Affirmative consent also makes no direct mention of the role that computers do or could play in consent exchange, given that it was devised in 1991. This has required HCI researchers to subjectively adapt or translate affirmative consent *to* computer-mediated communication [81, 148]. However, a participatory design study with online daters and social VR users found that affirmative consent is arguably impossible to practice online [32].

We pose an alternative approach: creating new consent models *for* computer-mediated communication. We take a human-centered approach to consent model creation grounded not in translation of a consent model that pre-dates most social technologies, but in the perspectives and experiences of people who would be expected to practice such models. We explored this approach through a speculative focus group and participatory design study of VR dating with women and LGBTQIA+ stakeholders who previously used dating apps and/or social VR. We chose VR dating environments to speculate on current and future possibilities for computer-mediated sexual activity and interactions surrounding sex. We chose women and LGBTQIA+ stakeholders because they are overwhelmingly the victims of nonconsensual sex [58, 109, 137]. Our research question is: ***How do online daters identifying as women and LGBTQIA+ envision the roles of people and technology in exchanging consent to sexual activity within virtual and augmented reality?***

Through reflexive thematic analysis of consent exchange scenarios created by participants, we elucidate four archetypes of new consent models for computer-mediated sexual activity that expand our understanding of *who* should have responsibilities in consent exchange, *what* can or should be consented to, and *how* consent could be exchanged. These include:

- **AI-mediated consent:** AI agents are active third parties in consent exchange between human sexual partners. They are assigned responsibilities to detect, communicate, and deny consent on behalf of their human users.
- **Visual consent:** Explicit verbal dialogue ("yes means yes") becomes an obsolete gold standard for consent exchange, usurped by the visualization of consent through VR/AR.
- **Consent to stimulus:** Before consent can be given to specific behaviors, users give consent to the *capacity* to experience the respective behavior (e.g., consenting to the possibility of haptic touch in VR before consenting to individual instances of touch).
- **Environmental consent:** System designers are prescribed the role of sexual consent authority with responsibility through virtual environment design for informing users' consent decisions and deciding what behaviors can and cannot be consented to.

We conclude by comparing the consent models articulated through our study to affirmative consent to reflect on which models could supplant, or be synthesized with, affirmative consent as official best practice for computer-mediated sexual activity, along with opportunities for future work.

2 Related Work

In this section we first situate consent among other HCI research pertaining to computer-mediated sexual experience and harm. We then provide historical context on consent to sex from social science domains before delving into prior work on computer-mediated consent to sex and other social interactions.

2.1 Computer-Mediated Sexual Experience and Sexual Harm

Research within HCI has explored computer-mediated sexual experience in a multitude of ways, both in its positive augmentation and enabling of sexual experience, and in its facilitation of sexual harm at scale. We position consent at the convergence of these two sides of computer-mediated sexual experience because consent is the defining characteristic that turns a sexual experience into sexual violence. For instance, the Centers for Disease Control and Prevention (CDC) in the United States define sexual violence as any activity of a sexual nature without consent [146].

Bell et al. [18] were arguably the first to point out the ever-frequent use of the internet for pornography consumption, spurring calls for further HCI research into technology and sex [30, 86, 87, 89], sometimes driven by a concern for social justice and related topics [10]. In the twenty or so years following their publication, the HCI community has explored computer-mediated sexual activity in quite some depth. Firstly, research has explored how individuals engage in sexual activities using computers, particularly around pornography [27, 169] and new social dynamics around buying and selling pornographic content such as through OnlyFans [69, 156]. Relatedly, computer-mediated sex toys can be used to sexually engage with other people remotely [10, 64], and in sexual experiences for those who have disabilities [62]. Other HCI research has empirically explored how computers mediate online sexual experiences between two or more people, such as through asynchronous nude image sharing or sexting [73, 74], and in synchronous virtual environments like Second Life for exploring sexual fantasies [11–13]. Computer-mediated sexual experiences can also traverse virtual and physical worlds, as evidenced by the popularity of dating apps for sexual activity [23, 25, 41, 176] and relatively less pervasive social platforms for sexual exhibitionism [88, 89]. Given risks associated with unprotected sex, additional work has studied the role of technology in sexual risk such as HIV [70, 161, 162] and safe sex practices including sex education [167, 168], HIV resources [145], and use of condoms [166].

The literature also speculates on how new and emerging technologies are—and could be—used to augment sexual experience. For example, prior work has explored interactions with sex dolls as antecedents to sex robots [52, 149]. Other speculative literature on sex robots has investigated public perceptions and ethics of their use [17, 67, 142]. Another emerging context for computer-mediated sexual activity—which we use as the basis for our study in this paper—is VR dating [152, 173], which blends elements of online dating with social VR's already-known use for relationship-building [171]. Mobile dating app companies [24, 131] have publicized intent to incorporate VR components into the online dating process, while startup companies have debuted new dating apps dedicated to VR such as Planet Theta [164], Nevermet [118], and Flirtual [91]. In fully virtual dating environments like Planet Theta, users discover and interact with potential dating partners in public and private VR worlds. Flirtual and Nevermet take an alternative approach through mobile apps that match social VR users for dating.

Considering the myriad sexual experiences that computers mediate, it is perhaps unsurprising that computers have also been shown to mediate many different types of sexual harm. A significant portion of reported experiences of in-person sexual violence have been linked to persons met on dating apps [158]. Furthermore, social media mediates sexual harm by allowing predators to traffick or harm individuals they have met through the platform [39, 54]. Additionally, research finds that computers mediate asynchronous forms of sexual harm through revenge porn [93], or the sharing of another person's sexual images without consent of the person depicted. Generative AI has added scale to nonconsensual image sharing through the creation of deepfake pornography [51]. Prior work has also considered computer-mediated solutions to some of the aforementioned sexual harms. These include AI-driven detection of attempts at sexual harm [26, 45, 82, 130, 170], support-seeking for victims during or after harm [7, 90, 140] including with AI chatbots [101, 121], and applications to support evasion of sexual harm in physical world contexts [2, 4, 139].

2.2 Consent to Sex Outside of HCI

Before delving into the HCI literature on consent, we first contextualize it with literature on consent to sex more generally. Research on consent outside of HCI has historically been contentious, marred by a lack of consensus over how consent is defined and how it can be exchanged between sexual partners [20], or if sex can ever be consensual in light of pervasive power dynamics [163]. Despite these discrepancies, sex scholars have generally converged on a definition of consent as voluntary and uncoerced [66, 77, 79] behavior intended to express an internal mental state of willingness to engage in a sexual act [103].

Models of consent to sex—or prescriptive guidance for how sexual partners should ask for and receive consent—are similarly contended. While formative models like communicative sexuality [125] have been broached, the current dominant model is affirmative consent [19], captured in the phrase "yes means yes" [56] and more recently in Planned Parenthood's FRIES acronym: consent must be Freely given, Reversible, Informed, Enthusiastic, and Specific to a particular act [126]. Affirmative consent was proposed in response to the "No means No" model of consent [119], which stated that a person was a victim of sexual violence if they said no, which was itself a step up from the perception that rape was only rape if the victim could prove they were physically forced [3, 72]. Within current laws and policies implementing affirmative consent, there is no consensus on whether "yes" to a sexual act must be verbal. Local laws differ quite significantly; for example, in the United States, New York's law implementing affirmative consent allows a "yes" to be conveyed through verbal or non-verbal methods [56, 83] while California's law is more strict [84]. The public also struggles to define affirmative consent [16, 42, 107], which is perhaps unsurprising when reflecting upon the lack of a universally accepted definition.

Affirmative consent is widely critiqued and under-adopted by the public, who describe it as unrealistic and awkward [42]. It is also critiqued by scholars and the public for failure to incorporate consideration of cultural differences [76], sexuality [47, 133], and gender roles [35], as well as for excluding those who are deaf or hard of hearing [94]. Aside from a few notable exceptions [120, 132], a large majority of prior literature exploring how consent is exchanged finds that young adults infer and imply consent through nonverbal and assumed cues [21, 66, 77, 78, 135, 144]. Some research even documents the most common mechanism for communicating consent to be a lack of resistance to sexual advances by another person [77]. Research has shown that university students are reluctant to practice explicit verbal exchange of consent because it differs starkly from normative practices of subtly inferred and implied consent between sexual partners [14, 95, 123].

2.3 Consent to Sex in HCI

Consent has been studied across multiple topic areas in HCI, with consent to data collection being one of the most popular. In light of legal regulations like the GDPR that require apps and websites to collect users' consent to collection of their personal data [157], HCI scholars have empirically assessed and critiqued data consent management interfaces for use of dark patterns [105, 116] and general failure to adhere to legal regulations [106]. This criticism has birthed entirely new models of consent to data collection [61, 98, 100, 115] and interface designs to better support data consent decisions [141, 160]—goals that research on computer-mediated consent to sexual activity could also aspire to.

Research on computer-mediated consent to social interaction, and sexual activity in particular, is in earlier stages. HCI research has yet to create new models of interpersonal consent that inherently acknowledge and prescribe the role of computers. Some literature has advocated for the adaptation of affirmative consent to social computing [92, 173, 174], despite historical issues with affirmative consent's adoption and public reception, and the fact that affirmative consent does not intrinsically provide guidance for the role of computers in consent exchange. Strengers et al. [148] used the FRIES acronym for affirmative consent [126] as the basis for their own TEASE model for interactions between humans and sex robots (e.g., "Establish ongoing dialogue"). Similarly, Im et al. [81] advocated for affirmative consent's adaptation to social media platforms, arguing that design features to support affirmative consent practice could address issues such as harassment and revenge porn. Also related, Nguyen and Ruberg [114] critiqued the design of mobile consent apps [124] such as Legal Fling and Good2Go (through which sexual partners log their consent) for its violation of affirmative consent principles, notably the inability to revoke consent during sex. They applied a similar assessment to sex-themed video games [114].

Noticeably absent in researcher-led adaptations of affirmative consent to social computing is the perspective of user-stakeholders who would be expected to practice the given consent model. Towards addressing this gap with participatory design, Burger and Tebbe et al. [32] found women and LGBTQIA+ stakeholders to be largely critical of affirmative consent in online settings; those stakeholders elucidated reasons why four of the five core components of the affirmative consent model are impractical—if not impossible—to perform in computer-mediated environments.

Empirical studies further demonstrate how computer-mediated sexual activity and social interaction stress the limits of transferability of affirmative consent through, for example, notions of consent exchange across virtual and physical boundaries, and through affordances not always available in physical, unmediated contexts. Zytko et al. found that dating app users signal and infer sexual interest through the dating app interface [178], such as through physically revealing profile pictures and even one's mere presence on the dating app, leading them to initiate a sexual act during face-to-face dates without asking for consent because they think it was already given online [175]. Another study exploring consent behaviors of men seeking men on Grindr found that

all participants in the study negotiated consent to sexual acts prior to meeting in person, yet only some re-confirmed consent when meeting face-to-face [49]. In social VR (although not necessarily sexual activity), Schulenberg et al. [143] found that consent is often portrayed through boundaries and presence in a private space.

Other work indicates that anticipated users have keen interest in charting the future of computer-mediated consent to sex and other social interactions. Zytko and colleagues [174] conducted participatory design of consent technology for online dating, elucidating opportunities for AI mediation, social robots, and wearable devices in mediating consent to sex across virtual and physical interactions. Social VR users have described preferences for clarity of consent across VR and AR modalities [152] and for VR consent mechanics that retain a sense of immersion without detracting from a "natural social experience" [143] (p. 18). In critiquing the practicality of affirmative consent online, stakeholders in Burger and colleagues' participatory design research also articulated opportunities for entirely new computer-mediated models of consent exchange [32].

Schulenberg et al. [143] acknowledge that consent technology concepts proposed by users in prior work pose "complications that established concepts like affirmative consent cannot account for" (p. 24). However, we have yet to see HCI research create alternatives to affirmative consent through the same participatory and human-centered methods.

3 Method

We explored our research question through a speculative study of VR dating with 16 women and LGBTQIA+ stakeholders in the Midwest United States. Participants took part in group-based workshop sessions that blended elements of focus group discussion and participatory design. They used speculative storytelling to propose ideal roles for sexual partners and technology in exchanging consent within VR dating scenarios. The study was approved by our institution's IRB.

3.1 Participants and Recruitment

Recruitment ads clarified that the study would involve group-based discussion and design regarding VR dating, sexual harm, and consent. Recruitment methods included messages on the research team's personal social media accounts, a university student mailing list, a sorority mailing list, and snowball sampling. Recruitment centered on women and/or LGBTQIA+ individuals because they are disproportionately the victims of nonconsensual sexual acts [58, 113]. We chose VR dating as the focus of the study because it serves as a speculative context for current and future forms of computer-mediated sexual activity, although we did not require direct experience with VR dating platforms because they are still in the formative stages of public access. Instead, we required experience with mobile dating apps and/or general social VR platforms so that participants would have at least a partial frame of reference for speculating on computer-mediated sexual consent (primers for VR dating were provided in workshop sessions; see Data Collection). Participants were compensated with a $50 gift card.

Two participants identified as non-binary and the other 14 as women. They identified as heterosexual (7), bisexual (4), homosexual (2), and pansexual (1), with two participants opting not to disclose their sexual orientation. The age range was 19-26, aligning with the most common age group for online dating [8]. Participants were White/Caucasian (14), Black/African American (2), and/or Asian/Pacific Islander (1). Thirteen participants had previously used mobile dating apps and 9 had used social VR platforms. Refer to the Appendix for participant demographics.

3.2 Participant Care

We directly consulted with a certified sexual assault nurse examiner (SANE) and multiple psychology researchers with expertise in empirical sexual violence research about our method. We chose to

conduct workshop sessions in groups to facilitate shared emotional and social support. In line with this intent of support, one woman-identifying participant had not used dating apps or social VR but was allowed to participate at the request of another participant for a sense of safety and familiarity. Group sessions were conducted in-person to support privacy and a feeling of camaraderie and trust among participants; food was also provided during sessions with frequent breaks to emotionally unwind and reset. Most sessions occurred in the authors' research lab, except for one session that occurred in a participant's home because all participants in that group were friends and were more familiar with that location. Participants were reminded that they could discontinue participation at any time, or ask the researchers to leave, without adverse consequence to their payment for the sessions attended.

Within the sessions, we opted not to use the term "consent model" explicitly due to concerns that participants might misunderstand it, thus posing a potential knowledge divide and an imbalance of perceived authority and expertise between researcher and participant (which have been ongoing challenges to participatory design as a method [28, 177]). Our method consultants broadly encouraged use of "behaviorally specific" wording, in other words: phrases that have innate, descriptive meaning. Hence, instead of using the term "consent models" with participants, we used descriptive phrases such as "rules for how consent should be exchanged in VR dating." Relatedly, we had participants express their ideas for how consent should be exchanged in VR dating through stories (scenarios) because they have proven to be a readily understood and accessible means of communicating design ideas not just in participatory design [34], but in HCI more generally [36].

3.3 Data Collection

Participants were split across four groups ranging from 3-5 people, with each participant engaging in up to three 3-hour workshop sessions. Twelve participants engaged in all three of their sessions, whereas four participated in the first two sessions but missed the third. The sessions blended elements of focus group and participatory design methods. Participatory design [111] seeks to involve stakeholders in design processes not merely as subjects who react to designs from others (such as in usability assessment), but to collaboratively and proactively contribute to design and decision-making with their own ideas and experiences. Artifacts of participatory design can vary, but often comprise visual artifacts handmade from stakeholders as well as transcripts of verbal discussions [5, 65, 104, 174]. Our sessions similarly produced verbal transcripts of group discussions and stakeholder-created visual artifacts because we considered them most accessible in ideation of prescriptive guidance for computer-mediated consent to sex.

The goal of the **first session** was to elucidate each participant's personally used or preferred practices for sexual consent exchange. It began with a primer on VR dating that lasted approximately 30 minutes, including a review of news articles and publicly available materials on VR dating apps such as Planet Theta, Flirtual, and Nevermet (see Related Work section 2.1).

Participants then performed a card sorting exercise in which they individually used note cards to write down examples of nonconsensual acts they considered most in need of prevention in VR dating environments and subsequent physical-world meetings between VR daters, and then placed their notecards on a board mapping with distinct phases of the VR dating process (discovering a potential sexual partner online, interacting with the partner in public and/or private VR environments, and face-to-face meetings; see Figure 1). This was followed by open discussions among all participants about the individually placed notecards, which were often grounded in deeply personal experiences with mobile dating apps and social VR platforms. In subgroups of two or three, participants then created scenarios for how consent should be exchanged to mitigate an unwanted behavior from the previous card sorting activity. These scenarios were subsequently verbally presented to, and

discussed by, all participants in the session. The discussion phase encouraged the use of feedback to clarify, modify, or expand the scenarios in real-time.

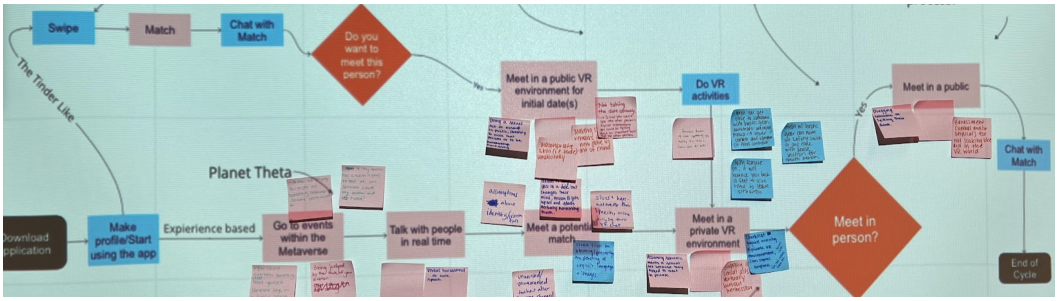

Fig. 1. In the first session participants individually used notecards to write examples of nonconsensual acts that were deemed most in need of mitigation and then pasted them on a board mapping to phases of the VR dating process where the act was most likely to occur. The board then served as the basis for open discussion about the nonconsensual acts and related personal experiences.

The **second session** iterated on participants' computer-mediated consent scenarios through a focus on how technology should be designed to augment their preferred consent practices. In other words, if session 1 posed the question "How should *people* exchange consent to interpersonal behavior in VR dating?", session 2 posed the question "What role(s) should *technology* play in how people exchange consent in VR dating?" The session started with a presentation of affirmative consent and the core concepts of the FRIES acronym [126], which all participants openly discussed and critiqued. We introduced affirmative consent deliberately after scenario creation from session 1 to inform reflection on their preferred consent practices, but without biasing their initial scenarios.

In subgroups of two or three, participants then created scenarios involving "consent mechanics": features or technologies that would support sexual consent exchange in VR dating environments or in subsequent face-to-face encounters. The consent mechanics, and associated scenarios of their use by sexual partners, were intended to foreground the roles and potential responsibilities of technology in how participants thought consent to sex should be given, received, and denied in VR dating. Participant groups created their consent mechanics with various arts-and-crafts supplies, or simple pen and paper. Afterward each subgroup verbally told a story/scenario of their consent mechanic's role in sexual consent exchange to facilitate discussion among all participants, where in-the-moment revision of the scenario and related consent mechanic was encouraged.

In between the second and third sessions, the research team created virtual mockups to demonstrate participants' consent mechanics from session 2 in ShapesXR (rapid VR mockup software). See examples in Figure 2. These were static mockups that often had text explanations embedded directly into their design to compensate for the lack of interactivity. Participants from all groups were invited to the **third session** together, with the intent to facilitate further iteration and refinement of their ideas on computer-mediated consent by using the ShapesXR mockups as discussion pieces à la an art gallery. In actuality, the session (attended by 12 participants) morphed into a "value gain event" [63] by participants where they used the time for socializing, reconnecting, and giving general pleasantries to the ShapesXR mockups.

3.4 Data Analysis

Participants produced and discussed over 20 scenarios for consent exchange to computer-mediated sexual activity across all session 1 and session 2 recordings. During data analysis, participants'

Fig. 2. ShapesXR mockups created by the research team were static representations of participants' consent mechanics as ideated in the second session's design activities. Some included embedded text descriptions to explain how users would hypothetically interact with, or otherwise be affected by, the consent mechanic.

scenarios—and associated focus group transcripts and visual artifacts they personally created—were analyzed to extract latent prescriptive guidance for the roles of humans and technology in how consent to sexual activity should be given and received in virtual and augmented reality. Transcription of the third session did not feature in data analysis because its repurposing as a value gain event did not provide insight into this paper's research question. The ShapesXR mockups from session 3 were also not featured in data analysis because they were intended as a data collection instrument rather than a study output.

We subjected the transcripts and visual artifacts from all four iterations of session 1 and session 2 to reflexive thematic analysis (RTA) [29]. There are six steps to RTA: (1) familiarizing oneself with the data; (2) coding; (3) initial theme generation; (4) developing and reviewing themes; (5) refining and defining themes; and (6) writing results.

Data familiarization (step 1) was performed by three researchers independently proofreading and taking notes on the transcripts and visual artifacts. The researchers then began initial coding (step 2) with a shared spreadsheet that contained quotes and preliminary codes as selected by each of the three researchers during individual review of every transcript. Codes at this stage were primarily semantic, reflecting surface-level understanding of the functionality of consent mechanics created by participants and literal descriptions of preferred consent practices. Initial theme generation (step 3) occurred over several collaborative coding sessions [29] between the researchers with broad themes pertaining to consent model concepts and reactions, consent mechanic ideas, nonconsensual acts to be prevented, and miscellaneous thoughts on VR dating.

Themes were reviewed and refined (steps 4 and 5) in Miro, a collaborative whiteboard accessible through web browsers through which we ported over participant quotes as virtual note cards. This allowed for visual (re-)organizations of quotes to reflect on different thematic structures, resulting in more specific and nuanced themes. Related to this paper, such themes related to negative reactions to affirmative consent as a model for computed-mediated sexual activity, as well as burgeoning notions of new consent models unique to computer-mediated communication such as framing AI agents as active parties in consent exchange, virtual environments as deliberate scaffolding of consent exchange possibilities, capabilities for consent exchange beyond our physical bodies, and increased agency of what *can* be consented to in interaction. Those themes were further refined through the writing of this paper's findings section (step 6), culminating in four distinct archetypes for computer-mediated models of consent to sexual activity.

4 Findings

Analysis of over 20 scenarios for computer-mediated sexual consent exchange and associated focus group discussions resulted in four overarching themes, or archetypes, of *computer-mediated consent models*, which we define as prescriptive guidance for the roles of humans *and* technology in how consent to sexual activity should be given, received, and denied in virtual and augmented reality dating contexts. We unpack each model archetype in the following subsections, summarized as:

- *Visual consent*, which employs AR/VR visualizations for communicating consent
- *Consent to stimulus*, through which a user must consent to the capacity to experience a behavior before consenting to the behavior itself
- *AI-mediated consent*, which positions AI as an active third party in the consent exchange process between human sexual partners
- *Environmental consent*, where the virtual environment and its designers are prescribed an authoritative role in scaffolding what behaviors can and cannot be consented to

4.1 Visual Consent

Virtual and augmented reality immerses users within alterable environments, where new objects and forms can be created and manipulated freely. This allows for the visualization and embodiment of information that would not be practical or possible in the natural physical world. Some participants considered how these new forms of visualization could become the primary means for individuals to deliberately and manually give or deny consent if potential sexual partners are interacting in VR or in the physical world while wearing AR glasses. Some participants imagined visual consent information completely replacing traditional means of explicit and deliberate communication of yes/no consent decisions through verbal dialogue (in effect rendering verbal "yes means yes" obsolete). Other participants envisioned visual consent being expressed in tandem with verbal consent confirmation. As P2 put it, visually expressing consent information would encourage VR daters to verbally acknowledge whether consent was given or denied. An advantage of visually communicating one's consent decision is the speed with which consent (or lack thereof) can be clearly and concisely conveyed. Multiple participants used words like *"alert"* and *"warning"* or *"pop up"* to describe the abruptness with which they could visually communicate consent, and in ways that demand the attention of one's (potential) sexual partner. See Figure 3 for a summary of the model resulting from data analysis.

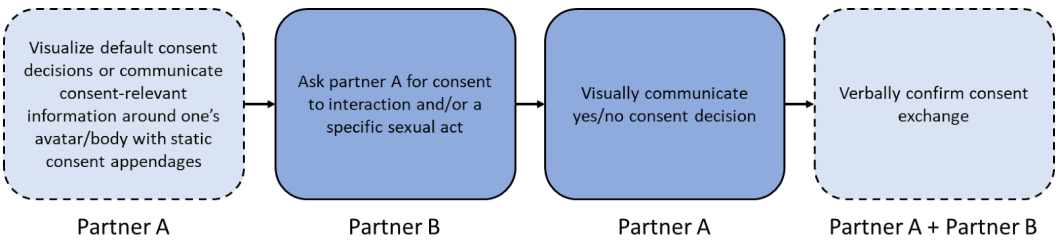

Fig. 3. Commonalities across participants' scenarios involving visual consent, through which users communicate their consent decisions visually through AR/VR. (The solid-lined boxes were consistent phases across participants' scenarios, whereas the dotted-lined boxes indicate phases that were optional or inconsistently advocated by participants.)

The most popular way that participants imagined visualizing their consent was as simple colors where *"the different colors mean different things"* (P16). In some cases this was akin to a red light/green

light pattern mapping to yes/no consent decisions, but in other cases with more complex color arrangements or *"auras."* In addition to visually communicating one's initial consent decision, users could deliberately change their colors to communicate changes in consent throughout a sexual encounter, such as changing their mind about a sexual activity during the act (P8 referred to this as a *"color-changing element"*). Ideation of consent-as-colors was sometimes introduced in the focus group discussions through analogies from participants' lives. For instance, P8 likened the idea to the video game *"The Sims"* and a color-changing *"plumbob"* above each character's head. P14 referenced two different inspirations from their personal life; wearing colored *"jelly bracelets"* in high school and color-coded clothing items like handkerchiefs in queer culture that are used to communicate relationship status or sexual interests. In their words:

"This is drawing like [from the] 90s, 2000s. But the jelly bracelets, you'd wear different colors on things that you're into, or if you're looking for someone [for a romantic relationship] or you're taken. Yeah. And likewise, like I think things like that are sometimes in [...] code, handkerchief code. Yeah. This one [the jelly bracelets] was more like high schools and handkerchief code is more like, like queer bars." (P14)

The color variations afforded through visualization were recognized by participants as an opportunity to communicate additional nuance to a yes/no consent decision. Enthusiasm was commonly mentioned as a typically nonverbal (and misunderstood) element of consent decisions that they could materialize and clarify through visualization. Several participants emphasized enthusiasm due to qualms aired earlier in their focus group discussions about affirmative consent and its requirement that consent be "enthusiastically" given; a requirement that they largely agreed with but found impossible to reliably communicate and detect with natural human communication capabilities. Relatedly, participants imagined using visual consent to intentionally materialize other important elements of consent decisions that would otherwise be left inferred such as *"mood,"* (P16) *"body language,"* (P16) and *"tone of [...] voice"* (P16). P16's notion of an *"enthusiasm meter"* pertained to a four-color consent visualization model in which they would intentionally use colors to convey not only a yes/no consent decision, but the level of enthusiasm associated with that decision. They could choose to display red, yellow, orange, or green, with red corresponding to *"not a very energetic response [...] they're uncomfortable,"* yellow indicating *"they're okay with it, but a little hesitant,"* and green indicating *"100% down [...] they're excited without a doubt."*

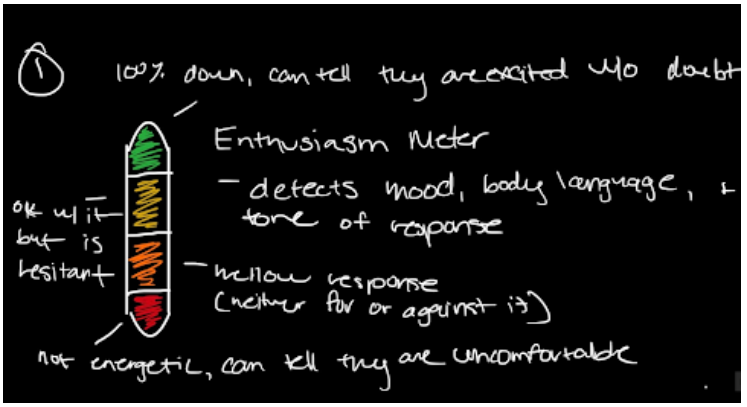

Fig. 4. P16's visual consent meter utilized different colors to convey consent decisions and the level of enthusiasm associated with consent.

Participants also recognized that visual consent does not have to be ephemeral like verbally conveyed consent. We used the code *static consent appendages* to refer to a stage at the start of the visual consent model in which a VR dater can statically convey consent-relevant information (or consent itself) around their avatar/body to inform a partner's inclination to start interaction and ask for consent to particular behaviors. Multiple participants discussed how a color-coding system could be used to convey not only consent decisions but consent-relevant information, such as whether a potential sexual partner is using haptic equipment that allows them to physically feel when their avatars are touched. They pictured a visual *"aura"* (P2) or *"glow around the person like a light blue, or green,"* (P2) or a *"warning [...] pop up in like your upper right-hand corner"* (P1) when approaching users with haptic capabilities so that they do not accidentally engage in nonconsensual touch.

Participants extrapolated on other miscellaneous personal information that they could statically convey to prospective sexual partners through more complex visualizations that include text-based information. These text-heavy static consent appendages, occasionally referred to as *"bubbles"* (P16), were analogous to *"business cards"* (P8) and *"preferences that they put like on the door [to a private space]"* (P7). Simpler text-oriented consent appendages were also suggested, such as displaying *"DNT"* (P10) or *"Do Not Touch"* (P10) near one's avatar to visually convey a default denial of consent to avatar touch. Multiple participants expressed interest in static visualizations of their (lack of) consent to any interaction—this was considered most helpful when one's avatar or body is in a public space like a (virtual) bar where strangers might assume it is acceptable—and even desired—to broach an interaction and communicate about sexual desires. Within VR dating environments, participants imagined using static consent appendages to communicate "no" to initiating an interaction with their avatar due to preoccupation with something in the physical world. For instance, P6 imagined a situation where a VR dater may be temporarily away from their VR headset to check a messaging app and would want to visually convey a default denial of consent to interaction with their avatar in VR.

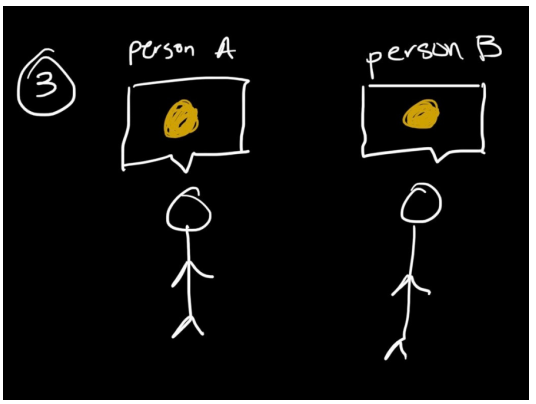

Fig. 5. P16 drew an example of how potential sexual partners could convey color-based consent decisions and text information about themselves simultaneously.

4.2 Consent to Stimulus

VR environments facilitate new capabilities for personal expression relative to the physical world, and also new capabilities to control the stimuli that one experiences—what they can see, hear, and

feel. Participants exemplified this stimuli control most often with haptic touch, through presumptions that VR daters may soon have ready access to consumer haptic devices that allow them to feel, and control, physical sensations when their avatar is touched in VR. This formed the basis for a two-layer consent model where a person first consents to the possibility—or capacity—to experience a given stimulus before any interaction begins. They then consent to actually experiencing the stimuli on a case-by-case basis during an interaction. Using the most popular example of haptic feedback, this would involve a VR dater first consenting to the possibility of feeling a physical sensation in the VR dating environment, and then later giving explicit consent to an interaction partner to touch their avatar, knowing it will trigger a physical sensation on their real body.

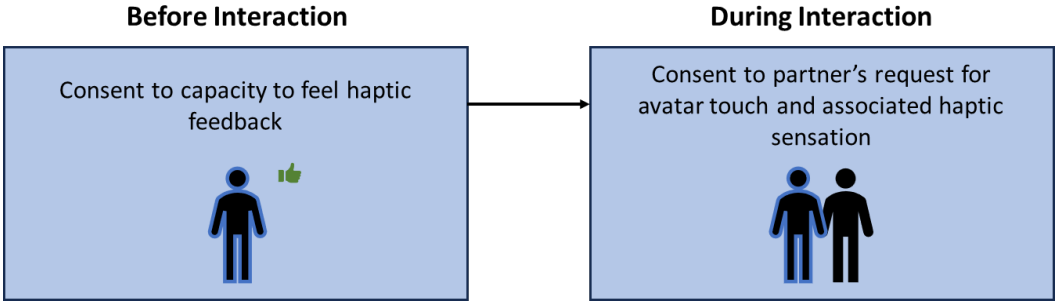

Fig. 6. The consent-to-stimulus model, using haptic feedback/touch as the stimulus example.

Participants proposed a range of approaches for managing consent to stimuli, which a user either performs alone or in collaboration with an interaction partner. Some participants favored a mutual consent system, requiring both parties to *"...check a box..."* (P14) to explicitly opt-in to feeling haptic touch for either of them to experience said stimuli. This was anticipated to prevent unwanted sensory experiences while fostering transparency and security. P14 articulated this need: *"Both players maybe need to like check a box, but if not, if only one of them checks a box, they can't [experience haptic touch]."* This approach stresses the importance of reciprocity and mutual understanding.

Other participants advocated for a more individualized process of consenting to stimuli, allowing users to manage haptic permissions independently from the decisions of a potential interaction partner. P9 described this control mechanism, stating, *"So you get to set your [haptic settings] [...] And then if you want another person like the approved or that one person [...] to touch you, you would add them into like a list using their username or something."* This approach provides flexibility for users to adapt to various social contexts based on comfort levels, regardless of their interaction partners' stimulus consent decisions. In line with this, participants elaborated on the granularity of haptic feedback settings that they anticipated users being able to consent to. P2 thought that settings should differentiate between sensitivity to the environment and other users, allowing for fine-tuning based on context: *"...do you want to be able to feel when someone touches your arm or whatever. You can have it like off, low, or high. And then how do you want the haptic gear sensitivity to your environment, because I think you have to differentiate between the two because if [...] you want to feel like the wind or whatever, you can be able to feel that without feeling or like being worried about other people touching you."* Expectations for nuanced stimulus consent settings were intended to be sensitive to the range of potentially intimate interactions that one may experience in a VR dating environment and the need for different settings at different moments.

Clear communication regarding adjustments to stimulus consent settings was an essential part of this consent model for some participants. They stressed that any changes—such as turning haptic feedback on or off—should be automatically relayed to relevant parties to prevent misunderstandings, especially in sensitive contexts. P13 emphasized this necessity by noting, *"...the VR system can sense the haptic thing and it will let the other person know regardless [...] it has to say this person is wearing haptic gear."* However, not all participants favored mandatory disclosure. Some valued privacy and suggested that users should decide whether or not to inform others about their haptic consent status. P2 proposed, *"Maybe that can be just another setting like, [...] do you want the person to be alerted or not [that you turned your haptic feedback on/off]?"* Some participants connected the consent-to-stimulus model with the visual consent model from the previous section through suggestions to use visual indicators of haptic consent settings to other users. They suggested that users could indicate if they wanted to visualize their haptic use to others through *"glowing blue"* (P2) auras or alerts.

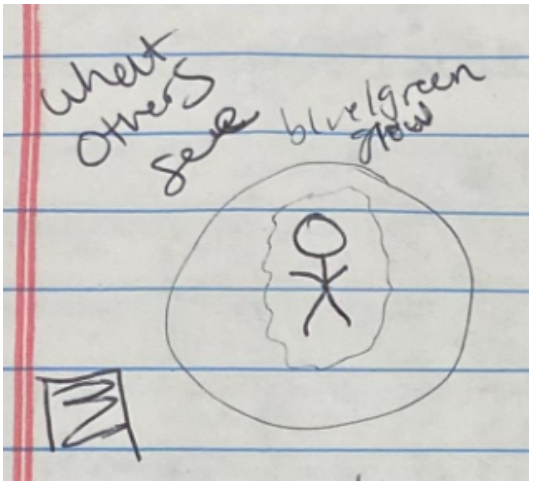

Fig. 7. P2 suggested combining consent-to-stimulus and visual consent by using a colored "glow" to convey consent to haptic feedback to other users.

4.3 Agent-Mediated Consent

AI has become a pervasive element in mobile dating apps as well as in social VR, and several participants were excited about potential roles for AI in sexual consent exchange. They constructed scenarios of computer-mediated consent exchange that, collectively, employed AI agents as active third parties in consent exchange between human users. To clarify, these AI-driven agents were not considered sexual partners themselves (i.e., they were not thought of as sex robots) but as mediators of sexual activity between two humans. Dubbed *consent agents* in our coding, they would be assigned responsibilities to detect and communicate (the absence of) consent on behalf of human sexual partners. Their intent would be to increase the consistent practice of explicit and specific consent exchange, while also excusing human sexual partners of the social burden and awkwardness surrounding it.

Under this consent model, participants described AI performing two roles: 1) *Establishing pre-consent:* User onboarding with their consent agent would involve articulation of behaviors that

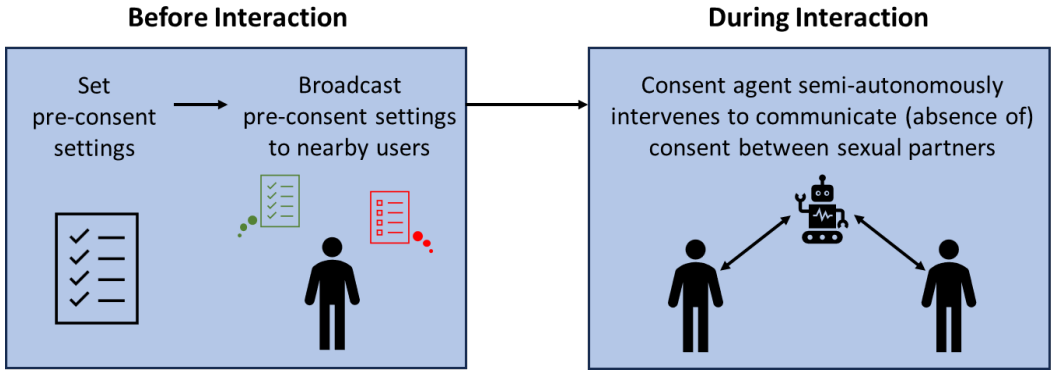

Fig. 8. Agent-mediated consent frames an AI consent agent as an active third party in consent exchange between human sexual partners. It knows when and how to intervene in interactions according to each partner's pre-consent settings (which behaviors they deny and give consent to by default).

are, by default, not acceptable to them and those requiring explicit consent exchange on a case-by-case basis. 2) *Semi-autonomously intervening in sexual interaction:* Pre-consent settings enable a consent agent to autonomously intervene in interactions to scaffold explicit exchange of consent to particular behaviors, to clarify absence/denial of consent, and to redirect interaction to consented behaviors if a nonconsensual act is detected. Users could also trigger manual intervention in unwanted interactions through covert communication with their consent agent, such as a verbal codeword or hand motion during synchronous VR/AR interaction.

The autonomous detection of nonconsensual behaviors by consent agents would be enabled through consent preferences and settings—in effect training the consent agent on which behaviors the user considers nonconsensual, which are always consented to by default, and which would require explicit consent exchange between partners. We coded these as pre-consent settings because they would be inputted by the user before interactions with potential sexual partners. The purview of pre-consent settings commonly referenced (non)consensual forms of speech and verbal phrases, bodily/avatar touch, and personal space around one's body/avatar (how close a potential partner can be to one's physical body or avatar before having to explicitly ask for consent to getting closer). For instance, some participants described a pre-consent settings phase occurring at the same time as avatar creation when setting up a VR dating account, through which they can establish expectations and pre-consent to avatar touch and personal space: Per P8: *"I'd like to see along with avatar creation, setting those expectations of conduct."* P10 similarly conveyed: *"Do you want to be touched? [And] like how much space you want [around your body/avatar where the invasion of personal space is considered nonconsensual]?"*

Participants also considered it essential that pre-consent settings be publicly communicated, or accessible for review, to potential sexual partners. Given the likely variability in pre-consent settings across VR daters, potential sexual partners would be less likely to unintentionally commit a nonconsensual act if they were preemptively aware of the behaviors that one does and does not allow. As some participants described it, broadcasting pre-consent settings would help avoid unintentionally making someone *"feel like they're an awful person because they didn't know [my pre-consent settings]"* (P8) while also saving VR daters from the labor of having to repeat pre-consent settings to each potential sexual partner by offering *"a way to advertise [pre-consent settings] without having to walk up to everyone"* (P8). These ideas sometimes overlapped with, or were inspired by, concepts in the visual consent model (see previous subsection). P10 shared one example of

conveying pre-consent settings to touch and personal space through visualizations: *"...it would show like with your avatar saying like 'okay to touch' or like a thumbs up. And then [there] would be a screen [that] would pop up and next to it, it would say DNT which was like 'do not touch'..."* Other participants shared more elaborate concepts for communicating pre-consent settings for interaction such as *"some sort of written or audible form that when people start looking to interact with me, they can check"* (P8).

While an interaction is occurring, a consent agent would monitor behavior and autonomously intervene according to pre-consent settings. This was sometimes envisioned as a proactive intervention to prompt both partners to explicitly confirm mutual consent to an upcoming experience (per P10: *"...the screen and a pop up say [...] 'Do both parties agree?'"*). Yet the vast majority of examples from participants pertained to the consent agent intervening in an act that it detects as nonconsensual according to its user's preconsent settings. Several participants exemplified this with the detection of non-consented speech between potential sexual partners: *"...speech recognition [...] like recognizing certain phrases and flagging them [as nonconsensual]"* (P11). Beyond behaviors themselves, some participants discussed consent agents intervening when they detect that verbal consent is not enthusiastically given, which may suggest that the partner is not truly comfortable with the given behavior. As P16 summarized: *"So it detects like your mood, body language, tone, and a response."*

Participants assumed that a consent agent's autonomous detection of nonconsensual behaviors would not be foolproof; it may fail to accurately detect a behavior that violates preconsent settings, or a behavior may occur that is out of the scope of those settings. As such, participants required that manual triggering of the consent agent be part of this consent model. In effect, this would allow a sexual partner to indirectly deny consent or call out the absence of consent by having the interruption of a behavior occur "through" the consent agent (thus putting the awkwardness for interruption on the consent agent rather than the human). Because manual intervention would likely be time-sensitive to help avoid further harm participants imagined ways that users could rapidly trigger their consent agent, such as verbally with a *"trigger word"* (P4) or a predefined button combination on a handheld device if in VR.

The ensuing intervention by the consent agent would serve to inform the offending partner that their behavior is nonconsensual. P5 described this as *"a warning"* that could lead to a discontinuation of the interaction if they continue with nonconsensual behavior. P8 wanted the consent agent's intervention to also remind the offending partner of one's pre-consent settings in an effort to help them avoid further nonconsensual acts. Per P8: *"...you can request the app to send a reminder of [your pre-consent settings]. Yeah, it would send them a message saying like, telling them either like a violation or like if they are not adhering to like the specific [pre-consent settings]."* Some participants stressed that the consent agent should use *"positive language"* (P8) when explaining a consent transgression because it may have been *"unintentional"* (P1).

4.4 Environmental Consent

VR environments, unlike physical world settings, are fully designed and modifiable by human designers, and to some extent users within those environments. VR environments, in turn, have a tremendous influence on the nature of interactions between users that occur within them. Participants likewise considered how to foreground virtual environments in what we coded as an *environmental consent model.* Participants outlined roles and responsibilities of virtual environments (and, by extension, their designers) in consent exchange in two ways: defining and restricting what behaviors can be consented to, and informing users' consent decisions. This was a controversial concept for some participants who cited concerns over whether or how a virtual environment can usurp personal agency.

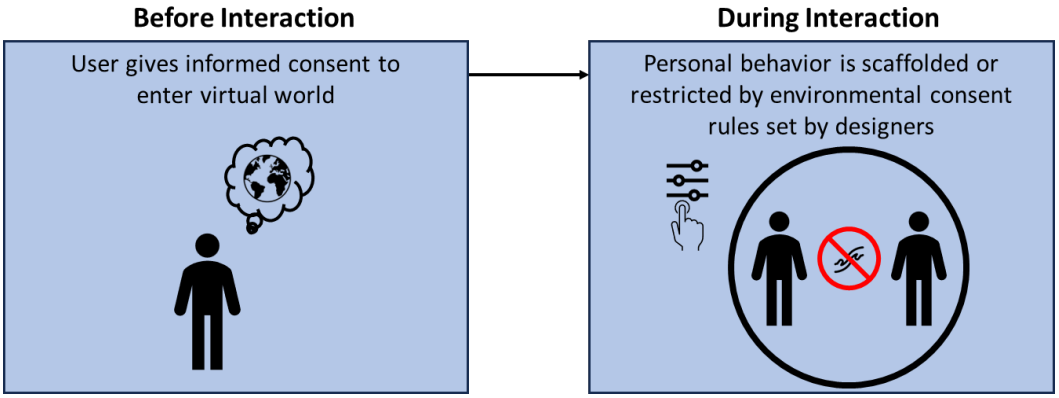

Fig. 9. The environmental consent model puts the responsibility on system designers to deliberately scaffold what behaviors can and cannot be consented to in a given virtual environment, and also to inform users of those environmental consent dynamics.

Participants frequently identified VR environments as central figures in determining acceptable behavior, which could effectively act as gatekeepers to what behavior can be consented to and what behavior is deemed nonconsensual by default, setting the stage for how consent is managed. Some participants likened VR environments to structured platforms like *"Discord servers"* where each space can enforce unique behavioral norms that are responsive to the particular user base and circumstances of interaction. One participant, P1, highlighted the importance of *"situational"* rules, noting: *"I think it is very situational. So [...] the separate servers have different rules, maybe defining these rules for [...] each world."*

Participants stressed that environmental scaffolding of what users (can) give consent to in VR dating would similarly allow for situationally specific constraints and affordances in different virtual environments and rooms that comprise the broader VR dating platform. During focus group discussions this was commonly exemplified through limiting certain activities, limiting personal expression in avatar design, and restricting particular avatar movements to align with perceived social and cultural norms. For instance, there were suggestions that the VR environment could intentionally cause *"glitches"* (P14) when behaviors violating environmental consent rules are attempted, which would effectively override a user's control over their avatar. P14 made a similar suggestion with a video game analogy: *"...in a video game and you like reach a barrier [that you can't pass]. I'm wondering if that would be possible with VR [to have a similar effect when consent isn't granted]."*

Participants voiced conflicting opinions on environmental consent based on this proposed opportunity, or responsibility, to control user behavior for the sake of adhering to omnipresent consent rules. This raised significant questions regarding the balance between personal agency and safety within VR spaces, leaving some participants unsure if a consent model giving unfettered authority to designers to dictate the dynamics of consent should be advocated.

A less controversial aspect of environmental consent proposed by participants was the responsibility of virtual environments and their designers to inform users' consent decisions to enter the respective environment. Participants stressed the importance of clearly communicating the nature of the environment and the activities that are or could be going on within it, particularly given the speculation that VR daters may choose to engage in virtual sex acts directly within VR. One proposal was the introduction of the ability for users to *"preview the room [that they want*

to enter]" (P9) which allows users to explore a VR space before consenting to enter their avatar into the space. P7 had a similar idea for private rooms that two VR daters may choose to enter after meeting in a public space: *"Both parties would know that the room is locked [to prevent screen sharing capabilities and entry from other users] with a symbol or switch visible to all."* Participants also debated more comprehensive ways of informing consent decisions to enter virtual worlds, some involving quizzes and pop-up screens of text to ensure users fully comprehend the normative and restricted behavior of the environment.

There was disagreement, however, over what VR environments need to inform their users of before entering, and whether users should be able to deny consent to particular actions of the environment. Such discussion mostly centered around recording user interactions in VR environments for the sake of collecting evidence of harmful actions for user reporting/blocking. Participants were divided on whether VR daters should be informed of, and allowed to deny consent to, recording in public VR spaces. P1 favored a requirement that users have to explicitly consent to recording before entering a private space with just them and a dating partner, presumably because intimate or sexual acts may occur: *"Like, right before you enter the room, like are you okay with being recorded? Yes or no?"* In contrast, P10 favored automatic recording of all VR spaces to ensure evidence of harassment is collected. Ultimately, this disagreement demonstrates how environmental consent models may leave users within those environments feeling stripped of personal agency and privacy.

5 Discussion

Technology plays an ever-increasing role in the discovery of sexual partners and the types of sexual activities that people experience across virtual and physical modalities. Despite the normativity of computer mediation in sexual experience, the role that technology does and could play in how people exchange consent—or agreement—to sexual activity is only beginning to receive serious consideration. Affirmative consent is the dominant consent model advocated in HCI, despite wide-ranging critiques that it is unrealistic [42] and under-adopted [21, 66, 77, 78, 135, 144]. Affirmative consent also does not provide explicit guidance on how to exchange consent when sexual acts are computer-mediated. These critiques and open questions about affirmative consent point to a need for new, inherently computer-mediated consent models that foreground the perspectives of those who would practice said models [32].

In this paper, we reported on a speculative study with women and LGBTQIA+ stakeholders about how consent should be exchanged to computer-mediated sexual activity in the context of VR dating: how they think people should ask for, give, and deny consent when technology is involved so as to mitigate unwanted sexual behavior. Analysis elucidated four archetypes for computer-mediated consent models: *visual consent* that uses AR/VR for visually expressing consent information; *agent-mediated consent* in which AI agents were imagined as responsible for communicating consent information between sexual partners; *consent to stimulus* in which consent becomes a two-layer process of first consenting to the possibility of feeling particular sensations before engaging in interaction; and *environmental consent* in which virtual environments are intentionally designed to enforce specific consent practices and behaviors.

In this section, we first compare the computer-mediated consent models from our study to affirmative consent to reflect on their synergies and conflicts and, ultimately, to make recommendations over which model(s) should be more fully explored in light of their potential to supplant or expand affirmative consent for computer-mediated contexts. This is followed by implications of computer-mediated consent models on future work in digital intimacy and sexual violence prevention technology. We conclude by discussing the limitations of our study and associated opportunities for future research.

5.1 Considering Which Computer-Mediated Consent Models Could Supplant Affirmative Consent

HCI scholars largely advocate for an affirmative consent model [81, 92, 174], yet affirmative consent has been widely critiqued in other disciplines [21, 42, 66, 77, 78, 135, 144, 144], suggesting opportunity for new, inherently computer-mediated consent models to potentially replace affirmative consent. As such, we use this section to critically compare affirmative consent with consent models derived from our study—including their ethical and technical feasibility complexities—to draw conclusions over which models should be given further consideration due to their potential to one day replace affirmative consent as best-practice guidance for computer-mediated consent exchange.

Affirmative consent, which originated in 1991 without computer-mediated communication in mind, puts the responsibility on the initiator of a sexual act to ask for and receive consent: in essence, requiring them to receive an explicit "yes" to sex rather than an explicit "no." This blatant asking and receiving of consent must be specific to a particular act, freely and enthusiastically given, and reversible—although research has repeatedly found this to be uncommon in real-world sexual encounters [21, 66, 77, 78, 135, 144], and critiqued as unrealistic for consistent practice [42, 144]. Nonetheless, HCI research has advocated for translating this model to computer-mediated communication [81, 92] and to sexual encounters in particular; the latter through the TEASE process by Strengers et al. [148] for sex robot interactions and through dating app-specific translations by Zytko et al. [173, 174] that emphasize transparent dialogue about sexual expectations through messaging on the dating app and then re-confirming explicit consent to sex face-to-face.

We see opportunity for affirmative consent to potentially be supplanted—or in some cases, expanded—by two of the consent models from this study if more specific prescriptive guidance could be elucidated for them through future work. These models include visual consent and consent to stimulus; we use section 5.1.1 to justify these models and articulate need for future work to elaborate and clarify their prescriptive guidance. Regarding agent-mediated consent, we cannot currently advocate for this model because it is the most speculative of the four, leaving open questions about technical feasibility and pertinent legal regulation (see 5.1.2). We firmly argue against the environmental consent model on conceptual grounds, which we discuss in 5.1.3.

5.1.1 Opportunity for Visual Consent and Consent-to-Stimulus to Supplant Affirmative Consent. *Visual consent:* Arguably the closest model to affirmative consent in our study is visual consent, which puts similar behavior expectations on sexual partners but frames visualization as the gold standard medium for conscious and intentional consent communication rather than verbal dialogue. Visually conveyed consent information has certain advantages over a verbal "yes," particularly in the range of information that can be conveyed visually beyond the yes/no consent decision. Multiple participants cited enthusiasm as an example, which is a required aspect of affirmative consent that is largely reliant on nonverbal communication and thus highly susceptible to misinterpretation. Visual consent communication can also be more accessible to people who are deaf or hard of hearing than verbal dialogue [94].

Visual consent and affirmative consent are not mutually exclusive and therefore visual consent does not need to outright *replace* affirmative consent. They can be practiced in tandem by expanding the accepted or recommended forms of deliberately communicating "yes" to include visual expression through AR/VR glasses, perhaps in conjunction with verbal dialogue, to be most accessible to people with sense-related disabilities. Prior HCI research has advocated that affirmative consent is already compatible with AR/VR consent mechanic designs [173] like "traffic light" indicators of consent [148]. Keeping in mind the persistent lack of consensus in affirmative consent literature as to whether explicit consent must be verbal, the introduction of visual consent can be used

as an opportunity to formalize allowable forms of asking for and giving affirmative consent in computer-mediated contexts.

Many current VR platforms already support features that could make visual consent cues feasible, including visual boundaries, static visual/text appendages around avatars, and color changes. However, several questions remain regarding the implementation or operationalization of a visual consent model through technology design. One critical consideration is accessibility: color-coded indicators may not be meaningful for users with color blindness (e.g., [153]). Iterations of this model could prescribe shape-coded or patterned indicators alongside color, enabling multimodal recognition (e.g., red + triangle = "stop," green + circle = "go"). Iterations and elaborations on prescriptive guidance in a visual consent model should also consider the placement of visual indicators—whether they appear on the user's body, float near their avatar, or are visible only to others.

Consent to stimulus: This consent model empowers an individual to preemptively disallow the experience of particular stimuli (e.g., haptic touch) prior to interactions with a sexual partner ever happening. Adding a precursory layer to consent exchange can address some of the greatest challenges with consistent practice of affirmative consent, notably the social pressures/scripts [57, 80] that may lead a person to allow a sexual act to happen that they actually do not want (e.g., risk of retaliation). Establishing stimuli settings before an interaction would allow one to make preemptive consent decisions free of those social pressures. Overall, consent to stimulus is not at odds with affirmative consent and the practices it prescribes to sexual partners. It arguably cannot be a stand-alone consent model at all because it does not prescribe how consent to a stimulus-allowed behavior should be exchanged during an interaction. In this regard, consent-to-stimulus could serve as an add-on to any other consent model that prescribes behavior directly preceding or during sexual activity.

Like the visual consent model, support for a consent-to-stimulus model is already technically feasible, albeit haptic peripheral devices are perhaps not as widely adopted by VR users as of this writing. Technical feasibility of consent-to-stimulus will only improve as the availability and granularity of haptic VR peripherals continue to advance. The primary challenge for practice and technical facilitation of a consent-to-stimulus model will be managing inconsistent haptic capabilities across users. Some will not have haptic devices at all, and those that do could have inconsistent haptic capacities (e.g., some devices may afford touch on a specific part of the body and another may only be able to simulate a single, localized haptic sensation). Future work should iterate and elaborate on prescriptive guidance for consent-to-stimulus in light of this haptic capability inconsistency.

5.1.2 Open Questions Surrounding Agent-Mediated Consent. Agent-mediated consent is the most speculative model in our study given its necessity of a technically competent AI agent. At least conceptually, the model boasts clear advantages over affirmative consent, but in terms of operationalizing the model it poses significant questions of technical feasibility and data ethics that prevent us from advocating for the model as a replacement for affirmative consent as of this writing.

The under-adoption and inconsistent practice of affirmative consent is in part because the responsibilities it places on sexual partners to explicitly ask for consent to specific sexual acts have been considered socially awkward [144]. Using AI agents to assume the socially awkward responsibilities of asking for, communicating, and denying consent could lead to these behaviors being more commonly practiced—albeit not by human sexual partners as affirmative consent prescribes. This echoes ideas for autonomous consent robots and wearable devices in prior HCI research [174], suggesting broader support for the concept of AI-performed consent practices.

Of course, the performance of key responsibilities in consent exchange by artificial agents necessitates a certain level of technical feasibility, which is currently not possible at scale. Social VR/AR platforms typically lack the infrastructure to support real-time behavioral parsing and personalized enforcement mechanisms. Operationalizing an agent-mediated consent model would require substantial technical advances, including the development of machine learning systems capable of interpreting context-sensitive interactions, a standardized schema for representing consent preferences, and low-latency architectures for enforcing dynamic rules mid-interaction.

Eventual technical feasibility of consent agents will also necessitate expansive datasets of incredibly intimate sexual data to train consent agents to identify nuanced sexual behaviors and their users' ongoing agreement (or lack thereof) to each act. This poses serious questions about data ethics and data privacy. Harms following from re-identification of individuals depicted in a deidentified dataset [50, 75] are quite possible, and yet there are documented barriers to public understanding of privacy policies and risks associated with their personal data (e.g., [147]). Even use of robust technical safeguards including encryption, minimal data retention, and user-controlled deletion cannot entirely eliminate the possibility that personal, sensitive, or sexual data may harm users if it is leaked or misused. While there are laws that regulate data privacy, most notably the General Data Protection Regulation (GDPR; [155]), implementation has been critiqued for being confusing [112, 122], complicated [15, 112], and inconsistent [40], suggesting that legal regulation on data privacy needs to be refined before agent-mediated consent can be earnestly recommended.

Concerns of AI bias in social VR environments have been noted in related work as well [172], which are pertinent to consent agent implementation. For example, datasets for training consent agents could mis-detect certain sexual acts or other interpersonal behavior towards, or from, users of marginalized groups if they are not adequately represented in training data.

5.1.3 An Argument Against Environmental Consent. The environmental consent model advocated by some participants most directly acknowledges the malleability of the surrounding (virtual) environment that simply is not possible in the physical world and was not possible when affirmative consent was originally formulated in 1991. Manipulating environmental conditions to be most conducive to the practice of a given consent model would solve a lot of the problems that affirmative consent was originally created for in its initial context of sexual violence on college campuses. For example, imagine if a college campus could prevent students from engaging in certain behaviors through omnipresent limitations on their physical body movements; in such a scenario, much of the need for prescriptive consent rules, and requisite consent education, would be superfluous.

Yet the environmental consent model also shows how environmental malleability can be a double-edged sword. Consistent, universal environmental rules cannot be established if a virtual environment's designer sets consent rules according to their own subjective understandings of how consent should be exchanged, or what behaviors qualify as harm. This can create confusion among users as they migrate across different virtual worlds. Environmental manipulation or restriction of one's own body would also undermine user autonomy and generate ethical concerns through potentially allowing harm to fester if environmental rules obstruct self-defensive behaviors. For these reasons, we would discourage adoption of environmental consent models unless universal criteria for how virtual environments can or should moderate consent-related behaviors are established.

5.2 Implications for Computer-Mediated Sexual Experience and Sexual Violence

HCI research into computer-mediated sexual experience weaves multiple topics that are connected by consent given its role in distinguishing sexual violence (i.e., nonconsensual sexual behavior) from desirable sexual experience [137]. The findings of our study thus have wide-ranging implications

on the intersectional themes of HCI research into sex, specifically solo sexual experiences, "safe sex," HIV/STI prevention, and sexual violence mitigation.

Our insights into new computer-mediated consent models can inform HCI research into sexual experiences that involve only one person. For instance, the consent models emerging from our study can also apply to human-sex robot interactions. Consent has been advocated as a framing for human-robot interactions more generally [138], and prior HCI research has speculated on the translation of affirmative consent to sex robot interactions [148]. Our study complements that work through additional computer-mediated consent models to be considered as the basis for sex robot interactions, some of which naturally cater to robot capabilities. For example, an agent-mediated consent model could be applied in which the sex robot is simultaneously a human's sex partner and consent agent through pre-consent settings of which behavior is (dis)allowed by the robot. Relatedly, some of the participant-generated consent models could benefit the use of teledildonics [67] (sex toys that are teleoperated by someone who is not physically co-present). The visual consent model, for example, may take on heightened importance in settings where teledildonics are used with minimal or no awareness of the partner's physical body, which has traditionally been important for nonverbal indicators of consent. Furthermore, while implications of VR/AR for pornography consumption have been noted [169], our study introduces another use as a medium for relaying consent information. In line with calls to model harm-mitigative consent practices in pornography [102], one might imagine visual consent artifacts being included in pornographic films as a way to socially reinforce their importance and normativity in sexual activity.

Our study also has implications on HCI's conceptualization of, and research into, "safe sex" [161, 162]. Whereas disclosure of HIV/STI status has been framed through the lens of privacy in prior HCI research [161], the public health literature has long contended with the implications of STI disclosure and condom removal on consent [31, 43, 46, 108]. Consent to sex must be informed according to dominant perspectives in the literature (e.g., [81, 126]), raising questions as to whether sex can truly be consensual if one's partner is under- or misinformed about their STI/HIV status. Our study's findings that depict new ways of informing sexual partners of information, such as stimulus capabilities (consent to stimulus) and enthusiasm (visual consent), suggest that computer-mediated consent models could also be an avenue to normalize and augment disclosure of STI and HIV information [162] while complimenting other approaches in HCI to managing HIV [145].

Computer-mediated consent models also have the potential to augment and improve technical approaches to sexual violence prevention. Consent technology not only complements sexual risk detection AI [130], but can directly inform its design and implementation in dating apps and other social platforms. The CSCW literature reports on women's preferences for risk detection AI to be tailored to their personal and subjective interpretations of harm [44]. An agent-mediated consent model could be used to reframe sexual risk detection AI as a consent mechanic that embraces the subjectivity of harm. Computer-mediated consent models can also be useful in physical world settings. Always-on AR, which some research anticipates being a near-term possibility [99], can lend feasibility to agent-mediated consent and visual consent in one's home where physical sexual activity—and nonconsensual sex—are likely to happen [134]. Such consent models can also address problems with misunderstood consent that are out of the scope of panic buttons [90] and other tools that address street harassment or related attempts at intentional harm and discomfort [2, 4, 139].

5.3 Limitations and Future Work

There are important limitations to the study presented in this paper that must be noted, and which also serve as opportunities for future research into computer-mediated consent.

5.3.1 Prescriptive Rules and Technical Implementation. The findings of our study are considered archetypes of computer-mediated consent models because they can serve as a basis for future derivative, and more nuanced, prescriptive rule sets for both users and platform developers involved in interpersonal consent exchange. Our study took a divergent thinking approach where participants used scenario-based design to ideate on personally preferred versions of computer-mediated consent exchange without the need to converge their ideas and preferences. Future work could take a convergent approach by having participants collectively articulate more exhaustive prescriptive rules for how sexual partners should behave, to be incorporated into consent education curricula. Convergent approaches could also articulate prescriptive rules to designers and developers for how platforms must be designed to facilitate a given computer-mediated consent model. This could be collaborative in nature, with platform designers and developers informing and refining the technical feasibility of consent mechanics (platform features) necessary to facilitate consent exchange practices according to the given model. Using the visual consent model as an example, future work could have user-stakeholders and platform developers jointly decide which colors coincide with yes and no consent decisions, and which symbols or visualizations should map to previously nonverbal signals such as enthusiasm.

5.3.2 Transferability to Other User Groups. This study is among the first to expand representation in computer-mediated consent model ideation beyond researchers themselves. This representation was limited to women and LGBTQIA+ individuals in the Midwest USA, in part, to avoid discomfort from disclosing personal experiences with consent and sexual violence in the presence of other stakeholder groups. An emphasis on specific stakeholder groups is typical in participatory design and focus group publications [9, 65, 104], which poses an opportunity to expand the involvement of other stakeholders in future work. Pursuant to forms of "qualitative generalisability" that recognize the "richly contextualised" nature of qualitative insight [159] (p. 285), future research should explore the *transferability* [37, 159] of our findings to other user groups and contexts, for example: if the consent model archetypes from this study would be advocated by other user groups. Representation of cisgender men—who represent a vast majority of perpetrators of nonconsensual sex [53]—should be considered because their voluntary adoption of any consent model is essential to its success. Other geocultural demographics should also be considered, especially in non-Western contexts given values and social norms around sex that may vary significantly from our United States-based sample. Future work may also involve consent experts and educators, such as sexual assault nurse examiners, who could have years of experience with sexual consent practice in real-world settings. They may identify latent issues with the consent models proposed in this paper and may have their own consent model ideas.

5.3.3 Transferability to Other Computer-Mediated Settings. We have discussed in the previous subsection how the participant-proposed consent models are transferrable to contexts beyond VR dating. Yet empirical research specific to other contexts may yield entirely different ideas for consent models if the unique affordances of such contexts are more directly considered. There are also some computer-mediated contexts that the proposed models may not directly apply to; nonconsensual image sharing being one [74, 151], which has received growing attention in the advent of deepfake pornography [154]. Future work could study consent model ideation specific to this and other contexts beyond VR dating.

6 Conclusion

This paper presented a speculative focus group and participatory design study of VR dating with women and LGBTQIA+ stakeholders to articulate directions for new models of consent to sexual activity that foreground the role of computer mediation in how consent to sex should be exchanged.

Using participants' personal experiences with online dating and social VR as the basis for computer-mediated consent models was intended as a contrast to prior research advocating for the adaptation of the affirmative consent model to computer-mediated communication, despite consistent criticism and under-adoption of affirmative consent by the general public. The four consent model archetypes produced through our data analysis illustrate the complexities and speculative opportunities inherent in developing consent models tailored to VR dating and contemporary computer-mediated contexts more generally. In particular, they show untapped opportunities for innovation in consensual sexual encounters through assigning responsibilities to AR/VR, AI, and haptic feedback devices in consent exchange. At the same time, the participant-generated models also pose questions about personal agency and the relative risks of sharing responsibility for consent exchange to human and non-human entities beyond immediate sexual partners. Collectively, the findings point to an opportunity—and need—for future work to further elucidate specific prescriptive guidance for inherently computer-mediated sexual consent models.

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A Participant Demographic Details

Table 1. Participant Demographics

Participant	Gender	Sexual orientation	Age	Ethnicity	Prior use of...
P1	Woman	Heterosexual	21	White	Dating apps and social VR
P2	Woman	Heterosexual	26	White	Dating apps and social VR
P3	Non-binary	Bisexual	21	White	Dating apps
P4	Woman	Bisexual	21	White, Asian	Dating apps
P5	Woman	Heterosexual	22	White	Social VR
P6	Woman	Homosexual	20	White	Dating apps and social VR
P7	Woman	Heterosexual	21	Black	Social VR
P8	Woman	Heterosexual	24	White	Dating apps
P9	Woman	Bisexual	25	Black	Dating apps and social VR
P10	Woman	Bisexual	19	White	Dating apps
P11	Woman	Not disclosed	22	White	Dating apps
P12	Woman	Heterosexual	21	White	Dating apps and social VR
P13	Woman	Not disclosed	22	White	Dating apps and social VR
P14	Non-binary	Homosexual	21	White	Dating apps
P15	Woman	Pansexual	22	White	Dating apps and social VR
P16	Woman	Heterosexual	21	White	Neither (participated for comfort of another participant)

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