What can HCI learn from sexual consent?

A Feminist Process of Embodied Consent for Interactions with Emerging Technologies

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Sexual consent has undergone a transformation toward an "enthusiastic" feminist model that emphasizes consent as an ongoing and voluntary process of negotiation and affirmation. This paper considers how such a model can advance understandings of consent in HCI research and design in relation to embodied interactions with emerging technologies that also occur outside of sexual interactions. We apply the popular "FRIES" model of sexual consent (Freely given, Reversible, Informed, Enthusiastic and Specific) to three areas of embodied interaction: 1) bodily-play interactions, 2) persuasive interactions with smart technologies, and 3) intimate interactions with anthropomorphized devices. Based on erotic play practices, we contribute a "TEASE" process guideline (Traffic lights, Establish ongoing dialogue, Aftercare, Safewords, and Explicate soft/hard limits) to advance consensual practice in HCI and develop implementation scenarios.

CCS CONCEPTS • Human-centered computing ~ Human computer interaction (HCI) ~ HCI theory, concepts and models • Human-centered computing ~ Human computer interaction (HCI) ~ HCI design and evaluation methods

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1 INTRODUCTION

Over recent years, high profile cases of male celebrities being held responsible for sexual harassment and abuse have led to international scrutiny of non-consensual acts mainly experienced by women. As a result, conversations about sexual consent have been propelled into the mainstream through movements such as #MeToo and Time's Up. "Enthusiastic" or "affirmative" models such as "Yes means Yes" [32] (where consent is defined as an ongoing process of affirmation) have transformed the negative "No means No" message. Corresponding changes in the legal definitions of rape and sexual harassment have followed in many gender progressive nations and changed how consent is taught in schools and discussed in popular culture [104].

Curiously though, the sexual consent "revolution" has had remarkably little impact in other fields where consent is required and discussed. In HCI, major breakthroughs in feminist understandings of sexual consent are now informing the design of intimate technologies, sexual interactions in gaming, and design for sexual wellbeing [47, 79, 98, 114]. However, despite scholars acknowledging the potential to extend these understandings to other forms of consensual practice in HCI [79], this opportunity has received little attention from the community. Analysis of how HCI talks about sexuality suggests that slow progress may be due to the taboo or lack of clear definitions surrounding concepts of sexuality, and the intractability and irreducible complexity of sexuality [48], which makes it difficult to work with—even within the so-called third wave paradigm of HCI [39].

One of the few examples that extends discussions of sexual consent to digital interactions *beyond* sexual encounters is Lee & Toliver's [53] primer on consent in HCI. Lee & Toliver's article reports on the innovative "Consensual Tech" design activist project to explore practices concerning digital bodies (made up of pieces of personal data such as photos, facial recognition information, search history and emails), which are "frequently acted upon in non-consensual ways". Examples include self-tracking apps that monitor people's movements without their knowledge, revenge pornography, or sharing biometric data about an individual across government databases. Nguyen & Ruberg's [79] analysis of queer and feminist video games demonstrates the value of this approach for "those who design technological tools, systems, and experiences to create more meaningful, ethical opportunities for users to give consent." In this paper, we take up this opportunity to explore how feminist

models of consent can be applied to a wider range of embodied interactions with emerging technologies, drawing inspiration and guidance from these past works.

Embodied interactions is a well-established field that is broadly concerned with technology interactions that involve a user's body in a significant way, such as by using gestures [40]. Less literally, Dourish [23] defines embodiment as "the way that physical and social phenomena unfold in real time and real space as a part of the world in which we are situated." Our focus on embodied interactions (acknowledging that the term is not without controversy [43]) provides us with a conceptual link between the physical "bodies" of concern for sexual consent and those implicated in the physical and social worlds we encounter with technologies. Specifically, we focus on emerging technologies that enable interactions that act on, act with, or act like bodies. In addition, embodied consent recognises the ways in which bodies (artificial and human) are entwined with processes of consent, and how consent is situated in physical and virtual space and time within specific contexts and experiences. Furthermore, different contexts and bodies also afford uneven privileges and opportunities for consent, which makes it impossible to provide universal recommendations, and is why we focus on consent as a process.

Our three areas of interest are: i) bodily-play interactions involving often uncomfortable and intense physical and emotional bodily actions; ii) persuasive interactions with smart technologies, which seek to manipulate bodies (and people's behaviors); and iii) intimate interactions with anthropomorphized devices such as digital voice assistants and sex robots, which raise new questions about whether technologies themselves should be designed to affirm or deny consent. Each focus area is located in one or more of the authors' areas of expertise.

Our analysis is broadly situated within the field of feminist HCI, which is concerned with issues of "agency, fulfillment, identity, equity, empowerment, and social justice" in the design of technology interactions [4]. As such, our aim is not only exploratory, but serves an advocacy agenda of seeking to improve consensual practice in relation to emerging technologies. In particular, we adopt a sex-positive feminist stance that advocates for affirmative consent and also incorporates nuanced negotiation as proposed by the "Negotiation Model" [2]. Our emphasis on emerging technologies [92] is also important and deliberate, and serves a feminist HCI agenda of social justice. This is because we focus on technologies that are not yet fully established, normalized or integrated into people's routines in design, form or function, thereby providing scope for change. We view our analysis as an opportunity to intervene in technologies and consensual practices currently under development or being trialled by HCI. This informs our paper's key contribution: the development of a process guideline inspired by the affirmative sexual consent movement, which could be applied to a range of emerging embodied interactions to improve current consensual practice in HCI.

To ground our analysis in the three types of embodied interactions, we draw on a popular consent model commonly known as "FRIES", developed by the US advocacy group Planned Parenthood [81] and previously applied to consensual interactions with technology by Lee & Toliver [53] and Nguyen & Ruberg [79]. FRIES is informed by the "Yes Means Yes" paradigm of affirmative consent, underpinned by nuanced negotiations [32]. As a widely cited and extremely accessible model, FRIES provides a straightforward analytical tool for considering the applicability of some of the most important elements of affirmative consent for HCI, specifically, that it is freely given (F), reversible (R), informed (I), enthusiastic (E), and specific (S). We use FRIES to conceptualize the shift from a static, binary (yes or no) model of consent towards a dynamic, ongoing and embodied process. We supplement our analysis of FRIES with concepts from erotic play practices originating

in BDSM communities.[1] Drawing from these, we develop the TEASE process guideline to provide inspiration for consensual practice in HCI, explore how consent is embodied and manifested in different speculative scenarios, and provide the basis for further design explorations on consent as an embodied process. TEASE stands for: traffic lights (T), establish ongoing dialogue (E), aftercare (A), safewords (S), and explicate soft/hard limits (E). We illustrate the potential value of this guideline by discussing how its processes could inform consensual practices across our three focus areas. We conclude that this guideline could provide significant insights for advancing consensual embodied interactions with emerging technologies.

2 RELATED WORK

Issues of consent and associated notions of ethics have been discussed in HCI for a while, and we do not wish to downplay the significant contributions of this body of work. Most HCI researchers engage with these issues when they plan to conduct studies that require approval from an ethics review board. Discussions on these issues are typically concerned with general aspects of ethics, investigating, for example, whether we should do research in the first place, or what the implications are for society. While these discussions are important, there is less prior work examining what approaches have worked (or not), such as providing guidance on how to "do the right thing" when engaging in the day-to-day realities of HCI research and practice. Most guidance, we find, is restricted to advice on a particular ethics review board website. In the remainder of this section, we identify key debates and advances in supporting consensual interactions in HCI.

2.1 Consent in online and ubiquitous computing

Consent is an important issue in digital technology design to protect privacy, trust and autonomy; hence it has received attention in HCI [1, 6]. Much of this work has focused on analyzing issues and addressing challenges arising in web-based applications [29-31], particularly with regards to platforms that collect users' personal data without meaningfully obtaining consent [62, 109]. For example, Friedman et al. [29] developed a model of informed consent in the context of online interactions, including six components: disclosure, comprehension, voluntariness, competence, agreement and minimal distraction.

The large-scale proliferation of mobile applications added further complications to achieving informed consent [15]. Lahtiranta et al. [50] suggested applying concepts of informed consent from the field of healthcare to mobile applications: the service providers should make clear what, why and how the data is used; who can access the data; and how long the data is accessible by the provider.

Achieving informed consent has become an even more challenging and pressing issue in ubiquitous computing because these systems usually collect the users' data without their awareness [33, 63]. With ubiquitous systems, consent is often gained implicitly via users' indicative actions, such as by opening an application or entering a physical area, rather than via explicit consent such as ticking a box [63, 69].

Researchers have developed a number of different approaches to address these issues. Luger & Rodden [63] suggested that ubiquitous systems should enhance users' awareness of system operation rather than being a mere disclosure. Similarly, Gomer et al. [33] presented a semi-autonomous consent (SAC) model for

[1] BDSM is a multifaceted acronym encompassing a broad spectrum of sadomasochistic culture. The term refers to Bondage and Discipline, Dominance and Submission, Sadism and Masochism. Integral to BDSM are clearly articulated, pre-negotiated power dynamics and boundaries of consent between participating individuals [110].

ubiquitous computing. SAC includes three phases: 1) the preference setting phase, in which a user expresses their preferences to the agent; 2) the consent phase, in which the agent responds to consent requests on behalf of the user; and 3) the review phase, during which the user can review the consent decisions, refine their preferences and provide additional information to the consent agent. Waern [111] suggested that for low-risk ubiquitous public interventions, the intervention can be ignored and implicit consent can be assumed to have been given. Moran et al. [69] proposed several approaches that help designers consider how to acquire consent in ubiquitous computing, including to request consent from the participants through their mobile phones.

Despite significant advances in consent models and applications, most of these studies have focused on whether users are adequately informed about the use of their data. Less attention has been paid to forms of consent that arise in situations where users are placed in embodied situations where they are not only interfacing with a screen – such as in the area of uncomfortable interactions.

2.2 Uncomfortable interactions

Work on uncomfortable interactions usually pays close attention to consent. Uncomfortable interactions are those that cause a degree of suffering or discomfort to the user, including possibly physical uncomfortableness or mental suffering. Benford et al. [8] proposed that with careful and ethical design, uncomfortable interactions can help achieve long-term benefits regarding entertainment, enlightenment, and sociality. Benford et al. [7] also discussed ethical concerns including consent and withdrawal.

Achieving informed consent might be challenging in uncomfortable interactions for three reasons. First, the risks of uncomfortable interactions in HCI are usually lower than in medical studies, hence consent is usually gained through informing users about the potential experience via advertising, ticketing and branding [9]. Second, informed consent is challenging for uncomfortable interactions as they often involve surprise. In other words, users do not know the exact degree of discomfort they might experience when they sign a consent form. Third, peer pressure might urge users to participate in uncomfortable interactions. Inspired by Benford et al. [8], several studies in HCI have included uncomfortable interactions [16, 18, 25, 37]. However, most of these works emphasized consent being obtained *before* conducting a study, while considerations of ongoing affirmative consent are often overlooked.

2.3 Persuasive design

Persuasive design refers to design practices that aim to change users' behaviors and attitudes [27]. Numerous studies have highlighted the importance of consent in the ethical practices of persuasive design [11, 49, 100]. Timmer et al. [109] proposed that consent becomes more challenging when persuasive design is used in collective settings such as workplaces where users might be forced to engage with the design. Similar situations might be faced when the persuasive design is integrated with smart environments [34]. In this case, users' autonomy might be hindered as they might be unconsciously persuaded by the intelligent ambient environment [38, 65].

Jacobs [45] proposed that to protect users' autonomy, persuasive design should embed a valid consent procedure, letting users consent to the design's expected outcome, persuasive tools, types of interactions, and the data used. McCall & Baillie [67] also presented a set of ethical guidelines for serious game designs which includes persuasive games, suggesting that informed consent should support "voluntary participation, competency to decide to take part, informed of all aspects and comprehensible information".

However, “informed” approaches to consent in persuasive design are complicated by their deliberately manipulative intent. Like advertising or social media feeds, they are designed to draw people in and get them “hooked” or direct their behavior in a certain direction. The degree to which this manipulation can be perceived as being “informed” is an ongoing ethical question with unresolved issues regarding consent [88]. To what extent, for example, does one-off and up-front “informed consent” for persuasive designs allow for ongoing awareness and affirmation? And to what extent is the embodied user even aware of the manipulation and coercion taking place, even after having been informed and agreeing to it?

2.4 Consensual interactions with conversational agents and intimate technologies

With the development of AI technologies, there is an emerging body of work exploring consensual interactions between humans and anthropomorphic agents, devices and robots. The central concern is that these interactions are likely to inform consent culture more broadly [104].

Lee et al. [52] investigated how users talk to conversational agents and found that users might abuse the agents with rude and negative behaviors. Saglam & Nurse [95] expressed concerns about how to design consent practices for conversational agents. Sankaran et al. [96] raised issues about whether humans could lose control over their actions when collaborating with conversational agents, particularly if people outsourced choices about their life to AI.

Other researchers have focused on how conversational agents respond to user abuse. Curry & Rieser [20] found that commercial conversational agents such as Alexa and Siri are designed to avoid answering their users when confronted with verbal abuse, such as sexual harassment. The authors criticized the current strategies that evaluate conversational agents based on customer satisfaction, and called for adding the ability to handle socially sensitive cases to the evaluation. Chin et al. [19] found that conversational agents that respond with an empathetic manner can cause users who abuse an agent to feel less angry and more guilty. Søndergaard & Hansen experimented with assertive and abrasive digital assistants as a design fiction to encourage consensual and respectful interaction between humans and agents [99].

Even more complicated issues of sexual consent arise in relation to whether people should be allowed to enact fantasies of rape and child sexual abuse on intimate technologies such as sex robots [21, 90, 101], and how people and robots should consensually relate to each other in companion relationships [22, 104, 106]. A number of researchers have suggested that the ways in which users interact with sex robots also affects consensual interactions between people [21, 36, 90, 101].

2.5 Taking stock of consensual practice in HCI

There are clearly complicated, ongoing consensual and ethical debates in HCI research [28]. These discussions have become more sensitive to the complex dynamics involved in interactions with emerging technologies. For example, ubiquitous computing, persuasive design, and conversational agents all raise new and tricky challenges for consent that HCI researchers have recognized need to be carefully addressed.

Nonetheless, our review of related work finds that consent in HCI is largely treated as a static moment and single decision, despite calls to move beyond this [3]. We create or encounter such consent events when, for example, an app requires users to assert they have read the terms of service and click “accept”. These end-user licensing agreements are, by design, one-sided, non-negotiated, and non-negotiable [15, 44, 93, 115]. “It is hard, therefore, to consider them to be free and voluntary arrangements since one party has no power to

enact their demands" [13]. Unfortunately, consent standards in most research designs stem from a similar approach to consent being a process of getting people to (freely) "agree". They assume consent unless the research participant explicitly states their desire to withdraw, thereby reinforcing a negative "No means No" model rather than requiring ongoing affirmation.

As discussions in feminist studies and sexual health [32] have argued, a meaningful conception of consent that respects human agency has to be an open negotiation based on free choice and equal standing, rather than an all or nothing proposition that takes advantage of power asymmetries. For Nguyen & Ruberg [79], who considered applications of feminist sexual consent to queer video games, this requires attention to "consent mechanics": "the rules of points of interactions that structure how a player experiences and interfaces with a video game", which they expressed as a series of self-reflective questions for designing consent. Building on this contribution, we consider practical strategies and applications of consent for in-the-moment interactions with emerging technologies.

We point out that consent should not feel like an annoying or intrusive thing that we have to get out of the way before doing anything interesting or fun. Instead, as contemporary approaches to sexual consent have shown, models like FRIES can be agency affirming and freedom enhancing, not purely restrictive [32]. They can create space for safely and respectfully engaging in activities that might cause discomfort in participants. Similarly, consent models from sexual communities such as BDSM are often part of the activity or "play" itself. As we explore below, such procedural and relational approaches can potentially support a wider variety of user studies and technology designs.

3 INTRODUCING SEXUAL CONSENT TO HCI

The FRIES model was developed by the Planned Parenthood advocacy group to improve education about consent and reduce sexual assault in schools and society more broadly [81]. We repeat their description of this model here:

- **Freely given.** Consenting is a choice you make without pressure, manipulation, or under the influence of drugs or alcohol.
- **Reversible.** Anyone can change their mind about what they feel like doing, anytime. Even if you've done it before, and even if you're both naked in bed.
- **Informed.** You can only consent to something if you have the full story. For example, if someone says they'll use a condom and then they don't, there isn't full consent.
- **Enthusiastic.** When it comes to sex, you should only do stuff you WANT to do, not things that you feel you're expected to do.
- **Specific.** Saying yes to one thing (like going to the bedroom to make out) doesn't mean you've said yes to others (like having sex).

Erotic practices from BDSM communities provide inspiration to help operationalize FRIES for HCI. Notably, BDSM has been criticized for non-consensual power dynamics and eroticization of violence involved in some of its communities' activities, particularly sadism [41]. However, some BDSM communities also strive to create spaces for safe and respectful interactions and elucidate a set of approaches for effective, ongoing consent negotiations, to establish consensual boundaries around challenging interactions [113].

Drawing on these applied approaches, and inspired by the use of playful acronyms from the sexual consent movement with FRIES, we propose the TEASE process guideline, encompassing: traffic lights (T), establish ongoing dialogue (E), aftercare (A), safewords (S) and explicating limits (E). TEASE is intended as a contextualized process, rather than a set of discrete "options", and the order of each component does not necessarily correspond with the order in which they can or should be applied. We use the guideline to speculate on possible methods and approaches to facilitate embodied consent in a variety of interactions with emerging technologies. TEASE complements the educational and advocacy model offered by FRIES by providing processes to help realise the principles proposed in FRIES. The focus of TEASE in this paper is limited to relational consent (e.g. between people and technology), rather than other relevant considerations such as legal and economic issues.

(T)raffic lights: A "traffic light" system of "red, yellow and green" is widely accepted within some sexual communities to denote "stop", "slow down" and "continue", respectively. In instances where participants cannot speak or utter safewords, body gestures and the Top's (dominant partner's) ability to read their Bottom's (submissive partner's) body language become important to ongoing consent [24]. Relatedly, it is common for interactive systems in HCI to communicate with their users through ambient feedback such as colored lights [35, 85, 103], making this a potentially familiar technique when applied to HCI design.

(E)stablish ongoing dialogue: Consent within BDSM communities is deeply embedded in interactions and erotic play. Various models emphasizing safety, risk awareness, care, communication and caution [113] provide a structure for ongoing conversations about consent and sexual gratification, which reflect the FRIES model of ongoing affirmation. Paramount to all these models is dialogue between participants around consent, boundaries and desire. In interactions with technologies, when systems are "black boxed"—that is, their operations are obscured to users—the open, ongoing dialogue that is a hallmark of consent is shutdown from the start of an interaction.

(A)ftercare: In Aftercare, participants check in after play, discussing how the "scene" (for a BDSM activity) met their expectations of consent and desire, or where limits may have been reached or breached. This dialogue before, during and after erotic interactions not only helps participants express and affirm their consent, but is integral to establishing an effective, evolving dialogue. Aftercare is sometimes extrapolated to the broader "vanilla" community[2], and bears further relevance to discussions of consent in HCI.

(S)afewords: "Safewords" are used to immediately withdraw consent, to stop erotic play or deny consent regardless of any pre-negotiated agreements [46]. They can also be utilized to signal that one party is becoming uncomfortable or that activities are moving with an undesired speed or direction. Safewords are out of context of the activity itself, to ensure there is no confusion regarding their intention. Common examples include "banana", "pineapple" or "red" (referencing traffic lights). The ability to quickly and easily "turn off" an interaction is relevant when considering alternative ways of interacting with technologies that are "always on" by design.

(E)xplicate soft and hard limits: In "consensual, non-consent" practices, participants engage in activities such as "rape-play" [14]. This play exists exclusively within BDSM interactions, as real-world equivalents, such as actual rape, are harmful and illegal [24]. BDSM employs "soft" and "hard" limits to define parameters of play,

[2] "Vanilla is a term used by BDSM participants to refer to non-BDSM sex, often with strong pejorative connotations (e.g., boring, unfulfilling, stereotypical, conforming, mindless, self-gratifying)" [97] Brandy L. Simula. 2019. A "Different Economy of Bodies and Pleasures"?: Differentiating and Evaluating Sex and Sexual Bdsm Experiences. *Journal of Homosexuality* 66, 2, 209-237. http://dx.doi.org/10.1080/00918369.2017.1398017

where hard limits are absolute prohibitions against certain activities, while soft limits denote something that is currently not allowed in the interaction, but may be revisited and permitted under specific circumstances [24]. “Grey areas” arise when boundaries are challenged or uncomfortable, but not necessarily breached [26]. In HCI, allowing users to determine and redefine their own limits helps empower them to take ownership over the terms of an embodied interaction.

4 APPLYING SEXUAL CONSENT MODELS TO CONSENSUAL EMBODIED INTERACTIONS IN HCI

In this section, we analyze the value of FRIES for informing consensual practice across three areas of embodied interactions with emerging technologies: 1) bodily-play interactions, 2) persuasive interactions with smart technologies, and 3) intimate interactions with anthropomorphized devices. We also provide speculative scenarios for each type of interaction, following our TEASE process guideline (Table 1). While we provide examples to aid understandability and relevance across a range of possible scenarios, it’s important to recognize that every situation will be unique based on contextual variables including the cultural, racial and gender backgrounds at play, the different privilege and power dynamics inherent within the scenario, and the nature of the activity or interaction itself. Due to our own cultural positioning as WEIRD (Western, Educated, Industrialized, Rich, and Democratic) society scholars [42], the scope of our scenarios biased towards studies and interactions we have experience with through our respective research areas, and should be read with this perspective in mind.

Table 1: TEASE process guideline with speculative scenarios for three areas of embodied interactions

	Bodily-play interactions	***Persuasive design with smart technologies***	***Intimate interactions with anthropomorphized devices***
Traffic lights	Introduce traffic lights as a form of play to indicate level of discomfort and provide ongoing consent (e.g. voice-activated wearables such as a wristband).	Allow users to choose from a spectrum of persuasion and data collection. It does not have to be a binary decision. Some collection, manipulation, or assumptions are acceptable, while some others are not.	Introduce traffic lights into the design to create embodied training opportunities for consent.
Establish ongoing dialogue	Develop an affirmative consensual process that fits the activity being played, using the language and dialogue common to the specific user group.	Provide early opportunities for engagement in the design of smart technologies with frank conversations about values and expectations.	Program consensual dialogue into conversational agents and sex robots.
Aftercare	Check in at the completion of play to discuss whether the activity met expectations, and to work through any uncomfortable interactions participants felt.	Check in to confirm whether the interactions are meeting participants’ expectations, see if any preferences have changed, and ensure they are happy to proceed.	Program voice assistants and sex robots to engage in aftercare with their users as best practice.
Safewords	Introduce safewords or gestures to withdraw	Introduce safewords or other quick commands that cause smart technology, for example,	Introduce safewords into the design of voice assistants and sex

	consent during play at any time.	to cease collecting and transmitting data. An easily understood safe word might be "Hey Alexa, banana!"	robots to create embodied training opportunities for consent.
Explicate "soft" and "hard" limits	Introduce hard and soft limits upfront to establish boundaries of the interaction and play.	Establish boundaries in terms of what persuasive tactics and pushy affordance users consent to receiving. Allow for establishing rules for acceptable means and ends.	Program conversational agents and sex robots to establish boundaries that if crossed makes them shut down.

4.1 Bodily-play interactions

Bodily-play interactions involve those that place the human body in the centre of the experience [71]. These types of interactions are becoming more popular through emerging technologies such as sensor-equipped game console controllers, VR systems or motion-tracking mobile phones that go beyond "traditional" considerations of informed consent [71]. Reflecting on past work on bodily play and games [10, 54-56, 59, 66, 70, 86, 87], we consider how FRIES and TEASE can offer new ways of supporting consensual practice.

Bodily-play interactions are similar to sport activities due to their body-focused character [78, 80]. This allows us to discuss consent from a body-centric perspective [10, 70] of play and entertainment. For example, in the bodily-play interaction system "Copy, Paste, Skate" [87], a camera tracks the skateboard's movement path and several projectors project a visual representation onto the environment, complemented with audio and haptic feedback. Participants reported that this enriched their bodily performance, "adding a new level to the skateboarding experience" [87].

In this study and others involving similar bodily-play interactions [76, 77], the consent process followed the university's ethics board guidelines: participants were asked to provide informed consent to being video recorded during the experience as well as during the interviews at the end. At first glance, the project appears to follow FRIES. Consent was freely given, consent was reversible in the sense that participants could stop the activity at any time in-between tricks or before and after an interview, participants were informed about what was going to happen, the play was enthusiastic (participants were highly motivated skateboarders), and the request was specific.

However, FRIES also suggests that participants should be able to withdraw consent *during* the activity. Withdrawing consent part-way through a bodily action, especially if fast-paced, is very difficult: not only will this need to happen quickly, but probably more importantly, engaging the "conscious self" (as required for consensus decisions) in fast moving actions such as in skateboarding can be detrimental to the performance [102]. This can lead to errors and hence increase the chance of falling and potential injury [102]. This raises difficult consent questions for bodily play, where participants often need to go with their "gut", and not think about the bodily-play interactions too much [102].

Further, most participants in bodily play and games studies are "enthusiastic". However, the consensual process suggested by most ethics guidelines does not match these user groups well. For example, in Copy, Paste, Skate, the skaters were informed that "you will be engaging in physical activity that can be dangerous. Please do not do more than you would normally do". This resulted in perplexed looks, as most skaters commonly do "more" in order to improve their practice. The idea of "pushing oneself" is part of most sports and hence also applicable to bodily-play interactions. In response, this should be reflected in a contextual approach to consent.

Issues of consent also extend to interactive games and play systems as they increasingly employ biosensors previously exclusive to the medical domain. In particular, ingestible games (i.e. where the player swallows a digital sensor [54-57, 59, 60]) represent an edge case in this design space, highlighting what the future can bring and how consent processes will need to evolve.

For example, the system "InsideOut" [58, 60] allows users to playfully interact with the real-time video of the interior body. The player swallows an imaging capsule and wears a display embedded in their shirt in front of the body showing their gastrointestinal tract's video in real-time. The player can explore various actions, such as eating, drinking and moving, or engage in a series of games, such as trying to tap an animated character moving quickly on their "guts video" shown on the screen.

The consensual process for such biosensor-based bodily games can involve not only the university's ethics board, but also medical practitioners, product manufacturers and distributors (as local laws might differ). In the case of InsideOut, this process took over six months and involved many rounds of feedback and changes to the system and study designs [58, 60].

Considering FRIES, "reversibility" is a challenge for ingestible games: with "traditional" interfaces, such as mouse and keyboard or gamepad, participants can easily reverse their decision to participate by putting the controller down. However, this is nearly impossible with an ingestible sensor. Before the player excretes the sensor naturally, the sensor can only be removed by surgery.

Similar to other bodily-play interactions, ingestible game participants are typically "enthusiastic" to play. Participants are usually not compensated for their time, with the "reward" assumed to be derived from the play itself. Hence the appeal for medical investigators to consider the potential drawing power of games to engage participants without the need to pay them may raise new issues regarding "enthusiastic" consent. For example, participants may be enthusiastic about the game, but not about the associated medical research.

Bodily-play interactions often benefit from supporting players' exploration [61, 73, 75], which complicates the "specific" element of FRIES. For example, in InsideOut, participants were encouraged to explore the ingestible system in any way they liked under safety instructions. As these images were livestreamed in-real time, it was challenging to predict what participants might see and consequently how they might react, highlighting the difficultly with being specific when working with interactive systems that deal with live data in in-the-wild settings [91].

The future of bodily-play interactions are likely to employ more emerging technologies that integrate with the human body through digestion, implantation or piercing [72, 74], hence raising ongoing questions about consent.

4.1.1 TEASE Speculative Scenarios

Traffic Lights: Bodily-play interactions could benefit from the "traffic light" system for consent, where green means everything is "okay" to continue, orange means proceed with caution, and red means stop. The design for such a system might resemble voice or touch-activated wearables (wrist- or head-bands). This system could aid play and research activities where the interaction is fast-flowing, based in immersive play, or likely to result in unpredictable discomfort. However, this is limited by the point made above that during fast-paced actions, the subconscious needs to take over, hence players might want to switch to a "yellow" before such actions.

Establish ongoing dialogue: The consensual process for bodily play and games could be improved with processes that are contextually specific, to develop trust between the research team and the participants of a particular community. This process would need to fit the activity, rather than the game being "retrofitted" into standard university consent processes that assume all risky play should be avoided. The process would also need to adopt language common to the specific user group, and consider the power dynamics present between researchers and different types of research participants.

Aftercare: At the conclusion of play, there is a duty of care associated with enthusiastic consent for the researcher to check in with participants, as is already common in some research. This could serve a number of purposes, such as: to discuss whether the activity met the participant's expectations; to make sure the participant is emotionally and physically ok; to talk through any experiences they had; and to reaffirm consent for using the participant's data.

Safewords: A safeword could be established pre-game with a clear procedure about what should happen if it is spoken or executed (e.g. the research team to stop all actions they can or take the participant to a safe space). Alternatively, a "safeword gesture" (such as a hand signal) could be used if, for example, a participant is out of breath or unable to speak.

Explicate soft and hard limits: As part of the consent process for risky or uncomfortable games, soft and hard limits could be used to discuss and establish safe boundaries with participants around what levels of discomfort or displeasure they are willing to experience. Rather than compromising games that are meant to be organic and improvisational, limits do not need to refer to specific experiences, but can be used to establish the *types* of experiences that are likely to distress or harm the participant (e.g. very loud noise [86, 87] or images of the anal passage [58]).

4.2 Persuasive design with smart technologies

Many smart technologies are designed to be observant with their operations being hidden from people. By considering increasingly common smart devices and appliances in homes (e.g. smart fridges), we anticipate a number of potentially thorny situations emerging regarding consent. When people use their smart device, how informed are they about the kind of data that is collected, or who the data is communicated to, or how it is analyzed for other purposes? Would they be enthusiastic about their smart fridge sharing user data with other entities who are interested in obtaining it, say, insurers or advertisers? Other than disconnecting the fridge or voiding the terms of service—preventing its use—can people reverse their consent?

Many smart devices are now also including more active designs intended to nudge or restrict certain choices [94, 108]. The smart fridge might, for example, try to incentivize people to buy healthier alternatives or report unhealthy choices to the owner's health insurance provider [64, 68]. The implementation of pushy affordances in smart technology—persuasive designs that are meant to modify people's behaviors—present serious challenges to standard models of consent [88]. For a start, they assume that one set of "expert" actors—e.g. designers who may be motivated by commercial imperatives—should be able to change how people act or influence the choices they make [116]. This is problematic when it comes to users who may be excluded from understanding the interaction and its implications due to a lack of specialized knowledge, lack of access to or control over technologies, or lack of awareness about interactions that are hidden or deceptive [82, 105, 107].

Already we can see serious challenges posed to the FRIES model. Freely given consent may not be possible when persuasive design involves deliberate deception and manipulation. Reversible consent may not be

possible without the option to erase data already collected. Informed consent is not, in many cases, even a realistic option. Enthusiastic consent is often fostered through persuasion intended to change people's preferences and present a narrow framing of the context.

These challenges become more severe when considered in the context of more complex types of interactions than a smart fridge, such as those that arise from the environmental and infrastructural systems of a smart city. When public space is instrumented and automated—when smart urban systems record and respond to residents without their knowledge—it is difficult to say these interactions are consensual. The standard approach to consent is to put up a sign: "By entering this area you consent to data collection about your activities." Even the opportunity to "agree" is removed and consent is treated as implicitly given by the person's embodied presence. In reality, different groups of people in smart homes and cities have unequal access and ability to participate in consent processes. There is a great diversity in people's experiences of these spaces and interactions. Accounting for the ways different "bodies" are afforded uneven privileges and opportunities for consent, as well as interpret interactions in contextually specific ways, is a critical part of what it means for consent to be embodied.

In an analysis of the social and political implications of smart technologies, Sadowski has argued that "there is little to no opportunity for the dialogue that is a hallmark of human relations. Instead, these interactions are at their core rigid and commanding rather than communicative" [94]. How should we redesign these interactions so they are more communicative, rather than commanding? A static approach to consent might require that we establish more "consent events" where everybody entering an urban space equipped with smart sensors is first given an information statement to sign. However, increasing the frequency of these events creates additional burdens on participants and may not be desired [79]. In contrast, a dynamic approach to consent could emphasize creating a trusting relationship between the participants and designers of such a smart environment [3].

4.2.1 TEASE Speculative Scenarios

Traffic lights: People should be able to choose from a spectrum of persuasive design and data collection. Instead of a binary decision of "Yes" or "No", there could be intermediary options in between the two extremes. Perhaps some types of manipulation, collection, or assumptions will be acceptable to some people, while other types will not.

Establish ongoing dialogue: This could be done by early opportunities for engagement where frank conversations about values and expectations can be had, followed by regular (but not overwhelmingly frequent) check-ins between different parties to see if people have changed their minds, if they desire something different, or if they are happy to proceed. Ultimately, both or all groups should feel that they are equal partners in the HCI relationship and fulfilled by its outcomes.

Aftercare: Since there is no clear endpoint, especially since many of systems are designed for constant awareness and continuous operation, aftercare could occur after a certain period of use (e.g. once the person has become familiar with the technology's functions). Aftercare could be like a debriefing where designers can confirm if the interactions and operations are meeting the participants' expectations, see if their preferences have changed, and ensure they are happy to proceed.

Safewords: Just as personal voice assistants like Alexa have "wake words" that activate them, safewords could operate like quick commands that cause smart technology to cease collecting and sharing data, or to turn off its always-listening mode. This would allow users to easily and instantly take control of the interaction. Effective safewords should be out of context of normal commands or requests, and unlikely to be misunderstood. An example could be: "Hey Alexa, banana!"

Explicate soft and hard limits: Participants should establish the parameters for what kinds of persuasive tactics and pushy affordances, if any, they consent to. For example, perhaps it is acceptable for an advertiser to use data collected from a smart fridge to provide promotional coupons based on consumption habits, but it might cross the line for an insurance company to use the same data to incentivize behavioral changes. Such soft and hard limits first require designers to be explicit about the features of the interaction, such as how the technology works, what it does, and who has access. This knowledge is crucial for users to effectively establish rules for acceptable means and ends in the interaction.

4.3 Intimate interactions with anthropomorphized devices and robots

Interactive devices that mimic human behaviors (in voice, appearance and mannerism) raise complicated issues of consent. One example is the deliberate use of female voice assistants to allay people's privacy concerns or cloak devices in feminine likability, making people more receptive to pushy affordances and persuasive design [12, 104].

Aside from the considerations anthropomorphized devices raise for *human* consent, research has expressed concern with how these devices are entangled in complicated forms of *programmed* consent that feed into "consent culture" more broadly [36, 51, 104]. Voice assistants, for example, have been criticised for responding positively or submissively to sexual solicitations and even abuse [99, 104]. Unless they are unable to understand their users' commands, they are routinely programmed to perform whatever actions are requested of them, even when insulted or abused. In other words, they have no capacity to refuse consent for inappropriate, harmful or abusive behavior directed toward them. In this regard, they meet no part of the FRIES model.

The issue is not that the devices *themselves* are subject to abuse or harmed by non-consensual acts, but rather that the way they respond to this kind of behavior (with agreeability, compliance, and occasionally even gratefulness) can normalize and perpetuate similar non-consensual behavior between humans, or more specifically, between men and women – thereby feeding into "everyday sexism" and rape culture [5, 84]. This in turn may erode or undermine affirmative models of sexual consent in other areas of everyday life. When Siri or Alexa respond to a request no matter how aggressive or abusive, or "give in" to advances after continual persistence, this can undermine progress towards FRIES [104, 112].

Likewise, issues of sexual and HCI consent become even more entangled when considering the design and programming of intimate technologies like sex robots. Here, the FRIES model has direct applicability as a model of sexual consent, given that people are invited to have sex with the robot. The issue is deeply gendered with a largely male consumer base purchasing highly reductive, pornified female facsimiles. Feminist scholars emphasize how the treatment and design of female sex robots propagates entrenched gender inequity with the potential to facilitate further violence towards women through conditioned behavioral patterns [36, 89, 104].

The question is, should sex robots be programmed to replicate a FRIES model of consent? Sparrow [101] examines the ethical complexities of robotic consent and argues that robots designed to refuse sexual consent so that users can enact rape fantasies are unethical, as the rape of a robot is representative of a rape of a

woman. Moreover, users may still try to have sex with the robots without consent, which would again result in an artificially simulated rape, and arguably contribute to rape culture. Sparrow also points out that a robot that universally consents is equally objectionable, as this promotes a harmful perception of women's sexual availability [101]. Conversely, Peeters & Haselager [83] utilize virtue ethics to argue that sex robots could act as a training tool to improve human morality and sexual relations. However, a sex robot that does not consent to sex or creates a perceived barrier to a user's immediate sexual gratification through consent dialogues could be seen as antithetical to its purpose. Despite these complicated ethical debates, it is possible to program a sex robot to express a dynamic consent model like FRIES, at least superficially. However, it is much more difficult for this programming to include the necessary contextual and nuanced approach required by an enthusiastic model of consent, or to take into account the unique power dynamics present between a person and robot engaging in intimate activities.

4.3.1 TEASE Speculative Scenarios

Traffic Lights: A digital voice assistant or sex robot could indicate when the interaction is respectful and consensual with a green light, where the conversation is becoming disrespectful with an orange light, or when the interaction needs to stop (which could be reinforced by the device turning off for a period of time). In relation to conversational agents, this could be an important educational tool in teaching young adults how to navigate consensual conversations.

Establish ongoing dialogue: A consensual dialogue between people and anthropomorphized devices could take several forms. First, devices such as digital voice assistants and sex robots could engage their users in discussions about sexual consent [99]. Second, devices could be programmed with a FRIES-inspired dialogue to establish boundaries for general conversation, data collection, or sexual intimacy. In cases where user behavior violates the pre-established negotiation or premeditated choice of sexual interactions, as well as in instances of abuse, the device or robot could be rendered inoperable as opposed to inert and still usable [101].

Aftercare: Where an anthropomorphized device engages with participants in a challenging or potentially distressing conversation, or in sexual interaction, it could be programmed to engage in aftercare. For digital voice assistants, this could involve providing information about relevant support services or mental health providers. For sex robots, a shutdown sequence could be initiated after use that could mimic and model the conversations recommended as part of safe and respectful sexual interactions. Altering shutdown from an immediate "off-switch" to a longer, dialogue-based sequence may help resolve dilemmas of immediate sexual gratification and availability that sex robots engender.

Safewords: Safewords programmed into anthropomorphized devices provide new opportunities to practice consent and reinforce consent culture. Alexa, Siri or Google Home's safeword, for example, could be used when racist, sexist or derogatory language is used to interact with the device. If the user continues, the device could remove itself from the interaction by shutting down, or reporting the user to an authority. Likewise, sex robots could use safewords to indicate that a boundary has been breached and to request the activity to stop. If the user continues, the robot could similarly shut down or may contain something like a "black box" that can be consulted by authorities [104]. Repeated and severe violations of sexual boundaries could eventually result in the software locking out the user, either permanently or until action is taken to educate and resolve their behavior.

Explicate soft and hard limits: Digital voice assistants and sex robots could discuss their soft and hard limits with users before they begin their interactions with them as part of a consent process. This might include what swear words or conversation topics are suitable in certain contexts for conversational agents. Prior to using a sex robot, a user could also "program" specific types of sexual encounters, specifying the nature of the interaction, with each scenario initiating a uniquely tailored dialogue on limits appropriate to the interaction.

5 LIMITATIONS AND FUTURE WORK

We acknowledge that our work has limitations, as does all work of conceptual nature. First, our TEASE process guideline has not been investigated empirically, and we note that some of the suggestions we have made for consensual interactions with emerging technologies are not yet (easily) implementable. Although based on existing theory and substantiated through conceptual analysis and examples from our own research, the guideline could be improved through experiments that, for example, compare studies conducted with sexual consent models to those conducted without. Alternatively, our guideline could be explored and evaluated with consent experts from other relevant fields such as law, or examined in workshops with HCI practitioners developing embodied interactions with emerging technologies, to consider how it would improve or hinder their practices.

Second, we acknowledge that definitions and interpretations of consent are deeply cultural, fluid, and evolving over time, similar to concepts such as gender [17]. As such, our work cannot be understood as a final result, but rather as a springboard for future investigations that will need to constantly respond to social and cultural changes, as well as technological developments that will raise new, previously unimagined issues and opportunities. For example, if biosensors could "sense" consent, how would we negotiate this new phenomenon within our existing guideline? This constantly changing landscape is as much an opportunity as it is a limitation. By imagining and performing new forms of affirmative and enthusiastic consent, the HCI community is uniquely placed to transform "best practice" expectations and realize new ethical relationships between people and technology.

Third, we return our earlier acknowledgement that we come from a WEIRD society [42] and hence bring a privileged perspective to this topic. Researchers from other societies and communities are encouraged to challenge, discuss and refute some of our assumptions and claims, strengthening the applicability of our work. Finally, we acknowledge that, although we have aimed to illustrate our analysis through examples across emerging technological advances, we can only provide a limited view on the different applications where our work might apply, or on the consent dynamics that may arise. Future work will find new areas where an enhanced understanding of consent can positively contribute to more ethical and consensual technological futures.

Despite these limitations, we believe that this paper makes a significant contribution to articulating the first HCI-centric discussion on sexual consent in the context of a broad range of embodied interactions relevant to emerging technologies. As such, we hope that our work will inspire future investigations, design speculations and consent processes by providing a structured approach and speculative scenarios to support consensual practice in HCI, within the broader IT field's increasing recognition of its ethical responsibility in society.

6 CONCLUSIONS

In this paper, we have analyzed three areas of embodied interactions with emerging technologies drawing on the FRIES model of affirmative sexual consent. These interactions are: 1) bodily-play interactions; 2) persuasive design with smart technologies; and 3) intimate interactions with anthropomorphized devices. Importantly, and building on the work of the Consensual Tech design advocacy project and emerging scholarship within the HCI community [53, 79], we have not only focused on *sexual* interactions with emerging technologies but on a broader suite of uncomfortable, deliberately manipulative or anthropomorphized interactions. A further contribution is the development of a set of speculative scenarios suggested for each of the embodied interactions we discuss, which are extensions on practices developed using affirmative sexual consent models. We developed a TEASE process guideline for affirmative consent—inspired by concepts and practices of sexual play in BDSM communities—and demonstrated how it can be applied to embodied consent in HCI. As such, our paper fruitfully extends other contributions in HCI that position consent as an ongoing affirmative dialogue rather than a series of consent events [3, 79].

In conclusion, consensual practice is an evolving field in relation to ethical considerations, emerging technologies as well as social and cultural expectations. We believe that the feminist sexual consent movement has much to offer the HCI community in this regard. Moving past the taboo and controversy surrounding sexuality [114] is essential if we are to realize more consensual relationships with emerging technologies.

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