

"Like a candy shop with forbidden fruits": Exploring Sexual Desire of Cohabiting Millennial Couples with Technology

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ABSTRACT

Many cohabiting millennials report dissatisfaction about declining levels of sexual desire. Barriers such as desire discrepancy, lack of communication, changing needs, and habituality interfere with sexual desire and relationship satisfaction. This paper explores whether technology has a role in supporting and increasing sexual desire or developing an understanding of different individual needs towards sexual desire within couples' relationships and how it can do so. To explore this, we conducted a survey (n=77) and interview study (n=12). Results show that participants wanted a shared, dedicated, and protected space to playfully explore their individual desire with each other. They felt technology could facilitate a better understanding of their evolving needs as a couple, motivate open sexual communication, bring spontaneity, and hands-on exploration; however, technology should not inflict judgement or obligations on desire levels; it should help to understand and situate differing needs in a relationship meaningfully. We share our reflections on the role of technology and raise important considerations in such technology design.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**.

KEYWORDS

Design research; Sexual Desire; Cohabiting Couples; Sketching

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1 INTRODUCTION

Many cohabiting millennials (people born between 1981 and 1996 [25]) in Europe report that they experience a significantly lower level of sexual desire compared to earlier generations [13, 20, 111], while their wish to engage in sex has increased. Factors such as habituality (being controlled by old habits), poor body image [28],

and stress have been cited as reasons in the Western world that negatively impact sexual desire in cohabiting couples [31, 85, 95]. The larger discrepancy between the desired and experienced level of millennials' sexual desire also point to contributing factors related to the introduction of technology in daily life, 'busyness with a modern life-style' and increased levels of stress [9, 111]. Some USA-based research shows that being satisfied in the experienced level of sexual desire may improve sexual and relationship satisfaction as well as overall wellbeing [60, 63, 76]. Although (digital) technology can have a negative influence on cohabiting couples' sexual desire [111], recent research and technical advances show that technology may also play a supporting role in sexual wellbeing and expression [6, 70]. However, HCI research has not explored how technology can support sexual desire or the mental side of sexuality within cohabiting couples, which Gibbs et al. already concluded in 2006 [37]. Previous studies have either focused mainly on sex toys [29, 41], sex robots [24], individuals (mostly women) [21, 52], or focused on tools supporting intimacy within couples in a long-distance relationship and co-located couples [5, 15, 115, 116]. Many of these products focus solely on sexual arousal in the moment, rather than increasing levels of sexual desire. Further, individuals within a relationship may have different levels of desire, and communicating or discussing such desire discrepancy or working to address it (by achieving an understanding of the discrepancy and what it means for the relationship, or increasing sexual desire if that is the goal) is not easy [64]. Thus, there is an opportunity here to explore if technology can play a role in supporting the exploration of cohabiting millennials' sexual desire. What could this role be?

To achieve this, two studies were carried out. The first study was a survey of 77 cohabiting millennials (predominantly heterosexual) to investigate needs and factors affecting their sexual desire. Most participants in the study were from Western Europe and the UK. The second study was an interview study to further understand cohabiting millennials' needs in exploring sexual desire and the role of technology. The second study had two parts, which included individual interviews with sketching activities with 8 participants, followed by a review of the sketches from the interviews by 11 participants (7 of the 8 Study 2 participants and 4 newly recruited ones).

To our knowledge, this research is the first in providing (1) insights into a playful interaction between users and technology to explore, understand and perhaps increase the satisfaction of their own and each others' sexual desires, and (2) considerations and implications on how technology could be used (and some caveats) in exploration of sexual desire in cohabiting millennial couples. This

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study also provides insights into and considerations for conducting HCI sexuality research.

2 LITERATURE REVIEW

Sexual desire can be described as an inclination or urge to participate in sexual interactions [8] or to "achieve sexual intimacy" [60]. It stems from multiple forces that inhibit or stimulate people to engage in sexual activities [56], such as a biological drive, psychological motivation (individuals' mental states, interpersonal states, and social circumstances), and cultural or social norms [56, 78, 80]. Various factors influence individuals' inclination or reluctance to participate in sexual activities [56]; they encompass biological impulses, psychological motivations (including mental states, interpersonal dynamics, and societal context), and cultural and social norms. It is a dynamic state that can vary widely, spanning from experiencing strong aversion towards the idea of engaging in sexual activities, to feeling intense passion accompanied by excitement and physical arousal [56].

Sexual desire is linked to individual wellbeing [55], as well as satisfaction within relationships [59, 64]. Difficulties with sexual desire, such as habituality and desire discrepancy [61, 85, 95] are reported by many cohabiting millennials [11]. Facing difficulties related to sexual desire, and discrepancy in sexual desire within a relationship, are among the most cited concerns for couples seeking therapy [30]. Desire discrepancy arises when partners in a relationship have different levels of desire; thus one partner may experience a higher or lower level of desire than the other [64]. Further, each partner may experience regular and often predictable individual fluctuations in sexual desire due to a range of external factors such as hormonal changes or body image [28, 63, 109]. These natural ebbs and flows of desire, along with the finding that if desire is low it is unlikely to change soon [109], make desire discrepancy a potentially unavoidable aspect of any relationship at some point, and one that could pose challenges for the relationship [44, 108].

Recent research has highlighted individual, interpersonal and social factors that impact sexual desire [63]. These factors encompass a wide range of influences that shape an individual's sexual desire. Individual factors include aspects such as personal characteristics, beliefs, experiences and feelings such as attraction to a partner [8], or stress [32]. Interpersonal factors include the dynamics, quality and length of relationships [2], level of communication [32, 76], and elements of unpredictability such as surprise, risk, playfulness, and innovative interactions [31, 32, 68], as well as relationship satisfaction and intimacy, both physical and emotional [18, 32, 78, 94]. By finding a balance between asserting individuality and fostering mutual intimacy in a relationship, couples can create a safe emotional space for exploration and risk-taking [53]. This can involve engaging in novel experiences, which evokes greater sexual desire, even in long-term relationships [32]. Finally, social factors include broader societal and cultural norms and expectations, including aspects such as gendered roles [75], and attitudes towards sexual activity [18, 22].

Long-term partners employ various ways to sustain sexual desire, with an emphasis on enhancing relationship and sexual satisfaction. These strategies involve actively avoiding monotony, engaging in

activities as a couple that foster novelty and experimentation, fostering emotional intimacy and communication, and practicing mindfulness [63]. Several researchers have studied more specific strategies and mechanisms that couples use for maintaining sexual desire and managing desire discrepancy in relationships [60, 62, 63, 108]. For example, one study [44] identified strategies that women in long-term relationships used to deal with desire discrepancy, including having sex without desire, scheduling sex, communication, and having patience. Although this study was among the first to try to identify specific strategies to address desire disparity in couples, it is important to note its limitations. The study sample solely comprised women, and its primary focus was on increasing and restoring desire, and getting it back on track, thereby framing desire discrepancy as a problem rather than acknowledging and managing naturally occurring and recurring instances of desire discrepancy. Building on this, a more recent study delved into the strategies used by both men and women in heterosexual relationships to address desire discrepancy [108]. Moreover, this study shed light on the significance of partnered strategies in managing and navigating desire disparities, such as effective communication, quality time spent together, and having sex anyway, in improving sexual and relationship satisfaction [108]. Recently, an online intervention was developed to address desire discrepancy and improve access to sex therapy as previous research has suggested that online interventions may be particularly useful for sexual problems due to increased stigma associated with sex [107]. The intervention used online sensate focus therapy: "a series of structured touch exercises that help couples to gradually habituate to the feared stimuli (i.e. sexual activity) and learn to be mindful and present in sexual encounters" [107]. The findings highlighted the importance of communication and addressing desire discrepancy together, rather than individually, to improve relationship satisfaction. However, some participants did not experience reduced desire discrepancy, and the author argued that this could be due to monotony in information and tasks in the application, lack of support in communication, and lack of personalisation [107]. While the sample size was too small to be generalisable, the findings indicate potential for technology to support sexual desire [107].

Other studies suggest that open and affectionate communication and sharing of preferences about sex, intimacy or relationships could address discrepancies and even enhance desire [10, 78]. However, research also indicates that open communication with partners about sex can be a challenge specifically faced by millennial couples [65]. This lack of communication, and shame and uncertainty of a partner's reaction associated with arbitrary attempts of initiation of sex [22, 43], can result in disappointment and withdrawal, frequently diminishing desire [67]. Sexual responsiveness and attentiveness (letting the other feel desirable) are also important for desire [76, 85], and desire discrepancy needs negotiation to avoid negative consequences, as partner disappointment can stifle sexual desire within couples [73, 78].

2.1 The role of technology in dwindling desire

The "busyness of modern life", reflected in the juggling of private space, work, and leisure - where these factors can also interact - can make it difficult to achieve intimacy and time for self. Longer work

hours, commutes, and having children can all interfere. The current ways of working with technology further blur the boundaries between work and leisure [3, 111] through introducing various distractions such as continuous notifications from smartphones in daily life [31]. Although the impact of technology on erotic life is insufficiently investigated [12], research shows that time spent online can interfere with meaningful face-to-face interactions [88], or interfere with the satisfaction of such interactions with common occurrences of 'phubbing' (snubbing a partner by using one's phone during interaction), negatively affecting sexual desire [69, 89, 97]. These factors can also contribute to stress and mental health issues, the biggest known factors diminishing (the motivation to experience) sexual desire [32, 81, 95]. They also contribute to a negative work/home balance [102], and a perception of lack of time in general [95]. The constant availability of entertainment, and use of smartphones, have reportedly led to fewer opportunities for feeling desire and initiating sexual activity due to the many choices of things for people to do instead of engaging in amorous activities [105]. This factor is important when thinking of designing technology for enhancing or exploring sexual desire, as technology itself can potentially become a barrier. In addition, individuals can be influenced by societal norms regarding sexual desire, which are perpetuated through media portrayals that often pathologize "low" sexual desire, while reinforcing gender stereotypes that expect men to display higher levels of sexual desire compared to women. There is also the prevailing assumption that low sexual desire among women in heterosexual relationships is a problem, leading to a research focus on investigating its causes and potential treatments exclusively aimed at women [106]. These societal norms contribute to unrealistic expectations and coping mechanisms around sexuality and body image [19]. More recently, however, (social) media has also shifted more towards a sex-positive perspective which has shown to have a positive impact on sexual scripts and sexual communication [112], illustrating how technology and media can also be a potential enabler in supporting couples' sexual desire, and communicating desire, when being exposed to helpful information.

2.2 Sexual desire in HCI

Currently, HCI focuses increasingly on subjective interactions and aesthetics, and embracing other dimensions of interaction such as emotion, experience, pleasure, embodiment, and physical intimacy, including an important space for sexual wellbeing [6] and desire [49, 86]. There has been increasing interest in designing for sexual intimacy [47], but, to our knowledge, HCI research has not yet explored how technology can support sexual desire in cohabiting couples [17, 37], or focuses on addressing their challenges in sexual desire, such as desire discrepancy, in a pathologising way. Through this paper, we aim to propose a space for opportunities in technology to playfully explore pleasurable interactions aimed at promoting sexual desire, not just with a focus on addressing deficits and gaps in the literature.

2.2.1 Principles for designing for desire. Earlier research has focused on principles for designing for desire. Work by Bertelsen and Petersen suggests providing an enabling context for erotic desire or activities to occur [12] by treating sexual practice and eroticism as

part of everyday life and designing for fun. This can create new perspectives and ways for exercising eroticism in a playful way with technology, rather than focusing on prevalent medical approaches [12]. They suggest designing for illogical combinations, unexpected openings, and inventiveness in sexual activities. These design suggestions are also reported by Eaglin and Bardzell, who conducted user research on the use of sex toys [29], and further suggest that the product should not dictate its purpose so users can explore and appropriate them, as sexual desire is personal [29]. Thus, designers should be mindful of how much control or responsibility they take in the use of the product and what implications this might have on users' sex life and desire [41]. However, these interactions or patterns when designing for desire need further investigation in HCI as they need input from users.

2.2.2 Design proposals for intimacy and sexuality. The focus of many HCI studies on couples about intimacy has been on long-distance relationships. Products explore mitigating the physical distance between partners by mimicking a feeling of presence using audio-and video streaming [5], robots [115], VR [116] and smart everyday objects [40]. Some products also focus on physical intimacy, mimicking cuddling or stroking [72] and kissing through haptics [93]. However, long-distance relationships face different challenges in maintaining desire from cohabiting couples, as being separated physically can be a factor in fuelling desire [85]. Less research has explored cohabiting or co-located couples, and mainly explored ways of promoting non-sexual interpersonal sharing by, for example, using a shared diary [15]. A similar product 'Whispers' enabled communication of physiological data between partners through haptics and sound, allowing shared embodiment [54]. This may facilitate playfulness and unexpected openings as Bertelsen and Petersen [12] suggested when designing for desire. While these studies may have a positive effect on sexual desire, also due to their focus on increasing intimacy [31], they did not explicitly focus on this aspect.

Some studies have focused on facilitating sexual activity through tools for pleasure and tactile stimulation [6] (e.g., OhMiBod: a vibrator that vibrates on your favourite music) [29] to enhance pleasure and sexual expression. Other studies report on the development and evaluation of products for sexuality, focusing on sexual discovery, arousal through simulations of sex using VR, sex robots, pornography [7, 24, 74], and normalisation of female genitals [52]. The latter, "Cunt touch this" [52], is an interactive game that stimulates people to colour a vulva (which makes sounds depending on where the player touches the screen/vulva). A less explicit interactive example is the multiplayer game 'Talk About Sex' that presents challenges players need to execute in turn, building in exercises on consent, intimacy, trust, and building momentum for intimacy [113]. Here, similar principles have been used to what Bertelsen and Petersen suggested when designing for desire [12]. Some products support existing sexual desires or enacting them, such as: IJustMadeLove.com [49]: a social media site where users share that they had sex by setting markers on a map and commenting on each other's markers. The elements of exhibitionism and voyeurism in a private environment enable people to freely express their sexual desires. Seeing markers of recent sexual activity close by (physical proximity) may induce arousal [49]. While these products do not

explicitly focus on sexual desire, they may have a role in promoting sexual discovery and normalisation as suggested by Bertelsen and Petersen [12], which may affect cohabiting couples' sexual desire. However, none of these studies have reported any specific findings or implications on this.

Several promising commercial technologies deal with challenges couples have in arousing sexual desire, such as Wheel of Foreplay [84], Coral [36], and Lover [58]. They bring in elements of sex therapy and education, prompts and exercises to do with a partner, and personalisation, to help couples communicate and explore. Interestingly, they feature many of the design principles mentioned by Bertelsen and Peterson [12], Eaglin and Bardzell [29], and Goodman and Vertesi[41]. However, the effect of these on cohabiting couples' sexual desire and the underlying contributing mechanisms have not been investigated.

3 STUDY DESIGN

Our research aimed to unpack needs around sexual desire among cohabiting millennials and if technology could be a medium to explore, communicate and support sexual desire when needed. We further investigated needs and associated design requirements with respect to technology in this space. We conducted two studies: (i) an online mixed methods survey to understand the initial characteristics and needs for millennials' sexual desire and their technology use, and (ii) online interviews with participatory sketching activities to explore how they envisioned technology could support these needs. The results from the first study were used to create data-driven personas (fictional characters that represent a user group and their goals, behaviours, challenges and motivations), which informed and were used in the subsequent study. The second study had two parts: the first involved 8 individual interviews with sketching activities and using the personas. This was followed by the second part, an anonymous review of sketches resulting from the interviews to clarify insights, probe to deepen requirements, and gather feedback or new ideas that may emerge from other's sketches. Sketches were reviewed through a short survey with the Study 2 participants, and short interviews with 4 additionally recruited participants to reduce any biases and validate the generalisability of the needs of this user group.

3.1 Ethical considerations

This study was ethically approved by (anonymous for review). Given the sensitive topic of our research, we were careful to frame questions in a way that would not cause any distress or embarrassment. We piloted all questions to avoid (harmful) misinterpretation and stressed to participants that they should only share what they felt comfortable with and that they could refrain from answering any questions. We used personas so that participants had the choice to answer questions from the persona's perspective or their own. Data was gathered and stored securely on Microsoft Teams and Redcap. The project was approved by the department ethics committee and all data collected was subject to Data Protection regulations. Due to the COVID-19 pandemic, all studies were conducted online.

3.2 A note on positionality

We believe it is important to reflect on our positionality regarding this work. Our approach in undertaking this work is not to problematise desire (or the lack of it), or to treat it as a medical or health issue. We do not subscribe to the medical model in which low desire is considered a disorder, or regard it as a "women's problem". Rather we are curious about how technology (as a tool or actor) could mediate desire in relationships by allowing people to explore and discover what brings them pleasure and satisfaction, in a playful and non-judgmental way, individually and within their relationships. Could technology, so ubiquitous in our daily lives, help to overcome some of the barriers and reservations people have towards exploring their own and others' desire with an open and curious mindset? Could it help to bridge gaps? We know that technology has the reverse role to play as well. Much has been said about the role of technology as a distractor that takes away from intimacy and interferes with sexual desire. But we explore how people want to use it to facilitate closeness in relationships and communication.

4 STUDY 1: ONLINE SURVEY

4.1 Method

We created an anonymous online survey as they are associated with more open self-disclosures on personal topics such as sexual thoughts and behaviours [38]. The survey consisted of questions selected from validated questionnaires measuring sexual desire, such as the Hurlbert Index of Sexual Desire (HISD) [4], Sexual Desire Questionnaire (DESQ) [23], the Sexual Desire Inventory (SDI) [96], the Female Sexual Function Index (FSFI) [91], and Brief Sexual Function Inventory (BSFI) [79] and questions that were informed by psycho-sociological factors impacting sexual desire from the literature [63]. Open questions also considered the impact COVID-19 had had on their sexual desire, their behaviours and experience in products used to support their desire, and needs in future technology. To protect participants' privacy as they were recruited conveniently, questions regarding their background were limited to age, sexual orientation, and gender identity. Six participants piloted the survey, which was refined based on their feedback.

4.1.1 Recruitment. We aimed to recruit a diverse group of participants (same-sex, heterosexual, polygamous, monogamous, different ethnicities and cultural backgrounds) to explore whether people in different relationships and contexts had distinct requirements for technology. Inclusion criteria were: participants aged between 24-39 years old, cohabiting for more than 6 months with a partner, able to give informed consent, and to communicate effectively in English. We did not restrict participation based on gender identity or sexuality. Participants were recruited through social media platforms such as Twitter and LinkedIn with a link to the survey and snowballing approaches. All respondents provided digital consent. At the end of the survey, participants had a choice to opt-in for a follow-up interview with participatory sketching activities (Study 2). Participants were asked to bring a partner or friend to the interview.

4.1.2 Participants. The survey sample consisted of 77 participants (44 identified as women, 32 identified as men, 1 preferred not to

say), mostly aged between 24-27(48.1%, n=37), 28-31(28.6%, n=22), 32-35 (19%, n=15) and 36-39 (3.9%, n=3), mostly heterosexual (96%), in a relationship for between 2 to 4 years (35.1%, n=27), with others between 6-12 months (3.9%, n=3), 1-2 years (11.7%, n=9), 4-8 years (27.3%, n=21), 8-12 years (14.3%, n=11) and more than 12 years (7.8%, n=6). Most participants did not have children, (84.4%, n=65), 3 were pregnant (3.9%), 8 had one child (10.4%) and 2 had between 2 and 4 children (2.6%).

4.1.3 Data analysis. We first carried out a descriptive analysis of the quantitative survey data and further multiple two-step cluster analyses [104] to determine the best fit for the data in clusters and construct data-driven personas. The first analysis was done to cluster participants based on all variables of the survey to identify clustering variables, which yielded 10 clusters with weak consistency. In the next iterations, weak clustering variables were excluded one by one until the cluster analysis yielded a result of 5 coherent clusters, which eventually were based on descriptive variables and the variables that depicted goals, needs, behaviours and frustrations (status and satisfaction of sexual desire and the agree-disagree questions on factors impacting desire). Data on the open qualitative questions were analysed using content analysis [66]. Descriptive statistics were generated per cluster to inform the personas, where answers from open questions within a cluster were compared and summarized.

4.2 Survey Results

In this section we present a short summary of the relevant findings from the online survey.

4.2.1 The sexual desire of cohabiting millennials. Most respondents (83%) thought sex was important; 64% considered a lack of sexual desire a problem (see Figure 1). The frequency of experienced sexual desire ranged from multiple times a week to multiple times a day, where 42% wanted to experience more desire, and 38% did not know how to increase this. Females wanted to feel sexual desire more often. However, this was not significant ($X^2(4, N = 77) = 8.33, p = .08$). Males reported experiencing desire more often ($X^2(14, N = 77) = 33.80, p < .05$), and engaging in sexual activities ($X^2(14, N = 77) = 48.87, p < .001$). Younger participants (aged 24-27) also reported engaging in sexual activities more often ($X^2(21, N = 77) = 36.03, p < .05$). The frequency of sexual activity ranged from once every 2-weeks to 3-4 times a week. This was significantly lower for people in relationships of 4-years and longer ($X^2(35, N = 77) = 67.02, p < .001$). Though this was not the case for participants in a relationship of 2-years or longer, they nonetheless significantly reported not experiencing sexual desire as often as they liked ($X^2(10, N = 77) = 25.88, p < .05$) and not engaging in sexual activities as much as they'd like ($X^2(10, N = 77) = 19.10, p < .05$). About 55% of all participants wanted to engage in more sexual activities. On average, people determined their sex life satisfaction to be a 6.5 (SD = 2.29) on a scale of 0 (absolutely not satisfied) to 10 (absolutely satisfied). People in relationships of 4-years and longer reported lower numbers, but this was not significant ($X^2(50, N = 75) = 64.06, p = .09$). No other significant differences were found for age, gender, or people with/without children. A large proportion engaged in sex for positive reasons, such as their partner's pleasure (91%),

their own pleasure (88%), and for emotional intimacy (86%). A fifth, however, engaged in sex because they felt they should (20%).

4.2.2 Frustrations. Communication about sexual desire with partners was reported to be difficult. While 83% knew what they liked during sex, a lesser proportion (57%) regularly discussed this with their partner. 60% reported a discrepancy between their sexual desire and their partner's. This was significantly more in people in relationships of 2 years and more ($X^2(20, N = 77) = 37.27, p < .05$); around half (46%) reported experiencing stress, with more than a quarter experiencing depression and/or anxiety or not enough time and/or energy to feel sexual desire (28%). Nearly a quarter (23%) of the participants reported that their technology/smartphone use affected their desire negatively, and their partners' use affected it even more (31%). Around half (53%) of the participants reported putting effort into maintaining sexual desire weekly to monthly, and most reported trying (and wanting to try) new things (66%).

4.2.3 Creating future products for sexual desire. 55% of respondents used technology products in their sex life (mostly to enhance bodily arousal using sex toys (71%)). In addition, participants who had never used technology for sexual purposes (44%) reported being open to exploring technology for sexual desire. Those who used technology for their sex life (39%), however, explained they had less time for sex in general and thus did not use the products often.

Three different general opinions were identified on how technology could be used to explore sexual desire: (1) by supporting the path to arousal, in particular communication, (2) by helping to break the routine (e.g. suggesting novelties, knowledge on sexual possibilities and seduction), and (3) by helping to understand (differences in) sexual needs and assisting couples to understand one another (e.g. through "erotic mindfulness" - survey respondent). Respondents prioritised discretion, privacy, to-the-point messaging, personalisation and low stress and time commitment as requirements for technology.

4.3 Developing Personas

We created five data-driven personas, based on the cluster analysis of the survey data, that covered a combination of various sexual desires, frustrations and goals. We kept the type of relationship open so monogamous and non-monogamous participants would be able to identify with all personas. Persona 'Charlie', the largest cluster, represented people who struggled to find time to feel sexual desire and felt uninspired (see Figure 2). Other personas included representations of people with a high sexual desire who wanted to make their sex life even more fun, those with a higher sexual desire who had a discrepancy with their partner, people who found it difficult to feel sexual desire and wanted to explore how they could enjoy it more, and those who would like to experience more sexual desire but struggled to move from intimacy to feeling sexual in a non-threatening way. Personas were given non-gendered names, and illustrations were varied among different personas based on the participant. Though there were some significant differences among men and women in regards to wanting to feel more desire and sexual activity, we tried to avoid biases of gender roles to allow people to identify themselves with personas.

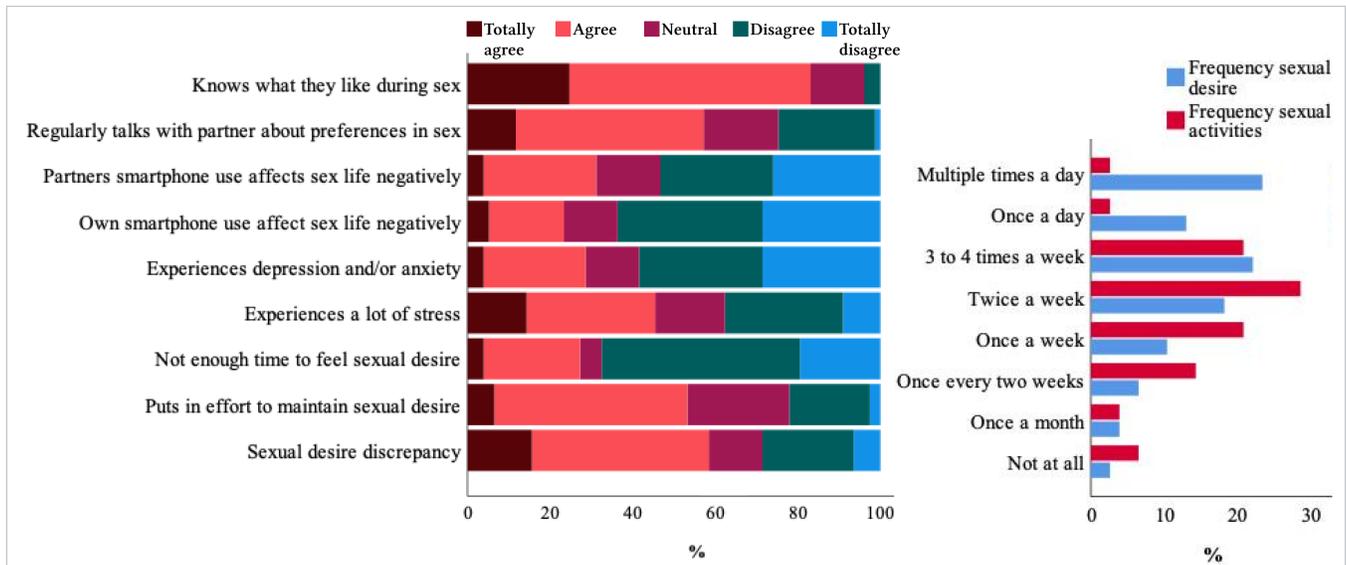


Figure 1: Results from online survey depicting participants feelings towards sexual desire and sexual activity



Satisfaction sexlife: 6/10
Feeling desire: 2/week & unsatisfied
Engaging in sex: biweekly & unsatisfied

Charlie (31)

Cohabiting 11 years

"It's not that I'm not interested or experiencing any problems, but I can't really get to it as often as I'd like and I feel uninspired."

Goal
 More mystery in their sex life and room for exploration. Having a good balance between intimacy with their partner(s) and their own life.

Scenario
 Charlie feels their sex life has become monotonous and finds it difficult to make space for bringing newness because of their busy life. Charlie would like more variety, surprise and playfulness by experimenting with new things to learn about seduction and experiencing pleasure.

Frustrations

- Sex life feels monotonous
- Low on time and energy
- Distracted by phone and Netflix

Behaviours in maintaining desire

- Making time and dress up a couple times a month
- Using sex toys and trying out an audio sex guide

Figure 2: One of the two most prominent personas: Charlie

5 STUDY 2: ONLINE INTERVIEW WITH PARTICIPATORY SKETCHING ACTIVITIES

5.1 Method

We used the data-driven personas created in Study 1 in our interviews, as intimate information is often linked with feelings of embarrassment or shame [71] and using personas in interviews or participatory design has been shown as helpful to mitigate this while enhancing introspection and creativity [103, 104]. Participants could opt to answer questions from their perspective or shield behind the personas [45] as it helps to decrease the distance between researcher and participant [45]. During the interview participants were asked to choose two personas to form a couple, so

they would also be prompted to think about a partner's perspective and the relationship.

We constructed an open topic guide to investigate different challenges and needs in exploring sexual desire, and if there was a space for technology to support this. During discussions around problems, needs and requirements, participants were also asked to explain and/ or sketch if they proposed technology to envision how it could be used to explore sexual desire, what they felt it would look like, behave, should (not) have, how it should make them feel, what it could achieve and scenarios of use. These sketching activities helped participants formulate and specify their needs and ideas more concretely, which is proven helpful in communicating and

contextualising design concepts [110]. A collaborative web whiteboard ('Miro') was used for sketching. Sketches mostly focused on a product or service itself, rather than providing a detailed context. The context (where it could be used, how it behaved over time) was either captured in annotations or narrated during the interview and thematically analysed afterwards. Some participants found it difficult to ideate, visualise and sketch their ideas online. In these cases the researcher sketched things out while probing and crystallising participants' ideas and needs. After the sketching activities, participants were asked about their thoughts on the most helpful, challenging and unhelpful ideas discussed during the session.

To gain a deeper and wider understanding of needs and ideas from Study 1, with permission gained during the interviews, participants' anonymised ideas and sketches were shared. Three weeks after the interviews, participants were asked to evaluate the probes on their own, using a separate document which contained all of the sketches and ideas. For each, four questions were asked: what do you like about this? what do you like less / would change? What questions did it raise? What other ideas could be considered? This method was chosen as these participants knew the study, could do this in their own time and could provide feedback on others' ideas unrestrained. In parallel, an additional four participants took part in an interview to explore and evaluate the probes in an unbiased way as they had not been involved in the research yet and would not be subjected to the IKEA effect [82] - a cognitive bias where people put significantly more value on things they have helped to create. We wanted to explore enthusiasm for ideas that existing participants came up with, and the generalisability of their needs related to the ideas. They were free to annotate or extend the presented ideas.

5.1.1 Recruitment. All participants provided informed consent to participate in the study and were provided options for their preferred mode of participating (video conferencing, audio conferencing or instant messaging in Microsoft Teams). All participants were provided with an option to bring a partner or friend to the interview who would be equally compensated. This option was provided in case people may want to discuss ideas in the presence of a partner or in case they felt more comfortable attending with a known person, considering the topic. However, no participant expressed interest in bringing a partner or friend to the interview. Participants in the interviews received a £15 Amazon voucher and those in the follow-up interviews received a £10 Amazon voucher.

5.1.2 Participants. The eight participants (4 female, 4 male, all heterosexual) were between 25 and 35 years old. Their cohabiting relationship duration ranged from 4 to 11 years; one was in an open relationship while the rest were in a monogamous relationship; only one participant had children. The four additional participants taking part in the follow-up interview (3 males and 1 female, all heterosexual) were aged between 24 and 29 years, in cohabiting, monogamous relationships of between 3.5 and 10 years long, and had no children.

5.1.3 Data analysis. All interviews were held in Microsoft Teams and were recorded with consent. Audio recordings of the interviews were transcribed by the first author. Transcriptions were analysed using inductive thematic analysis [16]. After transcribing and familiarisation (phase one), initial codes were generated by the

first author (phase two) where key observations were extracted and interpreted. Affinity diagrams were used to group themes (phase three), which were agreed by the three authors and iteratively refined. Data from the autonomous review of the sketches and the further short interviews were analysed using content analysis where patterns were identified in participants' answers and analysed data were analysed in light of the earlier identified themes. Findings from all studies are presented together in the following section for coherence and richer insights.

5.2 Results

The use of personas was reported to be particularly helpful during interviews, as it helped participants recognise and compare aspects of their sex life and discuss these openly with the researcher. Interestingly, most participants reported choosing personas in the session that reflected their own relationship. Additionally, the sketching activities motivated participants to be specific in their needs and requirements. See Figure 3 for some examples of the sketches and below a short explanation of the design ideas which we discuss in further detail in the results section.

Explanation of the sketches in Figure 3:

- Ideas on design elements for digital products: either light and soft, or dark and sexy
- Information that normalises (% of the people experience X)
- Exploring barriers and feelings through stories of others
- App in the homescreen to change color regularly to be discreet
- 'Challenges' to do with a partner with video or audio support
- Vibrating physical artefact that can help to remind to do something for sexual desire/the relationship, and is connected to a phone who can be more specific about what to do
- Vibrating coin that can be worn in a self-chosen (erogenous) area, controlled by a partner on a distance
- An app containing online workshops to do with a partner and being able to select randomly, send to a partner to surprise them or choose one to do by themselves
- Exploring preferences by swiping different prompts left/right that would specify preferences based on answers
- Being able to specify preferences into details ('soft', 'hard-core', 'out of the box', 'comfortable')
- Sex Pictionary (as an 'ice breaker')
- Features that validates a person's or couples' situation (how certain barriers impact the relationship, personas to identify with)
- Ideas on enabling enough flexibility for personal (changing) preferences (for both partners individually), like being able put in likes but also dislikes, provide feedback, and ability to always change preferences. Or 'snooze' (temporarily) disabling the product to move with the ebb and flow of sexual desire
- Showing visuals to show all possible things to do so couples can enjoy the viewing and choosing phase and build up desire from this

Through thematic analysis, we identified five themes: (1) Keeping in step with a changing other, (2) Creating a space for "us" to

help them to create and encounter (perhaps serendipitous) possibilities for feeling sexual desire more naturally. Participants felt this would bring inspiration, curiosity and motivation to experience new sexual things with their partner. Ideas included suggestions for spontaneous prompts for gestures they could do for themselves and their partner (e.g. dress to feel attractive, prepare for a date by buying something for their partner). Most participants felt spontaneous prompts could be key in igniting or maintaining sexual desire and building momentum to act. *P4: "When it is spontaneous or random moments, it makes you [think] more on your feet or something, that you also get more sexual desire overall. Like 'maybe there is something happening today'."*

Participants proposed playful ideas that could include both partners. For example, one proposed an app that could notify couples synchronously on questions or set up joint adventures and prepare the couple for a 'surprise date'. Both partners would have something to look forward to as each would receive different instructions to prepare. Many other participants felt this could be a good way to stimulate and create space for desire to arise, as it would take the "unsexy planning element out of it" (*P11*).

5.2.2 Creating a space for "us" to feel desire. Participants stressed the importance of making time for one another to provide a space where desire can arise. However, many participants experienced difficulty in finding or making the time to have such conversations.

Participants promoted the idea of sexual desire as a state, a space you go to, and they proposed ideas for technology to facilitate such a separate, dedicated space or product for sexual desire. They felt that it would be exciting to create a space or object that they shared only with a partner. For example, something that appeared like an "everyday object or app", discrete, secret and unassuming. Using this secret product would also emphasise the effort they were putting into feeling sexual desire and being desirable. They also proposed ideas for secret technologies (e.g. a code protected digital platform) that would facilitate remote foreplay and create space for desire when being apart during the day. *P5: "When I have the app, my partner should have an app as well and that would make it sexy. So you have it together."* In this, participants felt that a digital platform separate from their commonly used instant messaging platforms could help focus on desire and even enable positive associations. *P2: "If you are working and you see the app pops up, then you're like oh this is not something like .. 'who is going to do the groceries'. I have to open it in private, which would trigger that excitement."*

Participants expressed the need to engage different bodily senses and sensations, in addition to exciting the imagination or purely visual sense. Some expressed the idea of a physical technology artefact, an unassuming and hidden product, that would produce vibrations or sounds to communicate desire to a partner at a distance and many participants were positive about this. Many participants enjoyed the thought of naturally encountering the product in their environment. They felt just seeing such a product in their environment would be exciting and further expressed that they would enjoy being surprised by their partner through bodily senses. They explained that through this, a space for desire would already be created before they were together and that this would make it easy to intimately engage with each other. Being at a distance from each other during the day and communicating desire, without being

able to act on it, was exciting. Others felt that they would like to experience external sensory stimuli that could spark and help them focus on sexual thoughts through, for example, certain scents, lighting, and seeing or reading sex-related content, and technology could help in suggesting and actuating this. In this, participants highlighted that unexpected but perceptible and concrete stimuli were the most likely to stimulate fantasy and feelings of desire. These ideas are similar to those explored around twenty years ago [37, 99] that emphasised the potential for technology to mediate indicative, expressive and emotive interactions.

In participants' ideas, the technology creating a dedicated space for desire should also be protected from external distractions. This was important as participants expressed often being distracted by technology, such as use of TV and smartphones (and notifications) in bed even when with their partners. Some also mentioned being mentally and physically distracted by their work while being at home. Participants felt that their to-do lists and digital interactions such as "phubbing" came in the way of having spontaneous intimate communication with their partner. *P6: "What happens frequently is you wake up and read the news and get stuck on Twitter or something. And then they leave, and you don't have a meaningful conversation before they come home in the evening."* One participant outlined an app idea in which all notifications would be blocked when the app (for sexual desire) is active, to prevent distractions impacting their mood and desire levels. Other participants underpinned this and argued it to be particularly essential when a digital product is used during sexual activities, and that therefore it should have different modes (e.g. do not disturb) that are easily accessed or defaults. In these suggestions, we recognise the conundrum that technology solutions are proposed for a problem that is partly caused by technology-mediated distraction.

Moreover, participants argued that the type of technology itself is important in creating a dedicated space for desire. For example, they explained that a screen would be less natural and more distracting to use, especially as part of sexual activities as they would need to divide their attention between a screen and their partner(s). Therefore, participants thought that the user interface elements should be minimal and discreet and almost disappear during inactive states, and have minimal screen interactions and options during active states. *P3 "When you see an assignment or question you can push pause and then it goes black. Then you would want to put it away for a while, talk to each other, maybe have sex. So it should be really minimal."* This would reduce distractions and maintain sexual desire in the moment. Alternatively, participants suggested that the product could also be voice-controlled or that they could listen to intimate audio stories or instructions without interacting with a device.

5.2.3 Exploring desire playfully without shame. Several participants and/or their partners knew what they liked in sex or wanted from their partner, but expressed feeling ashamed, vulnerable and mostly afraid of being judged by their partner. This prevented them from initiating sex, feeling desire and openly discussing sexual matters. *P6: "We live in a world that everything is cool, at least in the world I live in. [...] but when it comes to things that you would desire in bed, then there is immediately something telling me 'That is sick', you know? You don't even think or talk about it."* Participants

proposed that any technological solution in this space should focus on overcoming feelings of vulnerability and awkwardness in interactions for initiating any sexual actions and improving exploration and playfulness.

To overcome such feelings, many participants proposed technology to randomly prompt challenges and ask questions to individuals. Participants felt that they could be more comfortable in exploring new ideas if they were asked or told to do something (such as by ideas in an agreed technology) P2: *"It's easier to do something if you are just told 'okay you are going to do this now'. Then you don't have to feel weird about it, don't have to feel shame about selecting that type of action."* Additionally, a few participants also proposed the use of synchronisation. Some ideas included technology that would prompt the same challenges and questions to a couple at the same time. This would remove the need to initiate creating a space for desire. Some felt that sharing thoughts at the same time could help people feel less vulnerable and express themselves more authentically. However, participants wanted to be able to indicate how often they would like to receive spontaneous prompts as there may be times when they did not want to engage in thoughts about desire. Other participants proposed submitting ideas or thoughts to an app on a sexual topic or question at the same time.

Participants also suggested that technologies could provide ideas for couples based on their individual preferences, which would enable them to see how their desires match their partner's. It could help to initiate and introduce new topics for conversations as they would know their partner amenable and in the same mood but it should not guide the conversation. A few participants explained this could be helpful when experiencing desire discrepancies, where discrepancies either led to feeling rejected and ashamed, or to feeling pressured and holding off sexual activities and feeling guilty by this towards their partner. P3: *"He is less inclined to react to my initiatives and that makes me feel rejected. And the behaviour [initiatives] just diminishes because it is risky."* In this case the participant felt that knowing more about her partner's needs and expectations and having more open conversations related to sexual desire and encounters could help them to understand each other, without judgement. Participants explained that the suggestions based on partners' individual preferences, could also lie in-between partners' wants and needs to explore compromises in their differences, reducing the risk of receiving content people might feel pressured about.

The right tone of voice of the product was often mentioned in ideas from participants. Participants explained that any product needs to create a safe space for everyone to avoid any feelings of shame and let all people feel accepted in their sexuality. Many felt that technology should aim to be "normalising" of different experiences and needs, "encouraging" to try new things or of their ideas, and "fun". P4: *"Maybe it has information about that there is not one normal so that everything is OK. It should be very inclusive."* People felt that there was a need for normalising and contextualising different experiences and different levels of sexual desire and providing prompts accordingly. P7: *"So, you are not just getting asked; what is the problem with your sexual life? [...] Your personas also triggered my thoughts and made me think about it again. I think this is just very helpful, you feel like you are not alone, and you don't have to start from scratch."*

Some participants suggested a digital tool providing topics with stories of other people where questions or challenges would be attached to, which exemplified a need for context. Participants thought that it would help to compare other stories with themselves to normalise concepts and desires, get new perspectives, and make it easier to start talking about desires with their partner. P6: *"You can discuss things that are not so personally related to yourself. It is easier to have these framed desires instead of saying 'I want to do this or that'."*

In order to maintain a safe space for everyone, all participants were concerned with the absolute need for transparency about data management and its privacy and security so that users are able to trust the product. Many wanted options to stay anonymous while using the product and that any (encrypted) data be stored on the product or device itself and not on the cloud or elsewhere. P5: *"I just want the feeling that it is really discreet and safe to use, especially in our time. We are used to being like on the lookout, and it's not sexy."* Participants thought technologies should explicitly mention how data was handled, encrypted and what was shared with their partner, as participants indicated not wanting to share all information with a partner.

5.2.4 Developing sexual wellness knowledge. Many participants reported not having encountered much information in the past to learn about sexual desire, due to superficiality of resources and lack of concrete guidance to implement the information in daily life. Participants' lack of knowledge and exploration seemed to make it challenging for them to bring variety and stimulation to their relationship and continue this sexual conversation. P2: *"We only talk about sex right now when there is a problem because it feels like the rest have been said."* Feeling uninspired in their sex life and not knowing how to improve intimacy with their partner was a much-expressed problem participants faced. Although some participants mentioned they talked openly about sex with their partner, they also had a hard time knowing and exploring what (new things) they liked or had a partner who did not know what they liked. Many reported wanting to learn new things about their partners' and their own sexual desire and to do things that pushed their boundaries and break their routines: things they would not have thought of or done before. P5 *"Like a candy shop with all those forbidden fruits. These are all possibilities I can try I haven't even thought about and that feeling is really priceless and hot, I think."*

Some participants reported attempts to find information, but found resources that felt like either too big a hurdle (such as attending a sex workshop), biased, or superficial. At other times they were inappropriate. P4: *"Most of the time you type in something sexual, you get porn sites or some lame health government website where everything is too medical. It is difficult to filter it for yourself"*.

Participants proposed many ideas, focusing on helping individuals and couples encounter, think and talk about new possibilities. Conceptual products included tangible and digital solutions that suggested or reminded them of possibilities of things they could explore. P6: *"I would like those products to help me to see something in life that I might have missed otherwise.[...] I want it to encounter me in a situation I would not be in without this technology."*

On the one hand, participants indicated that the product should suggest practical ways of discovering sexual desire by carrying

out concrete, step-by-step, explicit actions; exploring by doing. For example, individual challenges (to surprise a partner), challenges to perform together, new Kamasutra positions, non-interactive audio-guided sex workshops or erotic mindfulness sessions based on topics (such as balancing autonomy/intimacy) or new techniques. P4: "Together you try something new, you find new information and new ways to do things and by doing it together it is exciting." They highlighted the importance of the user interface being easy to co-explore. P8: "You could do challenges that you cannot touch each other for a few days [...]. But you could also do it more emotionally, like introducing 'a third', post your image online, or go all the way by having actual threesomes. There is a whole range of things you could do."

On the other hand, participants highlighted some topics would require more thought and users probably may not feel comfortable trying it right away, or at all. Participants suggested that a digital product could provide thought-triggering questions and topics to get more knowledge on their (and partners') sexual desire, current situation and relationship.

The suggested ideas were caveated often with the need for personalising content as participants reasoned that some people would want boundary-pushing content while others would want subtler content, still focusing on increasing intimacy but not 'too weird or crazy'. Users wanted to be able to indicate their preferences individually, with the opportunity to match these with their partners'.

Participants acknowledged that sexual desire is highly personal and that in order to explore their individual and partner's sexual desire and help build their way to feeling desire personalisation of both digital and tangible technology was key. P4: "Everybody has a different idea of what they find sexually attractive or something they like to do." They agreed that personalised preferences should be based on information about their sex life, and things they (do not) want from the technology. Ideas from participants included technology that facilitated a level of control for users to amend what topics it raised and the level of adventurousness it shared, how invasive the product should be, and types of content it would share. Participants explained that a product that could suggest content based on individual preferences would give them a space to explore topics themselves that they perhaps would not explore with their partner. In this way, participants could explore their own sexual desire then choose what to share with their partner. However, participants wanted to keep a certain level of spontaneity, as they still wanted to be surprised by content, interactions or stimuli they had not thought of themselves. Therefore, they thought there should be a balance so there was still space for surprise and inspiration.

Additionally, participants highlighted the importance of ongoing refinement of personalisation, as they predicted changes in their sexual or relational behaviour, and ebbs and flows in their desire which technologies should take into account. Examples they discussed were the ability to change settings easily and reviewing users' sexual desire and experiences of content so that the product could learn and provide fine-grained suggestions or change its content. This way, the product could 'grow' with the user, as participants thought that users might want to explore other things after a while. P4: "If you decline all the time, maybe that should automatically change in your preferences or something. That you can stay in contact with your app about that it works the way you like it."

In most ideas on personalisation to help them explore, participants mentioned apps as they could enable a high level of personalisation, flexibility and expansion of content.

5.2.5 *Promoting desire should not become another "to-do"*. Stress and symptoms of depression and low mood were often mentioned by participants as barriers towards being open to feeling sexual desire and making an effort. All participants would like technology to help them make this effort but were also concerned that using a future product to enhance sexual desire would become "another thing to do on the list" and still pose a barrier. In this, participants expressed the need for concrete, small and practical chunks of information to be able to implement in daily life straight away and experience small successes. P2: "I think it has to be short, with the questions and challenges. So you can really implement it in daily life without it taking too much time.". Additionally, they explained that different moods require different approaches to getting to feel desire and that it would support them if technologies provided contextual information such as suitability of the product, or recommendations on interactions or content, for different moods, and places. Most participants did not want sex or sexual desire to be quantified, specifically planned or goal-related ('another thing to do'), to avoid making it feel like a task or performance-related leading to further stress.

Aside from small implementable interactions, a few participants also highlighted the value of gamification in the process of enlivening their sexual desires. Some ideas included the use of scores or penalty points, which would work as an incentive to push peoples' behaviour and their boundaries within a light and playful perspective.

In terms of the type of technology, participants argued that interactions with an app on a smartphone would be easiest to incorporate in daily life since their smartphones are always around and to hand. Participants liked the thought of tangible physical products encountered naturally in their environment and being surprised by their partner through bodily senses. They however also argued it did not address the mental aspect of sexual desire much (and therefore less helpful in supporting lower desire in the long term). They also mentioned that there could have difficulty using it as they would need to actively think about using it, which was underlined by many participants as they explained hiding sex-related objects in their house and forgetting about it. A few participants raised ideas that combined tangible products with an app where the tangible product would be an extension of communication, or part of challenges in the app. Participants highlighted the benefits of apps to nudge them, while the related tangible products that focus more on sensory experiences, could help reinforce the experience or interaction provided by the app by bringing participants in the moment through the sensory experiences. This combination would also allow for flexibility in using the tangible product with(out) the app and using it individually or together.

6 DISCUSSION: RE-IMAGINING TECHNOLOGY FOR SEXUAL DESIRE

Sexuality, intimacy and desire are very personal topics and they ebb and flow for individuals and within relationships. While sexuality in HCI research [48] and sex-tech [26] are on the rise, there is much

space to explore sexual desire within intimate relationships. In this paper, we aimed to study how cohabiting millennials can leverage technology to support exploration, evocation and maintenance of sexual desire, and be an enabler rather than a barrier. To this end, we ran two studies. Findings from the first, online survey, showed that participants struggled with spending time and effort to create a space for sexual desire, and many felt the need to increase it. The main themes from the second interview study were: (1) Keeping in step with a changing other, (2) Creating a space for "us" to feel desire, (3) Exploring desire playfully without shame, (4) Promoting exploration and developing sexual wellness knowledge (5) Avoiding the need for promoting desire becoming another "to-do". Here we discuss the main insights and their implications for HCI research and design.

6.1 Promoting authentic desire in a couple

Previous research indicates the need for couples to engage in novel experiences to see each other differently, which can evoke feelings of attractiveness and growth, and with this, sexual desire [32, 63]. Suggestions from previous work have focused on creating novel ways for sexual expression and feeling intimacy, pleasure or tactile stimulation [6, 29, 49, 116], emphasising on bodily experiences; there has been interest in designing for long distance relationships [93, 116]. Our results suggest that there is potential for technology to leverage these ways of supporting and rekindling desire in cohabiting couples. Our findings suggested providing options to send users spontaneous prompts to create opportunities for new experiences (individually, together or enable users to surprise each other). Participants expressed the need for surprise and playful novel technology experiences that provided spontaneous prompts, which could help to maintain desire when they lacked novelty or felt stuck for inspiration, resonating with Murray et al. [77]. Our findings show that surprises may also be provoked by the content itself and suggest that content in technology should be explicit, playful, inventive and explore boundaries. Some of these characteristics have been identified in previous literature such as [12, 29] and in the present work we extend these by providing ideas and users' perspectives on how this can be achieved. In fact, in the future to encourage playful interactions within couples, these characteristics could go beyond content and may be embedded in a larger system of interconnected interactions that couples can build on in individual ways.

Our study results often speak to the needs stated by participants to explore, increase or maintain desire but equally, participants felt that they did not always feel desire equally to their partners. Not only that, but participants wanted to express their own needs so the couple could engage with each other by communicating their own desire whilst understanding their partner's level of desire and what they wanted or did not want from their sex life as a couple. Thus, technology could also be a facilitator of understanding differences in desire (and what was considered "desirable" or "sexy" for each individual in the relationship, as this can differ).

Furthermore, findings suggest that spontaneous prompts with accomplishable steps could be valuable in promoting people to create experiences or make an effort by providing immediacy and a low threshold. Earlier research has already shown that notifications and

prompts with small steps can guide behavioural change and reduce habitual behaviour [34, 87], though this has not been researched in the context of sexual behaviour. Future research needs to explore the acceptability and configuration of this in a sexual context.

6.2 Creating a dedicated space for desire

The results of this study show that technology should focus on providing space for desire to emerge, supporting intimate communication and erotic life activities, which confirms the suggestions of Bertselsen (2007) [12]. To effectively provide this space for sexual desire of couples, our results suggest design should take both the personal needs of an individual as well as the needs of a couple into account. It should enable opportunities to explore desires as a couple and individually, as well as support couples' communication. For example, participants spoke about finding ways to communicate desire and lust to their partner at a distance without being able to act as key in prepping space for desire, which could be achieved by using remote technologies such as smart speakers to speak at a distance or other Internet of Things (IoT) technologies to control and create playful communication or sensory experiences by controlling the environment (such as using an app to control lights to set the mood).

Participants in this study referred to different sensory stimuli triggering sexual desire and were hesitant on interacting with screens during sexual activities. In this, novel technologies with different sensory modalities could provide ways to introduce different smells or sounds into the ambient environment to provide excitement (for example, by reproducing memories of pleasurable past experiences) [83, 100].

In line with earlier research [69, 89, 97, 111], the current study shows that technology distracts people from being intimate, but indicates that people want to minimise this. One suggestion to overcome this is to provide a separate space for sexual desire in technology, where distracting sensory stimuli that could stifle desire are blocked during the use of the technology (such as incoming notifications and messages). Pro-active blocking software (blocking all incoming messages and notifications automatically in specific contexts) has shown positive results in reducing distractions [51]. However, it is suggested that this software should be semi-automated, giving users the final responsibility [51].

The aesthetics of a digital interface have a large impact on emotion [14] and (perceived) usability [101]. Findings suggest using illustrations, bright and warm colours or dark and sensual colours. Our results suggest providing a minimal, straightforward user interface that establishes an emotional space and looks approachable by communicating sexual desire as part of everyday life, resonating with earlier research [29].

6.3 Mitigating shame and encouraging engagement

Findings suggest that, in order to use technology for sexual desire, shame needs to be mitigated. Earlier research shows the importance of overcoming shame to talk and explore sexual desire [42]. There has been previous research about sexuality in HCI around decreasing shame mostly around pornography, sex toys, or female genitalia [6, 49, 52]. Our work suggests how technology could be

used to mitigate shame in initiating sex with a partner and sharing individual desires and needs. Our findings show that participants wanted to normalise feelings of sexual desire but hesitated to express desire because they were unsure of their partner's reaction, which resonates with earlier findings [22, 43]. One way that our participants felt that technology can match partners' preferences and send spontaneous prompts to help people overcome this feeling of shame to initiate new topics in conversations or activities, as it removes the responsibility of choosing. The results also suggest that technology could mitigate shame by providing normalising communication, stories of other people, and affirming transparent information. This has also been found valuable in mitigating shame around sex in earlier research [42].

In addition, the current study found that technology could help bridge the gap in desire discrepancies, resulting from the variability and uniqueness of sexual desire of both partners individually, by matching the personalised preferences of individuals in a relationship and providing suggestions to mitigate this gap.

Findings also highlighted the importance of trust in technology, in particular in secured privacy, to enable carefree use and exploration of sexual desire using technology. This is an important aspect, as services exist that use data from smart sex toys, smartphones, and mobile social networks to analyse (objective) human sexual behaviour, for example in China [117]. With the rise of technology for sex where intimate data is used in algorithm for product improvement, we need to be conscious of the risk of 'datafied' intimacy and pleasure and dictating what is a 'healthy' or 'good' sexlife [33]. In addition, much smart sex-tech is not well protected, which increases the risk on remote sexual assault [114]. Our results suggest this could be provided by protecting access to technology and providing discrete notifications. Also, options should be provided to use technology anonymously and store and use data only locally. However, this could be a barrier to designing IoT for sexual desire. New developments in data and privacy protection using blockchain technology could provide a secure way to store users' data in the future [39] and offer space for IoT technologies to support sexual desire. However, in the design of intimate technologies, it must also be remembered that the potential for harm can be very real with instances of tech-abuse on the rise, such as use of IoT or connected technologies for gaslighting and harming intimate partners [57]. Thus technology designers must take every care in designing remotely controlled intimate devices.

Our results indicate that personalisation could support cognitive planning by suggesting content that helps build up or explore sexual desire by, for example, providing options to indicate preferences on topics. Our users mentioned personalised recommendations and Artificial intelligence/ machine learning (AI/ML) applications could be implemented to recommend relevant, specific and inspiring content for users [90]. However, a significant downside is that this system assumes a user always wants the same [46], while individuals' and their partners' sexual desire can change. Besides, it is important to consider how people would feel and be transparent about the implications of AI/ML constantly collecting their personal intimate data if such systems are used. Earlier research highlights the importance of users' autonomy to control and define their use of technology was also mentioned in earlier research [29, 41]. It was however unclear how users would want this, operate this or

need this more specifically - what does this look like? Our findings fill this gap and suggest that it is important that technology provides options to personalise and adapt and grow along with peoples' fluctuating sexual desire. Our findings also suggest that in order to retain novelty and surprise, technology for sexual desire should provide options for personalisation but not constantly personalise and provide selections for individuals and couples to explore themselves.

6.4 The tension of control

Whilst participants wanted spontaneity, they also felt that desire is something they should work on and thus control. Our findings imply that technology could provide spontaneity, while users felt they are making an effort for their sex life by using the technology. However, users also felt that spontaneity/prompts should be well balanced with user control (e.g., the timing of these prompts) and users should be able to temporarily block other notifications to minimise distractions when they need to be present. Thus, there is a need for balance between spontaneity and control.

Creating space for desire in a couple's life with technology has important implications. What is the role of technology? Is it a facilitator and mediator or is it in the role of a participant? Most of our participants saw it as a facilitator though other roles have been discussed in the literature [27]. Our participants wanted to endow technology with control, something that told them what to do and hence gave them permission to explore outside their comfort zones. However, the implications of shifting power from people to technology warrant some thought. Some participants' ideas implied that the technology should take the initiative, would invite (or even tell) the couple to try things. This is an interesting proposition as the responsibility of bringing "variety, surprise and playfulness" is located in the technology, which rather than supporting sexual desire now becomes responsible for generating it. This "technology as an enabler of unplanned and unexpected encounters" is an intriguing path, and insights from participants not wanting to control their own initiation of sex encounters ties to the need of some people to be given permission and be invited to explore.

This also brings up the issue of consent. In addition to consent between partners, using technology for aspects of sexual activity needs to consider technology-mediated consent. Each can be in the role of victim of non-consensual activities by the other (e.g., feeling coerced to participate) or the perpetrator (e.g., making another participate in unwanted activity). The literature describes consensual as well as non-consensual sexual interactions using technology (e.g., [118]). Even adopting such technologies at one point in time, does not mean ongoing consent and many technologies have been previously criticised for failing to design for the possibility that a person may change their mind about sex-related activities and want to stop the experience.

When offering behavioural change related, persuasive and interactive technology, the risk of emotional manipulation and, in worse cases, abuse or violence, the role of mutual consent needs to be acknowledged and ideally built-in into the technology [98]. This was not explicitly highlighted by participants of this study, though they mentioned to base prompts on their and their partners' overlapping preferences which does not account for ongoing

dialogue that consent should be [98]. Though Strengers et al. (2021) already suggested requirements to implement this in different technologies [98], future research is needed to understand how consent would work best when designing for sexual desire, balancing the value of spontaneity and surprise with establishing ongoing explicit consent.

This also brings up the role of the designer in creating such technologies. Participants often highlighted ideas, e.g., around dressing “to feel attractive” or preparing for a date “by buying something”. This can arguably be seen as producing technology that could potentially feed stereotypes and consumerism. In reflecting on our role as the designer in this situation, we feel conflicted in offering the option to the user versus what our own values might be. In retrospect, foregrounding values in these design tasks could have provided opportunities for users to reflect if they were considering their values with respect to the task and enhance the awareness of these values by participants during design activity. Existing methods or frameworks such as value-sensitive design do attempt to engage with values and can be leveraged for this but their support of activities such as value discovery and awareness are often contingent on designers’ own reflective ability [35].

6.5 Limitations

This study did have many limitations. Our recruitment strategy, which led to almost only heterosexual, monogamous participants and few gay (3), lesbian, bisexual and polyamorous people (1). Thus, we were unable to explore whether people in different relationships have distinct requirements for technology. However, it could also be due to the fact that we may have insufficiently accounted for LGBTQ+ and polyamorous inclusive questions in our survey, resulting in unintended exclusion. Future research should mitigate this [92], and should target recruitment of these groups by approaching different communities outside researchers’ own bubble, which was assumed to be diverse. Because of this limitation, it is unknown how these design implications fit LGBTQ+ people. Future research should focus on co-investigating with LGBTQ+ people. We also did not focus on asexual individuals (not to be confused with aromantic) who can be members of millennial couples, and sometimes they are in couples with people who are not asexual, sometimes even engaging in certain sexual/intimate practices and with fluctuating and varied levels of sexual desire. Including diverse groups is essential to any big picture of designing for sexual desire and should be included in future work. We focused on millennials, though we want to research if requirements can be extended to other age groups, such as the sexual desire of older adults, which are often considered asexual [50]. As the research is conducted in Western Europe (specifically the UK and the Netherlands), it is unknown whether the design implications identified in this study also resonate with people from other cultures as sex can be highly subjective to culture [1].

7 CONCLUSION

This study explored how technology can support sexual desire in cohabiting millennial couples. A survey and interviews with participatory sketching activities identified feelings, needs and requirements. Sketches derived from these interviews were evaluated

to validate and deepen insights. Findings showed people wanted to use technology to support evolving needs, creating space and exploring desire together, mitigating shame and promoting playfulness, exploring sexual knowledge and to mitigate sexual desire feeling like an activity. Based on the findings, we discussed design principles on how future technology could play an important role and be situated within the comfort of users’ private space to support sexual desire. Studies such as this are important to explore what people need from technologies as it may not always be more advanced technology but uncovering potential patterns and interactions, and ways to use them in their personal lives in an innovative way. Our research is the first in (1) providing insights in which areas related to sexual desire, technologies could help overcome difficulties, and (2) providing specific design considerations to design for sexual desire.

As we focused on cohabiting millennial couples, and our sample was unintendedly heterosexual, future research need to be conducted to evaluate whether our findings and research methods can be extended to other generations and sexualities. Dedicated research should be conducted to explore queer individuals and their needs in technology to enhance sexual desire. This research was a first attempt at exploring foundational principles for designing for sexual desire. Future research could be conducted to explore how these principles can be used to create innovative design solutions to validate whether the design principles actually ‘work’ in practice, their context, and whether this elicits new needs. In this, it is important to gain more understanding on how consent and privacy should be situated within technology for sexual desire.

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8 APPENDICES

A APPENDIX: OTHER PERSONAS



Satisfaction sexlife: 7/10
Feeling desire: biweekly & unsatisfied
Engaging in sex: weekly & satisfied

Lou (27) Cohabiting 6 years

"Sex itself is not really important to me, it's more a way to connect with my partner and be intimate."

Goal

To explore whether they could enjoy feeling sexual desire to enhance intimacy with their partner.

Scenario

Lou sees how their partner enjoys feeling sexual desire, which Lou finds difficult and less necessary. Lou might want guidance on how to connect more intimately with their partner and their own body to better to explore whether they can more enjoy feeling sexual desire, but is hesitant to use technology.

Frustrations

- Struggle to feel attractive
- Difficult to get aroused
- Difficult to talk on what they like

Behaviours in maintaining desire

- Make time when they feel it's needed
- Tried toys, but they're not really open to use products



Satisfaction sexlife: 8.5/10
Feeling desire: daily & satisfied
Engaging in sex: 3-4/week & satisfied

Quinn (29) Cohabiting 3 years

"I am pretty happy with my level of desire and sex life, and am just looking for things to make it even more fun."

Goal

Further stimulate their desire and learn new fun things to try as a couple.

Scenario

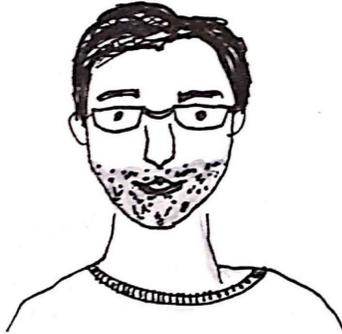
Quinn enjoys feeling sexual desire and is curious to learn more about the impact of different moods on sexual desire, but also more on exploring fantasies and types of sensual pleasure to further stimulate their sexual desire.

Frustrations

- Stress affects their sexual desire
- Smartphones can distract from their time as a couple

Behaviours in maintaining desire

- Weekly makes time, dress up, trying new things
- Sex toys, powerplay attributes



Satisfaction sexlife: 5.5/10
Feeling desire: almost daily & unsatisfied
Engaging in sex: 1-2/week & unsatisfied

Remy (35)

Cohabiting 5 years

"I'm quite a sexual person, but my partners' desire is lower. I don't know how to cope with this and can feel rejected."

Goal

Communicate more openly to understand and mitigate the differences in desire between them and their partner.

Scenario

Remy spontaneously experiences desire and tries to seduce their partner, who reacts dismissive. Remy feels rejected, and finds it difficult to communicate this. Remy would like to better understand and communicate their (differences in) sexual needs to become more intimate.

Frustrations

- Desire discrepancy
- Stress affects desire
- Difficult to talk openly
- Difficult to know what they like

Behaviours in maintaining desire

- Regularly make time
- Occasionally try new things
- Challenge games, porn, powerplay, toys



Satisfaction sexlife: 4/10
Feeling desire: 2-4/month & unsatisfied
Engaging in sex: 1-3/month & unsatisfied

Alex (29)

Cohabiting 7 years

"I'm currently just not feeling sexual. I want to understand why and experience more sexual desire, but I don't know how."

Goal

Knowing more ways on how they can go from intimacy to feeling sexual desire for or with their partner.

Scenario

Alex' partner tries to initiate sex, but Alex currently feels too stressed/low on energy to be able to feel desire. Alex would like support in communication and ideas on non-threatening activities that may lead up to feeling desire, to experience more intimacy and, if possible, also pleasure with their partner.

Frustrations

- Desire discrepancy
- Feels obligated to have sex
- No time or energy, stress
- Difficult to talk openly

Behaviours in maintaining desire

- (Bi)weekly dates
- Make time
- Use sex toys