



Shaping Romance: Mediating Intimacy for Co-located Couples

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ABSTRACT

During recent years multiple studies focused on how to mediate the intimacy of couples over distance by researching various intimacy aspects, such as physical contact and disclosure. At the same time, mediating intimacy for co-located couples remains relatively unexplored. Our paper focuses on this and presents an empirical field study involving 13 co-located couples that interacted with a technology probe titled ‘Shaping Romance’. In short, our qualitative findings show that technology can mediate intimacy by allowing partners to look inwards and reflect on their own desires, look outwards and reflect on the desires of their partner, and look at the whole by remembering, acting and validating. Our contributions to HCI are the technological intervention itself, our findings which highlight limitations and opportunities technology has for mediating the intimacy of co-located couples, and a design space full of dilemmas that we present for future researchers and designers.

CCS CONCEPTS

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

KEYWORDS

co-located couples, intimacy, togetherness, physicality, disclosure, field study, technology probe, design space, dilemmas

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1 INTRODUCTION

Intimacy is an interesting topic for conducting research within the HCI domain as it is related to our deepest desires and core sensitivities as humans. It is also a very delicate area because the idea that technology can always provide a solution is far from true. Intimacy is approached by the main body of research as a collection of attributes that are characterizing people’s relationships. Those attributes, which will be unfolded in detail in the related work section, are present in all types of relationships, and in particular in the romantic ones, which is the topic of this paper.

Multiple researchers have explored the intersection of technology and intimacy, and most research efforts focused on mediating physical intimacy over distance (for example [44, 59]), or facilitating awareness and a sense of presence of a distant partner (for example [20, 21, 57]). In this context, researchers have demonstrated that technology can have a positive outcome by bringing the partners closer to each other. In the case of co-located couples though, which is the focus of this paper, technology does not always have a positive effect. Often, technology can interfere, bring frustration, or even damage romantic relationships when its use is not relevant for both partners [25, 39, 42, 50, 52]. But in the cases where technology is specifically designed for mediating intimacy for co-located couples, research findings look more promising. For example, in [6, 8] where the researchers worked with marriage and family therapists and in Lucier-Greer et al.’s [38] work inspired by couple and relationship education (CRE), researchers found that some technological interventions can be beneficial as couples can develop new understandings of themselves and acquire a renewed sense of partnership and commitment.

In this paper, we extend this research domain by focusing on mediating the intimacy of co-located romantic couples through a technological intervention called Shaping Romance. Shaping Romance was deployed as a technological probe [26] on a two-week field study with 13 co-located couples. Our contribution to HCI is the technological intervention itself, our qualitative findings from its deployment and a design space full of dilemmas that can be useful for future researchers and designers.

Our paper is structured as follows. First, we discuss the various understandings of intimacy that exist in related work and after briefly presenting research for distant couples, we highlight research that focused on mediating intimacy of co-located couples.

Then we present our technological intervention along with details on our method, participants, data collection and data analysis. We proceed with our qualitative findings which revolve around three main themes and subthemes. We conclude by linking our findings back to related work, by highlighting a design space full of dilemmas for future researchers and designers, and by reflecting on our research approach and our limitations.

2 RELATED WORK

Intimacy is a term used in research but also in our everyday lives to describe a sense of closeness and connectedness with another person [25, 28, 42, 58]. It is an important part of the social life of humans (and animals), and having intimate relationships is linked with improved mental and physical health, lower levels of depression and less severe responses to stress [47, 58]. In relevant research work, there are multiple definitions of what intimacy is, and the most common approach is to understand intimacy as a set of attributes. Not all definitions use the same attributes though, but recurrent intimacy attributes consist of self-disclosure (e.g. [11, 35, 51, 58]), verbal communication (e.g. [1, 22, 43]), non-verbal communication (e.g. [35, 49, 51]), physical intimacy (e.g. [35, 40, 49, 51]), commitment (e.g. [11, 35, 40]), mutuality (e.g. [11, 35, 40, 58]), and trust (e.g. [11, 49, 58]).

In short, self-disclosure occurs when someone shares deeply personal information about oneself with another [11, 35, 51, 58], and an increase in intimacy may take place if the other person responds positively, or equally [35, 51]. Non-verbal communication occurs when people express themselves through body language, facial expressions or gestures [35, 51], either consciously or unconsciously [51]. Physical intimacy occurs when people are in general physically close to one another, have physical contact, or have sexual encounters [35, 49, 51]. Likewise, it also entails the bodily reactions to the aforementioned interactions, such as 'butterflies in the stomach' [35, 40]. Commitment is a feeling of cohesion and the extent people see a relationship to continue for an indefinite period [35, 40]. Subsequently, misunderstandings or different levels of commitment may lead to a decrease in intimacy [11]. Mutuality is closely related to commitment and is about building and nurturing a relationship [11, 35, 40, 58]. Finally, trust is the feeling of safety within a relationship that one's partner is not going to take advantage of it [11, 49, 58]. All these attributes can be present at varying levels in different kinds of relationships, such as between acquaintances, colleagues, friends, and family, but all of them are regarded as fully present in a romantic relationship [28, 40, 58].

We will start unfolding the related work by briefly highlighting some of the research carried out on intimacy within families. In [10] the whereabouts clock was created, which visualized each family member's current location, such as home, school, and work. Based on the families intimate knowledge of each other's routines, it was possible to interpret the clock and see "everything is right in the world" [10]. Virtual Box was designed to mediate play between parents and children over a distance [15]. The main idea behind the design was that a virtual box containing videos, pictures, text, and gifs is hidden and hereafter searched for in the physical space. When the box is found the content can be seen on an accompanying device. The authors found that creating the box could evoke

feelings of intimacy, and both searching and finding the box mediated expressions of intimacy [15]. Digitally enhanced storytelling was also identified as increasing intimacy among parents and children [12], whereas documenting and then projecting the history of a home through an oversized beanbag chair allowed for playful and intimate experiences of past memories [46].

For communication and self-disclosure of romantic couples, there have been many studies that focused on how they utilized existing communication technologies. In [43] researchers studied long-distance couples' use of video chat and found they are often left on for extended periods, creating a shared sense of presence and a feeling of being day-to-day companions. Furthermore, in [54] it was identified as common for couples to switch means of communication during a conflict at least once, (and sometimes multiple times) for managing or resolving it. This switching of means of communication for co-located couples was also studied in [14]. Such switches were typically based on the context of the conversation and time of day, and for leveraging the characteristics of different mediums for affect-oriented and practical purposes [14]. In [1] couples' use of multi-channel topic-based messaging apps was studied, and it was found they helped the couples feel more organized, keep track of topics, and find content more easily. No differences were found between co-located and long-distance couples. However, the value of such an app was only appreciated when both partners used it [1]. Furthermore, sharing of devices and accounts can happen intentionally or unintentionally, though specific content types e.g. a conversation with other people are desired to be kept private [27].

Within HCI multiple studies focused on mediating intimacy in romantic relationships through tailored made technologies. One of their common characteristics is that they typically deal with long-distance relationships or couples that are temporarily away from each other. Many of these studies (summarized by [23]) utilize six strategies for mediating intimacy: awareness (for example [2, 20, 21, 57]), expressivity [30], physicalness (for example [31, 44, 59]), gift giving [34], joint action [24], and memories [3]. In detail, for physicalness in [31] and in [44] researchers emulated holding hands over a distance, while in [59] they used an inflatable vest to emulate a hug over distance using pressure. In relation to awareness and presence of a distant partner, in [20] they are facilitated through the creation of digital notes which are then printed in their partner's sock drawer, while in [21] through The Sensing Beds, which create the sense of lying in bed with one's partner using heat. Towards this end, in [2] vibrotactile feedback is used based on a partner's arrival and departure from predetermined locations, and in [57] three minimal networked devices (feather, scent and shaker) are used for creating awareness between distant partners, similar to '*How do I love thee*' [31] and '*Honey I am home*' [29]. But whether a couple has previously lived together or not also influences the way these technologies are accepted and valued. In [37] MissU was created to privately broadcast music and background noise for long-distance couples. Couples who had previously cohabitated used MissU to maintain daily routines and that showed trust and openness, however, couples who had never cohabitated often perceived the application as an unpleasant tracking tool and as inefficient for communication [37].

While the aforementioned examples are representative of a larger number of HCI studies that focused on intimacy for couples over

distance, there are not that many studies that dealt with mediating intimacy for co-located couples. We have managed to identify 6 research studies and two commercial applications which are presented next. In [22] the mobile application Lifelines is presented. The application shares multiple persistent streams of data between the partners e.g., closeness to home, steps, and media, in one continuous visualization. The couples can toggle the individual streams on and off or remove the visualization on their partner's application. Based on their intimate knowledge of each other's routines, the couples were able to infer different activities or extract meanings out of multiple data streams [22]. Lifelines changed the couples' communication in two ways: data that challenged a partner's knowledge of the other triggered direct communication, and data that confirmed a partner's knowledge replaced direct communication. These new communication dynamics were generally used for implicit coordination of tasks, reassurance, and feeling more connected. However, if the application was not used much and data sharing was limited, that led to the partners feeling more distant.

In [32] expressing intimacy through lyrics is facilitated by Lily. Lily is intended to refine a couple's affective communication based on real-time suggestions from romantic song lyrics. Lily first reads a partner's original message and then provides three suggestions with similar meaning, but with richer expression. Lily inspired the participants to refine their affective expressions but also inspired conversational topics, and the effect was also extended beyond the use of Lily. However, in some cases some partners' affective expressions were perceived as fake and lacking integrity [32].

In [13] 'Digital Kick in the Shin' is presented, a design that enables partners to send subtle cues through vibrations for prompting an action. The intention behind the design is to be used during face-to-face conversations while in the presence of other people. Herein the design mediates and enhances non-verbal communication between partners. The authors conclude their paper with different scenarios on how the design could be used.

Focusing on self and mutual reflection a design titled 'A Diary Built for Two' is presented in [7]. It consists of two digital diaries with a function for sharing selected sections, and through reflection the design mediates self-disclosure and mutuality between the partners. After deploying the concept with ten couples for two weeks, the researchers identified that three couples saw utility in the concept. For those couples the diaries made them reconnect and feel more empathetic for each other. On the other hand, two couples experienced a disconnection between them. Therefore, the researchers concluded that technologies for intimacy might not be suitable for all couples, as some may have deeper issues and need a professional therapist [7]. Towards this end, in [38] a mobile application for enhancing relationship skills through principles from couple and relationship education (CRE) is presented. Each day a couple was presented with a question and when both partners have answered it, the answers were revealed to each other. The technology mediates self-disclosure and mutuality between the partners. The participants were highly engaged in using the application through the 21 days of the study. Participants stated the application was entertaining and efficient for staying connected and they also felt a renewed sense of partnership and commitment. Overall, by the end of the study the researchers identified a

significant improvement in the relationship skills for most participants [38].

Finally, we identified two commercial applications that are relevant for co-located couples. First, the application 'Fix a Fight' provides tools for repairing relationship ruptures after an argument [16]. The application is used on one device and is passed between the partners, thus mediating self-disclosure. Second, 'Kindu' is an application aimed at couples that want to explore their common desires [33]. Each partner is presented with an activity, which can be marked as desirable, maybe desirable, and undesirable. The common desirable- and maybe-activities can then be viewed by the partners afterwards. This application partially mediates self-disclosure as desires are revealed on the basis they are shared by the partners.

3 SHAPING ROMANCE

Shaping Romance is a technological probe [26] that consists of two parts: the personal sliders part and the joint objects part that both focus on facilitating *awareness* and enhancing *non-verbal communication* of co-located couples by mediating three intimate desires: togetherness, physicality, and disclosure. Togetherness refers to the desire to engage in activities together with one's partner, physicality refers to the desire to be physically close to and/or intimate with one's partner, while disclosure refers to the desire to share something personal with one's partner. These three desires were chosen inspired by the recurring attributes of intimacy presented in related work. In detail, our physicality and disclosure correlate with the two intimacy attributes of *physical intimacy (physicalness)* and *self-disclosure (expressivity)*, while togetherness is encompassing *connectedness* and *closeness* in an intimate relationship, that can be mediated through different activities. Furthermore, we did not include the desires of *mutuality*, *commitment*, *trust* and *memories*, as we see them as long-term effects of a couple being intimate.

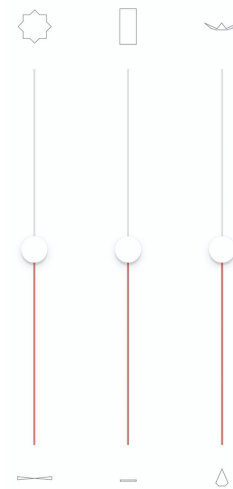


Figure 1: The personal sliders part of Shaping Romance where three sliders represent the three intimate desires of togetherness, physicality and disclosure (from left to right).

The personal sliders part of Shaping Romance consists of a mobile application which acts as an input interface where each of the

partners sets their own desires using three sliders, one for each of the three desires. How the intimate desires of togetherness, physicality, and disclosure will be understood and performed is left up to the partners though the ambiguity of the interface (Figure 1, ambiguous icons). We envisioned that partners would initially negotiate and reflect on how they understand the three desires, and then each partner would individually set their desires using their own mobile phone. In Figure 1 all three sliders have been set in the middle and the sliders correspond to togetherness, physicality, and disclosure (from left to right). Inspired by Gaver et al.'s work on ambiguity as a resource for design [17], we opted not to provide any numerical, or other types of informational cues for the sliders, besides an outline for the low and high points. Through this, we hoped that we would urge each partner to reflect on what a low or high desire means to them both in general and at a specific moment.

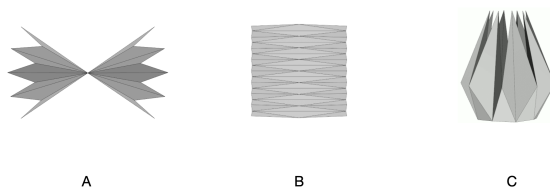


Figure 2: The objects part of Shaping Romance where three objects represent the three joint intimate desires. A: low togetherness, B: low physicality, and C: low disclosure.

Whenever a partner sets their individual desires, the objects part of Shaping Romance becomes the focus of attention. Here, another mobile application presents three objects which project the couple's joint desires of togetherness, physicality and disclosure. The joint outcome for a couple is defined as the average of the individual inputs as set through the personal sliders. For example, if the personal slider for one desire is being set as high from one partner and low from the other, then the corresponding object will project their average. Thus, the objects act as the joint output of a couple's intimate desires.

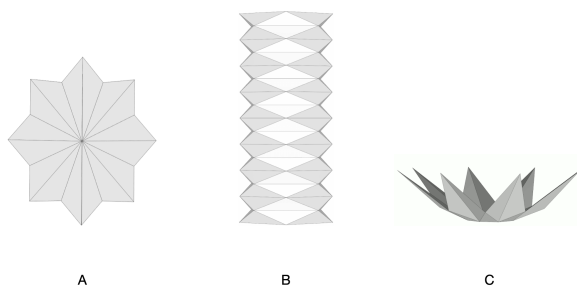


Figure 3: The objects part of Shaping Romance where three objects represent the three joint intimate desires. A: high togetherness, B: high physicality, and C: high disclosure.

In Figure 2 the objects reflect low joint desires, while in Figure 3 high joint desires. Every time there is a change in one partner's

individual desires through the sliders, the objects slowly animate to reflect this change. For example, if one or both partners sets the disclosure slider from low to high, then the disclosure object will start opening up accordingly. Again, inspired by Gaver et al.'s work [17] the objects were designed to be ambiguous urging the partners to reflect, this time, on their joint desires and the impact their individual desires have on the whole. For example, to reflect on what it means for them as a couple that the disclosure object is fully open. We envisioned that the objects part of Shaping Romance would be on permanent display at a specific location of the couple's home (for example, on a fridge, Figure 4C).

The design of the objects part is based on origami patterns. We opted for origami because they offered us numerous options of shapes that we could use and because each of their states is relatively easy to distinguish and/or control. All objects in Shaping Romance were created using an origami simulator [19, 55], where it was possible to record GIF image files of different folding sequences. We experimented with different origami for the three desires until we reached the final design. For togetherness, the object represents the idea of 'coming together' where the two sides of the object are coming closer and closer until they become one (Figure 2A and Figure 3A). For physicality, the object imitates a phallic symbol (Figure 2B and Figure 3B), while for disclosure the object represents the idea of 'opening up', where the object slowly opens up like a flower (Figure 2C and Figure 3C).

Shaping Romance was developed utilizing the JavaScript library React [48]. React enabled us to develop the two interactive interfaces in the form of a progressive web app (PWA). We opted for PWA mainly because users do not have to install something on their phone, thus no possible users are being excluded from using Shaping Romance as long as they have internet access on their phone. Each couple using Shaping Romance was provided with an authentication interface handled by Google Firebase, which also acted as a real-time database for storing the sliders' values. Finally, in order to collect interaction log data, we used Google Analytics.

4 OUR STUDY

A field study was conducted in order to gain insights into how technology can mediate co-located couples' intimacy in a real-world context and how did they understand and reflected upon the three desires of togetherness, physicality, and disclosure. For this purpose, Shaping Romance was deployed as a technology probe [26]. The following subsections present details about the participants, the procedure, and how the data was collected and analysed.

4.1 Participants

To carry out the study, we started looking for participants by asking members of social networks to post a call-for-participation message and by posting the same message to a local Facebook group intended for finding research participants. Three inclusion criteria were applied: participants had to be in a romantic relationship, they had to live together with their partner, and both partners had to want to participate in the study. No restriction criteria in terms of age, marital status, nationality, and sexuality were applied.

Table 1: Overview of couples, partners' age, duration of relationship, and time living together.

Couple	Age (P1, P2)	Duration of relationship	Time living together
C1	25, 24	1 year	1 year
C2	23, 21	3 years, 6 months	1 year
C3	28, 25	1 year, 6 months	1 year
C4	25, 25	9 months	1 month
C5	25, 23	5 years, 6 months	2 years, 5 months
C6	23, 22	6 years, 6 months	8 months
C7	23, 23	4 years	3 years
C8	23, 25	4 years	3 years
C9	25, 24	2 years, 6 months	1 year, 3 months
C10	25, 24	3 years, 6 months	1 year, 6 months
C11	25, 26	7 years	6 years
C12	28, 26	2 years	1 year, 6 months
C13	26, 27	9 months	6 months

In the end, and by strictly following our institution's policy for conducting research, 13 couples (26 people) volunteered to participate after being briefed on what the study was about and being informed that they could end their participation at any moment. In Table 1 their demographic details are presented. All participants were heterosexual and self-identified as male or female. Their ages ranged from 21 to 28 years old. They were involved in a romantic relationship with their partner for a duration ranging from 9 months to 7 years. All of them lived together from a minimum of 9 months to a maximum of 6 years.

4.2 Procedure

Since the study was carried out during the COVID-19 lockdown in Denmark, all interactions with the couples took place online. During our first online meeting with each couple, we explained our study's purpose, asked for their written consent, and instructed them that they could use Shaping Romance any way they saw fit and that they could end the study at any moment. Then, we introduced them to the probe, briefly explained the meaning of sliders and objects, and helped them install it on their devices. We also urged the couples to install the common objects part of Shaping Romance on a separate device and place it at a spot in their home they believed it was suitable. Four couples chose to do so and all installed the objects part of the Shaping Romance on a tablet. The tablet was placed on a shared workstation, on a bench in the kitchen, on a fridge and in the living room next to a TV. Figure 4 depicts example usage instances of Shaping Romance. In detail, C12 often negotiated together on how they should set their personal sliders (Figure 4A), C1P1 (couple1-partner1) used Shaping Romance as a discussion point during an online gin tasting event (Figure 4B), while C2 decided to permanently place Shaping Romance on their fridge (Figure 4C). Overall, the couples used Shaping Romance for two weeks.

4.3 Data Collection

During the two weeks the study was carried out, we collected data from three sources: interaction log data (automatically), digital diary data, and a semi-structured interview.

The interaction log data concerned: a) where each partner placed the sliders, b) time and date of setting the sliders, and c) time spent on viewing the objects. The last variable was only relevant for participants that only used their personal mobile phones, as in the cases where Shaping Romance was displayed on another device (such as in Figure 4C), time spent on viewing the objects was meaningless since the screen was basically turned on all the time.

As part of the study, each partner had to answer a digital diary [36] with five predefined questions concerning their day and their experience with the probe ('how was your day?', 'what did you do together with your partner?', 'how did the objects influence you?', 'how connected did you feel with your partner after these activities?', and 'how well did the objects reflect your sliders?'). Our intention was that each partner would individually answer those questions. Inspired by [5], the digital diary was set up as a chatbot on Facebook Messenger and all participants' answers were automatically logged in a Google sheet document. The diary questions were sent to each partner every day at a predefined time they had decided upon. All partners wanted the questions to be sent out in the evening and their selected times ranged from 19:00 to 22:30. Besides acting as a data collection mechanism for our study, the diary questions also acted as a reminder to the participants to use the probe (similarly to [45]). Moreover, the participants were encouraged to use the chatbot for sending pictures of different contexts/situations in which they used the probe. All data collected through the chatbot were only visible to the researchers.

Finally, at the end of the study, we conducted a semi-structured interview [4] with each couple, where both partners were present. We opted for a joint interview, as we wanted them to jointly reflect and express their opinions, agreements and disagreements about the prob. This was particularly useful, as we already had some data about their individual opinions through the diary questions, since friction points proved to be very revealing about their experiences with the probe. Besides using specific excerpts from their digital diaries, we also developed an interview guide to structure our interviews. The guide consisted of five main questions and several sub-questions, covering how the couples used and understood the probe, what was the meaning of the objects and the sliders for them,

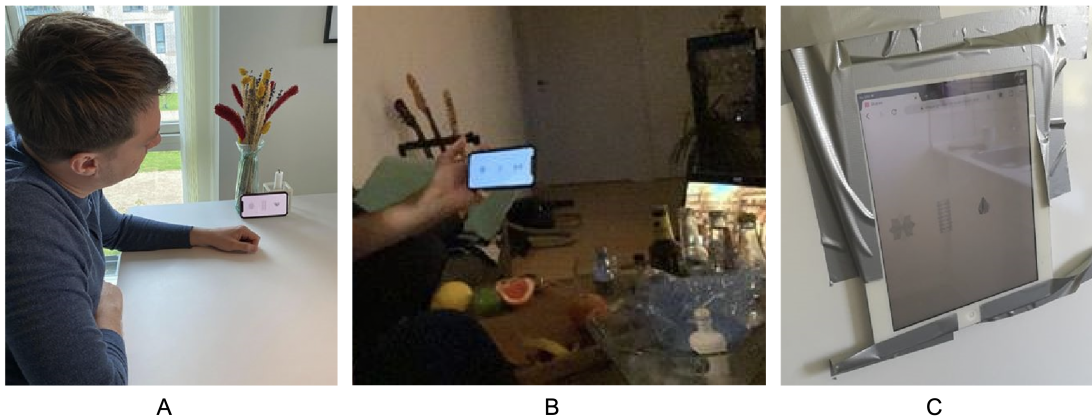


Figure 4: Examples of the different usage instances of Shaping Romance. A: using Shaping Romance together with your partner (C12), B: using Shaping Romance as a discussion point during an online gin tasting event (C1P1), and C: placing Shaping Romance permanently on the fridge (C2).

and how the probe mediated (or not) their intimacy. Each couple was interviewed together over Whereby, an online video conferencing software. The interviews ranged from 15 to 30 minutes, and all interviews were audio-recorded.

After collecting the data, each couple was assigned an id (e.g. C1-C13) and all data were stored anonymously. As a small note, prior to the actual study, a test run was conducted with another couple. The purpose of the 5-day test was to check for software bugs, and to refine and adjust the digital diary questions as well as the interview guide.

4.4 Data Analysis

The anonymous diary entries and transcribed interviews were analyzed inductively using thematic analysis in an effort to identify themes that could characterize the entire dataset [9]. Due to the inductive approach, data was coded without a pre-existing coding framework. Data were coded individually by three of the authors, whereafter, the codes were collated and then revised to ensure consistency. In the end, through an iterative process, the codes were grouped into themes, resulting in a final thematic map consisting of three main themes namely *experiencing the probe*, *mediating intimacy*, and *appropriating and extending*.

5 FINDINGS

Our findings are structured as follows. First, we briefly present relevant quantitative findings in the form of log data, and then we present in detail our qualitative findings using illustrative quotes that emerged from the digital diaries and the interviews.

5.1 Usage Data

Due to a technical error interaction log data were only logged for nine couples out of thirteen. Even though all couples had access to the probe for 14 days, they did not interact with it all the time. On average the couples submitted data 11 times over 6,6 days (max = 10,5 days, min = 2,5 days). The submits were predominantly done during the evening (19:00 – 22:30). The digital diary explains why this time window was used, as it often acted as a reminder for using

the probe, since the diary questions were sent at the aforementioned time frame. On average the couples interacted with the probe for 1m 12s each day of the study, while it is unknown how often they consulted the sliders without making any changes to them. In total, the couples created 210 diary entries (max = 14 entries, min = 2 entries), which varied between 1 and 109 words. Only three couples chose to send us pictures and five pictures were received in total.

In the following subsections, we will continue by presenting the three main identified themes and their subthemes, as they have emerged from the qualitative data.

5.2 Experiencing the probe

The first theme that emerged from the thematic analysis is related to how the probe was experienced by the couples. It consists of three subthemes related to how the couples assigned meaning to the probe, what was their attitude towards the probe, and their interaction strategies with the probe.

5.2.1 Meaning making of the probe. At the beginning of the study, all couples started exploring the probe and assigning different meanings to it. Their initial explorations revolved around the interface, where most started discussing what the sliders and the objects meant due to their ambiguity, even though they have been briefly introduced to the three intimate desires of togetherness, physicality and disclosure that were represented. For example, C1 informed us that they initially “[...] *tried to figure out what the objects meant*”, and C3P1 that “*they [objects] became a fertile ground for conversation, a fun one, on what they symbolized*”. These initial explorations also included playing around with the probe in order to understand the impact of the sliders on the objects: “*I put them all the way down to the bottom to test at some point, simply because I became curious*”, (C3P1). In general though, there was no ambiguity in the interaction with the probe: “*The more we needed something, the more they grew, the more they filled*”, (C11P1).

For all couples, togetherness was understood as doing activities together as a couple, but for the other two intimate desires, different

interpretations emerged. Physicality was understood in three ways. First, as doing physical activities together: *"I thought of it as a common physical activity"*, (C1P1). Second, as being physically close: *"When we both answered high on physical contact, then it did not matter to stay lying on the couch a little longer, because I felt more confident that he wanted it too"*, (C6P2). And third as having physical contact: *"You set your physicality completely up because you needed to hug at some point, also it was like that, so my physicality it is completely up so now I have to have a hug"*, (C12P1). These different meanings for physicality existed even within the same couple. For example, C1P1 viewed physicality as physical contact, while C1P2 as physical activity.

Different meanings were also assigned to disclosure. Some couples viewed the disclosure slider/object as indicating that they had to simply spend time with each other: *"We have found it also can be used as an opportunity to sit and talk together"*, (C11P1). Others approached it as a way to talk about how they felt (*"They made me think about what my needs are, which I then told my boyfriend"*, C12P2), to talk about their relationship (*"I think it was very nice [...] it was very good that it was very clear to both of us when it was needed. It's not [...] It's a little strange to talk to each other about what you need"*, C13P2), or to talk about difficulties they had during the day: *"So the last object, I see it a bit like a flower opening, which can be seen in relation to the fact that I needed to talk/come out with some negative feelings I had today"*, (C12P2).

These different meanings that were assigned to the three sliders/objects led to different approaches in terms of using the probe. Four couples felt they needed to set all the sliders at the same level, as they wouldn't distinguish among the three intimate desires. For example, C9P2 informed us that: *"From what I remember from the introduction [...] And maybe I mix these two, but it's something with physical contact and presence generally or something like that. But those two are always very similar in my mind"*. Others, used the probe as we envisioned by setting the sliders differently and independently from each other, while one couple moved a step further and started reflecting on the limitations of narrowing down a complex phenomenon such as intimacy into three sliders: *"But it's also something like, but what is behind it. It is a simplification [...] I think it is too simplified in some ways"*, (C4P1).

Finally, the objects themselves also became part of the meaning making process as many couples (10/13) started assigning symbolic representations to them. For example, C12P1 noted that *"this disclosure is like a flower that opens [...] and it shows the real you"*, while C1P2 moved a step further by stating that *"the one to the left [togetherness] looked like a butterfly, so there I thought it might be something like you need fine clothes and wine"*.

5.2.2 Attitude towards the probe. After the initial explorations and meaning making activities, the couples started embedding the probe into their everyday life. Besides its role in mediating intimacy, which is discussed in detail in the following subsections, couples had different approaches and attitudes towards the probe.

Overall, for the majority of couples (11/13) Shaping Romance made sense in the end: *"I definitely think the app has had an influence on our intimacy, since it has made us more aware of our desires. Therefore, we are better at taking into account that we should be together and do some activities that are not just work and other*

responsibilities [everyday chores]", (C8P2). Those couples reached this point even though in the beginning it may have seemed difficult for them: *"I think it was hard to get to use it, [because] it does not feel that natural, as we usually talk about what we feel"*, (C7P2).

At the same time though, two couples viewed the probe as awkward and unnecessary. In more detail, C7P1 informed us that *"it was a bit awkward in some way because it felt a bit like you distance yourself from your partner when you want to know what you are feeling by doing it through an app"*, and similar were comments from C2P2: *"If I really need to talk about something, then I think it is awkward to update it on the app"*. However, many couples could see some value in the probe for new couples: *"it is maybe something that is better for new couples, who are not yet comfortable opening up about these things"* (C7P1), or for couples that experienced problems in their relationship: *"I think it would be very good for people who might have major communication problems in their relationship"*, (C13P2).

Finally, in two cases only one of the partners saw value in the probe while the other did not: *"Not so much [came out of it], as my boyfriend forgot to use it"*, (C13P2), and *"it was usually just one of us who sent something in"*, (C1P1).

5.2.3 Interaction strategies. Throughout the two weeks that the probe was deployed, the couples developed different interaction strategies. Some found the separation between the personal part of the probe (the sliders, where they could express themselves) and the common one (the objects, where they could see their joint desires) as meaningful: *"I think it makes good sense there's a differentiation between what's commonly related to the relationship and one is more related to the individual"*, (C9P1). Typically, couples that approached the probe this way would individually set the sliders, and then observe the objects together: *"We filled them out individually, but then we talked together about it"*, (C13P1).

On the other hand, some couples developed the opposite interaction strategy and preferred to first negotiate together on how to set the sliders, and then set them at the same time: *"We set the sliders together and agreed that we would use some time for us now that our son has been tucked in"*, (C11P1).

Finally, very often the probe was also used to indicate or nudge that something should happen. For example, C14P1 informed us that she *"set the sliders all pretty high to communicate that we should do something tonight"*, or we found out that C8P1's partner set the slider high and *"[she] wanted to be more physical when I sat on the computer, so I went to you [him]"*. Often, these interactions were of playful nature: *"I got him to set his needs and then I could see he wanted physical contact. So, I gave him a hug. However, it was more for fun than it was serious"*, (C3P2).

5.3 Mediating intimacy

What was really interesting after the deployment of the probe was that almost all couples stated that the probe had minimum or no role in mediating their intimacy when directly asked about it. For example, C9P2 informed us that *"we do not think it is something for our relationship [...] because we are so outgoing and if there is something to say, we say it"*, while C7P2 highlighted that *"we do not think that it affected our intimacy since we have already established a good 'system' to show and talk to each other about what we need"*,

and C1P2 apologized to us for saying that *“I am afraid it had no big impact, but it may have helped us to think more about our needs on a daily basis”*.

At the same time though, during the discussions we had with the couples we discovered that Shaping Romance did play a role in mediating intimacy, which was often not realized by the couples. We categorized the different ways the probe mediated intimacy into three subthemes, which are presented next.

5.3.1 Looking inwards: Reflecting. Shaping Romance mediated intimacy by urging the partners to look inwards and reflect about themselves and how they felt. These reflections were mainly driven by setting the personal sliders and answering the diary questions. As explained by C12P2 setting the sliders had an impact on her as *“you are kinda forced to stop and reflect about, what is it actually I desire right now”*. Similar reflections sparked among most partners. For example, C11P2 informed us that *“the sliders made me think about, what my needs are”*, C8P2 that the diary questions *“dawned on us, or at least me, that I had written the same thing four days in a row”*, and C9P1 that he started reflecting usually in the mornings: *“I just felt, OK, now I have slept. It is a new day. Where am I? What do I need?”*.

As a result, such reflections helped some participants to better know themselves and to better know how they should/could act in their relationship. A representative example of the first was provided by C12P2 while stating *“I have become more aware of my desires because I should stop and feel”*, and of the second by C9P1 who said that the probe is about *“contemplating the relationship and yourself. I think it gives food for thought regarding how you should behave”*.

At the same time though, these reflections were not always shared with the partner, and thus they were often not acted upon, leaving the partner to presume that nothing has changed. The main reasons for this were a) that sometimes some issues were difficult to discuss but it was nevertheless important that they were visible for their partner to see: *“if you have some things that you do not just want to say [...] then it can be cool if [they] can see”* (C3P2), and b) sometimes some things were difficult to articulate: *“it was a way to express some needs that we otherwise express very implicitly”* (C2P1), *“it’s not something you ask ‘hello do you want to be with me right now?’, ‘do you want to talk with me?’ So, it’s not really something you ask each other about. So, it reflects. No, reflect is not the right word. It just tells very well something you do not necessarily talk about”* (C6P2).

5.3.2 Looking outwards: Caring. Shaping Romance also mediated intimacy by urging the partners to look outwards and reflect on the needs and desires of their partner. It helped some of them realize that it is often not clear for them how their partner felt, as highlighted by C6P2: *“We try to sense it, but it’s not always you can sense the right thing, so it would have been difficult without it [the probe]”*. Others did not have that need: *“I think we are very comfortable in just saying what it is we need and feel like doing”*, (C7P1).

The fact that one partners’ desires were made visible through the common origami objects led to two different caring approaches from our participants. Some realized that it was time to act, as explained by C12P2: *“if one has an actual desire for it, then it should*

be met”. A few felt compelled to act: *“We spent some time together since they [the objects] knew the need for physical contact”*, (C7P1). Most of the time these actions led to activities that both partners were happy to participate in: *“we have different needs, even if we put them individually. But we can just find something, one common denominator that we can do together so we are both happy”*, (C13P1). But they were a few instances where one partner got involved in an activity because *“sometimes you overlook your own needs if the partner has another need”*, (C12P1), or because *“it seems like the one who has the biggest desire has the most power. I had sat my need for intimacy somewhat higher than my partner, who sat it very low that time. The objects still showed a generally high [joint] desire for intimacy. So, I don’t think it reflects us as a couple very well. But, in some way it makes sense, since you should especially pay attention if one of us has an unfulfilled desire”*, (C2P2).

At the same time, often the objects were used in order not to act. A reason was the realization that they were not on the same page as their partner at the moment: *“it has [also] worked the other way around. That maybe we are better at figuring out what the other doesn’t want, since it’s not something you always share”*, (C6P2). Or because sometimes in a relationship it is normal to have some personal time: *“it was clear that I needed some alone time”*, (C11P1), or *“today it showed that both did not really want to share, so it was suddenly OK not to talk”*, (C6P2).

Overall, for most partners looking outwards and caring about their partners, urged them at some point to look inwards again and reflect if they have done enough for their partners, as highlighted by C3P1: *“it made you think if you took the [necessary] time for your partner”*.

5.3.3 Looking at the whole: remembering, acting (or not), and validating. All the couples that found value in Shaping Romance started thinking about what they did together as a couple: *“I think it made us think about how we spend our time together”* (C8P1), or *“it at least made us think about how much time we should just prioritize on each other”*, (C12P1). The main reason for this was highlighted by C4P2: *“it [the probe] confirmed the desires more than it focused on them”*.

This process led couples to start acting and doing activities together. For some, what to do was obvious: *“we both wanted to be together, which resulted in watching a series together”*, (C12P1). Others needed to discuss what they should do: *“if there is a moment where you do not know what to do, we used it as an opportunity to sit and talk together”*, (C11P1). This led to various different activities for the couples, such as taking days off to spend time together (*“and then we just chose to take half a day off the calendar where we just did nothing but be together. So that was cool”*, C8P1), taking breaks from work together (*“we both needed to be close to each other and therefore we took breaks together”*, C12P1), watching the stars (*“we went out and looked at the stars in the evening”*, C8P1), or simply hanging out and playing (*“we decided to go out and get ice cream and beer, and play different games out on the lawn”*, C8P1). What was challenging for all the couples was that even though they drew inspiration from past memories, things that they used to do together, and remembrance activities in general while trying to find what to do together, many of those were not possible to realize due to the COVID-19 lockdown: *“for me it’s more about what you do outside of*

the everyday, like when we had the option to go to the cinema or go out for dinner”, (C9P2).

Nevertheless, and within these restrictions, the probe mediated new understandings of their relationships and couples felt better about it: *“we have become better at spending time together during lockdown after we started using the app”* (C8P1), or *“we got [our] expectations matched, especially in relation to togetherness, which has been nice”*, (C11P1). But things were not always positive. In some cases, the probe helped the couples to talk about issues they had in their relationship. For example, C11P1 informed us that in a few instances *“it was more to be faced with. And ‘now we have to talk about this.’ Also, it was more the conversation that became something important [not the probe]”*. But unfortunately, there were a few cases where the probe had a negative effect, as explained by C6P2: *“but on the other hand, sometimes it also had a negative effect, if the openness was small, then it just made us talk even less to each other”*. But at least, even during difficult times, the probe often provided some validation and reassurance to the couples, as highlighted by C10P2: *“I could imagine that in periods where we may not have talked so much, or felt this intimacy, you can see via the app that it [intimacy] is still there”*, or by C6P2: *“More like a confirmation: ‘Okay. it’s okay that we do this or that’, ‘we both want to be together’, ‘there is none of us who thinks: so, I have to get out of [this relationship]”*.

5.4 Appropriating and extending

As with most field studies, our study also revealed a few instances where our prototype was not used in the way it was intended. We consider these colorful appropriations as important, as they reveal people’s imagination. In a bit more detail, one participant started using Shaping Romance as a way to relax after a stressful day: *“there was something meditating about the objects. Especially that flower slowly folding out. I could just sit and look at it”* (C12P2), while another felt compelled to start doing Christmas decorations, even though the study took place in late spring: *“something with origami. The objects look like origami. So maybe we should make Christmas decorations”* (C1P2). Most though started appropriating the sliders and the objects in order to reward themselves: *“So when the circle is complete that would mean we can order pizza”* (C6P2), or *“if the objects all match then we can go out for a dinner”*, (C10P1).

The couples that engaged a lot with the probe also took the time to suggest ways that it could be extended in the future. In total, three things were requested. First, multiple couples asked that the probe could be extended to be used as a planning and recommendation tool that would allow them to set activities they could do together in the future, or that would even suggest activities on their behalf. For example, C5P2 suggested that: *“it would have more influence if it actually came up with suggestions for activities, depending on what needs one has”*. Second, since most couples viewed the digital diary as an intrinsic part of the probe, they suggested that the questions should have been sent earlier each day (even though they decided on the times) because they did not have time to act: *“then there is not so much time to change what to spend your evening on”*, (C1P2). Finally, one participant suggested creating a physical instantiation of the probe because: *“it’s a beautiful thing. And I think it have been nice to look at. I could well imagine if one [...] It could be cozy if it could be a part of one’s home so it could be a super good tool”*, (C3P2).

6 DISCUSSION

Our discussion is structured around three subsections where we link our findings back to the related work, we present a design space full of dilemmas that highlights design possibilities for mediating intimacy through technology for co-located couples, and we reflect on our research approach and highlight its limitations.

Within the context of co-located couples according to related work, and perhaps our own everyday life experiences, technology can be invading in a relationship, leading to dissatisfaction, or even conflict when its design and use is relevant only for one partner, instead of the couple as a whole [39, 50, 52]. For example, when someone is interacting with their phone, this might be perceived as intrusive by their partner [25, 39, 42, 50]. Since Shaping Romance was designed with two people in mind, our findings highlight mostly positive experiences for our participants in specific contexts, similarly to the work of [52]. In detail, in [52] researchers have identified that within the context of the bedroom, technology may lead to positive experiences if its use is negotiated by both partners. In line with this, in our study, it was mostly acceptable to interact with Shaping Romance since its purpose was related to the couple as a whole. But our study also highlights a few negative aspects of our probe. In short, there was a negative impact on intimacy when one of the partners was not interested in the technology (similarly to [52]), and in a few cases where all intimate desires were set to low by both partners. Towards this end, feeling obligated to use specific technology within a relationship was also identified by [60] as a possible cost. Similarly to this study, our findings did show that when the partners are unequally invested in the technology it may lead to unmet expectations. Such instances were very few in our data, but we can speculate that they could increase with prolonged use.

Our participants were inspired by Shaping Romance to look inwards as well as outwards. These reflections about themselves and their partners were very important for them, and our findings are in line with research work with marriage and family therapists [6, 8]. In [6, 8] the researchers describe how virtually any couple can benefit from sharing feelings and experiences, by creating patterns of positive affection, or through reflective activities. Such findings were present in our study too. Furthermore, our diary questions acted similarly to the couple and relationship education (CRE) questions that were used in [38]. They helped the partners to improve their relationship skills by better understanding not only what they desired, but also what their partner desired. As in [32] our probe inspired couples to find new ways to express themselves, spend more time together leading to increased intimacy (as in [41]), and triggered direct communication, and inwards and outwards reflections as in [22]. Additionally, our findings extend [32], as we found that making the couples aware of their partner’s and own desires helped them express themselves without external suggestions.

Finally, even though Shaping Romance was designed to mediate togetherness, physicality, and disclosure, we saw that most of Hassenzahl et al.’s strategies for mediating intimacy [23] were instantiated by our probe and were present in our data, in different extends. *Awareness, physicalness, expressivity and joint actions* were highly present with couples becoming more aware of their needs, becoming physically close, finding new ways to express themselves and doing activities together. To a lesser extend *gift giving* was

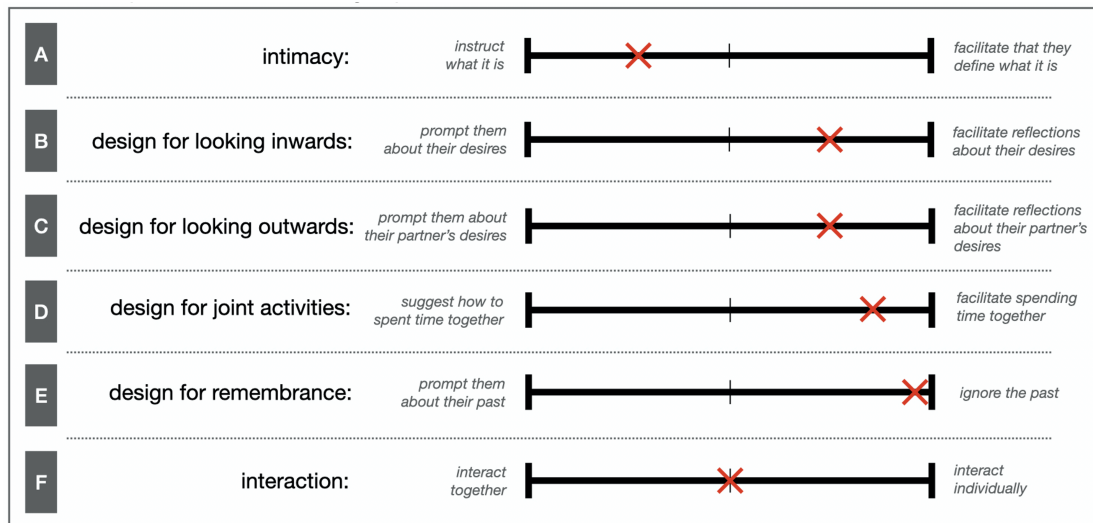


Figure 5: The identified design space for technologies that mediate intimacy for co-located couples. The design space is characterized by six dimensions (A-F), each facilitating opposing design dilemmas. Marks in red indicate how Shaping Romance populates the design space.

observed in a few instances (but approached as giving a gift to both partners simultaneously – e.g. ordering food from a restaurant), and *memories* for drawing inspiration for things partners could do together and for being reminiscent about the past. The latter though could also be present in our data due to the COVID-19 lockdown and the fact that the couples could not do the things they considered normal. We also extended [23] by highlighting the importance of disclosure and by identifying different ways some of these six proposed strategies could be understood by the couples. For example, physicality (or *physicalness*) was approached as doing physical activities together, being physically close, or having physical contact.

6.1 A design space full of dilemmas

Our findings suggest that technology can be introduced to the everyday life of co-located couples and mediate their intimacy. But even though most of our findings point to the positive aspects of technology, there were nevertheless some instances where our probe had the opposite effect, hindering the couples' intimacy. Such contradictions highlight a design space characterized by dilemmas for future designers of technologies that aim to mediate intimacy for co-located couples. This design space emerged from a combination of our findings and related work, and it requires further exploration from future studies. We treat this design space as far from complete and we hope that future research efforts will contribute to revising/extending it. Figure 5 presents the design space, along with the dilemmas in the form of extreme opposites. Marks in red highlight where Shaping Romance is placed inside this design space.

The first dimension is related to the dilemma of intimacy itself. As we know from related work there are many definitions of what intimacy is (for example [11, 35, 40, 49, 51, 58]). In our probe we defined intimacy as three intimate desires (togetherness, physically

and disclosure) and through an ambiguous design using sliders and objects, couples could either use our understanding of these desires, or assign their own meanings to them. Because in our study intimacy is defined as three desires that are open to interpretation, this is why our probe is placed towards the left side of this design subspace (Figure 5A). This decision resulted in most couples assigning their own meaning onto the sliders, while a few had troubles understanding them until the end of the deployment. Future designs can move more towards the left and facilitate couples defining their own intimacy, or more towards the right where more rigid definitions of intimate desires are provided.

An important finding in our study was the fact that partners started looking inwards, reflecting on their own needs and desires. This is also reflected in related work (e.g. [7, 22, 38]). In our case, such reflections were facilitated by our design during setting the personal sliders and during answering the diary questions. Since we did not actively prompt the couples about their desires, our probe is placed on the right side of this dimension (Figure 5B). Furthermore, what was really interesting is that all partners started reflecting, even the ones that did not interact with the probe or did not fully understand the meaning of the sliders. Future designs can move more towards the left and more actively prompt partners to think about their desires.

Of equal importance for our study was the finding that partners started reflecting on the desires and needs of their partner, which is also touched upon in related work (e.g. [7, 22]). Our participants showed a lot of care by acting, or sometimes not acting, and by reflecting if they have done enough for their partner. These acts of care were partially facilitated by our design through the common objects that signified the joint intimate desires of a couple. This is why our probe is placed on the right side of this dimension (Figure 5C). On the extreme ends of this dimension is actively prompting

the participants to think about their partner's desires or facilitating such reflections to emerge.

The next dilemma is about designing for couples to have joint activities and spend time together, which is similar to Hassenzahl et al.'s strategy [23]. Our probe is placed towards the end of the right side of this dimension (Figure 5D), since we did not actively design with this attribute in mind. Instead, the objects partially facilitated the desire to spend more time together by projecting the couple's joint desires. While the objects inspired all couples to get involved in different types of activities, many of them suggested that the probe could act as a planning or recommendation tool, suggesting them things to do. Thus, future designs can move more towards the left and more actively suggest or even instruct couples on things they could do together.

The next dilemma is about designing for remembrance (Figure 5E) (or memories [23]). Even though we somehow completely ignored the couples' past while designing Shaping Romance, in a few instances in our dataset our participants dwelled on the past. Either for getting inspired for future joint activities, during looking inwards towards themselves, or during looking outwards towards their partner. Future designs can move more towards the left of this dimension by more actively prompting the couple about their past.

Finally, the last dilemma is related to interaction (Figure 5F). Our probe is placed in the middle of this dimension, since we envisioned that the partners would independently interact with the sliders, while jointly interacting with the objects. Yet, we observed different interaction strategies, for example, negotiating together on how to set the sliders. These strategies highlight multiple opportunities for future designs, and we refer to the 4C framework [56] for inspiration on how to design for various types of complex interactions through communality, continuity, collaboration, and complementarity.

We treat this identified design space as evolving and we hope that future research efforts will contribute in extending and refining it. We also point out that this design space should not be perceived as a roadmap for success in mediating intimacy for co-located couples. As demonstrated in a few instances in our dataset as well as in related work ([7, 22], a design can have a negative impact on intimacy. Thus, we urge future researchers and practitioners that will utilise the identified design space, to also reflect and consider the negative aspects that may be brought forwards by their designs.

6.2 Reflecting on our research approach and limitations

Our initial design for Shaping Romance included a physical prototype that would shape change to project the joint intimate desires of a couple. Our idea was that it would be placed in a suitable location, such as a living room or a bedroom, and that it would constantly hint to the partners their joint intimate desires. Furthermore, similarly to [53] we wanted to play with the convention that intimacy should be hidden and kept away from others (such as visitors). Unfortunately, due to the COVID-19 lockdown we were unable to deploy it and we had to turn to a digital solution.

Having a digital solution was beneficial in terms of concurrently having access to more couples, but unfortunately it led to one of the challenges of our study. Due to our inability to physically approach candidate participants and explain to them what the study was

about, our findings only represent a demographic that is relatively young (21-28), heterosexual and western European. In terms of data collection, conducting interviews online was straightforward, while the approach of using a chatbot to distribute the diary questions proved extremely valuable as it acted both as a reflection as well as a reminding tool for our participants. Furthermore, using the chatbot to send the questions provided enough flexibility to the couples allowing them to answer them at their convenience. Even though such flexibility might also challenge data collection efforts, as in the study presented in [18] where they observed that participants sometimes forgot to answer, or answered multiple times, we recommend to future researchers and designers to seriously consider using the different combinations of data collection methods as this proved beneficial for our study.

7 CONCLUSIONS

In this paper, we reported on a field study with 13 couples that interacted with a technology probe for two weeks. The probe is titled Shaping Romance and its purpose is to mediate the intimacy of co-located couples. Our participants brought the probe into their everyday life and used it as they deemed fit. Through a combination of log files, diary entries, and interviews, valuable findings emerged on how the probe was experienced, how it mediated intimacy, and how the couples would like to see it develop in the future.

In short, our findings showed that couples were able to assign meaning to the probe and adopted specific interaction strategies for using it, while the probe also mediated the couples' intimacy by urging the partners to look inwards and reflect upon their desires, look outwards and care about the desires of their partner, and look at the whole by remembering, acting and validating.

Overall, our contributions to HCI are the probe itself, our findings that highlight limitations and opportunities technology has for mediating intimacy of co-located couples, and the identification of an evolving design space full of dilemmas. We believe this design space is valuable for future researchers and designers as it highlights possibilities and opportunities for mediating intimacy for co-located couples, and offers flexibility for design exploration. We also urge them to refine and extend it, while keeping in mind the negative aspects on intimacy that may be facilitated through their efforts.

In future work, we aim to explore more the identified design space through the deployment of different physical and digital prototypes as well as expand our understandings to couples from different demographics, sexualities and cultures.

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