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Understanding Design as a Catalyst to Engage Remote Couples in Designing for Long-Distance Relationships

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There is a gap between understanding the needs of couples who are in long-distance relationships in research and designing technologies for them in practice. The aim of this study was to understand how design can act as a catalyst in bridging the gap. Taking a user-centered approach, the study engaged with ten participants, i.e. five remote couples who had remained committed to each other in serious long-distance relationships. The goal was to build empathy with them, explore their experiences and skills for coping with long-distance relationships, identify their main challenges and needs, and understand their perspectives on existing artifacts that mediate intimacy between remote partners. As design considerations for future technology development, the findings reveal there is a need to take the strategy of customization into account when designing technologies for long-distance relationships, where customization can serve as an aid to empower remote couples as skilled practitioners to creatively use technologies so as to meet their diverse needs.

user-centered design, long-distance relationship, customization

1 Introduction

When you tell someone that you are in a long-distance relationship (LDR), what follows is often a look of pity implying “doom”. In a narrow sense, an LDR can be defined as an intimate relationship in which the couple is separated by a geographical distance that restricts physical contact and face-to-face communication.

Culturally, geographic proximity and frequent face-to-face interaction have been valued as relational necessities (Stafford, 2005). In opposition to those traditional values, studies of LDRs have remained marginalized in traditional relationship research (Jiang & Hancock, 2013). The growing interest in this domain started when Rohlving (1995) claimed the LDR as an under-studied phenomenon. A survey conducted by Guldner (2005) suggested that there are over seven million couples (i.e., 14-15 million individuals) who consider themselves in an LDR in the US. LDRs among college students occupy a significant proportion; reports estimated that 75% of college students have at some point been in at



least one LDR (Guldner & Swensen, 1995). Married couples also occupy a place in LDRs. According to Conlin (2009), approximately 3.5 million Americans live apart from their spouses for reasons other than marital discord. The international job market has been boosted by the integrated global economy, which pushes people to be apart from their loved ones in order to pursue overseas workplaces in today's competitive environment. This reason for separation from a loved one is on the rise among other causes for separation, including educational demands, dual-career pursuits, military deployment, emigration, and other such factors (Stafford, 2005). As a matter of fact, there is a tendency that the number of interpersonal relationships that have to face geographical separations, including but not limited to romantic relationships, has been steadily increasing over the past few years (Griffin & Bone, 2015).

The phenomenon of LDR has become prevalent. Despite the fact that there are numerous communication channels that have made it much easier for couples to stay in touch across the miles, technology presents a double-edged sword for LDRs. Couples maintain LDRs by using various interpersonal media, e.g. phone calls, video chats, texting, instant messaging, e-mail, etc. (Jiang & Hancock, 2013), whereas the point of frequent exchange of messages is emotional connection rather than just sharing information (Quintanilha, 2008). It has been found out that:

Most available technologies however focus on the transmission of explicit information, which neglects the emotional and subtle communication so typical for close relationships. (Hassenzahl et al., 2012, p. 30:2)

Having acknowledged the above-mentioned problem, there has been a growing body of work on designing technologies aimed at mediating emotional communication in LDRs in the field of human computer interaction over the past decade. Early studies on connecting distant loved ones through an ambient communication channel have presented a pair of beds that bridge the distance between two remotely located individuals through aural, visual, and tactile manifestations of subtle emotional qualities (Dodge, 1997); a pair of interactive picture frames which, when one of them is being touched, the other lights up through an Internet connection (Chang et al., 2001); and virtual intimate objects that were designed to express intimacy in a rich manner so that when one circle is clicked, the remote partner's circle turns bright red, and then fades over time via a low bandwidth connection (Kaye, 2006). Technologies have advanced greatly over the past decade; recent work has introduced, for instance, concepts using a pair of bird-shaped devices wirelessly connected and used to send color messages as intimate acts back and forth between two lovers (Jespersen, Stounbjerg & Verdezoto, 2015); a set of two bathroom mirrors which makes it possible to leave a message on a steamy bathroom mirror over a distance (Schmeer & Baff, 2011); a vibrotactile glove that allows couples to feel the flex actions of their remote partners' fingers through vibrotactile sensations on their skin (Singhal et al., 2017); a ring that can measure the wearer's heartbeat and send it to the loved one's ring in real time (Werner, Wettach & Hornecker, 2008); and a distributed tangible jigsaw puzzle allows couples to play remotely and synchronously (Pan et al., 2017).

It can be seen from the above that wearable technologies, ambient media, biosignals, haptic sensations, hybrid interactions, etc. are widely employed to create a relatedness experience for couples in LDRs, in order to mimic the core components of every relationship, which are to be able to see, listen to, smell and touch each other. However, the focus has been put on technology-based experience to facilitate such communication, which might make users feel overloaded by technologies, as lifeless machines and standardized tools may fail to build an emotional connection needed by them. As a result, there is a gap between understanding LDR users' needs in research and designing technologies for them in practice.

The aim of this study is to bridge the gap between research and practice. Taking a user-centered approach, this study engaged five LDR couples in a series of design activities, with a view to building empathy with them, discovering their needs and challenges, and generating insights on designing for LDRs. The intention of this study is not to present a finalized solution to LDRs, but to discuss how

design can act as a catalyst to elicit empirical insights around the experiences, challenges and needs of LDRs, and how these can act as a foundation for future technology design, so as to close the gap between research and practice.

2 Engaging authentic participants thoroughly in the design process

Prior studies have involved LDR couples in the process of designing technologies to mediate intimacy and relatedness over distance. For example, Lottridge and her colleagues engaged 13 LDR couples in the design of a technology probe to support the sharing of empty moments (Lottridge, Masson & Mackay, 2009); Chien developed different versions of a robotic pet and applied it to his own LDR in the sense of an autobiographical design exploration (Chien, Hassenzahl & Welge, 2016). LDR couples are often involved in the evaluation stage so as to achieve feedback from end users for improvements. For instance, Yang and her colleagues performed a four-week field test on a telepresence robot with two LDR couples in real-world settings (Yang, Neustaedter & Schiphorst, 2017); Gooch and Watts undertook a case study involving a single couple, who lived around 120 miles from each other, for an eight-week evaluation of a prototype device intended to allow distant lovers to share goodnight messages (Gooch & Watts, 2012b). Nevertheless, the results of a recent systematic literature review on research addressing the design of systems with unconventional user interfaces for emotional communication between partners' LDRs has revealed that most of the recruited participants in the analysis of 52 systems – filtered from the systematic search results of a total of 150 papers – were actually not remote couples in real life, but substitute participants were used instead (Li, Väänänen & Häkkinen, 2018).

LDR couples who have sustained a long-term commitment in their relationships are experts in the LDR experiences. Such authentic participants should be engaged throughout the design process as co-designers, not just in the evaluation stage, so as to design desirable LDR-oriented products that can fit into the lives of the end users. Furthermore, authentic participants should be encouraged to feel that they are seriously regarded as experts in the LDR experiences. In doing so, they will feel that they need to respond as experts in their experience domains (Visser et al., 2005), thus allowing their contributions to provide valuable insights on how technology can be designed to enhance the users' experience in LDR-oriented artefacts.

This study engaged a total of ten participants, i.e. five LDR couples (M=5, F=5) ranging in age from 23 to 45, who were involved in different stages of LDRs. The most experienced LDR couple in the study was a married couple who had been in an LDR on and off around 14 years, while the most inexperienced one was a couple who had been dating for two years, but were forced to live apart from each other for five months due to study-related obligation. Every couple selected for this study had remained committed to each other in a serious LDR, as opposed to a casual dating relationship; all participants had been in steady romantic relationships for at least two years. LDRs are diverse in terms of relationship stage, reasons for separation, miles apart, and communication patterns (Merolla, 2010). These were used as the basis for recruiting participants, who varied significantly in terms of nationality, age, occupation, location, marital status, and personality.

Given that the participants were all currently involved in LDRs, they were divided into two groups. The 'local' group included five participants (M=1, F=4) who were recruited from Rovaniemi, Finland, where the study was carried out, whereas the 'remote' group consisted of their remote partners, who had to participate remotely from China, the US, Poland, Russia and Helsinki. The participants volunteered for the study. Consent forms were provided, so as to ensure that the participants fully understood the potential risks and benefits of participating as well as their right to privacy.

3 Study design

This study consisted of three stages (see table 1) that followed an iterative design thinking process which consisted of empathizing, defining, ideating, prototyping and testing (Institute of Design at Stanford, n.d.). Firstly, the study began with gaining an empathic understanding of LDR couples.

After gathering the initial findings, challenges, needs and skills of LDRs were then defined. Following this, two workshops were conducted in order to ideate and prototype possible concepts with the participants to collaboratively design for LDRs. Lastly, the study attempted to test the feasibility of the solution for supporting LDRs. In doing so, the aim was to bridge the gap between understanding the needs of LDRs in research and designing technologies for LDRs in practice.

Table 1 Overview of the design activities.

Stages	Activities & Duration	Aim	Tools	Participants
1	Semi-structured interviews 2 hours each	To build empathy with participants, explore their personal experiences and skills for coping with LDRs, identify main challenges and needs, and understand current perspectives on existing LDR-oriented artefacts.	<ul style="list-style-type: none"> • Recorder • Skype • 12 images of existing LDR-oriented artefacts 	N=10, M=5, F=5
2	Workshop #1 2.5 hours	To engage participants in the design process by encouraging them to collaboratively design possible solutions for mediating emotional communication for LDRs.	<ul style="list-style-type: none"> • Recorder • Black Sharpie pens • Sticky notes • Persona • Rip+Mix set • Prototyping materials 	N=5, M=1, F=4
3	Workshop #2 2.5 hours	To evaluate the need and potential of customization when designing for LDRs without the support of technology.	<ul style="list-style-type: none"> • Recorder • Clamshell-shaped containers • Materials brought by participants 	N=5, M=1, F=4

3.1 Stage One: Building Empathy and Defining the Problem

Empathy is a powerful tool and strategy that can be used to understand users – their needs, challenges, experiences, thoughts, feelings, motivations, preferences, interests – based on which, designers are able to create desirable user experience. Empathy can be defined as:

Our intuitive ability to identify with other people's inner states based upon observation of their outward expressions, their behavior. (Fulton Suri, 2003, p. 53)

To build empathy with the participants, a set of semi-structured interviews was carried out with each remote couple. The participants were divided into two groups, i.e., on-site participants (N=5, M=1, F=4) and their remote partners, who took part in the interviews as remote-site participants (N=5, M=4, F=1). Skype was used as a support for remote-site participants who were unable to reach the place where the interviews were carried out.

To create a relaxing and familiar atmosphere where the participants would feel comfortable enough to share thoughts, insights and personal experiences, the interviews were conducted in each on-site participant's residence where they usually had video chats with their remote partner (see figure 1).

The questions embedded in the semi-structured interviews were intended to broadly understand LDR couples' needs, identify their challenges, and investigate how they tackle LDRs differently.



Figure 1 The participant discussing existing LDR-oriented solutions with her remote partner

To gain a deeper understanding of the real needs in LDRs and the current LDR couples' perspectives on existing LDR-oriented artefacts, a host of existing LDR-oriented artefacts that imply different needs – i.e., physical needs, emotional needs, sexual needs, social needs – were presented as 12 images to the participants. The presented LDR-oriented artefacts included published design concepts and existing products as follows:

- Pillow Talk (2010), a pair of wristbands designed to pick up the user's heartbeat and play in real time to the paired user's pillow speaker.
- Couple (2012), an intimate mobile application designed for two remote partners, where LDR-oriented interactive functions such as Thumbkiss and Live Sketch are available.
- Touch Room (2013), an interactive mobile game application where the users can both enter a virtual room, and when their fingers touch the same spot, the phone vibrates.
- Frebble (2012), a pair of hand-holding devices that allow users to hold each other's hands and feel each other's touch, even if they are on opposite sides of the world.
- Kissenger (2012), a mobile accessory that enables remote couples to send kisses over distance.
- Hug Shirt (2002), a shirt that enables users to send hugs over distance.
- Beam (2013), a telepresence robot that provides authentic eye-to-eye connection instantly across distance, allowing users to seamlessly move within space and engage in real time.
- Onyx & Pearl (n.d.), a pair of wirelessly connected masturbators enabling an interactive erotic experience for two individuals online.

- Roly Poly (2012), a pair of egg-like objects designed to sense the presence of each other, each object mirroring the other's movements and creating a simultaneous reaction.
- AmBird, a prototype device wirelessly connected in pairs and used to send colour messages as intimate acts back and forth between two remote partners (Jespersen, Stounbjerg & Verdezoto, 2015).
- RingU, a ring-shaped wearable prototype system for sharing intimate, interpersonal interactions remotely through subtle colored lighting and tactile expressions (Pradana et al., 2014).
- CheekTouch, a prototype device of an affective audio-tactile communication technique that transmits multi-finger touch gestures applied on a sender's mobile phone to a receiver's cheek in real time during a call (Park, Bae & Nam, 2012).

The participants were asked to choose four preferred artefacts out of the options provided. The six strategies used to create a relatedness experience, i.e., awareness, expressivity, physicalness, gift giving, joint action, and memories (Hassenzahl et al., 2012), were used as a basis for selecting the LDR-oriented artefacts shown to the participants. The workshop closed with the participants discussing the pain points in terms of current LDR-oriented solutions.

3.1.1 Findings from Stage One

All the semi-structured interviews were audio recorded and then transcribed. The transcripts were then subjected to a thematic analysis (see table 2) to form a viewpoint on each couple's skills for coping with LDRs, challenges and needs in their LDRs. Every participant faces own challenges, has diverse needs, and uses different skills to maintain and nurture an LDR. Table 2 only presents the main challenges, needs and skills that mentioned by both parties in each group.

As can be seen from table 2, some common challenges, i.e., geographical separation, an unstable communication environment and unsynchronized daily lives, can be identified. As mentioned previously, geographical proximity and frequent face-to-face contact are commonly assumed to be necessary to maintain close relationships (Stafford, 2005). A lack of these two relational necessities is believed to be the killer of LDRs. However, the participants highlighted that distance does bring inevitable challenges to LDRs, albeit to varying degrees, while those who have remained committed to their LDRs have proved that distance does not necessarily kill a relationship. This can be seen in the following comment by a married couple who had been in an LDR on and off for about 14 years:

We have no choice but to be in an LDR; it is damn hard, but we finally have become the experts [on tackling issues and challenges in an LDR] ... distance starts to mean nothing when someone means the whole world to you.

Every couple's needs are different when it comes to LDRs. Showing the 12 images of existing LDR-oriented artefacts to the participants and asking them to choose four preferred options helped reveal their real needs. It turned out that the most primary needs were emotional needs, accounting for 63.9%. This demonstrated that emotional impact plays a significant role in LDRs.

Although the participants had a variety of ways of maintaining LDRs, they relied on mainstream communication tools to keep in touch with their remote partners, as mainstream communication tools provide instant, cheap, and convenient ways to stay connected. However, one of the pain points of mainstream communication tools is that they are designed for a large variety of end users. Thus, the emphasis is then placed on functionality, rather than providing the emotional communication needed for LDRs (Hassenzahl et al., 2012). As one participant said:

Sometimes we have nothing new to talk about at the end of the day, because we already know each other's stories from Facebook.

Table 2 Details of the semi-structure interviews.

Groups	LDR Duration ¹ & Type	Main Challenges	Main Needs	Skills
Couple #1	14 years International LDR	<ul style="list-style-type: none"> • Time zone differences • Unstable communication environment • Safety issues 	<ul style="list-style-type: none"> • Create playful experience with children over distance. • Keep each other updated in real time. 	Fully trust and be committed to each other.
Couple #2	Three years International LDR	<ul style="list-style-type: none"> • Time zone differences • Unsynchronized daily life • Unstable communication environment 	<ul style="list-style-type: none"> • Do more activities together to synchronize daily life. • Create some shared experiences during separation. 	Get creative in using social media to connect with each other constantly.
Couple #3	One year International LDR	<ul style="list-style-type: none"> • Unstable communication environment • A lack of physical intimacy • Absence of tangible support 	<ul style="list-style-type: none"> • Find out ways to avoid misunderstanding. • Learn to control negative emotions. 	Keep reinventing romance and creating pleasant surprises for each other.
Couple #4	Five months International LDR	<ul style="list-style-type: none"> • Unstable communication environment • Unplanned changes • Insecurity and uncertainty 	<ul style="list-style-type: none"> • Know each other's schedules in advance. • Schedule more regular communication dates. 	Have some hobbies outside the relationship and pursue common interests.
Couple #5	1.5 year Domestic LDR	<ul style="list-style-type: none"> • Hyper-connectivity • Overwhelming communication tools • Unnecessary online misunderstandings 	<ul style="list-style-type: none"> • Set up healthy communication patterns. • Find out ways to avoid excessive communication. 	Make the distance in-between seem more bridgeable by doing the same things at the same time.

Unlike mainstream communication tools, LDR-oriented solutions are targeted at a specific group of users, that is LDR couples. However, only one couple claimed they had experience of using LDR-oriented products in real life. Furthermore, despite the 12 LDR-oriented artefacts being introduced and shown as images to the participants, it is noteworthy that one of the participants chose none of

¹ All the interviewed participants had been in steady romantic relationships for at least two years. The durations shown in table 2 were the lengths of time they had been apart in the relationships.

the provided options. As a matter of fact, most LDR-oriented artefacts provide a traditional one-size-fits-all solution, even the same package for every user, which might not be appealing and sufficient to meet every user's needs, as the following comment by one participant shows:

Every single relationship is supposed to be unique ... how does my ring [one of the LDR-oriented artefacts shown to the participants] differentiate itself from others? ... are these [functions of the artefact] adjustable?

The participants also raised serious concerns about experiencing intimacy through technology. Seven participants described using technology to share intimate moments with a remote partner as being "uncomfortable", "unreal", "weird" and "geeky". The emphasis of existing LDR-oriented artefacts has been put on technology-based experience, which might make users feel overloaded by technologies, as one participant said: "Sometimes I feel a bit overloaded by all these fancy products; I can't keep up."

Another important feedback was linked to the possibility of using current LDR-oriented artefacts without an internet connection. As one participant suggested:

I can't access the internet when I am at work; even my phone doesn't have any signal ... I'd prefer something else other than instant messaging applications.

As can be seen from the initial findings gathered from the empathizing stage, the problem of the current LDR-oriented solutions could be defined as a gap between understanding LDR users' needs in research and designing technologies for them in practice.

3.2 Stage Two: Ideating and Prototyping for LDRs

Having empathized with the participants, identified emotional needs as the most primary needs in LDRs, and defined the problem statement, the aim of the first workshop was to encourage the participants to step into the role of designer, ideating possible solutions for mediating emotional communication to support LDRs. The workshop started with ice-breaker activities that enabled the participants to introduce themselves and learn more about each other. Due to geographical barriers, their remote partners were not able to participate in the workshop.

Before the workshop, three personas were created based on the valuable personal stories revealed during the semi-structured interviews. The purpose of applying the persona methodology is to exhibit the real motivations, reactions, goals and needs of a specific group of LDR couples, while using fictional characters to present the participants themselves (Stickdorn & Schneider, 2011).

The participants were encouraged to collaboratively design ideas that would make the personas feel emotionally connected, even when interaction and communication are restricted due to a breakdown of the internet connection.

Users can become part of the design team as 'expert of their experiences', but in order for them to take on this role, they must be given appropriate tools for expressing themselves. (Sanders & Stappers, 2008, p. 9)

To encourage creative and innovative thinking and allow the participants from a non-design background to be easily engaged in the design process, the notion of Rip+Mix, a fast and effective idea generation tool (Press et al, 2011), was introduced to the participants. The idea was to mix a pleasurable experience in real life and a painful experience in LDRs, in a fast and intuitive way to think of new or improved solutions. As mentioned earlier, an unstable communication environment has been identified as one of the common pain points in LDRs. Choosing an unstable communication environment as a painful life scenario and using the provided template, the participants successfully generated ideas that responded to the identified needs of the personas (see figure 2).



Figure 2 The participants using Rip+Mix worksheets to generate ideas for the provided personas

Following the ideation stage, the workshop entered the next phase, where the participants were encouraged to make their ideas tangible by using prototyping materials – e.g., Legos, plasticines, strings, cardboards, etc. – to visualize their design concepts (see figure 3). The workshop closed with the participants picturing how they might interact with the design concepts in their own LDR in real-life settings.



Figure 3 The participants using prototyping materials to visualize their ideas for mediating emotional communication in LDRs

3.2.1 Findings from Stage Two

The challenging topic of designing an emotional connection for couples to maintain LDRs without the support of an internet connection triggered a lively discussion. The participants found that modern society is becoming too reliant on technologies to maintain a relationship, which is a significant contrast with the old times. As one participant revealed:

My grandpa was a sailor; he used to write letters and send postcards to my grandma... my grandma had to sit by a landline waiting for my grandpa to call her at a specified time ... they finally got married after three years of dating long distance ... my grandma still keeps some of those letters and postcards; she looks back on her treasures [letters and postcards] every now and then; they remind her of the good old memories...

Taking the persona as a user-centered approach, the participants found themselves resonating with the provided personas, which helped spark insights for designing feasible solutions for LDRs. Using Rip+Mix as a hands-on idea generation tool, the participants – notably those without a design background – were easily engaged in the design process.

During the idea-generation phase, the participants outlined a set of simple and practical ideas which not only could fit in real-life scenarios, but also could be regarded as an emotional attachment: e.g. a blanket that maintains a constant warmth which synchronizes itself with the temperature of a remote partner's body. The participants discussed and shared their ideas. The most favored idea was a pair of keyrings that display meaningful and personal information, such as the current time of a distant loved one, the time until the next reunion, reminders for special dates, a memory photo gallery, etc. Additionally, the functions and appearance of the keyring are customizable, so that users will have a one-of-a-kind keyring that reminds them of a distant loved one.

When asked the reason why they favored the concept, the participants highlighted that it was "portable", "customizable", "interesting", "multi-functioned", and "private". When asked how the concept could build an emotional connection between LDR couples, the participant who came up with the idea stated:

It [the keyring] might seem like an ordinary accessory to others, but to the owner it's more than that ... the functions can be customized, so the owner is able to decide how it will work the best ... if a couple invest effort in customizing the appearance together, it then becomes something special between the two, and that would make them feel mindfully connected with each other.

This demonstrates there is a need to apply the strategy of customization when designing technologies for LDRs. The design concept is discussed and presented as a starting point to provide a range of preliminary insights and design considerations for further technology design for LDRs. Customization offers opportunities for users to adjust, specify and modify a product, where they are able to creatively use technology to better fit their diverse needs in real-life situations. By inputting efforts in customization, it makes a lifeless object become meaningful and symbolic to users, and as such the object will become a one-of-a-kind object to which users become emotionally attached.

3.3 Stage Three: Testing the Role and Impact of Customization

In order to evaluate the role and impact of customization when designing for LDRs without the support of technology, the second workshop was carried out, where a couple of small clamshell-shaped containers were provided for the participants to customize their ideal necklace that could make them think of their distant loved ones. Before the workshop, the participants were asked to bring materials that could remind them of their remote partners. Using materials, e.g. photos, accessories, perfume, etc., that were brought to the workshop for customization, the participants made a number of low-fidelity prototypes (see figure 4). The purpose of taking the low-fidelity prototyping approach was to enable the participants who came from a non-design background to easily participate in the design process (White et al., 2003). The workshop closed with the participants sharing the backstories behind their designs, and all of them had big smiles when they left the workshop.



Figure 4 The participants customizing their ideal necklaces, and a few examples of the low-fidelity prototypes they produced

3.3.1 Findings from Stage Three

The participants had positive feelings about the strategy of customization, as it helped them build a bond with an ordinary object using materials that would make them think of a distant loved one. The relationship itself is one of the crucial criteria for developing an artefact that can function as a representation of remote presence (Tollmar & Persson, 2002). Even though the workshop itself did not involve any support of technology, the implementation of customization was able to help the participants who have sustained a long-term commitment in an LDR to feel emotionally evocative across the miles, as in this feedback from one participant:

I gave it [the necklace] special meanings by customizing exactly the way I want it to be... for me it's not just an ordinary necklace; I just feel it reminds me of my partner and the feeling makes me feel connected...

During the process of customization, the participants started to open up and share their personal LDR stories with the others, which evoked some shared memories with a distant loved one. One participant recalled a memory of an event she had with her remote partner, and related it back to the necklace she customized:

It was the day he proposed to me... the place was covered with hundreds of blooming daisies that spelled out "marry me" ... Daisies are my favorite flower.

This demonstrates that the strategy of customization could provide more fun interactions to enrich user experience and enable emotional connection even without the support of technology. There is no doubt that technologies can provide immediate access to talk to, see or even to feel a remote partner in real time. However, it is questionable whether the technology-based one-size-fits-all solutions for LDR are still useful when there is no internet connection or technology to support such communication and interaction between LDR couples. In this light, customization can play a subsidiary yet important role when designing technologies for LDR couples. Although it may not seem surprising that customization was seen positively by the participants, given that it has been well-known for engendering value for an object that cannot be obtained through mass production, customization adds to the positive impact of what technology is able to bring to LDRs, as customization supports LDR users as skilled practitioners in utilizing technology to meet their diverse needs in their own creative ways.

4 Discussion

4.1 The Need and Potential of Customization in LDRs

It has been noted that current commercial communication tools are often standardized:

Each individual has a unique voice and style of handwriting, things which are identifiable by people who know that individual well. In contrast, all email messages or typed letters look the same regardless of who the author is. (Gooch & Watts, 2011, p. 238)

Gooch and Watts (2011) propose a design framework for mediating personal relationship devices, where personalization is valued as one of the key factors. Prior work has proven the merits of personalization in designing technologies to support couples in LDRs, which can enhance communication affectivity in terms of providing awareness and reminding people of their specific distant loved one in the context of remote interpersonal communication (Saadatian et al., 2013). For example, to activate different metaphors of hand-holding, personalization was utilized in order to make the prototypes stand out from a standardized object and meaningful to participants (Gooch & Watts, 2012a).

Customization and personalization both refer to tailored contents. The difference between these two terms is that customization is user-tailored while personalization is system-tailored (Sundar & Marathe, 2010). When designing technologies to enable an emotional connection in LDRs, it not only brings to light the need of employing personalization to symbolize a remote partner, but also sheds

light on employing customization as a user-tailored approach to enable creativity, where remote couples who are the experts in LDR experiences can feel empowered to become designers on their own, having space to adapt, modify, specify and create a desirable product according to their own preferences and needs, which is thereby able to meet their diverse needs.

4.2 Design as a Catalyst for Engagement and Empowerment

Design enabled this study to work at two different levels. The first was a strategic level, where design was used as a catalyst to enable engagement. Given that the majority of the participants were non-designers, Rip+Mix was used to help encourage creative and innovative thinking; a low-fidelity approach was taken to ensure they could be easily engaged in the design process. The use of three typical personas enabled the participants to feel resonance with other LDR couples, so that empathy was able to be generated.

To develop empathy is an individual act, but by discussing it in a team, the discussion serves as a trigger for others to make more connections, which will lead to increased understanding (Kouprie & Visser, 2009, p. 439).

While discussing ideas for mediating LDRs in real-life scenarios, the participants revealed the need and potential of customization as an experience-driven user interaction when designing technologies for LDRs. The ideation process empowered the participants to take on roles as co-designers and experts in LDR experiences, to collaboratively design possible solutions to tackle the problems that they had encountered in LDR experiences. This entered the second level, where design catalyzed empowerment. Encouraging the participants to make their ideas tangible during the prototyping process, caused the participants to shift their roles, becoming builders who visualized their ideas and storytellers who shared LDR experiences. These two levels working together helped bridge the gap between understanding LDR users' needs and designing technologies for them.

4.3 Limitations and Future Work

Several limitations of this study should be acknowledged. Firstly, the size of the sample may limit the study's generalizability. Due to geographical barriers, the remote-site participants were not able to participate in the workshops. However, every participant varied dramatically in terms of nationality, age, occupation, marital status, personality, etc. Additionally, every LDR couple in this study was a typical case among most types of LDRs, as their relationships differed with regards to communication preferences, relationship length, relationship stage, geographical distance, reasons for separation, etc. The typicality of the sample is believed to give solid indications on understanding LDR couples' needs, identifying their challenges, and investigating how they tackle LDRs differently. Although a relatively small number of participants were involved, they were engaged thoroughly in the study. Moreover, they were skilled practitioners of LDRs who were more likely to contribute valuable insights on how technology could be better designed for LDRs, as they had been involved in steady romantic relationships for at least two years and had remained committed in serious LDRs. Therefore, the study size is appropriate, given the level of intensity of the authentic participants' involvement. Secondly, the short-term duration of the study and a lack of real-life prototyping over time may not be sufficient to assess the value of customization for LDRs. Although the findings are encouraging, the evaluation was conducted with only one side of the five LDR couples. In future work, continuing towards more mature prototype development and more comprehensive evaluation is needed.

5 Conclusion

Through this study, design has acted as a catalyst to encourage storytelling and build empathy with ten authentic participants who had remained committed to one another in serious LDRs, with the aim of bridging the gap between understanding the needs of LDRs in research and designing technologies for LDRs in practice. A deepened understanding of current LDR couples' perspectives in regard to existing LDR-oriented artefacts, as well as their challenges, needs and skills in LDRs have

been provided. The findings indicate that there is a need to take the strategy of customization into account when designing technologies for LDRs, where customization can play a subsidiary yet important role: that is, empowering LDR couples as skilled practitioners to use technologies in their own creative ways to meet their diverse needs. In doing so, customization makes a lifeless object become meaningful and symbolic to users, and as such the object becomes a one-of-a-kind object, which thereby enables an emotional connection with it. Further research is needed to pursue a more longitudinal and in-depth study on further scoping the design space around employing customization to design technologies to support emotional communication for LDR couples.

With the increasing popularity of 3D printing technology, which has been assessed as an enabler for customization (Srinivasan et al., 2017), more possibilities for mitigating challenges on customization will be opened up. This study can be considered as a step towards developing new concepts for designing customized technology based on individuals' needs.

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