

ThisCloser: Introducing Technology-Facilitated Self-disclosure into Romantic Relationships

Intimate relationships are fundamental for our overall well-being as these, among other factors, shield us against isolation and loneliness. Although, at present, there is a tendency that some couples experience distress due to declining intimacy. Intimacy is an outcome of our interactions with others and comes primarily from sharing personal information about oneself through the act of self-disclosure. Drawing on the advances of Voice-User Interface (VUI) technology for facilitation, this study aimed to explore ways of engaging couples in self-disclosure, which in turn can positively affect their overall feeling of both personal and relational well-being.

We deployed a technology probe, consisting of a Google Nest Mini device and an application (app) for self-disclosure that we developed, in order to explore how the study participants perceived it and also to capture preliminary design ideas for technology-facilitated self-disclosure. The technology probe was deployed “in-the-wild” in the private homes of six couples over a one-month period. Prior, during and after the deployment period, interviews were conducted with each couple and throughout the period we logged usage data from the app (Which day it was used, what part of the app was used, at what time). Following the “in-the-wild” study, we held a co-design workshop with the aim of transforming the preliminary ideas into more qualified ones and inform design of technology-facilitated self-disclosure. The workshop was structured through a Make-Tell-Enact framework, and the data gathered from it was in the form of tangible artefacts (collages that the participants made), video, and audio recordings. All the couples from the “in-the-wild” study were invited to the workshop and three couples chose to participate.

Our findings show that technology-facilitated self-disclosure supported the couples in prioritizing disclosing on a regular basis and that this had a positive effect on their overall well-being. Having technology facilitating self-disclosure shows promising results in relation to it being impartial and reducing the couples fear of judgement when disclosing. There are a number of future possible directions in which the development of this kind of technology can go. One direction could entail an investigation of how couples that are in a distressing stage might be impacted by the introduction of technology-facilitated self-disclosure. Another direction could consist of a further examination of couples’ routines and how to integrate self-disclosure technology into these. Aside from these possible future directions, we also identified a need for further exploring how to maintain motivation for using technology for the purpose of self-disclosure.

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Livia-Manuela Boeriu
Aalborg University
Aalborg, Denmark
lboeri18@student.aau.dk

Martin Valdemar Anker Lindrup
Aalborg University
Aalborg, Denmark
mlindr15@student.aau.dk

ABSTRACT

From the dawn of day, intimacy and intimate relationships have played an essential role in our overall well-being. Although, at present, some couples experience distress due to declining intimacy. A well-known way of increasing intimacy is through the act of self-disclosure. In this study we investigated how to facilitate self-disclosure by utilizing Voice-User Interface technology for developing and maintaining healthy relationships. The study consisted of the deployment of a technology probe in the private homes of six couples, and a digital co-design workshop with three out of the six couples. Our findings showed that the couples enjoyed self-disclosing on a regular basis and that this had positive effect on their well-being. Moreover, that facilitation of self-disclosure through technology has benefits in relation to it being impartial and reducing the couples fear of judgement when self-disclosing. Lastly, we propose design guidelines for technology-facilitated self-disclosure based on our exploration.

Author Keywords

Voice-User Interface; VUI; technology-facilitated; self-disclosure; technology probe; "in-the-wild"; co-design; workshop

CCS Concepts

•**Human-centered computing** → **Human computer interaction (HCI)**; *Haptic devices*; User studies; Please use the 2012 Classifiers and see this link to embed them in the text: https://dl.acm.org/ccs/ccs_flat.cfm

INTRODUCTION

Intimate relationships are essential for our overall feeling of well-being [18, 32], as these, among other factors, shield us against isolation and loneliness [16, 35]. Intimacy and the feeling of closeness are outcomes of our interactions with others [18] and come primarily from verbally sharing personal information with one another about oneself, through the act known as self-disclosure [1, 7, 18].

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Declining intimacy is nowadays a common challenge that leads couples into distress. Couples in distress tend to face a downward spiral that often ends in a breakup if nothing is done to prevent it [10]. There is also a tendency of declining relationship intimacy being associated with health problems, such as poor sleep quality [16] depression, anxiety, alcohol abuse and more [36]. The majority of couples do not seek therapy for various reasons, although it has shown to be effective in helping relationships in distress, by increasing intimacy and closeness [36]. Also a proactive stance in connection to relationship distress has shown to be very beneficial [15]. Jourard [15] describes continuous engagement in self-disclosure as a proactive stance that can prove beneficial in this regard. It is a way of (re)discovering each other, which helps in maintaining and further developing the relationship [7, 8, 15].

There are three basic parameters characterizing self-disclosure 1) breadth, the amount disclosed, 2) depth, the intimacy level of the disclosed information, and 3) duration, the time spent disclosing [1, 7]. Although self-disclosure is characterized only by three parameters, it should be noted that it is a rather complex and almost ritualistic behavior intertwined in the social practices of the everyday life of people [11]. It depends both on the personality of the individuals [35] and changes over time as the relationship develops [27]. Early stages of relationships are usually typified by factual disclosure, whereas emotional disclosure evolves during later stages [18, 27]. Kane et al. [16] argue that especially emotional self-disclosures are important, as they predict good psychical and mental health, intimacy, and are associated with functioning relationships.

Throughout the years multiple attempts at increasing intimacy through self-disclosure in couples facilitated by technology have been seen, both in relation to therapy and in private settings. During recent years the use of Voice-User Interfaces (VUIs) as facilitators for conversation has been growing, also in relation to self-disclosure studies (e.g. [4, 36]). This has to do with vast advances in speech recognition, verbal interaction, and portability of VUI technologies (virtual assistants, smartphones etc.).

Drawing on the advances of VUI technology for facilitation of conversation, we aimed to explore ways of engaging couples in self-disclosure and create shared emotional experiences, which in turn can positively affect their overall feeling of both personal and relational well-being.

This paper has two contributions. First, it contributes with a technology probe study in the homes of six couples to provoke design ideas for self-disclosure facilitated by VUIs. Before, during, and after the deployment period of the technology probe, interviews are conducted with the couples to capture their experiences and ideas. Second, it contributes with a participatory co-design workshop to generate design ideas after the couples had interacted with the technology probe, and thereby informing design of technology-facilitated self-disclosure.

RELATED WORK

Self-disclosure in romantic relationships is a complex phenomenon that plays out in various ways. This section strives to provide an understanding of this complexity. Moreover, it gives an overview of previous attempts to facilitate self-disclosure through technology and more specifically through VUI. Lastly, it provides a closer look at VUIs embedded in virtual assistants in everyday contexts.

Communication rituals in couples

Communication is key in relationship satisfaction and the effects of sharing information have been studied extensively. Gable et al. [8] look into sharing positive events with a significant other. They describe that retelling such events create an opportunity for reliving them, which contributes to well-being [8].

Couples communication also have a ritualistic character as Hicks and Diamond [11] show. They examine affect regulation in relation to the "How was your day?" conversation and find that couples who engage in day-to-day disclosures over time will experience greater feelings of closeness and intimacy [11]. They stress the importance of continuous and proactive regulation of affect in romantic relationships and note that this often happens during ritualistic activities that the couples share [11].

Studying self-disclosure and intimacy increasing acts in general in romantic relationships is challenging as they are often *"ephemeral and transient yet ubiquitous and crucial to the ongoing life of an intimate relationship."* [38]. Mediating intimacy through technology is both about mediating the spoken and the unspoken parts of human communication [38]. While Vetere et al. [38] seek to capture the unspoken intimate events with prototypes such as "Hug over a Distance" and "Secret Touch", they leave the verbal experience of intimacy rather unexplored. Others have tried to capture the verbal experience of intimacy through self-disclosure with both multi-user [36] and single-user [12, 33] technology, which we will present in the following.

Technology-facilitated self-disclosure

Multiple attempts at technology-facilitated self-disclosure have seen the light of day. Ho et al. [12] investigate self-disclosing to a chatbot. They show that disclosing to a chatbot is just as promising as disclosing to a person by looking at different effects, such as feeling better, reduced negative mood and more. Although, this equivalency between willingness to disclose to a chatbot and a person is only present in contexts

where people may fear being judged [12]. An identified limitation of their study is that it does not take into account the reciprocal self-disclosure that happens when self-disclosing to a person [12]. As described by Shenk and Fruzzetti [31], the benefits of self-disclosure are amplified through reciprocity, when the recipient responds with genuine support and validation [31].

Soleymani et al. [33] investigate single-user self-disclosures to a technological therapy counsellor and show that spoken language is the most optimal modality when self-disclosing. It is also the general assumption from literature that verbal self-disclosure is more effective than non-verbal (e.g. written, drawn) [25, 26]. In a multi-user context, Utami et al. [37] show an attempt at developing a counsellor for couples. Their findings indicate great acceptance towards robot-facilitated communication [37]. Furthermore, the facilitated self-disclosure session helped the participants in opening up to each other, which is consistent with similar sessions that have a human facilitator [9]. It is noted that this sort of technology-facilitated couples' counselling can be an alternative for people who fear visiting a counsellor [37]. Lastly, the study finds that the participants had a hard time taking the robot counsellor seriously and feeling empathetic towards it [37]. Although the study shows promising results, a different design for this kind of technology-facilitated self-disclosure might be needed, where one avoids having to disclose directly to a robot.

Virtual assistants in our everyday lives

Commercially available VUI intensive virtual assistants (e.g. Google Home, Siri, Amazon Echo, Cortana) have become more prevalent in our day-to-day lives and while they are created with the expectation that one day they will be able to simulate natural conversation, their current capabilities include only being able to carry out a limited number of verbal exchanges based on voice commands [23]. They are neither ready for natural conversation events, nor multi-user interaction, which create core challenges that need to be considered in the design process [6]. Virtual assistants are limited also in relation to context awareness. Being aware of the context entails knowing something about it (e.g. who are the individuals using the virtual assistant, when are they home, what are they talking about), and this raises privacy concerns of Orwellian proportions [17]. Liao et al. [19] discuss the increased privacy concerns among virtual assistant users and argue that these might contribute to a decrease in context awareness by this device. Seeing that privacy is a central concern, designing in a way that protects personal information becomes increasingly important.

In the field of HCI there has been a growing interest in how VUIs should be designed, moving away from only supporting question and answer interactions, to a more advanced and natural conversational experience [5, 6, 21, 23]. Luger and Sellen [21] go to the length of saying that: *"conversation is the next natural form of HCI."* [21]. Although, as for now, natural conversation with virtual assistants is looked upon as a utopia, seeing that the capabilities are mostly bound to question and answer interactions, with the purpose of carrying out particular tasks [21]. However, users are able to build a relationship with

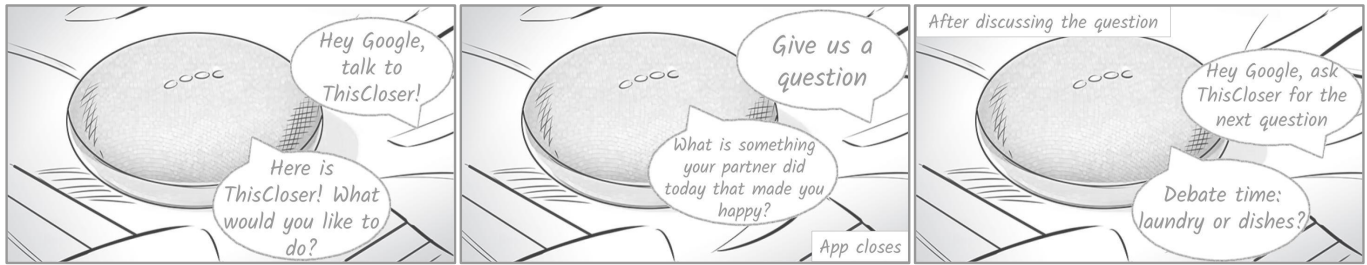


Figure 1. Use case example of an interaction between a couple and ThisCloser

their virtual assistant, even though rudimentary at the moment, the development in recent years is offering the promise of these becoming advanced facilitators for conversational experiences [21].

The growing interest in recent years for taking another approach to VUI design and stepping away from the direct manipulation behaviour (e.g. setting reminders, controlling smart home appliances), which is the current practice, gave us the incentive to further explore these possibilities. We aimed to expand the application domain to multi-user technology-facilitated self-disclosure and study the adoption of this "in-the-wild" by deploying the VUI in private homes over a relatively long period of time.

METHOD

In order to study self-disclosure in couples in their private homes, we saw participatory design tools and techniques as appropriate, since these offer ways of engaging people directly in the design of technology to support everyday experiences [13]. We deployed a technology probe for the participants to explore, and thereby provide us with preliminary design ideas for technology-facilitated self-disclosure. Furthermore, we hosted a co-design workshop with the aim of transforming the preliminary ideas into more qualified ones and inform design of technology-facilitated self-disclosure. Here, we provided the couples with tools for expressing their thoughts, feelings, and dreams, as a way of giving them a more advanced language in the design process [29].

In-the-wild study

A technology probe was deployed in six different households where couples were living together. The probe comprised of a Google Nest Mini device which had an integrated application (app) for self-disclosure. The main goal was to investigate the adoption of the technology probe "in-the-wild", both in general and in relation to self-disclosure. The couples had very little prior experience with this kind of VUI technology.

Procedure

The technology probe was deployed over a four weeks period, from the 1st of April until the 1st of May 2020. Before the participants started using it, we had a pre-interview with each of the couples in order to get insight into their backgrounds, self-disclosing behaviour and prior experience with virtual assistants. Following the interview, the technology probes were set up in the participants' homes. The participants were instructed to use the technology probe during the four-week

period, whenever they saw fit to do so during the week. After a two-week period, we had a steering interview with the participants in order to collect feedback regarding how the technology probe was used, and also to identify any technical issues. When the study reached its end, the participants were interviewed one last time in order to gather information on their overall experience with the technology probe.

Development

The app was developed in accordance with the guidelines proposed by Hutchinson et al. [13] for technology probes: simple functionality, high flexibility, and data collection as the primary goal [13]. In order to accommodate simple functionality, we developed only a few easily accessible functions. We developed them in a way that did not inscribe a specific place, time, way of use, or mood, in respect with the guideline concerning high flexibility.

The app that we developed for this study, which we named "ThisCloser", was simple and open-ended with the purpose of encouraging people to figure out their own way of use, reinterpreting it to fit their habits and rituals. The app was created with multi-user interaction in mind, shifting away from the current design practice of virtual assistants [23] and accommodating to the reciprocal effect of self-disclosure that Sherk and Fruzzetti [31] argue amplifies the benefits of self-disclosing. It was also designed to protect users by not recording their conversations when using the app. Self-disclosing in the presence of a device that has the ability to store the information can be very uncomfortable, because of the intimate nature of self-disclosure. We therefore developed the app so that it closed down when the participants were self-disclosing to each other (See figure 1).

The software for the app was developed using tools provided by Google. It used Actions on Google along with Dialogflow, a platform for building natural conversational experiences. The app was extended by using a webhook service, which allowed the integration with Firebase for customization and storage of the data from the app. By using Firebase services, we were also able to log and monitor usage data in order to get a better overview of how the app was used and at what times of the day, and thereby correlate this with the data from the interviews. The app was then deployed on the Google Nest Mini, which is a virtual assistant that allows for the creation of external applications. This device has limited tactile interaction options, but allows voice interaction in the form of commands from the user to the device. We chose to deploy the app only on a

VUI device rather than also on a Graphical User Interface to see what would be the result of using only voice-commands.

Introducing ThisCloser

ThisCloser was deployed with the purpose of facilitating self-disclosure between partners. It was designed for multi-user interaction and comprised of three modules: game, conversation, and message board.

We developed a game module in order to find out whether introducing game-like elements had an impact on self-disclosing in this context. The specific game that we integrated is called "Two Truths One Lie", where one user tells three statements out of which one is a lie. A second user must guess which of the statements is the lie and wins the round if the guessed statement is indeed the lie. This game was meant as an alternative and playful way of revealing information and it was chosen because it prompted a self-disclosing behaviour in the users. It further introduced game features, such as turn-taking and guessing mechanics to invoke a motivating sense of competitiveness [14].

We developed a conversation module in order to find out how the couples perceived traditional self-disclosure conversation in this context. For the conversation module we took inspiration from the Disclosure Game by Jourard [15] and from the work of Aron et al. [2]. The users request a topic for conversation which is being returned by the assistant in the form of a question, i.e. "What is something your partner did today that made you happy?" or "When was the last time that you really felt like making a difference for your local community or for the environment?". The questions were indexed by their degree of intimacy, ranging from low to high. When asked a question, the users were prompted to talk about it with each other for as long as they pleased. If they wanted to request another question, they were able to do so by invoking the app again.

We developed a message board module in order to introduce a way in which the users could relive memories that they previously entered. The message board module was developed with inspiration from Gable et al. [8] who stress the importance of sharing positive experiences with each other. The message board module was able to store up to three messages at a time and it was created in order to see what impact it would have in how the users self-disclose, and subsequently create a feeling of well-being by sharing with each other. The app prompts the users to leave either a memory or a message of significance, which they can at a later point relive. When the user invokes the module with the intent of rehearsing a stored message, the app returns one of the three messages stored at random. This randomness feature was introduced following the serendipity design, as presented by Odom et al. [24], in order to investigate whether this unknown element would have an impact in how the participants self-disclose by using the app.

Participants

The participants for the "in-the-wild" study comprised of couples with different backgrounds. The criteria for choosing the participants were that they had to be in a romantic relationship and live together. The participants' ages ranged from 19

years old to 36 years old with the percentage of males and females equally divided. The time period for their living together ranged from half a year to seven years. The participants were recruited by snowballing through our own social relations. The demographics of the participants can also be seen in table 1.

Couple	Ages	Nationality	Relationship length	Time lived together
1	20 & 20	Bulgaria	2 years	0.5 year
2	26 & 27	Denmark	8 years	7 years
3	19 & 21	Poland	1.5 years	0.5 year
4	25 & 27	Latvia and Denmark	5 years	5 years
5	31 & 36	Portugal and Germany	7 years	6 years
6	33 & 33	Romania and Iran	1.5 years	1 year

Table 1. Demographics of the participants, showing age, nationality, relationship length, and the time they have lived together as a couple

Data gathering and analysis

In total, we conducted 18 interviews, six prior to the study, six during, and six after (three with each couple). During the majority of the interviews, both individuals from each couple were present. All interviews were audio recorded and transcribed. Furthermore, they were coded and categorized thematically.

Digital co-design workshop

The second part of the study comprised of a digital co-design workshop. The reason for choosing a digital workshop, rather than a physical one, was mainly due to the context in which the study took place, during the breakout of the global pandemic that started in the beginning of 2020. The goal of the workshop was to uncover design guidelines for creating technology-facilitated self-disclosure through VUIs and unravel appropriate contexts, where the introduction of this type of technology would prove useful.

The workshop focused on using generative tools for Make-Tell-Enact activities [3]. These tools provided the couples with a language that allowed for them to create common ground in understanding specific contexts, ideas, and emotions [30]. At the core of the participatory design mindset, all these tools converge together in order to engage the participants to become collaborators in the effort of designing technology that supports and enhances their lives.

Procedure

The workshop was held in an online conference environment by using Zoom as a conference tool. The Make-Tell-Enact activities were carried out by using Google tools (Google

Drive and Google Drawings). The workshop was divided into three parts with a total duration of two hours.

The first part of the workshop comprised of a brainstorm activity that lasted for 10 minutes with an initial round where the couples had to write down up to five words on post-its in a shared Google Drawings board to illustrate their perception on the concept of self-disclosure (See figure 2, top). This was followed by a round where they had to write down in another shared Google Drawings board their last positive self-disclosure experience (See figure 2, bottom). This first part was designed in order to comply with the Tell activity in the participatory design framework.

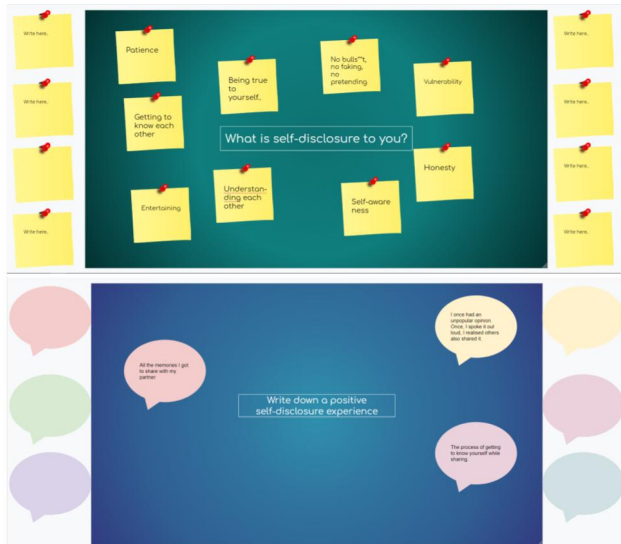


Figure 2. From top to bottom. The brainstorm activity concerning what self-disclosure is to the couples. The brainstorm activity concerning reminiscing positive self-disclosure experiences

In the second part, the couples were given instruction for creating a collage that captured their perception of an optimal future VUI technology for self-disclosure. Each couple was given access to different Google Drawings boards, where they could modify the canvas and add any elements they deemed necessary. This part lasted for 30 minutes and is representative of the Make activity in the framework.

The last part of the workshop comprised of short presentation of each collage. This part was representative for the Enact activity in the framework and lasted for 15 minutes. This was followed by a discussion with the participants in order to capture thoughts and ideas on possible guidelines for designing VUI technology that can support self-disclosure in couples.

Participants

We invited all the couples from the "in-the-wild" study to participate in the co-design workshop. Three out of the six couples agreed to participate.

Data gathering and analysis

The workshop was both video and audio recorded with the purpose of exhaustively covering all the activities taking place. Furthermore, the Google Drawings boards for the Tell and Make activities were also part of the data gathering process,

acting as tangible representations of the participants' thoughts and ideas. The data from the Enact activity and the discussion was coded and categorized thematically.

FINDINGS

The technology probe triggered a range of different reactions throughout the study, captured both during deployment and in the co-design workshop. Based on identified patterns from interviews and usage data from logs, the following unfolds how both the virtual assistant and ThisCloser were used and perceived by the six couples. Furthermore, we present suggestions for how to improve the experience of ThisCloser by drawing on the interviews, usage data, and the workshop.

Perceptions about virtual assistants

As the couples' experience in regard to virtual assistants was slim to none before the start of the study, not only the adoption of ThisCloser was an object of study, but also the adoption of a virtual assistant in their everyday lives.

Throughout the study, a slight shift was seen in regard to the couples' attitude towards virtual assistants. In the beginning of the one-month deployment period, the participants' knowledge about virtual assistants was limited and their opinions towards it predominantly negative. Multiple couples expressed their concerns in relation to this: "[...] it seems a bit invasive to have this in the house.", "[...] I do not trust that it is going to understand my commands correctly.", and "[...] not so useful and a bit creepy.". Their concerns were regarding privacy and the technical capacity, whether the device would be able to live up to their expectations and replace other technologies in the house.



Figure 3. One couple placed the device on a windowsill in their living room

After using the virtual assistant for some time, we observed a change in attitude for some of the couples. One couple went from finding virtual assistants useless and slightly creepy, to later wanting to own one. Their reason was that, since they have gotten a bigger house and more devices to connect it to, they saw a clearer purpose of owning one. However, three out of the six couples did not show a change in attitude and did not

find the virtual assistant particularly useful in their daily lives. One of the couples had a wary stance towards it. They were not comfortable leaving the microphone open: *"I noticed that I prefer if it is muted, like the microphone, when I am not using the device."* Being aware of the risk that the device might be listening in on what was being said without permission was a general theme.

Approaching the end of the deployment period, five out of the six couples had grown fond of using the virtual assistant. They used it for various everyday tasks and built routines around it, such as asking for the temperature before leaving the house, saying good morning to it, obtaining information about trivia questions, and playing music. Also, when cooking, two couples used the assistant to provide them with recipes. The majority of the couples also used it in relation to controlling other electronic devices around the house. They used it for e.g. turning on and off the lights and controlling their TV. The last couple did not find the need to incorporate the virtual assistant into their home, seeing as it did not improve their lives and that they felt it had no utility for them currently.

Engaging in continuous self-disclosure

Out of the three modules, the Conversation Module was used far more than the other two. One couple explained their experience of the Conversation Module as follows: *"It is always a pleasant experience. Even though it is hard to answer the questions, the experience is always pleasant. We never feel afterwards that.. Oh I wish I did not say that or this was too hard."* and *"[...] the conversation and everything was something new and something different, so we had nice time using it."* Another couple described their experience as being a bit awkward at first, but after a few questions they pointed out that it felt good and got them talking about various different topics.

The couples had a pleasant experience with rediscovering their bonds through discussing the questions, and saw it as a relationship exercise and an opportunity to push boundaries in a safe environment. One couple noted: *"It should not be seen as a fix to something, but rather as an improvement or an enhancement."* In their study of affect regulation, Hicks and Diamond [11] find that this kind of day-to-day self-disclosure has positive effects on both feelings of closeness and relationship satisfaction over time. Fostering this kind of continuous self-disclosure can thereby be seen as highly desirable.

Although it was perceived as a pleasant experience, it sometimes required a certain state of mind. One couple noted that some preparation was needed: *"[...] for me it is not just an activity to do always, just like every day for five minutes. It is more something you have to prepare for [...]"*. This had to do with the high intimacy level of some of the questions. It sometimes made the couples experience a feeling of being in a therapy session: *"[...] a couple of the questions I felt were too much like: 'I am in a therapy session' sort of thing. And that makes you feel almost attacked by something."* When engaged in this kind of continuous self-disclosure, connotations of being in a therapy session are clearly not appreciated as they invoked a feeling of discomfort and tension.

The majority of the couples also tried the Game Module, but experienced usability problems when interacting with it (e.g. ThisCloser not understanding or interrupting commands). Furthermore, two couples also found it hard to come up with truths and lies about themselves. One couple noted: *"I think it would be a very nice game to play if it is two people who just met each other or just learned to know each other."* It might be a better game for acquaintances than for couples, seeing that all of the couples already knew a lot about each other, which made it difficult for them to think of any additional pieces of information. On a more general note, there was great optimism about introducing game elements into the context of self-disclosure, as this counteracted the feeling of being in a therapy session.

The Message Board Module was the least used one. Two couples tried it once, leaving a message, listening to it, and then deleting it again. One couple did not understand the intended purpose of it and the three other couples did not try it at all, mainly based on the context of the deployment period, where all the couples worked from home and generally also stayed at home with each other. Since the couples were at home with each other the vast majority of the time during the deployment, leaving messages was not needed. The couples saw an opportunity in using this for leaving small notes for each other if they were away during the day or if they had a long-distance relationship. When this is said, it seemed that the Conversation Module supported the couples in verbalizing and listening to good memories, therefore adopting part of the purpose of the message board.

Having technology facilitate self-disclosure

Another theme that surfaced during the deployment period concerned how ThisCloser managed to facilitate self-disclosure between the participants. The app showed to be promising in facilitating self-disclosure in a couples context, both in relation to their perceived fear of judgement and well-being. Furthermore, the impartiality of the technology was also perceived as a positive aspect.

Self-disclosing is an intimate act and therefore fear of judgement can be an issue. The participants reflected on how it would feel to self-disclose in the presence of a human facilitator rather than the technological one that we provided them with: *"You do not get this fear of judgement because it is an app, a device. So you do not have to be scared of it."* In general, they believed that they would prefer a technological facilitator rather than a human in this context, as it did not invoke fear of judgement, which they believe a human facilitator would do. This finding shows consistency with other literature in the field [20, 37].

Another aspect concerned well-being as a result of having self-disclosed to each other. Although the participants were aware of the benefits of self-disclosure before the study, not all of them prioritized it. Having the app made it a routine activity to self-disclose, which made the participants prioritize it more in their daily lives. One participant elaborated upon the experience of self-disclosing to their partner: *"Even though it is things that we know about each other, sometimes it is just good to remind each other of those things. It kind of becomes*

something that is implicit rather than explicit and then when you say it, it feels really nice!". Hicks and Diamond [11] argue that daily affect regulation, in the form of self-disclosure, can promote physical and mental well-being, thereby we have a strong indication that this kind of technology-facilitated self-disclosure can positively affect well-being in couples. However, further examination of how to motivate the couples is needed.

The majority of couples also mentioned impartiality as an aspect of ThisCloser that they enjoyed. One of the couples elaborated that if it was person asking intimate questions, they would have thought that he or she had a hidden agenda or incentive for doing so. Since it was the app presenting them with questions, they were more inclined to answer without concerns about why they were presented with that particular question and it also neutralised the feeling of discomfort between them: "*Because it is a non-human facilitator I don't feel so awkward when asked intimate questions, as it is the facilitator asking and not any of us.*". A similar finding in relation to reduced feeling of awkwardness is seen in Utami et al. [37] in the context of a robotic couples' counsellor.

Co-designing technology-facilitated self-disclosure

After the deployment period, we invited the couples to come share their views in a co-design workshop regarding how to design technology-facilitated self-disclosure. The outcome of the workshop consisted of different concepts extracted from digital collages that the couples created, presented, and discussed (See figure 4). As expected, the concepts did to some degree mirror what the couples had experienced through engaging in self-disclosure with ThisCloser. What became visible were the distinct differences that the couples pointed out through their collages, showing unfulfilled needs in the interaction with the technology [29].

The first collage, *The Lovable Robot*, was made to express what role and characteristics technology-facilitated self-disclosure should have. *The Lovable Robot* is a facilitator of conversation, rather than an active practitioner. This means, that it does not take part in the conversation, but instead brings up intimate questions that the individuals do not have the courage to do themselves. It acts with impartiality yet being aware of the situation. The purpose of *The Lovable Robot* is to push boundaries, exercise the relationship by challenging them through self-disclosure conversations, such as asking really inappropriate questions. With this, the couple framed the proactive aspect of self-disclosure as being important for designing technology-facilitated self-disclosure. They emphasize pushing boundaries in the relationship in order to strengthen it. Furthermore, their attitude towards privacy protection was contradicting with literature on this subject [17, 19], which might be a starting point for future research.

Second collage, *The Friendly Cloud*, was created to display how the interaction with the technology takes place. Starting from an argument or uncomfortable situation, one or both of the individuals sometimes carry with them traces of that argument without being able to put the feelings into words. Suddenly, at a later point in time, when either of the individuals gets clearance on the argument, they recount the situation to

the *The Friendly Cloud*, thus unburdening themselves and revealing aspects that were not mentioned during the argument because of the uncomfortable nature of the situation. The device listens and saves the information until a time where the couple is together again. When *The Friendly Cloud* senses good vibes and judges that the present moment is right for self-disclosure, it brings up what was left unsaid from the last argument. Here, the main emphasis is on timeliness, as in when the conversation should happen. Understanding the dynamics of the relationship, as Vetere et al. [38] point out, is important for identifying the right time for self-disclosure. Drawing on non-verbal cues in the relationship by e.g. using sensors in combination with VUI-technology can be seen as one example of how one can accommodate to timeliness in self-disclosure.

The third and last collage, *The Good Morning Mirror*, resembles a seamlessly integrated assistant that not only focuses on self-disclosure, but also on routines. It greets the couple in the morning and presents them with news and their schedules. Moreover, it gives the couple a topic or memory that they are invited to individually reflect upon as they go along, and then, at the end of the day, they can talk with each other about it. *The Good Morning Mirror* is personalized in the sense that it identifies patterns out of what has been talked about the most. It introduces self-disclosure as a whole-day experience, rather than just sitting down together without feeling ready for engaging in self-disclosure about an unknown topic. Moreover, it emphasizes daily routines as way of seamlessly integrating self-disclosure into the relationship.

Overall, the workshop resulted in general ideas for how to design for self-disclosure. The predominant themes that were articulated concerned: seamless integration, including personality and situational awareness, impartiality, and proactively maintaining a healthy relationship. In relation to seamless integration, it was particularly mentioned that technology in this context has to accommodate the dynamics of the relationship, the atmosphere between the individuals and their personality for it to be able to intervene in a natural and non-intrusive way. Furthermore, the technology has to be impartial, non-judgemental and subtle in the way that it appears, putting the couple in focus. This is also visible in existing literature in regard to anonymity and feelings of non-judgement being positively linked with self-disclosure [12, 37].

Proactiveness and continuous engagement in relation to self-disclosure are important in keeping a healthy relationship [8, 11], therefore technology-facilitated self-disclosure, in this context, is to be seen as a way of strengthening the relationship rather than mending it. By taking a lightweight approach, we found that it is possible to have couples adopt self-disclosure actively into their everyday lives.

DISCUSSION

At the beginning of this study we set out to uncover whether VUIs could represent a good modality of facilitating self-disclosure activities through technology and to uncover possible design directions for enabling self-disclosure in couples that live together.

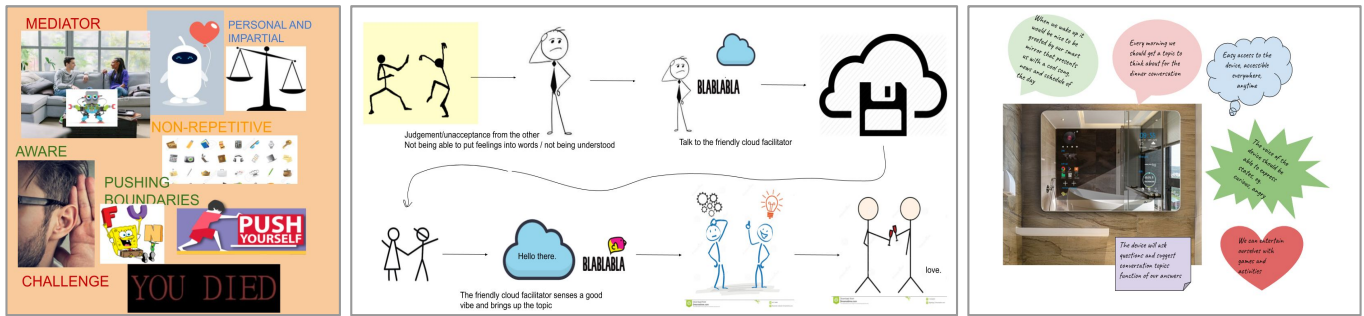


Figure 4. From left to right. First couple's collage that they called "The Lovable Robot". Second couple's collage, "The Friendly Cloud". Third couple's collage, "The Good Morning Mirror".

Tailoring technology for self-disclosure

In its current state, VUI technology mainly supports direct manipulation. There is still a long way until this will be capable of supporting a more natural conversations. For this to become possible there are a number of elements that have to be accounted for such as social cues, atmosphere, and the inherent tendency of people to make constant changes to what they are saying during conversations [34]. These are some of the aspects that should be considered when designing technology aimed at supporting self-disclosure activities in couples. As previous research shows, self-disclosing activities can lead to positive feelings and a sense of closeness when done in a proactive manner and on a regular basis [11]. Thus, designing technology with the purpose of facilitating self-disclosure should consider the role of the context and the different rituals that couples engage in. Most of the couples in our study found the evening to be a good time for engaging in this type of activity. This might have been because of the calm that this period of the day usually brings along, where any work-related activities are mostly finished and there is a window for unwinding. Additionally, the different rituals that most couples engage in should be taken into account, because they represent opportunities for the introduction of technology-facilitated self-disclosure.

On this note, it is important to also reflect on the vocal interaction between the user and the device. As of now the state of VUI technology raises problems in relation to speech-recognition, which does not behave as expected in many cases [34]. This can lead to frustration, as the results from our study also show, and possibly to discouragement. The design of future VUI technology should therefore take into account these limitations and strive to be simple and straightforward in order to diminish possible dissatisfaction. By considering the above it becomes clear that in order for technology to have a positive impact in couples it should be able to identify the appropriate window for interaction, be able to seamlessly become a part of their routines, and become a subtle presence that supports them.

Another aspect that became evident in our study was the need for providing the users with a clear purpose for using technology for self-disclosure (e.g. increased intimacy, strengthened relationship). This in turn can help maintain the motivation of using this technology on a regular basis and make it easier for the users to understand what they are achieving. Moreover,

self-disclosure should be seen more as a subtle effect that one can achieve from using this type of technology, but not a purpose in itself. This also ties well with the fact that there is a preference for a more lightweight interaction, where the users do not necessarily want to be too self-aware when engaging in self-disclosure. This preference also comes from being too self-conscious of the deepness of the conversation which can put additional pressure in regard to the interaction taking place. Thus, the possible future applications of technology-facilitated self-disclosure should not burden the users and make them overly aware of their self-disclosures. Instead, the aim should be to have self-disclosing as a subtle effect that derives from an activity that resembles more a healthy exercise than a chore.

Motivation for proactive self-disclosure

The inclusion of entertainment in designing technology for self-disclosure could prove to be effective, seeing as there is a need to make sure the self-disclosure activities offer a lightweight interaction to the users, without straining them. This enables the users to enjoy the activity without being overly self-aware, which would allow for it to become a regular event in their everyday lives. One of the ways in which inclusion of entertainment could be made possible is through social games, which can provide structure to the self-disclosure activity. As seen from our findings, most of the couples pointed out the need of having a faster paced interaction so that it makes the use of the application more appealing. One of the examples that was identified in the workshop for creating games that would be appropriate for enhancing self-disclosure was for instance a game where users would have to debate between two different options, while having a short time limit. This in contrast to just providing the users with questions on which they can endlessly discuss, give clear and simple directions for completion. Furthermore, another example of a social game could offer the option of having multiple levels of difficulty where at the easiest level it would give users low intimacy questions, which would become more personal as the difficulty increases. Similarly, this has also been seen through Jourard's work on self-disclosure questionnaires [15].

Seamless integration and internet of things

Throughout our study, while discussing with the participants, one of the aspects that was brought up multiple times in regard to what would motivate people to use an app for self-disclosure, but also the virtual assistant on a general level, would be the

integration of other smart devices around the house. This opens the door to many different possibilities through which the virtual assistant can be extended. One option would be to connect the virtual assistant to smart lighting that can allow for more complex functionality. Here, the light could turn on at certain times of the day and act as a reminder for the users to use the app. Another way through which this could possibly work implies that the users set an ambience through the lights and the app would pick up this information and act according to the ambience that is set in the room. This could also be based on a questionnaire that is filled out each morning about needs for closeness, intimacy, self-disclosure etc.

Also wearables could prove useful in the digital ecology [28] between the app and the user by capturing different bio metrics and informing the app hereof. These could be used to identify periods of relaxation by looking at the pulse indicator which could mean the person is in the right mood to engage in self-disclosure activities. Smartphones or mobile devices could also be an interesting option for finding out when both partners are in the same space, by using GPS localization. They could subsequently receive a notification that would remind them of using the technology for self-disclosing.

It is important to point out that all these integrations raise concerns in regard to the privacy aspect and the fact that the users would need to give access to technology to a much larger extent. All these concerns should be taken into consideration in the design process as they represent the pillars on which the trust between the users and the device is formed [19].

Technology as a part of our relationships

The prevalence of technology in our lives has increased in the past years and one could argue that the introduction of yet another piece of technology into the interaction between romantic partners might possibly lead to negative effects in relation to their quality of life. Studies even suggest that overuse of technology might be detrimental to real-life intimacy due to the rapid gratification they offer [22]. Rather than enhancing the closeness between people through increased interconnectivity this can in turn lead to a feeling of being alone even when effortlessly connected with others [22]. With this in mind it is important to note that, as it was the case with our technology probe, technology-facilitated self-disclosure should be designed with the purpose of offering support and enhance our everyday lives, rather than create dependency and allow for disjointedness between people. It is therefore inferred that self-disclosure facilitated interaction through technology should be inviting rather than forceful, and should offer full choice to the users over whether they want to make use of it or not. Moreover, it should undoubtedly be designed in a way that leads to well-being and positive outcomes instead of creating distress.

Further work

There are a number of future possible directions in which the development of this kind of technology can go. One direction could entail an investigation of how couples that are in a distressing stage might be impacted by the introduction of a technology that facilitates self-disclosure. Moreover, it

might be interesting to further examine the couples' routines and how to integrate technology into these. Other possible explorations could be done in regard to different contexts in which technology-facilitated self-disclosure can be introduced. Examples for this can include public spaces, academic or professional contexts or group activities. Aside from these examples there is also a need for further exploration into motivating factors for utilizing this type of technology.

LIMITATIONS

Due to uncontrollable circumstances, there were some limitations throughout the study that are important to note. As previously mentioned, the study was carried out during a period of social isolation mainly due to the global pandemic that started at the beginning of 2020, thus physical contact was not possible. All interaction with the participants was therefore carried out in a digital environment, which, at times, hindered the communication due to connectivity issues. Furthermore, because of this situation the couples were together for most of the study period which might have impacted their overall experience.

ThisCloser was released as an alpha version on the Google platform, which made the invocation of the application problematic. This greatly influenced the participants' interaction with the it. Moreover, in regard to the participants it is also important to mention that the recruitment of the participants was done by snowballing through our own social relations. Lastly, the study had a focus on healthy couples, and it is therefore not certain that our approach would be beneficial for couples already in distress.

CONCLUSION

Throughout this study, we have investigated technology-facilitated self-disclosure in couples, using VUI technology. The goal was to gain insight into how individuals adopt VUIs in their everyday lives and also whether proactive and regular self-disclosing would prove beneficial when facilitated by VUI technology. Furthermore, we strove to inform future design hereof. Our findings show that technology-facilitated self-disclosure supported couples in prioritizing disclosing on a regular basis and that this had a positive effect on their overall well-being. Additionally, the couples enjoyed engaging in this activity and the proactive nature of it, where the focus was on developing the relationship rather than mending it. Having technology facilitating this activity shows promising results in relation to it being impartial and reducing the couples fear of judgement when disclosing. Important aspects to consider when looking into technology-facilitated self-disclosure in this context include how to seamlessly integrate this to accommodate the dynamic behaviour of couples.

Future directions in this problem area can include how to further motivate individuals to engage in this kind of proactive self-disclosure. Moreover, it is also worth examining who else would benefit from technology-facilitated self-disclosure, including how to design specifically for different relationship types, contexts, and age groups. Lastly, it is important to find out how engaging in this type of self-disclosure over a longer period of time might affect the relationship.

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