Evaluating Live Typing Indicators for Social Presence in Online Communication

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ABSTRACT

Messaging has become one of the most ubiquitous digital communication mediums. While efforts have been made in the development of messaging indicators to support co-presence in real-time, much information is still lost during message composition - tone, facial expressions, hesitations, pauses, and a train of other person's thoughts. This paper presents a combination of quantitative and qualitative approach for analyzing text visibility in messaging interfaces. We adopt survival problem-solving scenarios to study the impact of text visibility on (N=24) participant's perceived social presence. By assessing users' subjective workload and interpreting these findings in the context of users' experiences, we show that text visibility can help people express themselves more, allowing for closer connections and heightened co-presence. In addition, our research demonstrates the applicability of personalized messaging interfaces in everyday lives for deep personal conversations, conflict resolution, and text-based therapeutic avenues.

1 INTRODUCTION

Despite its popularity and convenience, messaging consists of many similar limitations as other computer-mediated communication (CMC) technology. One limitation of messaging is its lack of social cues [1]. Social cues play a significant role in conversations as they influence a user's perceived social presence, enjoyment, and usage intentions [48]. People generally respond to social cues in face-to-face communication by modifying their behavior based on who is present and observing their partner's body language. However, facial expressions, tone, and emotions are not easily identified in messaging. This makes it challenging to follow turn-taking and activity when communicating through messages.

In particular, messaging for discourse is more difficult in a relational conflict due to the medium's inability to convey nonverbal cues [35]. In spaces where users have to navigate disagreements to reach a solution effectively, users might differ in their perspectives, values, goals, and perceived assumptions. This disparity can affect their joint coordinated effort in reaching a resolution [31] because of the channel's miscommunication nature [11].

To enhance users' perceived social presence, *is-typing* indicator was introduced in instant messaging (IM) applications to support awareness of co-presence in real-time. The indicator, which shows moving dots (...) or displays *Person A is*

typing shares the status of the other user's message of when they are typing to support turn taking. Current studies on typing indicators show that they can substitute as a social cue, making the interaction appear more natural by enhancing social presence [41].

However, the *is-typing* indicator only helps in the detection and awareness of co-presence. The transactional model of communication [2] states that feedback received during communication, through facial expressions and nonverbal cues helps us adjust our subjective lens for the interaction. This feedback is lost during message composition. Although current studies have tried to examine this information by analyzing keystroke level data [7], not much research has been conducted in designing messaging indicators beyond awareness systems.

To address the research gap, in this paper, we designed four text visibility indicators in messaging platforms. First, we designed two new indicators for message transparency:

- *masked-typing*: Message is concealed and displayed as # characters. The actual message is revealed once it is sent.
- *live-typing*: Message is displayed in real-time.

We compared the above two interfaces with:

- *no-indicator*: Message is sent only after the sender presses "Send". This is currently the default in SMS texting. We used this as our baseline interface. No cues were presented while a user composed a message.
- *is-typing*: View when the other person is typing through moving dots "..." or through "Person A is typing". This cue is currently adopted in most IM applications.

We measured users' subjective workload assessment through NASA-TLX and interpreted the findings in the context of users' experiences with each interface. We used a Glaserian approach to understand users' perceptions of how the interfaces affected their contribution for the problem-solving task and the applicability of each interface in their daily lives. In this paper, we contribute the design of two transparent messaging interfaces, and present participant's perceived workload, reflections and experiences. We present applications of transparent messaging indicators, such as in facilitation of deep personal conversations and the indicator's feasibility for online text-based therapeutic communication.

2 RELATED WORK

2.1 The Impact of Visibility Features on Social Presence

According to Rice and Love [37], social presence is the feeling of involvement in communication exchange. In recent years, many studies have investigated visibility features in messaging platforms in the context of social presence. Cho et al. [9] examined "private activity sharing" and "sender-controlled notifications" and found that these features lower the anticipation for instant replies. These personalized components allowed for both the sender and recipient to comprehend each others' "real-time availability". Rost et al. [39] explored aspects of mobile messaging history and found that removing the history feature made users feel more relaxed and lenient about what they wrote.

However, visibility features do not always have positive effects. Hoyle et al. [20] investigated the 'seen by' indicator in Facebook Messenger and found that users experience a range of negative emotions. In addition, Shin et al. [41] found that visibility statuses like "read receipts", "typing indicators", and "contact synchronization" forced users to be attentive to their messages and caused them a significant amount of stress. In contrast, Hwang et al. [21] found that typing indicators heightened user involvement but failed to find any significant effects on time-sensitive tasks.

The current findings indicate that different visibility statuses affect users differently depending on the context. It is still unclear whether these interfaces help increase social presence, especially in the event of discourse. Moreover, during messaging, users tend to turn their attention to the linguistic characteristics of interaction. Studies have found

that the use of emoticons, interjections, punctuation, affect terms, and speed of response can influence perceived social presence [16, 18]. These findings allow researchers to compare the effects of different text visibility and further understand how social awareness is facilitated during message composition.

2.2 Comparing Text Visibility Messaging

Several studies on social cues surrounding text–based messaging systems (e.g., turn–taking, message editing, and text readability) have looked at how various text visibility features affect discourse and collaborative work. For instance, Dringus [10] examined the performance of group decisions between "delayed-time messaging" (e.g., emails) and "real-time messaging" (character-by-character transmission of messages) and found that groups took longer to reach solutions when using delayed-time messaging. Solomon et al. [43] discovered that real–time text, when compared to messages that are displayed to the recipient after being delivered (even when the *is-typing* indicator is present), caused users to edit their messages less. On the other hand, Phillips et al. [33] found that users who conversed with real–time turn-taking interfaces, compared to those without, performed lower on collaborative thinking and resulted in less effective communication.

While these results yield advantages to both spectrum of text visibility, there is still insufficient information to conclude which type of interface is more efficient for problem-solving. These studies have also been conducted in a lab setting and are primarily quantitative by design. Few efforts have shed light on users' experiences, thoughts, and feelings toward these text-visibility in messaging. To understand the value of real-time text display or *live-typing* as we call it, and its impact on facilitating social awareness in the context of discourse, a more comprehensive approach that compares gradual levels of text transparency in a relaxed environment is needed.

3 METHODOLOGY

This study aimed to identify the impact of messaging transparency in spaces where users might have to navigate spaces of disagreement to reach a resolution. We also aimed to understand how users perceive different design strategies for messaging transparency and if they can be leveraged to increase a user's perceived co-presence. The data collection focused on participants' subjective task workload scores. A Glaserian approach was used to understand participants' experiences and the applicability of the interfaces in their daily lives.

3.1 System Design

The experimental materials consisted of four different messaging user interfaces. All interfaces allowed the user to join a chat room, send a message, use emoticons, and exit from the room. In the baseline, no cues were presented when a user would compose a message. This is currently the default in SMS texting. The second interface adopted current IM indicator design where both users could see if the other person was typing.

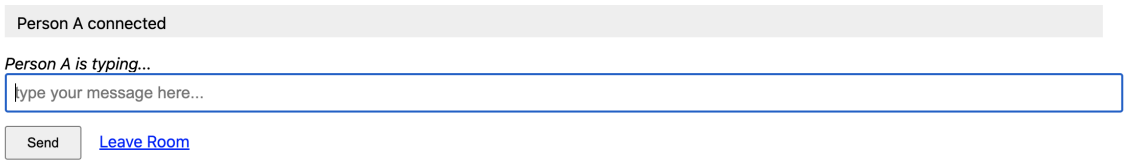

Fig. 1. Person B waiting for a message as it is typed with the is-typing indicator.

We developed two more interfaces for our research questions for understanding user experiences with text visibility in messaging. In one interface, the recipient could see the actual characters typed by the sender in real time, including edits and pauses as if they were watching the senders' screen. We call this interface *live-typing*.

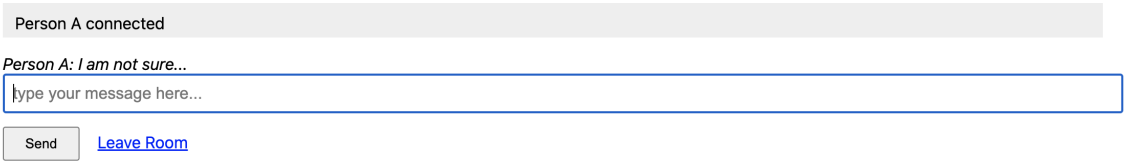

Fig. 2. Person B waiting for a message as it is typed with the live-typing indicator enabled.

In the second interface, characters appeared as they were typed, but the displayed characters were replaced by a '#' glyph. Therefore, the recipient could see that the sender was actively typing, and the speed and number of characters typed or edited as they were happening, but not the actual content of the message, allowing for the senders to edit more comfortably. This interface was referred as *masked-typing*.

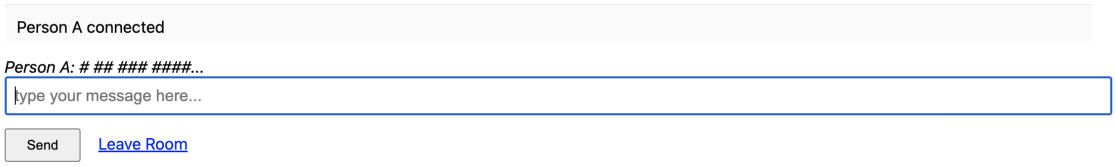

Fig. 3. Person B waiting for a message as it is typed with the masked-typing indicator enabled.

Both interfaces were designed to have a various degrees of text transparency. For *masked-typing*, users could see the keystroke-level information: length of the message, backspaces, and pauses (that is, no character is typed, implying the sender is away or thinking). The design considerations for *live-typing* involved more transparency than *masked-typing* as it aimed for complete text visibility during message composition. The keystroke level information was combined with the actual keystrokes (or the message) to preserve information loss during message composition.

3.2 Study Design

We use messages to communicate from almost anywhere, while driving [14], walking [25], eating, and even parenting [49]. Messages are used in various settings ranging from classrooms [45], workplace [32], subways and in the toilets [46]. We conducted a remote study to reflect the above setting, allowing participants to experience the messaging interfaces without the constrictions of a lab setting. We used a within-subjects design experiment to understand and compare users' experiences across all four interfaces.

To eliminate the carryover effect, a complete counterbalancing design experiment was adopted. Participants (N = 24) were divided into three sets of eight individuals. Dividing the participants into groups of eight individuals allowed us to ensure unique pairs in our sample (that is, no two participants talk to each other again). Each pair of participants interacted with an interface in different orders within each set. Four problem-solving tasks were presented in a shuffled order for every three sets of eight participants to reduce the practice effect. The problem space for the three sets was

Table 1. 24 participants ordered: Study conducted in 3 sets of 8 participants

	Room A	Room B	Room C	Room D
Problem 1	(P6, P7)	(P1, P5)	(P2, P4)	(P3, P8)
Problem 2	(P1, P8)	(P4, P7)	(P3, P5)	(P2, P6)
Problem 3	(P3, P4)	(P2, P8)	(P1, P6)	(P5, P7)
Problem 4	(P2, P5)	(P3, P6)	(P7, P8)	(P1, P4)

balanced using a 4×4 Latin Square where the last row of the square was not used. Lastly, for the fatigue effect, we limited participants' interaction on each interface to 7–8 minutes to make the tasks shorter and less intense to perform (Table 1).

In the context of this study, problem-solving was defined as a pair's ability to select a demonstrably correct answer [28]. Problem-solving was assessed using collaborative tasks that presented participants with survival scenarios. These tasks have been used in numerous group decision studies [27], and as messaging tasks to promote collaboration[5]. Initially, the tasks provided participants with a list of 10–15 available items to rank them in order of importance from most important to least important for crew survival. Since we could not replicate personal conflict resolutions, we modified the survival scenarios. We asked the participants to select the top three items from the given list which allowed room for more discussion, disagreement and communication to express why a participants thinks the item should be in the top three. Their answers were compared against the expert's answers to determine if they were in the correct order.

If a pair's top three items matched the correct order, the pair received three points according to our point system. If only two items matched the correct order, two points were given. If only one item matched the correct order, one point was awarded. If none of the items matched the correct order, zero points were given. Participants were notified that, for each correct answer, they would earn $0.50. We added this criterion to allow room for discussion within the task. The added compensation based on performance helped us avoid passive agreement within the session and allowed space for discussion when a pair had conflicting preferences for the top three items.

Tasks differed in their survival scenario and the list of items that were to be ranked by the participants. We selected the following four parallel versions of the survival tasks for balanced complexity:

- Desert Survival Task with validation provided by the Chief of the Desert Branch [26]
- NASA Moon Survival Task with validation provided by NASA experts [17]
- Lost at Sea Task validated by the US Coast Guard [29]
- Plane Crash Task validated by the US Army [24]

3.3 Participant Recruitment

A variety of social media apps are now used for messaging: Facebook Messenger, Instagram, Twitter, and Reddit (for anonymous conversations). Hence, electronic flyers were posted on authors' personal feeds on these platforms (Twitter, Facebook, and Instagram) and Reddit's r/SampleSize, an online discussion forum for recruiting participants. Combining these channels helped us recruit a diverse sample based on gender, occupation, and age. Both authors were international students, which enabled them to recruit people from different backgrounds. In contrast, Reddit ensured that our sample is not entirely college students or falls under the research denomination.

For eligibility, participants had to be 18 years or older and frequently use messaging platforms to communicate. A total of 98 people applied for the study. N=24 participants were recruited and N=50 were placed on a wait list to accommodate no-shows. N=24 is considered a good sample size for studies that include qualitative data. Previous work has suggested

that increasing participants for qualitative research can lead to data saturation and variability throughout analysis [15]. This saturation was visible in our last set of interviews. We did not select users of a particular messaging application which meant our sample included users that use one or a variety of apps - Whatsapp, Facebook, Instagram, Twitter, and Reddit. Participants ranged from 19 to 35 years old, and six were female. All participants currently reside in the United States. The ethnicity of the sample ranged from Caucasian, African American, Hispanic, Latino, Southeast Asian, and Indian American. Participants came from different occupational backgrounds such as student, teacher, architect, sales associate, engineer, and infantry, to mention some.

At the end of the study, each participant was compensated with a $15 Amazon gift card for participation. Each participant had the opportunity to earn up to an additional $6 based on their performance. For each correct answer, the pair of participants earned $0.50.

3.4 Study Procedure

All participants filled out a consent form before the study. The study took place on three days: one day for each of the three sets of eight participants. On the day of the study, participants met over Zoom with both researchers. Zoom links were shared over email. Upon joining Zoom, participants received emails with the links to their (four) chat sessions. Each link opened a private chat session with their partner. The link contained the participant ID, chat session ID, and interface type in the form of GET parameters. Upon clicking the link, the application welcomed participants and notified them that their partner was in the room.

Participants were asked to click the link (at their respective time) and communicate with their partner to solve the task. The nature of the task allowed for degrees of cooperation or disagreement. Each session was timed to last no longer than seven minutes. Participants were notified that the task is simply logical in nature and would not elicit any information from them (i.e., their political or philosophical views). However, we did not place any restrictions on topics of conversation.

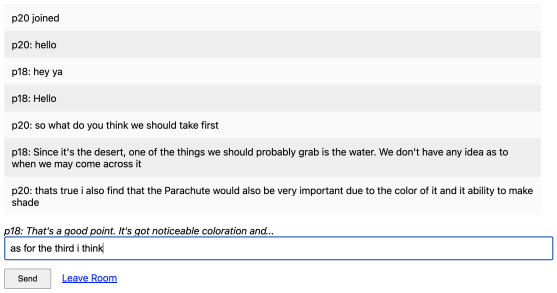

Fig. 4. Chat log of *live-typing*: P20's screen.

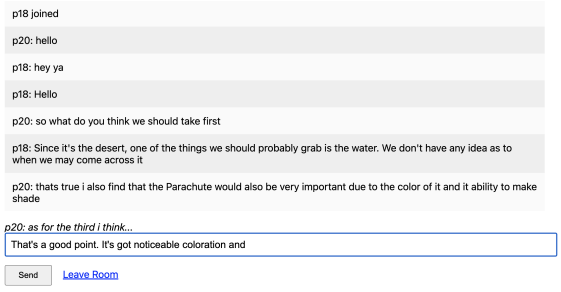

Fig. 5. Chat log of *live-typing*: P18's screen.

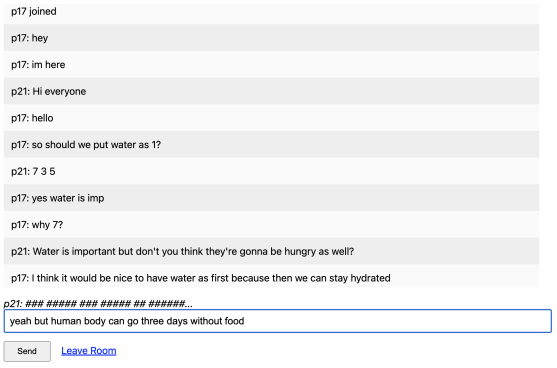

Fig. 6. Chat log of *masked-typing*: P17's screen.

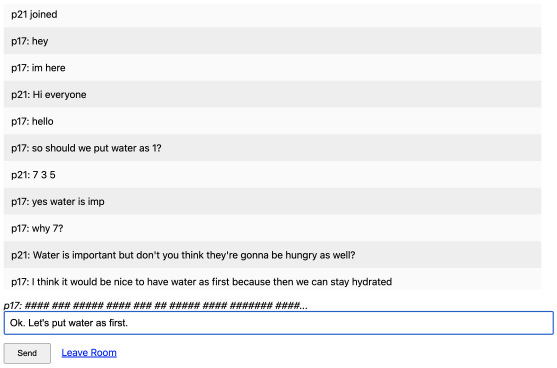

Fig. 7. Chat log of *masked-typing*: P21's screen

At the end of each session, participants completed a NASA-TLX form rating their effort, performance, and frustration. Participants also reported their physical, mental, and temporal demand (perception of time) for completing the task on the respective interface. The survey was quantitative and included questions that assessed participants' task workload. This survey was inspired by all aspects of NASA-TLX, a workload assessment tool that has been successfully proven to evaluate factors related to subjective experiences of workload across a variety of activities [19]. The NASA-TLX questions were reordered for each interface to reduce familiarity bias. The reports were collected using Qualtrics. The ratings were later analyzed for each messaging interface for comparison.

Upon completion of all (four) sessions, participants were asked to rate their preferences and the helpfulness of the interface on a 7-point Likert scale. We also asked participants which interface they are likely to select in their personal lives for daily conversations and resolving conflicts. This was followed by a semi-structured interview. The focus of the interviews was on the (1) participants' thoughts, feelings, and behaviors around each interface, (2) the effectiveness of the interfaces for the problem-solving task, and (3) the applicability of these interfaces in real life. The interviews were conducted in a semi-structured style to allow flexibility for following up on emerging topics.

For each participant, the study took less than 60–70 minutes. The sessions lasted about 50 minutes, whereas each interview lasted about 8–12 minutes. As part of the consent process, we notified participants that they had the right to stop participation at any time. We also stressed that they do not have to answer questions.

We collected 43 chat sessions logging the events exchanged between the client's socket and the server. These logs included when a participant connected, disconnected, and every keystroke pressed. These events were logged along with their UNIX timestamp. There was one no-show we could not substitute for, and one participant did not have internet connectivity for one of their sessions, which resulted in the loss of five chat sessions. Two of the participants had mic issues during the interview. Their responses were not included in the qualitative analysis due to audio disruptions.

3.5 Qualitative Analysis

We used an inductive, open coding approach or Glaserian approach [12, 13] guided by our considerations of user experiences with *live-typing* and *masked-typing*. Two researchers independently re-listened to the audios and transcribed the interviews that they conducted. We merged all the transcripts in Google Sheets, where one column represented all participants' answers to the question asked. We then met to identify and discuss themes guided by our research questions. Specifically, codes were developed for users' perceptions; level of communication; feelings of annoyance, stress, and frustration; level of comfort with the interface, the interface's helpfulness for the task, and its applicability to real-world

communications. Coding results were then discussed in the second round, where we removed overlapping codes and codes not central to our research questions. Codes included 'isolating', 'express', 'communicate', 'helpful', 'mistakes', 'relationships' and so on. The final round of codes was then used to generate themes. The broader themes from our coding process focused on users' thoughts, feelings, and behaviors with *live-typing*, the effectiveness of *live-typing* in the tasks, and the implications of text visibility in real life.

4 RESULTS

Below we present findings from our mixed-methods analysis. We present the NASA-TLX ratings and user preferences (collected over a survey). These are combined with the qualitative findings from the semi-structured interviews that shed light on users' experiences with all four interfaces. We also present insights from our reflective activity on the impact and applicability of text-visibility and co-presence in participant's daily lives.

4.1 Subjective Interface Assessments

According to the NASA-TLX comparison *live-typing* and *masked-typing* improved in every measure over the baseline *(no-indicator)*. The overall cognitive score for NASA-TLX is significantly lower for *live-typing* compared to the baseline ($t(39) = 3.22$, $p = 0.002$).

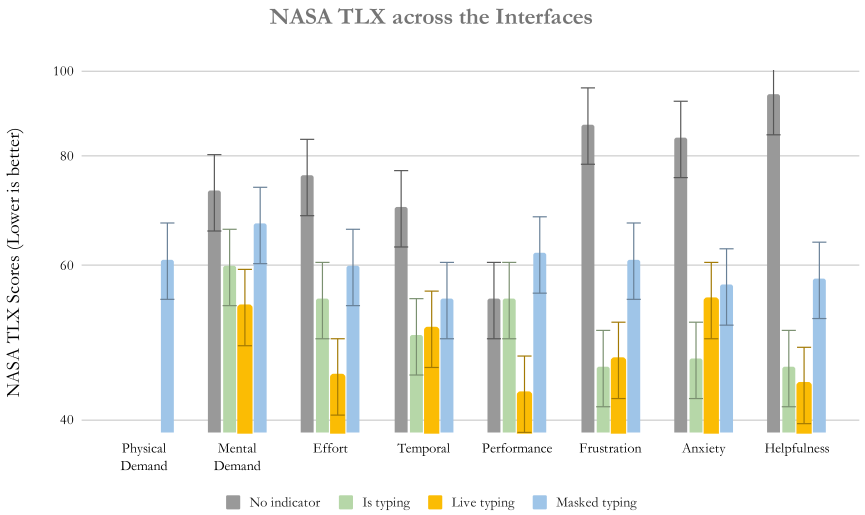

Fig. 8. NASA Task Load Index assessment shows that *live-typing* significantly causes less frustration and stress, has lower temporal, physical, and mental demand, higher perceived performance, and has less perceived effort compared to the baseline.

A one-way repeated ANOVA was performed to compare the NASA-TLX measure outcomes across four interfaces. The tests revealed that there was a statistically significant difference in effort ($F(3, 86) = [3.72]$, $p = 0.00142$), frustration ($F(3, 87) = [6.9207]$, $p = 0.0003$) and stress ($F(3,87) = [4.2986]$, $p = 0.0071$). Tukey's Post hoc pairwise comparisons showed a statistically significant difference in effort required to complete the tasks on the baseline and *live-typing* (Tukey HSD, $p = 0.0081$). There was also a statistically significant difference in frustration on the baseline and *is-typing* indicator (Tukey

HSD, p = 0.0081), *live-typing* (Tukey HSD, p = 0.0049) and *masked-typing* (Tukey HSD, p = 0.0255). These differences were also reflected in participants' interviews. Participants also reported higher stress (F(3, 87) = [4.2986], p = 0.0071) on the baseline in comparison to *is-typing* (Tukey HSD, p = 0.0439) and *live-typing* (Tukey HSD, p = 0.0057).

Participants' preferences also differed significantly across all interfaces (F (3,79) = 11.69, p < 0.001) in addition to ratings collected for helpfulness (F(3,96) = 16.84,p < 0.001). We found a statistically significant difference for overall preference (F (3,79) = 11.69, p < 0.001), preference for personal conversations (F (3,76) = 9.83, p < 0.001) and personal conflict (F (3,77) = 14.68, p < 0.001). Post hoc pairwise comparisons showed that *is-typing*, *live-typing* and *masked-typing* ratings are significantly higher for both preferences and helpfulness as compared to the baseline. No statistical significant differences were found among *is-typing*, *masked-typing* and *live-typing*.

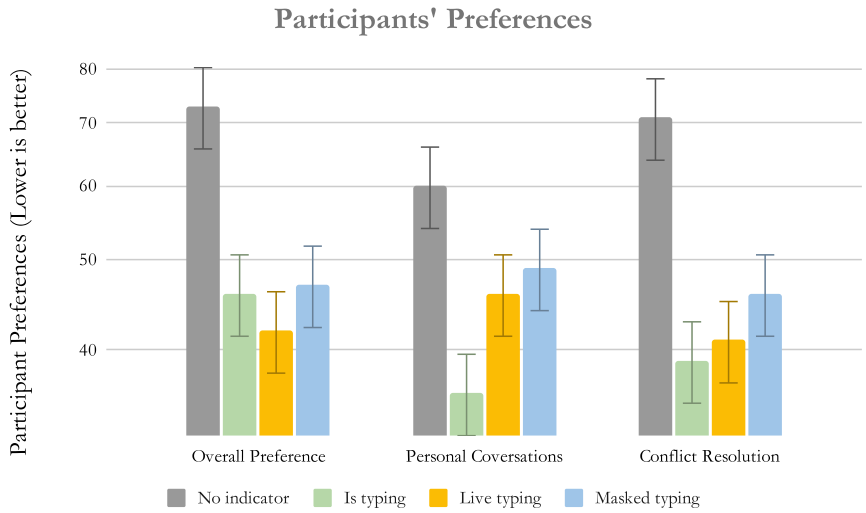

Fig. 9. End-of-study survey shows that participants' overall preferred *live-typing* however for personal lives and resolving conflict, most participants preferred the *is-typing* interface. *is-typing*. None of the participants opted for the baseline (*no-indicator*).

In addition to perceive cognitive workload for each indicator, a one-way repeated ANOVA was performed to compare the number of exchanged messages and words across the four interfaces. Although we could not find any statistical difference between messages (F(3,44) = 1.3, p = 0.27) and words exchanged (F(3,44) = 0.43, p = 0.73), both *live-typing* and *masked-typing* had a higher standard deviation for a total count of messages and words. This was reflected in the final survey where twenty participants (83%) stated that they prefer *live-typing* and *masked-typing* for the problem-solving task as it helped them express themselves better whereas others (17%) who found the new interfaces challenging and limiting in their communication with their partner. In addition to these quantitative results, we found a striking qualitative difference in user experiences and perceptions for both modes of texting transparency.

4.2 User Experiences with Perceived Co-presence

4.2.1 ***Isolation despite Connection***. 62% of the participants reported that *live-typing* allowed them to share their thoughts more than any other indicator and 79% participants stated that *live-typing* was the most helpful in communicating

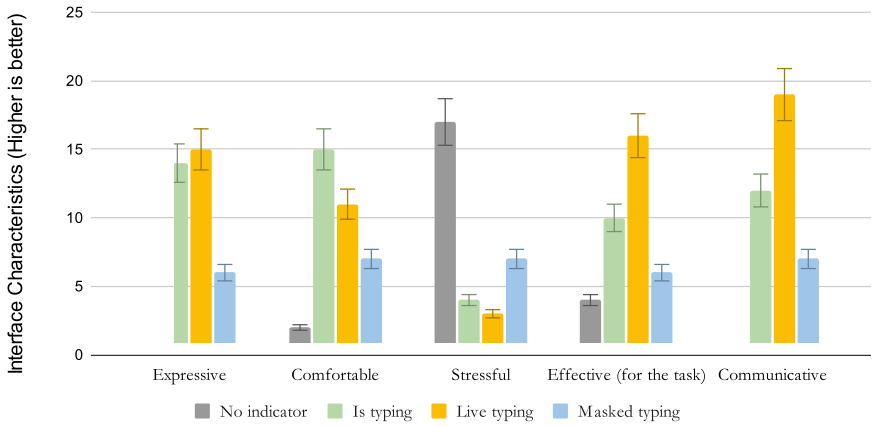

Fig. 10. *live-typing* was perceived to help participant's share their thoughts (expressive), was effective for the task and helpful in communicating with their partner. *is-typing* was rated to be the most comfortable indicator.

Table 2. Number of Messages Exchanged across all Interface

	No Indicator	Is Typing	Live Typing	Masked Typing
Total	210	248	246	190
Mean	17.50	20.71	20.50	15.85
STD	7.42	6.72	8.05	5.87

Table 3. Number of Words Typed across all Interface

	No Indicator	Is Typing	Live Typing	Masked Typing
Total	1192	1198	1494	1282
Mean	99.33	99.85	124.5	106.85
STD	42.07	47.9	57.94	88.96

with their partner. Overall, *live-typing* chat sessions were perceived as the most expressive and communicative. For example, P7 felt their experience with *no-indicator* was isolating and limited them in communicating with their partner: *"The one with no-indicator, I felt alone, which was so hard. I couldn't even see what was up with my partner, like whether they were seeing I was typing, if they were listening to me, if they agreed with my choices, or if I needed to say more. It limited me and my communication."* P9 also felt this isolation: *"I would literally second guess and just be in my own head and ask myself what is he really saying? So they (the no-indicator interface) played on my mind."* This feeling of isolation was particularly associated with the inability to predict their partner's actions and sense their partner's presence. P20 said, *"The no-indicator was very frustrating because I didn't know if they were texting or when they were texting. Sometimes I thought they disconnected, but they didn't and they just took a minute to type,"*. Similarly, P11 mentioned, *"When there is no-indicator, you don't know if anyone is actually in the room with you. I had to write out three sentences (separate messages) at first before I could even get a reply."*

4.2.2 ***Engagement, Comprehension and Validation.*** The immediate feedback delivered in *live-typing* helped participants feel heard, seen, and engaged. For instance, P7 felt comfort when someone read their response, and they received immediate visible feedback which helped them *"have a broader discussion about their lives".* P14 also felt that *live-typing* helped them understand the other person better: *"Seeing what they are typing in real-time helped me pay more attention like someone is speaking their mind on the go."* Participants noted that the interface opened room for more dialogue: "*I usually don't type that much, and that's what happened with my other partners, but here I felt kind of responsible for validating what the other person was saying like restatements, or it was my way of nodding,"*(P13) and *"We were talking more and on different trains of thought because none of us had to wait for the other person to finish typing"* (P9). The communication and attention the participants received encouraged them to experience closer connections with their partners: *"It was like face-to-face communication because I could see them making mistakes, and one time they were testing if their keyboard was working,"* (P16). These shared experiences helped participants relate to each other.

P17 noted this sense of validation in *masked-typing*: *"I wanted to know the person is there (compared to no-indicator) and is making an effort. I didn't want to see their message in real-time (like live-typing) because that overwhelmed me."* P18 liked that *masked-typing* gave a general overview of the message: "*It (masked-typing) showed summaries of your words like knowing the rough outlines."* Likewise, P5 favored how *masked-typing* measured response length: *"It (masked-typing) helped me process that the other person is typing and see that they really care about me by writing a big response."*

Live-typing and *masked-typing* helped most of the participants express themselves and allowed them to collaborate more. P16 preferred live-typing because *"it was faster to answer my partner's questions before they even finished typing"*." More participants agreed on the solution(s), whereas this agreement was low in the baseline (*no-indicator*) and *is-typing*indicator.

Table 4. Agreements Reached across each Interface

	No Indicator	Is Typing	Live Typing	Masked Typing
Agreed on all 3 choices	3	4	7	8
Agreed on 2 choices	3	4	3	2
Agreed on 1 choice	2	2	1	1
No agreements	3	1	0	0

Table 5. Correct Answers across each Interface

	No Indicator	Is Typing	Live Typing	Masked Typing
Number of Correct Answers	10	11	13	16
Number of Correct Answers (in order)	3	6	9	13

4.2.3 ***Discomfort, Vulnerability and Privacy Invasion.*** Five participants (20%) felt uncomfortable and found that either one or both transparent interfaces limited them in their discussions. For instance, P11 said that *live-typing* was *"like walking on eggshells"* and P21 found that they were *"formulating the perfect response in their mind before saying (typing) anything."* When informed that the problem encouraged them to "think together," P21 stated that *"they were not sure of their choices, and until they were, they would not type."* P19 resonated with this experience: *"It's (live-typing) not easy to use when someone is already typing at the moment."* Moreover, several participants found masked-typing impractical and uneasy to adapt: *"I found it extremely annoying as it's like playing hangman without the fun and using more pixels than*

necessary," (P20), *"It (the # symbols) made it seem like my partner was not sharing any important information with me,"* (P2). Similarly, P12 found the design choices *"unfamiliar"* and *"weird"*.

Further, some participants expressed privacy concerns. P21 said, *"live-typing made (them) feel raw and exposed,"* similar to P18 who mentioned: "you can't use it *"live-typing in all situations, especially with personal and confidential information."* P11 also felt monitored and vulnerable when using the interface and said it : *"did not let me express my mind openly."*

Conversely, there were participants who felt that *live-typing* did not have an impact on their privacy. When asked if they were concerned that their partners can see their mistakes, P12 opinion-ed indifference because they *"fat-thumb their keyboard anyway."* Likewise, P20 mentioned that they were generally *"a confident and transparent texter"* regardless of the situation.

4.3 User Reflections on Perceived Co-presence in Real World Communication

In the reflective activity, we asked participants to speculate on the practical aspects of text visibility in their daily lives. Follow-up questions centered around situations where these interfaces could be beneficial and the effect of co-presence in messaging platforms for everyday conversations and conflict resolutions.

4.3.1 ***Reflections on Text Visibility: Applications and Navigation.*** Twelve (50%) participants said they could see *live-typing* being applied in professional settings. P7 preferred *live-typing* for formal occasions: *"in a formal setting, the interface can help you express your mind. But on a day-to-day basis, this would cause chaos."* P20 could see *live-typing* applied for team business meetings as : *"it can replace Zoom calls."* Participants mentioned *live-typing*'s applicability in educational environments: *"For learning, like solving a math problem, it (live-typing) will be easier for the other person to pull me on the right path if I am making a mistake"* (P3) and *"it can be an add-on for group co-ordinations in final projects"* (P13).

Participants also suggested that *live-typing* could be implemented in chatbots for customer support. For instance, P4 mentioned that *live-typing* could be used for *"customer care service like chatting with Walmart about a product I thought wasn't good."* Likewise, P10 reflected on *live-typing*'s applicability in chat supports when *"a website is not working to help with user satisfaction"*.

Despite *live-typing*'s applicability, only ten participants (41%) stated that they would use the interface in their personal lives. Most participants were apprehensive and uncomfortable with the "raw exposure" it would cause in communication. P11 felt invasive to see the other person typing: *"It can be nice but also really rude to peek in someone's thoughts. Maybe they made a mistake and want to correct themselves before sending them."* P12 also felt that *live-typing* is too excessive: *"it's better just to let them know that you're coming up with a response."*

In contrast, P6 felt that the interface has the potential to *"improve long-distance communication"* and P24 viewed *live-typing* as preferable when there is continuous dialogue to be exchanged: *"I treat texting as informal emails: messages to be seen later. If I were to have a whole conversation, I'd use live-typing"*. P2 thought *live-typing* could be used in social media applications where " *you can say what you want without committing to your words (posting). It's freedom of speech for the mind."*

Beyond daily life discourse, participants expressed that *live-typing* would be helpful in cases of urgency. P11 commented that *"in emergency situations, the person can seek help faster by saying less."* P18 also noted that they *"can see live-typing being used in situations where information needs to be shared with somebody immediately, for instance, in emergency services"*. In addition to emergency services, P7 reported that *live-typing* could be a tool to manage psychological and physical distress: *"In some situations where someone is having a mental crisis, live-typing can give immediate affirmation or validation"*. Similarly, P11 found that the indicator can be used during time-sensitive tasks: *"If you're under pressure*

and you are looking for a reply soon, the feature will actually let you know if you should continue relying on that person or if you need to move on to someone else."

4.3.2 ***Reflections on the Impact of Text Visibility on Relationships.*** We saw contradictory views on the impact of perceived co-presence through text visibility in messaging. P7 strongly believed that *live-typing* would hinder relationships: *"I don't think there would be any relationships at the end of the day. It's easier to express negative emotions through text than on calls. People are harsher on texts. What makes messaging appealing is a lot of anger is lost during message composition"*. P17 also felt that *live-typing* would cause *"chaos in relationships"*. Most participants reported that the indicator's heightened co-presence conveys their "true feelings" and cannot let the person change their mind. However, they fell silent when asked how it compared to face-to-face communication, where there is no edit or taking back option.

In contrast, other participants addressed that *live-typing* could improve relationships as it fosters communication more than the current awareness indicator. For example, P8 noted that: *"The back and forth of exchange of real-time messaging is engaging. Anytime we engage in a communicative conversation, it positively affects relationships,"* P6 said, *"It (live-typing) can be good for relationships where people feel like their friends are ignoring them,"* similar to P2 who commented that *"relationships will be better because you'll know your partner is into the conversation and not busy with something else."* P20 explained that *live-typing* will *"allow people to be more accepting of others' views and feelings,"* and P21 stated that *"we will not have a filter to screen through before expressing ourselves."* P11 felt that *live-typing* could mitigate the situations of *"late replies from (their) partner (significant other)."*

4.3.3 ***Reflections on Text Visibility on Problem Solving and Conflict Resolution.*** Most participants noted that they would choose *live-typing* for the problem-solving task. These results are also supported by NASA-TLX, where overall effort, mental demand, and physical demand were lower when participants used *live-typing* to complete the task. P5 found *live-typing* was effective in understanding the problem: *"Seeing text in real-time helped me pay more attention and agree more with their first instincts."* When asked why they preferred this interface for problem-solving, the participants thought back to the study: *"it was like teamwork,"* (P19), *"it helped me contribute more,"* (P22), and *"solutions came more swiftly"* (P11).

However, participants leaned towards *is-typing* indicator when asked which interface they would choose for personal conflicts (Fig 9). For example, P12 noted, " *is-typing just lets them know that you're coming up with a response and that you're still thinking without them seeing everything."*. P5 would resort to is-typing because *"some things can come to appear harsher"* with more text visibility.

5 DISCUSSION

In this section, we present the trade offs for designing for presence in computer-mediated written communication. We combine participants' reflections and real-world situations where *live-typing* would help individuals connect, communicate and express themselves. Specifically, we present insights that can act as venues for redefining human connection over text-based mediums:

- Design for participant's subjective values
- Design safe spaces for vulnerability that fosters authentic connections and
- Design for co-presence, self-reflection and active listening

5.1 Design for Participants' Subjective Values

Eighteen participants (75%) reported that *live-typing* helped them communicate better with their partners during the task. Two (10%) of the participants preferred *masked-typing*, and four (15%) felt the *is-typing* indicator was the most communicative as it was the most familiar indicator cue. P15 felt that *live-typing* was *"faster, more involved, and shows that your partner is contributing to the conversation."*

However, in the reflective activity, when participants were asked to reflect on the implications of messaging this way, fifteen participants were apprehensive and surprised at the idea. This was observed through recording interjections of surprise and shock ("oh my", "gee", "wow"). Twelve participants said they would not use *live-typing* in their personal lives as *"you can say something wrong and not be able to delete or fix it"*. Four of those participants were unsure, reporting, *"either way, the message is going to go through."* This meant that even though most participants felt *live-typing* was the most comfortable medium for problem-solving as it *"helped them have a richer experience"*, the participants felt uncomfortable with the same medium in a different setting (their personal lives). This was reflective in P19's experience: *"It was definitely stressful – like real conversations, I was saying things in real-time with no control on what I'm going to type (say)."*

However, some participants had opposite reactions and were thrilled at the implication of *live-typing* for personal communication. Participants in this subset imagined that they would feel validated, heard, and seen as they felt in the study. P11: *"In my relationship, I tend to get a late reply often from my partner. With the live-typing feature, it's actually making me know when I can get a reply because I am online quite a lot."*

This discrepancy in user experiences provided us with an understanding of different user values in our trial. The distinction in values was prominent as the transparent nature of *live-typing* was perceived as *"privacy-invasive"* for some while *"validating and heard"* for others. The same applied to *masked-typing*, where users' reactions ranged from *"annoyed and irritated"* to *"it helped me wait for my turn."* The subjective, individual value for texting transparency on relationships ranged from *"relationships can be more honest and open*" to *"there will be no relationships at the end of the day"*. According to Schwatz [40], these values exist before users interact with evaluated systems. Human subjective values are detected not instilled when interacting with the system. Hence, leveraging *live-typing*'s real-time synchronous communication that focus on co-presence could especially be appropriate in settings where users value social presence and high engagement. The design strategy should be subjective where a person *"hesitant of exposure can opt out"* (P21) whereas the recipient valuing presence in their interaction *"can enable the setting"*(P8).

5.2 Design Safe Spaces for Vulnerability that Fosters Authentic Connections

One of the biggest concerns of participants was that *live-typing* enabled their partners to see their mistakes. When asked how it differs from real-life communication or a phone call where there is no "taking back" or a backspace option, participants fell quiet. Messaging was seen as a way to *"uphold an image where there can be no room for error, vulnerability, and a close human connection"*(P7). None of the participants cared when their partner made a typo or a mistake. P7 reported that "using *live-typing* for daily communication is like a Twitter for messaging where a lot can go wrong."

Messaging popularity is said to lie in people's fundamental need to connect and belong [47]. Research findings have shown that awareness systems (e.g., *is-typing* indicator) have the capability of enhancing an individual's sense of connectedness [22]. However, current messaging interfaces still lack the complete synchronous affective characteristics of communication. For most participants, mobile communication (texting, emailing, posting) enabled them to *"change their mind while writing a message"* - editing and deleting their thoughts before they can communicate to their partner whereas interpersonal communication is rich in vulnerability [30] and authenticity [36]. Current messaging interfaces enable

us to omit these vulnerable and authentic components in our communication which sometimes can compromise a rich connection for mere communication. P5 reported that they found themselves agreeing to their partner on the *live-typing* interface more as their instinct was to *"trust their partner's first instinct."*

Showing vulnerability by portraying an authentic image of self, whether in the form of making mistakes, hesitating during a conversation, emotional exposure, or keeping the authentic and instinctive parts of your reactions in your communication has its benefits, including fulfilling close relationships[44], better health[8], and increased creativity[6]. However, these rewards can be hindered because of fear of rejection or negative evaluation associated with vulnerability[38]. The current messaging interfaces have the risk of stripping all of that information, leaving us with a perfectly edited and well-thought script. Leveraging more transparency in messaging that focus on presenting *"our raw self"* could be helpful for individuals who use messaging for rich conversations. Ultimately, a balance of vulnerability and the ability to *"safely say things before I commit to them"* (P21) could help users present themselves, their viewpoints and navigate their differences together with respect and validation. This can be crucial in online peer support communities where people seeking support are already in a vulnerable state. The shared vulnerability and raw exposure associated with *live-typing* can help, both, the person seeking support and the person giving support, to form a connection.

5.3 Design for Perceived Co-presence, Active Listening and Self-Reflection

In addition to authenticity and vulnerability of self, active listening and social presence are central components of rich communication. Short et al. (1976) hypothesized that the interaction through communication media is determined by the variations in the degree of social presence present in these platforms. Media capacity theory places audio-visual communication at a richer, more fulfilling social end than written communication. However, the current work is limited in its research as it has not yet analyzed ways to increase the degree of social presence in written communication, especially messaging (which billions of people use to stay connected) beyond awareness indicators (*is-typing*). These awareness systems can be poor, and the measure of social presence is low [22].

This low social presence could be attributed to Bionca and Harms' [3] definition, which states social presence is a "moment-to-moment awareness of co-presence of a mediated body and the sense of accessibility of the other being's psychological, emotional, and intentional states." Specifically, they state that social presence varies in three levels. Level 1, or the perceptual level is the awareness of a co-presence in a mediated communication. This is evident in the current messaging interfaces as the *is-typing* indicator. Level 2, or the subjective level, is the awareness of the other person's attention, engagement, emotions, and behavioral interaction. The third level is that the user is aware of how the other person is perceiving their social presence [4]. *Live-typing* enabled us to go beyond the first level, as P4 reported: *"It was funny in a way, the backspaces, and the pauses when they were thinking or hesitating because they knew I was seeing everything… it was as if I am thinking with them."* P5 also felt live typing helped as *"We were being together while not being together.."*

In terms of active listening and self-reflection, users reported that *live-typing* and *masked-typing* helped them *"wait their turn"* and "process what the other person was saying." This, in turn, helped them be more mindful of their words. P23 reported that they were *"really processing their words instead of being in my head and thinking what are they typing and how I would type back."* The self-reflection was fostered in the platform where users did not *"have the ability of taking back their words."*

Reflecting on our perceptions before conveying the information is a central component of self-awareness. Active self-reflections encourage listening with self-conscious awareness [34]. One of the central components of a good communication is listening. The self-reflective nature of the interface encouraged active listening in participants. P23 felt

that *"their words mattered as if someone was listening and attentive"* where as P1 *"was conscious of their words instead of typing a perfect response."*

These design implications are particularly relevant in online written therapeutic avenues that value active listening in peers and encourage active self-reflection in people seeking support. Future work can investigate the role of *live-typing* in peer support platforms and how users of these systems perceive the heightened co-presence nature of the interface.

5.4 Future Work and Limitations

The reflective activity for the implication of *live-typing* in real life has limitations as users can only experience their values by interacting with the interface. These results might be more realistic if users would use *live-typing* in their daily lives and share their experiences. Experience with an interface is also susceptible to change and evolves over time after repeated interactions in the intended social setting [23].

Future work might investigate the effect of text visibility and its association with perceived social presence by studying the interactions for longer duration of time and with users' personal contacts. Since, *live-typing* was perceived as making participants feel connected, vulnerable and have richer conversations, future work might investigate how these characteristics are perceived by users who seek social support in distressful situations.

Because of the logistic challenges of coordinating 24 participants over multiple time zones and accommodating no-shows, we could not recruit a large sample for our study. Both authors manually scheduled, coordinated and reminded participants about their scheduled sessions. Future work could expand our study by observing the statistical difference between each interface for larger samples of people.

We could also not replicate a personal conflict in the study and adopted a problem-solving scenario that would potentially raise disagreements, creating a space to mutually navigate a conflicting viewpoint. While the problem statement enabled a consistent and controlled experiment, it limited our ability to understand participants' experiences with the interfaces in a natural conflicting environment. This limited us in formulating any relationship between user's perceived co-presence and conflict resolution.

6 CONCLUSION

This study explores a subtle but impactful cue for redefining human connection and communication that takes place over messaging, whereby enabling us to bridge the long-distance isolation and lack of social presence beyond awareness that is still prevalent in written mobile communication. We designed four online messaging interfaces with varying degrees of co-presence. The interface designed for maximum co-presence, called *live-typing*, was perceived as deeply enriching. *Live-typing* was the preferred interface for problem-solving as the interface helped participants come to agreements more. The interface also increased users' perceived social presence, but provoked vulnerability and exposure for some users. Participants reflected on the implications of each interface's applicability in real-world communication. While awareness indicators were reported as the most comfortable indicator cue in messaging, *live-typing*'s engaging nature was considered most appropriate for deep personal conversations. Participants also reported on the interfaces' suitability in crisis situations like online therapy and peer support as it provides immediate feedback and validation. We hope that this study will motivate future research on increasing social presence in written computer-mediated communication.

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