Do You Think What I Think: Perceptions of Delayed Instant Messages in Computer-Mediated Communication of Romantic Relations

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ABSTRACT
In romantic relationships, Instant Messaging (IM) can serve as a communication channel to maintain a sense of mutual presence and relational closeness when being physically separated. However, IM is asynchronous by design. There can exist time delay for people to receive and reply to incoming messages, which may violate romantic partner's mutual expectation. Limited understanding is available around how unintended and intended delays affect the relationship of romantic partners. This work examines how romantic partners grow, perceive, and use mutual knowledge about each other in delayed IM to resolve the expectancy violation. We conducted a 7-day diary study on 16 pairs of romantic couples and used the diary entries as probes for post-study one-on-one interviews. Our findings show that couples employ different strategies of information grounding to parse and resolve delayed IM. Based on these findings, we propose several theoretical and practical implications.

Author Keywords
Computer-mediated communication; instant messaging; delayed communication; relational communication; romantic relationship; common ground; grounding; expectancy violations theory

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous

INTRODUCTION
Nowadays, couples use text-based Instant Messaging (IM) to maintain romantic relationships on a daily basis [21]. IM not only affords awareness of each other's status but also sustains psychological connection when they are not co-located [9, 21]. Distinctly from face-to-face (FtF) communication, communication via IM may experience delays between messages due to asynchronicity. Drawing on Expectancy Violations Theory (EVT) [2], several empirical studies [16, 22] suggest that delay can impact interlocutors' perceptions about one another when the recipients' responding time deviates from sender's expectation. In such context, *how* senders interpret delayed messages may act as a key mediator. The latency can be construed as intended delay (e.g., a possible sign of rejection or indifference [11]) or unintended delay (e.g., unawareness of incoming messages or unavailability of response).

While much literature focuses on *senders'* expectancy violation, less attention has been paid to *receivers'* perceptions. Since communication is reciprocal, how receivers perceive and interpret senders' expectation about responsiveness and their own delay deserve equal attention. Based on EVT, we introduce the theoretical framework of grounding to examine how delayed IM affects both senders' and receivers' communication behaviors and relationship dynamics.

Mutual knowledge facilitates interlocutors to perceive and interpret information in communication [5]. When mutual knowledge is deficient, it may form obstacles to communication process and interpersonal bond [7]. *Grounding* [5], the process of exchanging evidence of understanding and collaborating in conversations to fill knowledge gaps, is important for communicators to achieve mutual understanding. Several designs were proposed to facilitate grounding in Computer-Mediated Communication (CMC) (e.g., workload indicator [10], task information sharing [24]), but they primarily focused on availability sharing in *workplace scenarios*, not *relational communication*.

In romantic relationships, the time spent on communication and relationship closeness can help couples develop mutual knowledge towards each other [19]. Nevertheless, how romantic couples engage in and deal with expectancy violation in delayed mediated interaction has been overlooked. Given the gap in the existing literature, we investigate the following research questions:

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RQ1: How is mutual knowledge anticipated and developed in delayed IM in romantic relations?

RQ2: How does mutual knowledge affect expectation about responsiveness, interpretation of delay, and perception of each other on both parties of a couple in the context of delayed IM?

To answer the set of research questions, we recruited 16 pairs of romantic couples and conducted a 7-day diary study to collect incidents of delayed messages. We asked both parties of participating romantic couples to document their respective perceptions of and reactions to each delayed message, no matter who was the delayer. We compared and contrasted viewpoints from both sides to explore (in-)consistency. Next, we used the diary entries as probes and conducted one-on-one in-depth interviews with our participants, investigating how mutual knowledge was developed, perceived, and used in the incidents where delays happened. We also covered their general experience with respect to delayed IM in the interview.

Our findings show that couples employ different strategies of information grounding to parse and resolve delayed IM, including status grounding, process grounding, and context grounding, which further affect their perception of each other, and the romantic relationship between them. These findings point to both theoretical implications and design space for technology that can support better communication in romantic relationships.

RELATED WORKS

In this section, we review how mediated and delayed communication affects the perceptions of interlocutors about one another, and the process of developing mutual knowledge.

Mediated and Delayed Communication

Text-based CMC allows a conversation to proceed near-synchronously, with prompt exchanges of messages, or asynchronously, with hours passing between incoming and outgoing messages [20]. As communication on IM can be asynchronous, the dynamic of a conversation as well as interlocutors' perceptions (e.g., intimacy, affection, dominance) of each other may be influenced when communication flow is disrupted [25]. Two mediators have been proposed in the literature regarding delayed communication: *the expectation about responsiveness* and *the interpretation of the delay*.

The Expectation about Responsiveness

Research revolved around expectancy violations suggests that people develop norms and expectation about responsiveness [16, 22]. When users send messages, they carry an expectation about when responses should arrive and may draw negative conclusions if they are delayed. A lab experiment [16] investigated messaging among known acquaintances has evidenced that senders who experienced higher expectancy violation of responsiveness perceived lower social attraction of respondents. For message senders, "delay" may be perceived beyond a time lag between messages sent and received; instead, it is a deviation from what is expected. Understanding how expectation is shaped is critical to understanding delayed communication. EVT outlines three factors that influence one's expectation [12]: communicator characteristics (e.g., personality, communication style), relational characteristics (e.g., the type of relationship, shared experience), and context characteristics (e.g., environment, social norms), which guide us to resolve the perceptions of delayed messages between romantic couples.

The Interpretation of the Delay

In delayed communication, not only *expectation* but *interpretations* of the delay is the key. An unanticipated response latency can be interpreted as intended delay (e.g., a possible sign of rejection or indifference [11]) or unintended delay (e.g., unawareness of incoming messages or unavailability of response), which further determines how people perceive their interlocutors [25] and deal with the unanticipated delayed responses. Interpretation of such chronemic cues acts as a significant mediator in delayed communication; however, ambiguity may introduce different ways of interpreting the chronemic cues and result in unintended misunderstanding [8].

Much research has explored how senders experienced expectancy violation of responsiveness and interpreted implications of latency in delayed communication. However, less attention has been paid to receivers' interpretation. Communication is reciprocal. How receivers perceive and interpret senders' expectation about responsiveness and their interpretation of their own delay require investigation. We argue that this can be especially true when talking about romantic relationships. In the context of delayed response, it can affect coupled individual's coping strategy and influence the subsequent interactions and the perception of the partner. We propose to use the theoretical framework of grounding to discuss how expectancy violation revolved around delayed messages are perceived and interpreted in romantic couples.

Grounding in Communication

Effective communication is contingent on what information is delivered and how it is perceived and interpreted [5]. During the communication process, both parties must establish a mutual knowledge about what has been conveyed and what has been understood, or called *common ground*; the interactive process for reaching mutual knowledge is called *grounding* [5].

Grounding Types

Clark and Brennan [5] further distinguished grounding into *content grounding* and *process grounding*. During grounding, conversation content (what is communicated) is not the only information that needs to be coordinated, metadata like process grounding (how to engage in conversation) is also essential. Content grounding involves negotiation and coordination of conversation subject and background knowledge. Process grounding focuses on how the

conversation is processed like the rules, procedures, timing, and manner. Research further suggests grounding needs to take affect into consideration [18], in which mutual knowledge about one another's emotion should be ensured.

Grounding in CMC

In FtF interaction, grounding can be built on both verbal cues, such as spoken words [5] and nonverbal cues like eye gaze, facial expressions, head nods, gestures [4, 6, 15]. In CMC interaction, nonverbal cues are lean, which makes grounding more challenging [17]. In FtF interaction, people usually engage in grounding synchronously [5]; however, in CMC interaction, such as the use of IM, people may not necessarily engage in synchronous conversation [5]. Many researchers were dedicated to improving responsiveness in CMC through designs. Dabbish and Kraut [10] used partner's workload as an indicator of appropriate timing for interruptions. This mechanism can potentially improve grounding for availability. Tang and Birnholtz [24] demonstrated an IM prototype that provided task information and suggested that such information sharing can be used both to predict partner's availability and to explain the cause of the late response. Much previous work revolved around grounding aimed at workplace coordination or task-oriented collaboration. Less attention has been paid to investigate grounding in romantic relationships.

Grounding in Romantic Relationships

Co-membership and interpersonal understanding facilitate reaching common ground [3, 19]. In romantic relationships, couples commit to relationship building and maintenance. The degree of interpersonal understanding for romantic couples should be higher than other types of collaborators and communicators. Due to the level of relational communication engagement, daily interaction, and mutual knowledge, romantic couples may experience less difficulty in achieving grounding.

To complement previous studies, we investigated how romantic couples leverage their relationship to reach grounding and resolve delayed IM in the following aspects:

1. IM serves as an essential channel for relationship maintenance between romantic couples, but delayed IM may violate each other's expectation regarding responsiveness and affect the intended affordance of relationship maintenance.
2. The discussion of expectancy violation in delayed communication should be extended from sender to both interlocutors.
3. How common ground facilitates interpreting delayed messages to resolve expectancy violation may help extend theory building.

METHOD

We conducted a 7-day diary study and one-on-one in-depth interview study to understand the perceptions of delayed instant messages between romantic couples and how they deal with them.

Participants

Sixteen pairs of heterosexual romantic couples aged from 19 to 33 years old (M = 23.56, SD = 3.40) participated in this study. We posted the recruiting messages on a Facebook page of domestic study user pool and a LINE (an IM tool similar to WhatsApp popular in our research site, Taiwan) community. Our recruiting criteria included couples who communicated actively on instant messengers, such as Facebook Messenger or LINE. We used a screening question that asked "We frequently text each other on instant messaging," with a 5-point Likert scale item that ranges from 1 being "strongly disagree" to 5 being "strongly agree." All our participating couples self-rated above 4. At the time when they were recruited, they had been in the relationship with each other from 1 to 116 months (M = 22.19, SD = 26.61). Most of them were in dating relationships; only one pair was engaged. Eight couples (50%) categorized themselves as long-distance (LD) relationship during the study, and eight couples (50%) self-evaluated as geographically close (GC) relationships. They lived in northern or southern Taiwan. Twenty-one participants were students (66%), and others worked in industries like engineering, marketing, and planning. Nine couples (56%) used LINE as their primary conversational channel, and seven couples (44%) mainly communicated on Facebook Messenger. The interviewees were anonymized, and their quotes are presented in the following format: "relationship distance-number-gender" (relationship distance: GC or LD; group index: from 1 to 8; gender: M = male or F = female).

Instant Messengers

In this session, we reviewed two instant messengers mainly used by participants of our study, LINE and Facebook Messenger, and compared their similarities and differences, especially the designs that can potentially affect the delayed response context.

Both LINE and Facebook Messenger are popular instant messengers [1] that enable users to send messages with one another privately on multiple devices, such as cell phone, tablet, laptop, and desktop computer.

LINE and Facebook Messenger both distinguish unread messages from read ones in the chat window. However, only Facebook Messenger displays the following availability cues: online signal (green dot indicates online), the last time shown online and responding indicator when interlocutors are typing in the chat window.

Users can also connect with others and construct a social network (namely the friend list) using LINE. In addition to chatting, LINE also affords "timeline" with which users interact with the community by posting, commenting, and "liking" their friends' posts as Facebook "news feed" for Facebook Messenger users.

Study Procedure

In the beginning, we collected demographic information about our participants and their IM usage in a pre-study questionnaire. We then asked each couple to keep a diary for a week to gather materials about the contexts of delayed responses. We used the information provided in the diary study as probes for interviews. Subsequent to the diary session, we conducted one-on-one interviews with each participant individually. After the interview, each participant received NT$ 750 (approximately US$ 25) as compensation.

Diary

To compare and contrast perceptions about delayed response incidents, we asked each participant to keep individual diaries that documented incidents of delayed messages, their correspondent perceptions about the incidents, and how they dealt with them. The diary entries serve as initial data about (in-)consistency of perceptions and the types and frequency of delayed messages. Later we also used the entries as customized interview probes to reduce recall bias.

Participants were instructed to keep the diary for seven days. We asked our participants to report any outgoing and incoming instant messages that they considered a reply was needed but delayed for more than 30 minutes. We scheduled an information session before the study for each participant to ensure that they comprehended the criteria for diary keeping. A trial day was also given to each participant, and we provided feedback on whether the diary was correctly kept.

Diary Entries

For each diary entry, we asked our participants to complete the items based on the roles in the incident of delayed IM. For senders, those who sent out messages, expected responses, but received delayed ones, they needed to complete the following items (marked in column S in Table 1): *time*, *message content*, *online status*, *message read*, *location*, *activity*, *expectation*, *understanding*, *reason*, *feeling*, and *perceived urgency*. For receivers, those who were expected to respond but delayed theirs, they needed to complete the following items (marked in column R in Table 1): *time*, *message content*, *online status*, *message read*, *location*, *activity*, *understanding*, *reason*, *feeling*, *perceived urgency*, and *responsiveness*.

Message Coding

To understand what types of messages were mostly delayed, we conducted content analyses, examined the message content of each entry in the diaries and identified the following categories (defined in Table 2) using open coding method: *information*, *personal perception*, *concern*, *intimacy*, *status report*, *status request*, *time-constrained incident*, *non-time-constrained incident*. Then we asked two research assistants who did not know the goal of the study to code the messages. Each coder examined half of the message corpus independently with 20% randomly selected

Item	S	R	Instruction [Sender / Receiver]
Time	✓	✓	Record the timestamp of the [outgoing / incoming] message shown on the instant messenger.
Message Content	✓	✓	Describe the [outgoing / incoming] message. (We encourage you to provide the exact sentence of the message. Alternatively, for privacy concern, you can paraphrase the incident.)
Online Status	✓	✓	Assess [partner's / your own] online status with a 5-point Likert scale: "[My partner / I] was active on the instant messenger when [I / my partner] sent the message." (1 "strongly disagree" to 5 "strongly agree")
Message Read	✓	✓	Assess whether the message was read with a 5-point Likert scale: "[My partner / I] read the [outgoing / incoming] message within 30 minutes." (1 "strongly disagree" to 5 "strongly agree")
Location	✓	✓	Assess [partner's / your own] location.
Activity	✓	✓	Assess [partner's / your own] offline activity.
Expectation	✓		Assess the expectation about responsiveness with a true-false question: "The delayed response was expected."
Understanding	✓	✓	Assess the level of mutual knowledge about the delay with a 5-point Likert scale: "[I / My partner] understood the reason why [my partner / I] delayed response." (1 "strongly disagree" to 5 "strongly agree")
Reason	✓	✓	[Assess / Describe] the reason for the delay.
Feeling	✓	✓	Describe the feeling resulting from the delayed response.
Perceived Urgency	✓	✓	Assess how urgent the response was with a 5-point Likert scale: "From my perspective, the messages need to be responded immediately" (1 "strongly disagree" to 5 "strongly agree")
Responsiveness		✓	Assess the delayed interval ("0.5 to 1 hour", "1 to 3 hours", "3 to 6 hours", "6 to 12 hours", "more than 12 hours" and "no response") and describe the response if responded, which can be the exact sentence of the outgoing message or paraphrase of the incident.

Table 1. The diary items and corresponding instructions for participants. "✓" in column S (= sender) refers to the items in *senders'* diaries; "✓" in column R (= receiver) refers to the items in *receivers'* diaries. When items shared between senders' and receivers' diaries had different instructions, we use "[]" to separate the dissimilarity. The phrase prior to "/" is for senders, and the latter is for receivers. Items refer to the numerical items that required for both senders and receivers to rate. These variables were used for descriptive and inferential statistics that determine the differences between two partners.

Code	Definition	Example
Information	Share information related to third parties	*Description: "News about prosecuting illegal parking"*
Personal Perception	Share personal experience, feeling or thought	*"I rode bike faster than a motorcycle"*
Concern	Express sympathy, care or support	*"You looks so tired"*
Intimacy	Express intimacy	*Description: "Hug me"*
Status Report	Report personal early, present or future status, such as activity, location, and companies	*"I'm going to conduct the experiment"*
Status Request	Request partner's early, present or future status, such as activity, location, and companies	*"Are you still discussing with your group members? Tell me when you head to the restaurant"*
Time-constrained Incident	Propose or respond to time-constrained question or instruction which determine current movement	*"Come downstairs"*
Non-time-constrained Incident	Propose or respond to non-time-constrained question or instruction which do not determine current movement	*Description: "Discuss the trip of New Year's Eve"*
Miscellanea	Unable be identified with limit description or classify into above category	*Description: "Chatting"*

Table 2. The codebook developed for categorizing message content of each entry in the diaries.

overlapping data. Then they met to discuss and resolve any mismatches until achieving inter-coder reliability (Cohen's kappa = .861).

Interview

We conducted follow-up one-on-one semi-structured interview with each participant. The interview outline covered: 1) their general IM behaviors, 2) specific practices based on what we collected from the diary, and 3) some interesting cases about delayed responses that happened in the past. We allowed our participants to elaborate on the delayed response contexts and their perceptions about them using any facilitating materials they had, such as diary entries, messaging history on their phones, and calendars. Each interview lasted around 60 minutes.

Interview Analysis

Using a bottom-up approach, the first author analyzed each transcript. All authors then discussed the codes and their meanings until several recurring themes emerging from the transcripts and the final themes becoming stabilized.

DIARY FINDINGS

A total of 432 diary entries were collected from both sides of the couples. Among them, 210 entries (105 incidents) were matched, meaning the same incident was reported by both parties. There were 222 mismatched entries: 114 entries were documented by the senders but not by the delayers; 108 entries were the opposites. Mismatched entries indicate that the couple may have misaligned and inconsistent interpretation of the necessity of delay or reply. We later asked the participants about these inconsistent situations in the interview.

Among matched entries, 45% were reported by the GC couples, and 55% by the LD couples; 45% were delayed for half an hour to an hour, 38% within an hour to three hours, and 11% were not responded at all; 62% fell within expected delay, and the rest 38% did not. For 12% of the matched incidents, the recipients were active on the instant messenger and read the message immediately but still did not respond.

For each matched entry, we calculated inaccurate interpretation (hereafter called *inaccuracy*), the absolute value of subtracting receiver's measurement from sender's, on the numerical items (marked in Table 1) reported by both parties, including *online status*, *message read*, *perceived urgency*, and *understanding* (all measured with 5-point Likert scale). We then conducted Wilcoxon signed-rank tests to determine whether the difference of these measurements between senders and receivers are significant. Wilcoxon signed-rank test is a nonparametric statistical test used when comparing matched samples to test whether the mean ranks of their population are different.

As Table 3 depicted, there were significant differences for *online status* and *message read*. Receivers rated online status (M = 2.50, SD = 1.32) higher than senders (M = 2.01, SD = 1.21), $p < .001$. Receivers' message read (M = 2.50, SD = 1.32) was higher than that of senders (M = 2.20, SD = 1.20), $p = .017 < .05$. It evidenced that there are gaps between senders' and receivers' perception on these two items. In other words, participants did not share information about each other's online status sufficiently. However, senders and receivers did not differ significantly on *perceived urgency* and *understanding*, suggesting that romantic couples can accurately interpret the urgency conveyed in the messages in

Item	Measurement				Inaccuracy		*p*
	Sender		Receiver				
	M	*SD*	*M*	*SD*	*M*	*SD*	
Online Status	2.01	1.21	2.50	1.32	1.05	1.26	.000***
Message Read	2.20	1.20	2.50	1.32	1.03	1.39	.017*
Perceived Urgency	1.90	1.11	1.92	1.13	.88	.89	.980
Understanding	3.89	.99	3.95	1.13	.06	1.54	.643

Table 3. The differences between senders and receivers on the four items. * = $p < .05$, *** = $p < .001$.

Category of Message Content	#	Measurement of Perceived Urgency				Inaccuracy of Perceived Urgency	
		Sender		Receiver			
		M	*SD*	*M*	*SD*	*M*	*SD*
Information	16	1.75	.93	2.00	1.10	.50	.52
Personal Perception	**25**	2.00	1.26	1.76	.88	.96	.89
Concern	10	2.10	1.20	2.5	1.43	1.20	.92
Intimacy	3	1.00	.00	1.00	.00	.00	.00
Status Report	7	1.86	1.07	2.00	1.41	.71	1.11
Status Request	13	2.38	1.26	1.62	0.96	**1.69**	**.95**
Time-constrained Incident	11	2.36	1.29	2.82	1.33	.64	.67
Non-time-constrained Incident	11	1.27	.47	1.45	.93	.55	.69
Miscellanea	8	1.63	.74	1.88	1.13	1.00	1.07

Table 4. The count of each message category (#) and the corresponding differences between senders and receivers on urgency measurement (i.e., inaccuracy of perceived urgency).

general and be aware of whether their partner understands the reason for delayed responses.

We further looked into the means of inaccuracy of perceived urgency for all message types. From the descriptive statistics (see Table 4), we observed that messages regarding *personal perception* (defined in Table 2) were the most frequent message category of delayed messages. Messages regarding *status request* (defined in Table 2) were the category that had the highest inaccuracy of perceived urgency. The observation may suggest that participants shared less common ground on status request messages than other types.

INTERVIEW FINDINGS

We observed that romantic couples appeared to engage in three dimensions of grounding, including status, process, and context, in dealing with delayed responses. We summarized the operational definitions of different grounding types in Table 5 and elaborated each one in the following section.

Status Grounding

We define s*tatus grounding* as sharing the common knowledge about interlocutors' availability or movement, such as current activity, location, and companies. In text communication, status grounding heavily relies on technological support and explicit coordination between senders and receivers.

For romantic couples, it is not sufficient to know simply whether their partner is available to respond or not. More than that, they pay attention to the details about their partner's movement.

"While waiting for his response, I kept checking my mobile phone and wondered what he was doing" [GC2F]

"He wondered [and messaged] where I was and whether I had arrived home safely." [GC2F]

They leveraged both indirect and direct channels to accomplish status grounding on IM. For indirect channels, they speculated and learned what their partner was doing through user-generated and system-generated information on social media, including status signals (e.g., cues like online, offline, last time shown online), actions on instant messenger (e.g., messages read or unread, responding or not), and digital footprint on the platform (e.g., posting, commenting, "liking").

"I will check the status signals. If it shows he was active 7 or 8 hours ago, he is likely to be in sleep; if it is an hour ago, I will speculate what he is doing." [GC6F]

"He 'liked' the post which was posted a minute ago and you know that he was online a minute ago." [LD1F]

In addition, participants interpreted status information based on the pattern of each other's messaging behaviors. For instance, the length of the messages was used to imply the availability of conversation engagement.

"His short and pithy phrase such as 'in the class,' 'yeah' or 'ok' explicitly implies that he does not intend to have a conversation. If he types a long sentence, it indicates that he has an intention to chat." [LD4F]

Besides relying on these indirect channels, our participants also adopted direct channels to learn about their partner's status. Our participants stated that it is quite common for them to report and check the status of each other as a daily routine.

"Generally, if I am not available, I will tell her like I am walking to a certain place so that she won't get anxious because of my delayed response." [GC8M]

"She asked me why I responded so slowly and question me what I was doing" [GC5M]

Grounding Type	Operational Definition
Status Grounding	Share the common knowledge about interlocutors' availability or movement, such as current activity, location, and companies.
Process Grounding	Reach mutual understanding about when a conversation is meant or perceived to start, pause, or terminate.
Context Grounding	Correctly interpret the contextual information, such as affect or urgency, behind the message.

Table 5. The operational definitions of different grounding types.

For romantic couples, status grounding plays a vital role in adapting to contexts where delayed responses take place. With status grounding, the senders could adjust their expectation and feelings toward a delayed response. For the delayers, they could be relieved from impractical expectation and negative feelings resulting from it.

"She had a meeting, so it is reasonable that she did not respond the message. It was as expected. … I felt nothing [about her delay]." [GC2M]

"If I know she is busy with something, I won't ask her to reply immediately." [GC8M]

"I will be fine with her delayed response if I knew where she is." [GC7M]

"It's fine. … She knew that I'm used to chatting with my family after arriving home, so she knew that I was not available during that time." [LD2M]

Much coordination was carried out between romantic couples. When they failed to coordinate, problems emerged. Sometimes, participants believed that their partner should have understood their status since they shared their daily lives with each other frequently. It led them to think that they did not need to inform the other of every detail explicitly. Such assumption was wishful at times because the perceptions about each other's status may be misaligned. When the pairs hold inconsistent assumptions, they may expect the reaction of each other differently, and handle the delayed response out of each other's anticipation. Our participants even picked a fight because of lack of status grounding.

"I probably assumed that she knew what I was doing in general, so I did not respond to her messages. But she argued that how on earth she would know if I didn't respond. So we fought a little bit over it." [GC5M]

Process Grounding

IM supports both nearly-synchronous and asynchronous communication. When communication is mediated by such channel, people can choose when to engage in communication and when to leave. A delayed response in CMC may break the social norm we follow in FtF conversation where clear beginning and ending are expected for both parties to complete turn-taking in conversations. If there is no coordination and contextual cues, people may not be able to identify whether a conversation is initiated or finished and this situation may influence the dynamics of a conversation. In other words, *process grounding* [5] may be needed for both parties to reach mutual understanding about when a conversation is meant or perceived to start, pause, or terminate.

We found that our participants, despite being close romantic partners, could not pinpoint whether their partner intended to start or finish a conversation so they could not identify whether the incoming message was expected to be responded or not. That is the reason why more than half of the incidents reported in the diary entries were mismatched.

"Initially, I expected [his response], but he did not respond. He probably thought the conversation was over." [GC6F]

To reach process grounding, three couples developed their communication norms, such as using certain stickers or phrases as an indicator of the end of a conversation.

"It is kind of our secret agreement. She probably sent 'Good night,' but she didn't go to bed. She may respond to the following messages the next morning. Similarly, I possibly read her messages after I said 'Good night,' but I would respond to her tomorrow because I wanted to focus on studying or did something now." [GC1M]

"She just wanted to express that she had read it, she had nothing to say, or she didn't know what to say, so she just typed 'meow,' and I moved on my work" [GC8M]

"Sometimes, I sent a sticker meaning the end of the conversation." [GC6F]

But for those who did not rely on explicit coordination, interpreting the meaning of a pause in a conversation is difficult, especially when both sides hold distinct perspectives on how IM is supposed to be used. Sometimes, it brought negative impacts on the relationship.

"Most of my friends and I message this way; we did not say 'See you' or 'Bye' explicitly. But she [my girlfriend] thought that if I had something to do, I should tell her. It would piss her off if I go for lunch without letting her know in advance. Her point is that I should tell her I'm going for lunch so she wouldn't stay in front of her phone or computer and wait for the messages. But I treat this sort of chatting application as more real-time messaging. If you have something urgent or you don't want an intermittent talk, just call me on the phone. Messaging is for something trivial." [LD2M]

Context Grounding

When people correctly interpret the contextual information behind a message, we consider that they're coordinated on *context grounding*. Two major subcategories under context grounding emerged from the interview: urgency and affect.

Affect

Affect is especially challenging to ground on IM because non-verbal cues such as eye contact, facial expressions, and body language are either not well afforded or take more time to develop [14]. To express their affect in delayed IM communication, our participants reported that they explicitly expressed their affect like how they did it in FtF. They also strategically leveraged the nature of delayed responses to convey their anger or indifference. With context grounding, their partners could parse such expression and determine if the delay was intended or unintended.

"Avoiding reading messages intentionally usually refers to displeasure." [LD1M]

"She probably did not read the messages. … Nothing to be angry, so she didn't need to avoid reading messages." [LD1M]

However, when context grounding around affect is unclear, interlocutors may misinterpret the intention of delay. One of our participants said that her partner regarded the latency of an incident as the sign of anger and exhibited fear; actually, she did not mean to convey such expression.

"[If I didn't respond for a long time, He] may be a little bit afraid that he pissed me off unintentionally." [LD7F]

Urgency

The affordance of asynchronicity provides opportunities for users to determine when to respond to the incoming IM messages. The perceived urgency of the message is usually regarded as a key factor in delayed communication. Most participants are more responsive to urgent messages; therefore, how people assessed the level of urgency would affect the dynamics of a conversation. When the perceived urgency level was commensurate for both parties, they could react more closely to each other's expectation.

The most common way to evaluate the level of urgency is how much coordination is required on the spot. The more coordination involved, the higher urgency was rated, such as scheduling a forthcoming appointment and asking for instant help. However, the level of urgency is subject to individual variance. Five interviewees pointed out that the level of perceived urgency was relatively high when they expressed their negative feelings and relied on their partner's responses for comfort. Two of their partner raised the issue as well, indicating that they have achieved context grounding in such situation.

"When I am in a bad mood, I hope that he can respond to me quickly. Since I have been in a bad mood, I hope that he can be aware of it, comfort me and be there with me as soon as possible." [LD6F]

"When she is in a bad mood, she needs instant reply." [LD6M]

DISCUSSION

Prior works suggested that senders' expectation about responsiveness [16, 22] and their interpretation of the delay [11, 25] together shaped the perception of the respondent, which can influence their relationship. However, our findings pointed out that perceptions of responsiveness and the interpretation of the delay were dynamically shaped by both senders and receivers of romantic couples. The level of mutual knowledge between communicators is critical in delayed communication. More specifically, status grounding and process grounding affect how senders possess the expectation about responsiveness and how receivers resolve the violation of the expectation; context grounding facilitates receivers to parse how senders interpret the delay. We first examine how grounding affects romantic relationships and depict how mutual knowledge is developed. Then we discuss how expectation about responsiveness and interpretations of delays influenced by different types of grounding.

Grounding in Romantic Relationships

How Mutual Knowledge Developed in Delayed IM

Our findings suggest that romantic couples develop mutual knowledge from both direct and indirect channels. Direct channels refer to explicit coordination, such as sharing each other's schedule, developing routines of conversation ending indicators, or explicitly stating their feelings. Indirect channels can be system-generated or user-generated cues, such as information conveyed through social media and mutual understanding cultivated from experiences like interpersonal messaging pattern or daily routine. Due to its affordances, couples can get better support of indirect channels from Facebook Messenger, which displays status signals and responding indicator, than LINE.

These two grounding sources fulfill two key factors in EVT: communicator characteristics (e.g., communication style) and relational characteristics (e.g., shared experience) [12], supporting that mutual knowledge can shape the expectation about responsiveness.

Simplified Grounding Process

One source of common ground is co-membership and interpersonal understanding [3, 19], which suggests that it may be easy for people in romantic relationships to achieve grounding. However, our findings suggest that romantic couples engage in a high level of grounding for relationship maintenance and expectancy violations resolving.

The principle of least collaborative effort [5] suggests that interlocutors tend to minimize their communicative effort. The more mutual knowledge, the less grounding process required. Dyads in romantic relationship accumulate mutual knowledge through their daily interactions; they can simplify grounding process. However, when grounding is oversimplified, it can lead to misaligned understanding and increase the gap between senders' expectation and recipients' assessment. Our interview illustrated a case where the assumption of the delayer caused him to misdiagnose sender's expectation and resulted in a fight. Much mismatched understanding arising from oversimplified grounding process in the context of delayed IM can impact the dynamic of the conversation and romantic relationship.

The Expectation about Responsiveness and Grounding in Delayed Communication

Consistent with the previous studies [16, 22] that adopted EVT to explicate the mechanism of delay effects, our findings point out that senders experience expectancy violations when the amount of time it takes for recipients to reply diverges from that they expect. Our study further extends the perspective from sender driven to both interlocutors in mediated delayed communication. We examined how receivers assess senders' expectation about responsiveness and found that status grounding and process

grounding can close the gap between senders' expectation about responsiveness and recipients' assessment of it.

Status grounding informs the availability or the current activity of recipients and facilitates senders to predict if and when recipients can respond. Process grounding informs the beginning and the termination of a conversation and facilitates senders to assess whether recipients feel obligated to respond. On the other hand, recipients also assess senders' expectation about responsiveness based on both status grounding and process grounding to realize whether or how they violate expectation imposed on them. We illustrated the phenomenon by a case that an interviewee deployed status grounding to settle expectancy violation: A recipient knew that the sender knew the recipient was occupied by a two-hour business meeting; therefore, the recipient could assume that the sender would not have expected to receive the reply before the end of the meeting. In this case, there was no expectancy violation by the sender even if the response was delayed.

With status and process grounding, senders and receivers can resolve expectancy violations and consequences associated with them. Senders can possess more practical expectation about responsiveness and experience less expectancy violation; receivers/delayers can assess the expectation of senders more accurately and deal with the delayed incidents more properly and promptly.

However, when mutual knowledge is insufficient, the problem emerges. Another example in our findings demonstrated the condition where the sender and the recipient failed to achieve process grounding: The sender did not realize that the recipient treated the message as the end of the conversation; thus, the sender expected an immediate response and experienced expectancy violation. But the recipient did not know that the sender did not know the reason why s/he stopped texting. The recipient failed to stay aware of sender's expectancy violation and took no further action to handle the situation.

In delayed communication, status and process grounding can influence senders' expectation about responsiveness, recipients' assessment of senders' expectancy violation and their coping strategies, which further affect the perception of each other and the relationship.

The Interpretation of the Delay and Grounding in Delayed Communication

Consistent with prior studies [11, 25], our findings indicate that interpretation of the delay is a key determinant of the perception of each other in the context of delayed response. Our study complements previous ones by pointing out how to enhance interpretation of violations. When unexpected latency occurs, context grounding provides cues for senders to parse and resolve the cause of the delay and identify whether the delay is intended. Similarly, recipients can assess how senders interpret their delays and handle the context of delay more appropriately.

Context grounding conveys exchanges of affect, which allows senders to infer whether the delay is utilized to express anger or indifference and facilitates recipients to understand whether senders misinterpret unintended delays as intended ones or vice versa. When context grounding around affect is missing, interlocutors may misinterpret delayed messages and further affect the interpersonal perception of their partner. Another example from our interview is that the lagged response was misperceived as intended delay, which was perceived as an indicator of anger from the delayer. This terrified the sender, which may increase the tension between interlocutors.

Additionally, context grounding around urgency also informs how recipients perceive the necessity of immediate response and facilitates senders to interpret whether the outgoing message is delayed for low perceived urgency.

In delayed communication, context grounding can facilitate both senders' and recipients' interpretation of the delay and their interaction, which further affect the perception of each other and the relationship.

DESIGN IMPLICATIONS

Several designs were proposed to facilitate grounding in CMC, such as workload indicator [10] or task information sharing [24], but they primarily focused on availability sharing in *workplace scenarios*, not *relational communication*.

Without the support of contextual cues (e.g., body language, environment information, and surrounding incidents) and synchronicity, it is especially challenging to detect and repair the misaligned knowledge about one another instantly in text-based CMC [7], such as IM. Our findings indicate that romantic couples encounter just as many, if not more, grounding challenges as other types of coordination in different contexts. Designs should support their specific communication needs on instant messenger. We present several designs to support each type of grounding with direct or indirect channels.

Status Grounding

For better status grounding, we suggest enhancing the visibility of interpersonal status on instant messengers by: 1) integrating and presenting system-generated or user-generated information about each other's status from indirect and direct channels and 2) promoting explicit coordination. For the former, the system can auto-extract status information from interpersonal message history (e.g., "I have a lunch meeting tomorrow"), social media information (e.g., check-in location, event calendar on Facebook), personal calendar, with user's permission. Our participants reported that they already did this manually by sharing their near future schedule on IM and weekly calendar with each other. Gathering such information distributed across different tools and displaying both parties' status on the chat window during the corresponding time interval can make each other's status salient. Systems can also allow users to edit the information

and add new incidents to the schedule directly. When users are ready to leave a conversation, systems can further request users to provide information about the reasons of exit, such as "going to work, going to bed, commuting, etc.," for more contextual nuances.

Process Grounding

To strengthen process grounding, systems should facilitate users to identify the margin of a complete cycle of conversation. We propose the mechanism of highlighting a pause or ending in a conversation, which enables both parties to indicate the time when they intend to leave. Establishing such direct channel not only transfers implicit understanding to explicit shared information, but affords users to pay attention to process grounding, prompting users to coordinate such information. This design should narrow the gap between the perception and the reality of how conversation proceeds and reduce the conflicts arising from misaligned assumption and expectation about responsiveness.

Context Grounding

To reinforce context grounding in terms of urgency, we suggest that instant messenger designers build a direct channel that enables message senders to express responsiveness expectation, especially for extreme cases: expecting an immediate response. For example, users can attach a specific mark on outgoing messages when they consider an immediate response is necessary. It informs the recipients on how their partner assesses the urgency and implies how to react to the context appropriately.

While these technological supports can improve the ambiguity of shared information, grounding cannot be achieved without social processes. Clearly, romantic couples need to be aware of what information is shared and what is not, and communicate interactively when it is equivocal.

LIMITATIONS AND FUTURE WORKS

Our current study is subject to three limitations. First, we intended to use the diaries to prompt participants' reflections on practices in the interview; however, it is possible that by keeping the diary, our participants paid more attention to their behaviors of delaying responses. This variation may prime them into doing things they did not normally do. For instance, five participants described that they would intentionally reply to the messages within 30 minutes just to avoid making an entry in the diary. Delayed responses may take place more often than what we collected.

Second, we studied Taiwanese couples aged from 19 to 33 years old, and fifteen of sixteen participants were in dating relationships. While our findings and interpretations are grounded on the literature and can provide an updated understanding of related issues, our empirical observations may have limited generalizability with respect to some populations. More specifically, the current study didn't consider: 1) couples in different stage of the relationship (e.g., married) who may have different communication strategies [23], 2) couples in different cultures by which different communication norms are shaped [13], and 3) older couples, who may not leverage mediated indirect channels (e.g., social media) as much. However, age is negatively associated with IM use [21], which makes our sample practical for understanding the users.

Third, given a small sample of GC and LD couples (eight for each) in the current study, we were not able to make quantitative inferences regarding whether GC and LD dyads differed. Currently, we saw mixed results reported by GC and LD couples. In future work, there's need to increase the sample size to look into whether distinctions between GC and LD couples substantiate.

CONCLUSION

In this paper, we explore grounding mechanisms between romantic couples in delayed IM communication, and through the theoretical lens of expectancy violation theory. We conducted a 7-day diary study on 16 pairs of romantic couples and post one-on-one interviews. Our findings show that couples employ different strategies of information grounding to parse and resolve delayed IM, including status grounding, process grounding, and context grounding. Different sources of grounding provide cues to resolve expectancy violations between romantic partners. Based on our findings, we present research and design implications to understand and support romantic communication.

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