Because I'm Restricted, 2 – 4 PM Unable to See Messages: Exploring Users' Perceptions and Likely Practices around Exposing Attention Management Use on IM Online Status

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ABSTRACT

Attention-management tools can restrict online communication, but may cause collateral damage to their users' fulfillment of communication expectations. This paper explores the idea of integrating attention management into instant messaging (IM), by 1) disclosing restriction status via an online status indicator (OSI) to manage contacts' expectations, and 2) imposing communication limits to reduce communication distraction. We used a speed-dating design method to allow 43 participants to rapidly compare 48 types of OSI restriction in various conversational contexts. We identified two "tug-of-wars" that take place when attention management is integrated into IM apps: one between fulfilling one's contacts' expectations and protecting one's own attention, and the other, between protecting one's privacy and asserting the justifiability of using communication restrictions. We also highlighted the participants' desire to be diplomatic for sustaining their positive images and maintaining relational connectedness. Finally, we provide design recommendations for integrating attention management into IM apps.

CCS CONCEPTS

• **Human-centered computing → Empirical studies in ubiquitous and mobile computing**.

KEYWORDS

Attention management, instant messaging, availability, response expectation, online status indicator, restriction, design research

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1 INTRODUCTION

The high penetration of instant-messaging (IM) apps allows their users to send and receive messages nearly instantaneously, anywhere, and at any time. This convenience has resulted in messaging becoming one of the most common online activities, and thus also the major source of online distraction in workplaces [67, 74] and in academic settings [3, 34, 77]. To help IM users stay focused and improve their productivity, numerous experimental and commercial attention-management tools have been developed. They can operate by imposing time limits on use of certain apps (e.g. [61, 99]), restricting access to them (e.g. [36, 80, 99]), or blocking incoming notifications from them (e.g. [6, 38]). However, while such restrictions reduce distractions [72, 73], they may result in fear of missing out [73, 88, 100], as well as anxiety and feelings of pressure and obligation arising from not meeting their usual conversation partners' existing expectations about their responsiveness and connectedness [88]. Hall et al. [41] have suggested that such perceptions of obligation are positively correlated to feelings of being trapped, and lead to lower relationship satisfaction. Probably due to such pressure or the fear of missing out, many users of such systems do not strictly follow their restrictions, or deactivate them, or abandon use of them altogether [61, 73]. Alternatively, they may feel obligated to explain their prior unavailability, or coordinate their future unavailability, to manage their conversation partners' expectations [12, 42, 90]).

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However, people who activate attention-management functions are presumably trying to stay focused and avoid distraction from online communication. To help them indicate their unavailability and low responsiveness to their conversation partners without creating a burden in the form of additional coordination effort, researchers have proposed awareness systems [16, 25, 26, 46], such as ones that present their users' receptivity status. Indeed, mainstream IM apps already include some awareness cues [33, 35, 69, 70], e.g., online status indicators (OSIs), and numerous prior studies have reported that these cues successfully shape conversation partners' expectations of each other's availability for communication [23, 26, 106]. Thus, awareness cues may help alleviate social pressure to be responsive, while at the same time reducing the number of messages sent at inappropriate times [66, 82]. Together, these findings intuitively suggest that it would be beneficial to disclose IM users' attention-restriction statuses in OSIs, both in terms of alleviating negative feelings caused by the pressure to be responsive, and in terms of reducing distractions. Moreover, especially given that they are one of the main sources of distraction, IM apps themselves would appear to be ripe for the incorporation of their own attention-management functionality. Indeed, the recent release of a "focus mode" feature on iOS that can be shared on a messaging app [1] suggests that this idea is gaining traction.

Nevertheless, beyond this recent release, there has been little exploration of the possibility of integrating attention-management and communication tools. Thus, users' perceptions of, acceptance of, likely concerns about, and probable practices arising from such an integration remain uncharted territory. To successfully integrate these two commonly used sets of tools, then, it will first be necessary to understand such user perspectives. This paper represents a first step in that direction.

To conduct this exploratory research, we used a research technique known as speed dating [30] to make participants rapidly compare 48 different mockups of various restrictions and communication limits disclosed on an OSI, among 43 participants. We found that many of these individuals, from either a recipient or sender perspective, saw the benefits of integrating attention management into IM. Yet, they also shared various concerns about it, relating to attention protection, communication expectations, privacy, connectedness, and diplomacy. Specifically, their comments reveal the existence of a tug-of-war between attention management and expectation management, along a spectrum running from attention regulation as the highest priority at one end, to expectation fulfillment as the highest priority at the other. Users in the middle of this spectrum strive to strike a balance between the level of disclosure and the level of justifiability for their use of communication restriction. Finally, most of our participants valued being diplomatic, i.e., sustaining and maintaining connectedness and a positive social image. As such, how they disclosed their use of attention restrictions via OSI was seen as a manifestation of the outcome of the struggles among the five intertwined elements noted above. Therefore, we conclude that, while the proposed integration is promising and worthy of further exploration, careful account of these concerns and the tensions among them needs to be taken if it is to be successful and widely accepted.

To sum up, the contributions of the current paper are threefold:

- It is believed to be the first study of people's perceptions of, concerns about, and possible practices arising from the integration of attention-management tools into IM applications.
- It delineates the five major elements that underlie disclosure of attention restrictions via OSI, and the intertwined tensions among these five elements.
- It offers design recommendations for future efforts to integrate attention management into IM applications.

2 RELATED WORK

2.1 Attention Management, Self-regulation, and Self-interruption

As an increasing proportion of work and learning activity moves online, self-regulation and attention management have become quite challenging [15] due to the variety of sources of distraction and interruptions in the online environment [29, 34, 74, 75, 100], notably including from social media [61, 74], email [76], communication-related notifications [32, 68, 88], messages [20, 63], and web surfing [103]. Increases in the amount of time people spend online have also led to them to habitually engage with technology simply to pass the time [92]. Feeling a need to be "always on" and "always connected" to fulfill others' expectations about one's responsiveness is a contributing factor to the tendency to check phone notifications frequently [32], especially when notification alerts are disabled [20, 88]. This habitual behavior, in turn, tends to increase exposure to distractions and thus lower productivity [59, 83]. In addition, the prevalence of multitasking [3, 18] has been identified as a vital contributor to the detrimental effects of distraction on productivity. These issues are observable not only in the workplace [67, 74] but also in academic settings [3, 34, 77]. People find it difficult to resist the temptation to check for new sources of distraction [44], and thus self-interrupt themselves [29, 50, 52, 55, 96]. This self-interruption can usefully be distinguished from external interruption, such as social media feeds, that constantly arrive at people's devices unbidden [32, 68, 87].

To overcome these issues, with the aim of keeping people focused and improving their productivity, numerous commercial and research platforms and applications have been developed. One type focuses on time-tracking, to make users aware of the time they spend online (e.g., [56, 61]). For example, Borghouts et al. [13] developed TimeToFocus, which provides its users with feedback on the duration of their interruptions while working on a task. They found it helped their study participants to avoid task-irrelevant activities and focus on the primary task, and thus improved their productivity. Another mainstream type of attention-management tool restricts usage of and access to the Internet and notifications [2, 55, 60–62, 72, 73, 100]. For example, commercial apps such as Freedom [36], RescueTime [99], and AppBlock [80] allow their users to block distracting websites and apps on their computers and smartphones. Other apps provide punishment mechanisms for using restricted services. For instance, Flora [49] and Forest [93] associate growing virtual trees with restricting app use, as a means of staying focused; if one of their users accesses blocked functionality while a task timer is running, his/her "tree" will die. In addition to these third-party apps, mainstream smartphone systems including iOS [6] and Android [38] allow their users to activate "Do Not Disturb" mode that block notifications from certain people and apps to reduce interruptions.

Lyngs et al.'s [72] recent typology of 367 existing self-regulation and productivity tools indicated that blocking and removal were the two major means of attention-management being adopted, with the majority of such tools blocking access entirely (n=132) or setting limits on Internet-activity time or specific uses (n=23). Among the tools that provide blocking functionality, some block all content from a specific source, while others allow their users to block specific content such as newsfeeds and communication notifications from social media and communication tools. Blocking/removal were also commonly combined with self-tracking, such as blocking while a timer counts down, or a counter presenting the number of times the user accessed restricted apps during a blocked session.

The effectiveness of blocking is supported by empirical evidence. For example, Mark et al. [74] showed that blocking online distractions made their participants more focused and productive than when they were not blocked, and that this technique was especially helpful to those more susceptible to social media distractions. Lyngs et al. [73] found that both goal reminders and removal of newsfeeds helped their participants focus on their tasks and be less distracted. Kovacs et al. [60] reported that the time being saved through the use of blocking was not redistributed across platforms (i.e., from browser to mobile phone or vice versa), further suggesting its effectiveness in helping users stay focused. On the other hand, a follow-up study by Kovacs et al. [62] found that, when choosing which restriction to use, users typically began with high-challenge interventions, but over time slipped into reliance on easier ones.

Importantly, however, researchers have found large individual differences in how smartphones are perceived as a distraction, even in similar contexts [54]. To accommodate such individual differences and situational needs, researchers have suggested that attention-management systems need to be context-aware, or allow more flexible restriction configurations encompassing what is restricted, when restrictions start and end, and/or conditions for allowing exceptions [54, 73].

Finally, despite the benefits of restrictions in terms of their users' task focus, people who activate them inevitably sacrifice timely access to certain types of information, and have negative feelings about that sacrifice. These feelings can usefully be further divided into fear of missing out on information [73] and stress/anxiousness about not being able to meet others' responsiveness expectations [88]. While prior studies have yielded rich insights, it remains unclear whether disclosing people's use of attention restrictions to potential communication partners, for instance via OSIs, would help alleviate these negative feelings. Sharing awareness via OSIs is widely accepted as a way to reduce incoming interruptions while shaping expectations around unavailability; yet, it also opens the door to privacy concerns. We review the literature on those topics below.

2.2 Awareness Cues and Availability Status Sharing

Since computer-mediated communication (CMC) became prevalent, researchers have paid increasing attention to enhancing CMC conversation partners' mutual awareness of their statuses [51, 53, 104]. This is because the lack of both nonverbal and temporal communication cues in CMC environments makes it difficult to perceive whose conversational turn it is, and whether one's partner is paying attention to the conversation. Specific approaches to enhancing such mutual awareness have prominently included the provision of *awareness cues* (e.g. [31, 81, 82, 98]). One strand of such work directly presents low-level contextual cues about the other party, such as his/her location as determined from sensor data (e.g. [8, 9, 27, 39, 43]). More recently, advancements in modeling techniques have inspired various researchers to create models of IM users' availability status and sharing it with their contacts (e.g. [9, 10]). The statuses presented in such studies have variously focused on recipients' presence [10, 45], reachability [101, 102], interruptibility [107], and availability [9, 20, 24]. Researchers have found that adding these awareness cues help potential senders to become more aware of potential recipients' situations, and thus to make better communication decisions, e.g., about when not to disturb them or when to expect responses from them [106]. When they allowed IM users to customize their own statuses, Cho et al. [24] found that they mainly indicated the nature of their current activity or task.

2.3 Privacy Concerns about Online Statuses

In recent years, several popular IM applications have included OSIs, which show when their users are online, and read-receipt features, which indicate when they have seen particular messages. Since these features automatically track users' online activity, researchers' attention has also been drawn to how users perceive them, and how far they accept them. For example, Pielot et al. [87] investigated how people perceived sharing predicted attentiveness and the "last seen" feature on WhatsApp. They found that sharing last-seen time was valued because it provided a way of knowing whether the conversation partner was available for reading messages; yet, privacy concerns about their status being tracked were also widely expressed. Based on an online survey, Church and Oliveira [25] found that the majority of WhatsApp users were concerned about privacy when using WhatsApp because the read-receipt feature showed when they were online, even if only indirectly. Lynden and Rasmussen's [71] participants also reported these features to be useful in certain circumstances, but that they were concerned about their status being disclosed, especially because this made them feel social pressure to respond.

A more recent survey by Cobb et al. [26] showed that while most IM users had experience of OSIs, a significant proportion of them misunderstood aspects of their use, including which apps had them. Many of the same study's respondents wanted more scope to customize their online statuses, such as showing them only to certain contacts, and/or noted that OSIs' existence had led them to adjust their behavior to avoid encountering specific persons in the messaging environment. Interestingly, 25% of the users reported wanting to avoid people in general in such environments. And some said they wanted to be "invisible", or falsely shown to be offline, when they were busy or trying to reduce distractions: a preference also noted in other studies [24, 86]. Moreover, some of Cobb et al.'s respondents attributed receiving certain messages purely to the fact that people could see they were online. This perception, unsurprisingly, makes shaping unavailability a legitimate means of avoiding communication. Finally, some of the respondents said they would observe other people's OSIs and, on that basis, try to make sense of their routines and activities, and speculate about why they were online (see also [11, 16]). In short, prior studies have consistently highlighted users' privacy concerns about presenting their online/offline and availability statuses. In contrast, the present work will show that, at least in the specific context of using attention-management tools for protecting their attentional resources, people may be willing to compromise their privacy due to the strength of their perceived communication obligations.

To the best of our knowledge, this is the first study to explore the possibility of integrating attention-management tools into IM applications.

3 STUDY METHODS

Our study was designed to be highly exploratory in nature. That is, we hoped to stimulate the participants to envision numerous different possibilities for the integration of attention management into IM, and talk in depth about their reactions: i.e., their perceptions, desires, decision-making, sense-making, concerns, and choices about different kinds of restrictions in different conversational situations. Because status presentations by attention-management tools have not yet gained much if any consumer visibility, we utilized a research technique referred to as speed dating [30]. In it, participants were shown a series of variations of possible/imaginary status presentations and communication limits, reflecting the possible usage of different attention management configurations on IM, and asked to discuss the reactions mentioned above. This method is similar to envisioning design method [89, 91], in which participants envision and reflect upon their uses of and other practices around fictitious designs. It has been utilized in recent years in exploring the design space of intelligent systems, such as smart-home [22]. This format of data collection facilitated exploration of users' preferred status presentations regarding attention restriction in various conversational circumstances, thereby informing the future design space of the integration of attention management into with IM tools. Below, this study design is explained in more detail.

3.1 Speed-dating Approach to OSI Restriction Types

3.1.1 Categories and Variations of Restriction Presentation. Due to the COVID-19 pandemic, the study was conducted remotely via a video conferencing tool. Each participant's time commitment was between 90 and 120 minutes. As shown in Figure 1, all participants were shown 48 different mockups of an IM conversation window, each of which depicted an OSI automatically displaying one or more user-specified attention restrictions enforced by a fictitious attention-management tool.

The 48 mockups were divided into six categories. Three of these pertained to restricted communication availability – 1) availability time indicator, 2) future unavailability, and 3) future availability – while the other three were fictitious communication limits: 4) contact limit, 5) message limit, and 6) character limit. It should be noted here that these mockups were not intended to be experimental treatments, but rather, material for inspiring the participants to reflect on them and other possible combinations. As such, we intended the mockups to manifest the wide array of variations of OSIs and restrictions that might arise if attention management were integrated into an IM application. We intentionally did not balance the variations, as doing so would have resulted in a proliferation of many very similar mockups.

The first category included 12 variations: i.e., three forms of restriction on communication availability (unable to receive notifications, unable to see messages, unable to respond) × two restriction-time types (period vs. countdown) × two restriction states (activated vs. deactivated). Examples include: "8:00-10:00 notification blocking activated", "message concealment deactivated in 10 minutes", "unable to respond for 10 minutes".

The future-unavailability and future-availability categories included six variations respectively: i.e., two forms of restriction on communication availability (receive, reply) × three levels of precision (no time information, in a few minutes, in five minutes). Examples include: "will be unable to receive messages", "will be able to reply in five minutes". We reminded participants that "five minutes" was an example of showing a system countdown.

The fourth (contact-Limit), fifth (message-limit), and sixth (character-limit) categories each included eight variations. Within each of these sets of eight, six were combinations of three levels of time precision (no time information, vague period, precise period) × two status limits (reached, unreached). Examples include: "number of contacts reached", "number of messages unreached in this period", "8:00-10:00 number of characters reached". The other two variations in each set of eight were another two ways of showing limits: 1) showing limit status, e.g., "messages received 10/100"; and 2) showing countdowns (e.g., "remaining contacts left: 2").

3.2 Study Procedure

Most study sessions were attended by two or more researchers, with one serving a moderator, and the other(s) observing and taking notes, and one participant. Before a given participant's session, the research team mailed him/her informed-consent documentation, and sent an email with the link to the conferencing session. At the appointed time, the moderator walked through an overview of the study and the informed consent. After the participants reconfirmed their agreement to participate and to be screen-shared and screen-recorded, respectively, the moderator directed them to the research environment, which was hosted on Figma [1]: an online collaborative-prototyping tool where the 48 mockups and other study material had been placed. The moderator then delivered a tutorial on how to operate Figma (Fig. 2), followed by a high-level overview of the variations among the mockups, how they were organized, and how the study was meant to flow among them, as shown in Figure 2.

The moderator also introduced a list of types of conversational scenarios and relationship types. The 48 mockups were arranged in six columns, each of which represented one of our six above-mentioned categories, while variations within each category made up the rows. We stressed to the participants that the mockups' coverage of conversation scenarios, relationship types, and system features was not intended to be exhaustive, but to serve as material for inspiring them and reminding them of the diverse possibilities.

[1] Figma: the collaborative interface design tool. https://www.figma.com/

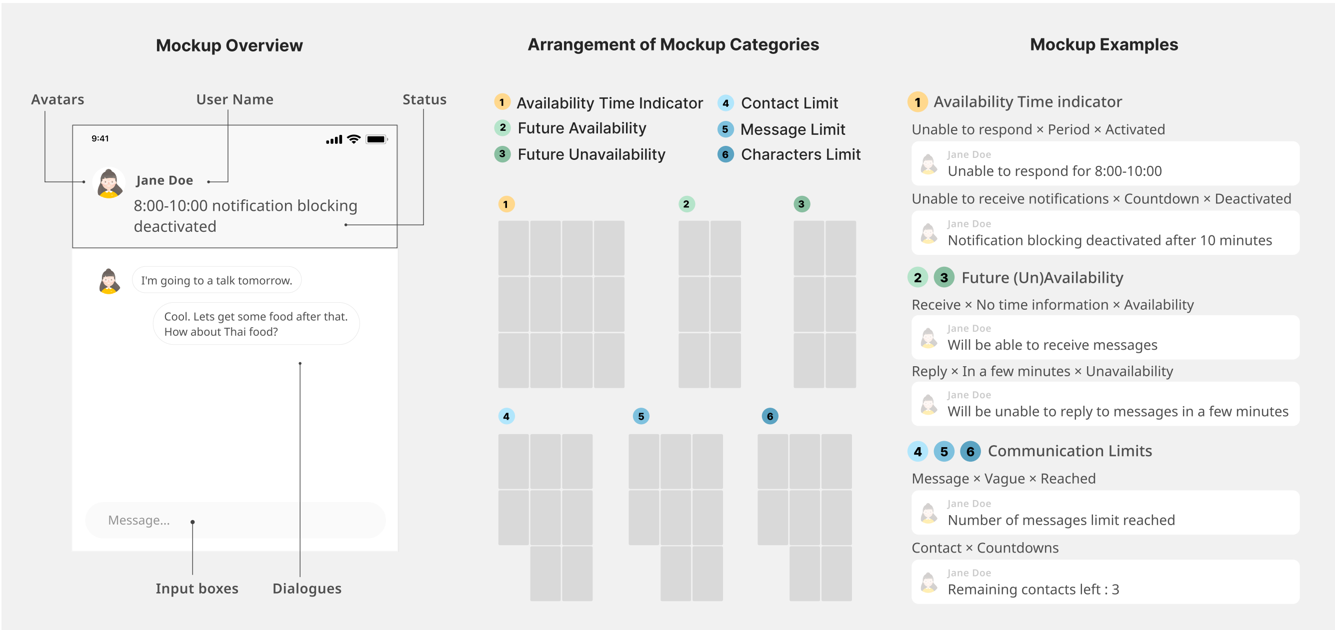

Figure 1: Six of the 48 combinations of OSI presentations and attention restrictions that were shown to the participants in our speed-dating study

We also told them that the statuses they were seeing were set by an attention-management system, but encouraged them to reflect on a scenario in which they had instead been set manually by IM users, and how they would perceive them differently if that were the case. We stressed that they could reflect on any mockups, scenarios, IM contacts, and combinations of restrictions of their choice that were or were not covered by the material we provided.

With regard to reflection on specific mockups, the moderator focused on the participants' perceptions of and concerns about seeing and using these status presentations and communication limits. S/he also proactively prompted them to make comparisons and contrasts among mockups, contexts, and contact types, to ensure that a diverse range of contexts and concerns were discussed. Using this approach, we hoped to capture emergent patterns, similarities, and discrepancies across analytical categories in our qualitative analysis. The moderator asked participants to reflect from both the recipient and sender perspectives, albeit with a primary focus on the former.

The flow of each session generally started from the left, i.e., with lower-numbered categories, and gradually moved rightward across higher-numbered ones. However, this was not in any sense enforced; indeed, whenever the moderator found it made more sense to let the participants compare mockups across category blocks, s/he did so. After the participants had reflected on most, if not all, mockup categories, the moderator asked them to share their overall impressions and comparisons among the mockups. Each participant was given compensation of NT$400 (US$14.32). The video-recordings of all sessions were transcribed, and after each one, the researchers who had attended it conducted debriefing sessions on their observations and notes, and generated initial codes.

3.3 Recruitment

The Facebook pages from which we recruited study participants included a group dedicated to recruiting participants for research participants in Taiwan. We also advertised the research via the researchers' personal networks. Our recruitment goal was to reach IM users who had used either attention-management tools (whether websites or smartphone apps) or Do-Not-Disturb functions on their smartphones. Within that population, we recruited participants whose IM usage was diverse in both quantity and purpose. Later, i.e., after data collection had started, we followed the theoretical sampling approach suggested by Charmaz [21], with the aim of finding participants from whom we could learn more about specific experiences that we had not heard about from the existing participants. The final pool of study participants therefore comprised 43 people (24 males, 19 females). The participants were all aged between 20 and 49; 16 were students, and the other 27, non-students with diverse occupations. All participants used Facebook Messenger and/ or LINE Messenger as their primary IM application. Participants' demographic backgrounds and IM-use frequencies can be found in the Supplementary Material Table S1.

3.4 Data Analysis

Our data-analysis and data-collection processes were conducted in parallel. For analysis, we adopted an inductive thematic analysis approach [14], in which the generation of the codebook was iterative. Specifically, the research team collaboratively coded the transcripts using the ATLAS.ti [2] software. The preliminary code lists were developed based on the researchers' notes from the first 10 study sessions, in conjunction with memoranda explaining the

[2] https://atlasti.com/

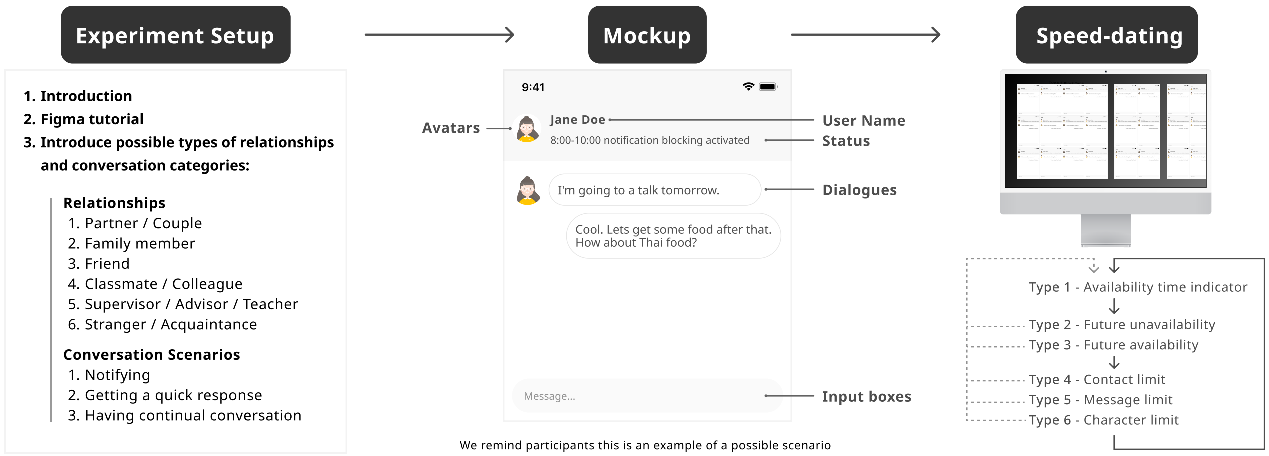

Figure 2: The flow of the speed-dating session: 1) experiment setup; 2) introduction to the types of restrictions shown on the OSI; and 3) speed-dating session

meanings of the codes and categories. The research team then used these preliminary codes to independently code the transcripts, as data collection continued. During such coding, the researchers constantly compared data, codes and memos, discussed them as a team, and revised codes iteratively whenever needed. Whenever new codes were added, refined, or revised, their applicability was examined against the other data, until all research-team members reached consensus on the themes and codes. Eventually, many themes emerged from the rich qualitative data. These themes will be covered in the following sections.

4 FINDINGS

Our participants saw various upsides to disclosing their use of attention restrictions on IM OSIs. Prominent among these was that doing so could signal to their conversation partners that *"now is the time I'm supposed to be working"* (P3); that they should not *"expect me to reply promptly"* (P30); that *"I am too busy to respond rather than not wanting to respond"* (P40); and that there is a particular time *"when I can start receiving notifications"* (P15). Some others highlighted more general benefits of attention restrictions, such as "making conversation *concise"* (P5) or *"efficient"* (P10), and *"preventing people from being flooded with many messages in a short period"* (P14).

However, we were mainly interested in understanding the participants' concerns about disclosing restriction use, and what they anticipated doing and not doing with this feature, and why. During data analysis, what intrigued us most was the complex and intertwined relationship among various needs: for protecting attention, for preserving autonomy, for fulfilling expectations, and for sustaining connectedness. Our goal in the following subsections is to do justice to these complex phenomena as concisely as possible.

We begin in Section 4.1 by illustrating the participants' concerns about using restrictions, and particularly, their fears of missing important or urgent information when using them. Then, starting in Section 4.2, we look at disclosing the use of restrictions, starting with the first layer of tension – i.e., between attention management and expectation management – which mainly influences choices around (un)availability shaping. Next, in Section 4.3, we explore the second layer of tension, privacy vs. offering justification, which mainly influences the type and granularity of the restriction information being disclosed. On top of these two tensions, we illustrate in Section 4.4 how the participants desired to phrase messages disclosing their use of restrictions, which varied chiefly according to how much they valued being diplomatic, i.e., maintaining connectedness and a positive social image. After we discuss these complex relationships, Section 4.5 presents the participants' perceptions from the sender's perspective. Finally, in Section 4.6, we set forth the participants' desired characteristics for an intelligent integration of attention-management tools into IM.

4.1 Fear of Missing Important Information Hinders the Use of Restrictions

Although all our participants had used either attention-management tools or do-not-disturb functions on their smartphones prior to the study, some nevertheless expressed concerns about using restrictions. Overall, our results resonate with prior work [73, 88, 100] that fear of being out of the loop hinders people from restricting their online activities and communication. Specifically, participants were worried about being unreachable in emergencies, not receiving important information, and missing out on valuable opportunities. For example, they were worried that communication restrictions would cause *"screw-ups"* (P25) because their significant others, colleagues, supervisors, and clients *"could not find them"* (P21), especially when matters were *"time-sensitive"* (P41). In particular, those participants who deemed communication to be the core of their work thought restrictions would cost them job opportunities and cause them to miss important requests from their clients.

By the same token, limits on communication time, message numbers, and numbers of characters were also perceived by some participants as likely to make important communication insufficient, e.g., truncated (P37), unfinished (P39), oversimplified (P17), or simply too short to serve its purpose (P36). Several participants were particularly concerned about the likelihood of missing information that would bring benefits to them if they received it. As P12 explained, *"If your cohorts are going to help you and offer you some solution, but you happen to have reached a message limit, that would be a real bummer. It would block you from reading that message [if the limit has been reached], wouldn't it? I feel that this [restriction] is likely to make me not receive something important."*

To overcome this fear, many participants suggested that restrictions should have exceptions, such as extensions to unrestricted time (P14), conditional restriction release (P21, P29), or non-imposition of restrictions on alternative channels (P25), because they deemed it crucial to *"leave yourself a way out"* (P29).

4.2 Tension between Attention Management and Fulfilling Expectations

In this section, we discuss the tug-of-war between attention management and fulfilling expectations that participants perceived when disclosing their use of restriction on OSIs. On one side of it, the highest priority is placed on protecting one's own attention and autonomy, and on the other, it is placed on fulfilling contacts' expectations.

4.2.1 Precisely Disclosing Restriction Periods to Shape Unavailability Expectations. We explored the participants' desire to precisely disclose their unavailable periods, as a means of shaping their conversation partners' expectations about their availability for communication. To achieve this purpose, most participants advocated explicitly and precisely disclosing the periods in which they were under restriction on IM apps' OSIs. They expected that their conversation partners, when seeing such statuses, would be aware that they were busy and unavailable to respond during the periods in question, and thus not attempt to reach them even via other channels such as voice calls. This, they thought, would also effectively manage their contacts' expectations that they would not respond during such periods. For example, P35 noted, *"If somebody wants to send me messages, and he notices my restriction, he'd know that I am busy from 8 to 10 and I won't see his messages"*. Such precise restriction statuses also gave them a sense of autonomy: i.e., that it was *"their own choice whether to reply or not in the period"* (P9). Participants who liked to give clear, explicit indications of their unavailable periods also disliked creating a vague space in which conversation partners could misunderstand when restrictions had started or ended, via statements such as *"in a few minutes" and "going to" that "don't really say anything"* (P38). As P27 commented, *"In a few minutes could mean in one minute or in nine minutes."*

Some participants mentioned that disclosing restriction statuses was particularly helpful for them in both setting and signaling the boundary between their work time and personal life. They mentioned several interesting ways of leveraging the OSI to achieve this. One was setting off-work time as restricted time, to *"pretend to be busy"* (P31) and to avoid *"sporadic [work-related] messages"* (P14) outside of working hours. Others took the opposite approach: marking work time as restricted, to indicate that they were available for work-related messages during that period, while implying their unavailability for such messages outside it. As P4 explained, *"I think it's fantastic. Like setting from when to when I'll be working, I will make it all set, and then they [workmates] would know that they shouldn't bother me outside that time."* Signaling this boundary via restriction statuses was perceived as particularly important in the working-from-home era spawned by the pandemic, as it was perceived that *"their hours [when working from home] are much longer than in the company office."* (P36). Setting this boundary helped them *"only get the urgent notifications"* (P36)

Finally, several types of communication limits were perceived as helpful to protecting the participants' attention, by making communication efficient, focused, and concise. As P35 indicated, *"I want to show that within this two-hour period, I'll just take ten people's messages."* Similarly, P14 said, *"It's like setting a quota and telling them that 'you only have a few more [messages].'"* Notably, most of the participants who made such remarks only mentioned this usage in work-related contexts. On the negative side, some limits were perceived as easily bypassed by workarounds that might actually take more time to process, such as voice messages (P14, 17), large blocks of text converted into single messages (P23), images containing more information than textual messages on the same subject (P12), floods of stickers/emojis (P19), and so on.

4.2.2 Sustaining Autonomy by Avoiding Availability Disclosures. Meanwhile, some participants expressed their desire for sustaining their autonomy by avoiding making disclosures of their availability information to their conversational contacts when using restrictions. One concern that the participants expressed about disclosing restriction statuses was that on the flip side of a period of restriction is a period of non-restriction, which implies or exposes their availability for communication in that period. As P5 said, *"I won't tell you when I'm restricting notifications, because if I do, I'm also telling you the other times I'm not."* Some participants feared that their periods of availability, as inferred from their statuses, would elicit more incoming communication, harming their sense of autonomy and placing them under pressure to respond promptly during unrestricted periods. As P17 explained, *"If it says 'going to be unable to read', it means being able to read now. [...] It's like I already claimed that I will not respond. Doesn't that mean I'd better do it now?"* Such concerns regarding post-restriction periods were even more acute, with many participants perceiving that their conversational partners would be waiting for them to become available and have inflated expectations of how promptly they could or would respond. *"What if I was interrupted by other stuff during the period that made me unable to reply? People would think, 'You said you can reply in this period, but you aren't. Why?'"* (P4). Thus, they were especially worried about using restriction countdown timers, which imply an overly specific moment of transition into available time. For example, P16 said, *"If it shows 'Able to receive after five minutes', but it turns out that I'm not ready at that time, and a message comes, and I don't reply, this puts pressure on me and makes me look inconsistent."* On the other hand, participants who considered their time to be flexible, fluctuating, and unpredictable preferred not to disclose their available time, since even they were uncertain about when they might become unavailable. As P41 explained, *"I may* *be free at the time, but it's just a transition, like a five-minute break within an hour-long busy period. Maybe I'll get a call right away and need to work on a case immediately."* For both these reasons, they expressed a wish for statuses to become vaguer as the end of the restriction neared: *"Like I set a status 'eight to ten a.m., in a meeting,' and it just ended, but I still need to organize something. Then I'd like the status changed to 'likely to respond after a few minutes,' because I'm not exactly sure how many minutes later. [Making it more vague] gives me more flexibility"* (P30).

4.2.3 Under-representing Unavailability Because Availability Is Part of a Service or Commitment. Lastly, some participants' showed a desire to under-represent their unavailability information when using restrictions, because they perceived their availability to be a part of a service they offered, or some other form of commitment.

This desire represents the other end of the spectrum, where the participants' highest priority was fulfilling the expectations of a certain group of people. Even though their original use of restrictions was to protect their attentional resources and keep themselves focused, they reported that it was crucially important to them to under-represent their unavailability to that contact group, because they perceived their availability as an obligation and commitment to its members, against which their own needs had to be carefully weighed, since showing restrictions might signal lack of commitment and/or inattention to such obligation. This was especially the case with conversation partners, especially work contacts, on whom participants perceived themselves as highly dependent. P11, for example, said *"In my work context, I should not tell others that I would not be able to reply to messages because that will be too reckless."* P42 felt he could not show any unavailability to his clients, regardless of whether he was actually busy: *"If I can choose, I hope it won't display any of my restrictions (laughter). Like I said, the restriction is for regulating myself. But to [the client] it has to be wide open. [...] It's the feature of my work, which is that you can't show people that you're not reading messages or restricting notifications. It will harm your image."* Several participants who felt a strong commitment to their teams also indicated that displaying unavailability at work is a sign of laziness: *"They will think that you're slacking off at work when they see your [restriction] status"* (P13).

4.3 Leveraging OSI Restriction Messages to Justify or Explain Unavailability

In some situations, participants deemed it necessary to compromise their privacy via their OSIs, based on a perception that doing so helped them to defend their use of restrictions. That is, when discussing the pressure caused by response expectations, many participants mentioned that it was vital for the restriction-related information that appeared on OSIs to justify both their unavailability and their use of restrictions, or at least make these things explicable to their conversation partners. In exploring how to present statuses that could achieve this purpose, we observed another tug-of-war: between the need to provide justification/explanation and the need to preserve one's privacy. The next two subsections discuss this tension in more detail.

4.3.1 Attributing Unresponsiveness to the System. Many participants reported that, while a simple "Unable to respond" had the benefit of disclosing little if any private/sensitive information, it sounds like it reflects a personal decision to not respond. Thus, they preferred that their unresponsiveness be ascribed to their being unable to see messages, or unable to access notifications due to the system. As P19 put it, *"If I can't read your message, I certainly can't reply."* In addition, several participants mentioned that, to help them evade personal blame for their restrictions, the system should adjust their statuses automatically, because they assumed a system-generated status would be deemed neutral, genuine, and *"unequivocal"* (P43). On the other hand, if it were widely known that such statuses were set by the user, *"people would be more sensitive to what the status shows"* (P43). For example, P17 commented, *"If it is manually set, some people would wonder, 'Why would he/she set this status' and then start getting suspicious."*

Additionally, some participants mentioned that communication limits could help them evade blame for not responding. As P10 noted: *"I just want to show 'There's a reason that I can't reply to you'. It's reached the limit, so I can't say more."*.

4.3.2 Willingness to Compromise Privacy in the Name of Justifying Restriction Use. Many participants told us that sometimes, attributing their unavailability to the system would not sufficiently justify their unresponsiveness or their use of communication restrictions, since, after all, they could have disabled or deactivated the latter. They further suggested that disclosing *some* details of their activity, at least high-level ones, would be the minimum to make their lack of communication seem justifiable. This perception was very often reported by those participants who perceived their communication obligations – usually to their workmates, supervisors, and close contacts – as high. For instance, P38 said, *"I need to share [detailed information] with people I have shared interests with, whom I'm in the same boat with, such as my manager and my wife. Friends don't care much if I don't respond, even for days; but for my manager, I need to let him know what I am doing. [...] As for my wife, I have to share information like 'In a meeting', 'Driving' and 'Sleeping', or she may overthink."* Moreover, because the people who expected them to respond quickly were typically the same ones who would expect them to be transparent, they reported that it was acceptable, and probably also easier, for them to just disclose activity details. As P30 put it, *"For people in my work group or those I'm very familiar with, who would need to reach me right away, I would prefer to disclose a concrete and precise time of my availability. With them, privacy is less of a concern for me"* (P30).

Interestingly, we observed a moving tension between how much this subset of participants wanted to justify their unavailability for communication, and how much detail they were willing to disclose for that purpose. Several participants told us that they would disclose current-activity information only 1) to the degree necessary to justify unavailability, and 2) to those who could understand and empathize with the situation. As P43 said, *"my colleague can better comprehend my unavailability, because we work together [and so I'd share details]. But clients can't. So I'd rather have them judge for themselves."*

On the other hand, when these participants perceived that their conversation partners were already broadly aware of their activity, they felt it less necessary to disclose as much: *"My manager can check my calendar himself, and would not bother me when I am in* *a meeting"* (P42). To disclose only just enough, some participants preferred disclosing their status progressively. As P40 suggested, *"I think it [the system] should tell the sender 'I'm unavailable' by default. But when someone who's seen this tries to send a message to me anyway, the system tells him/her when I will become available."* And, upon entering a period of personal/free time, when they did not feel a strong need to be transparent with their work partners, they said they would prefer to immediately turn off the disclosure of details, and that *"the system not collect any data or share anything"* that might disclose what was going on in their personal lives (P31).

It is worth noting that our participants' motivation for disclosing details was not always to alleviate the pressure of response expectations, but sometimes simply to be considerate, e.g., to prevent their close contacts being worried about them after seeing a restriction status. As P20 commented of disclosing some activity information to her significant others, *"I think it's better to let them know the situation, so that they will not feel unable to find me, and worry."* Similarly, P28 said, *"I'd absolutely share my status with my partner [...]. If you don't share it and don't respond, they think something happened to you, and call you."*

4.4 Communicating Rather than Simply Exposing: Diplomacy in Restriction Disclosure

As well as mentioning the need to explain/justify their unavailability and use of restrictions, most of our participants thought that presenting a restriction status should not simply disclose the use of a restriction, but should also communicate about the use of it. That is, as message recipients, participants ultimately wished that their conversation partners would comply with their personal *"communication protocol"* (P39), in light of their stated availability or lack thereof. For example, P43 explained that, by using restriction statuses, he hoped to shape an ideal communication protocol in which the parties *"leaving messages rather than concurrently exchanging messages in real time"*. However, when seeking to coordinate and shape communication, it was perceived by many participants that justifying the use of restrictions might be necessary, but not sufficient, to convince one's conversation partners to accept such restrictions. To guarantee such acceptance, participants deemed that they would have to diplomatically communicate their use of restrictions via appropriate status wordings, and thus project images of themselves as tactful (P12, P32, P43), polite (P17, P18, P22), flexible (P4, P11, P21), respectful (P4, P12, P35), and considerate (P7, P30, P31). For example, P42 preferred presenting the status "Going to be able to respond" over "Now unable to respond", because, as he put it, *"It's a matter of wording. 'Now unable' is like 'I decline you in your face', whereas 'Going to be able to' means 'I'm busy now but I may respond later.'"* Several participants also disliked showing the wording of communication limits such as "limit unreached", citing a perception that this would readily cause their conversation partner to feel unfairly treated. As P10 said, *"People would challenge me, 'Your status says your limit was not reached yet. Why didn't you respond?' "*.

For contacts with whom they had particular types of relationships, the participants deemed diplomacy to be especially crucial, and to require careful consideration and handling. For example, as P4 commented, when a power disparity between the parties is involved, showing a message that one is currently unable to read messages *"is somewhat offensive. It's like saying 'Finish talking quickly or I'm leaving'."* P17, on the other hand, perceived it more socially appropriate to announce the use of the restriction before starting: *"Before I enable these restrictions, I'd explain why I'm doing it [in a post] first, because the tone of the status is kind of strong, and I feel kind of sorry for my contacts, because they can't send me anything once I set this. It's kind of showing superiority."*

Several participants argued that, even in situations where using restriction messages with particular wordings is unavoidable, the frequency of restriction-disclosure must be regulated. Otherwise, they said, repeated disclosure would gradually produce a sense of isolation and inadvertently reduce not only information exchange, but the sense of relational connectedness between them and their contacts. As P12 put it, *"They will probably not message me at all because they've seen me set a message limit, then I'd lose my opportunity, right? [...] If I were the sender, I'd dislike it. I'd think this person is unapproachable and condescending."*

Finally, it was widely perceived that being flexible and accommodating was vital, so that one's conversation partners would not feel they had no option but to comply with the status message. After all, P7 said, *"people have their own ways of doing things"*, and therefore, it was crucial to accommodate people's habits and preferences by reserving some work-arounds for specific contacts. This, others agreed, would let them feel like *"VIPs"* (P23), and avoid *"irritating"* them (P28) or even *"harming the relationship"* (P23).

Unsurprisingly, some participants felt that to be effective, diplomacy had to be personalized. That is, for certain groups of people whom they disliked and perceived to be *"bothersome"* (P15), *"annoying"* (P12), and inconsiderate, the participants preferred their statuses to be unreserved, direct, and authoritative. As P15 noted, *"If you see my message limit being reached, you should know to retreat."* Similarly, P12 said that he would like to show the message *"Going to be unable to respond"* to these contacts all the time. P23, on the other hand, wanted to show *"Unable to respond"* during certain periods to project an image of being *"commanding"*, because this status *"creates a sense of authority."*

4.5 Senders' Perceptions of, Reactions to, and Understanding of Restriction Statuses

Finally, we looked at how, when they adopted a sender's perspective, the participants perceived their conversation partners' disclosures, via IM apps' OSIs, of their use of restrictions. Most indicated that such disclosures were generally useful, because they allowed them to estimate when such partners would be 1) responsive (P8, P30), 2) busy or trying to stay focused (P38, P43), and 3) most likely to find incoming communication disturbing (P43). However, even participants who perceived such benefits expressed various concerns about restriction statuses from the sender perspective. The following three subsections respectively summarize how participants reported they would interpret, react to, and act upon their conversation partners' various restriction statuses as shown on IM apps' OSIs.

4.5.1 Seeking Explanations and Justifications of Restrictions Being Set. Many participants mentioned that, upon seeing a conversation partner's restriction status, they would speculate about the intentions behind it. Not surprisingly, common speculations included that such statuses were related to productivity, including that the conversation partners are busy (P38), or want to stay focused (P43), avoid distractions (P19), reduce communication time (P4), or regulate the overall quantity of communication requests they receive (P15). These speculations were typically based on the participants' understandings of the partners' routines and activities. P36, for example, commented: *"If it's work time, it makes sense that they are busy."* Interestingly, they also made numerous speculations about restriction statuses' social purposes: such as *"avoiding someone"* (P43), *"being selective"* (P1), *"saving time"* (P10), *"making their conversational partner efficient in communication"* (P4), and so on.

Being able to account for their partners' decisions to set restrictions helped them avoid negative feelings. Nevertheless, when participants perceived a major conflict between the speculated intent and their own self-interest, e.g., that setting the restriction violated their communication expectations, they tended to perceive the choice to restrict as unjustified.

Participants more often sought justifications when the restriction was set by their significant others or (if the restriction was set during work hours) by work colleagues. For example, P36 said, *"The bottom line is letting us know what you're working on. If you're working on our project, I'll leave you alone. But you need to let us know when we can find you, or when you plan to respond after you see the message."* Some other participants argued that restrictions should never be set at all, or at least never during working hours. P12 commented: *"If he [a colleague] set up this thing during work time, I would be very mad. If I need to find you for an important issue, but you set up this and make yourself not able to see my messages, it's very improper."*

4.5.2 Relational Alienation and Uncertainty Due to Seeing Restriction Statuses. Alongside the negative feelings that arose from their conversation partners not meeting their response expectations or violating their own communication obligations, some participants felt alienated from them due to constantly seeing their restriction statuses. P42 said, *"The feeling of seeing 'Going to be unable to respond' is like you just don't want to receive messages, you want to take no more, you want to reply no more."* The participants' feelings of exclusion and being ignored were particularly acute when they saw communication limits on numbers of contacts, which made them wonder, *"Why am I not on the list?"* (P42), and *"Why did he take others' messages but not mine?"* (U10). P43, for example, also commented, *"You'd be worried about disturbing them [...]. But if he [my boyfriend] keeps showing this [limit], it's like, am I dating a customer service representative? If I see it on my friends' statuses, it's still weird to see it often. How am I supposed to ask them out for dinner or something? Can't we just chat? The feeling is like you have tried asking them a lot of times, and then you ended up letting it go and don't want to do that anymore."*

Some participants claimed that the wording of statuses did not sufficiently inform them of their conversation partners' actual statuses, and that this uncertainty caused them to feel insecure, especially when their messages were not responded to. For example, P38 commented on seeing notifications turned off by his partner, *"you start to speculate about what she is doing. When you can't guess it, then you start to panic. I think this status should say what she's doing. [...] You don't know if they are doing something bad or not."*

4.5.3 Meaning-making and Sense-making about the Effects of Restrictions. Finally, the participants reported various meaning-makings about the wordings of the restrictions that their conversation partners set, and various sense-makings about the restriction mechanism itself. Underlying both such efforts was a desire to understand the effects of restrictions on their communication with these partners. In the process of meaning-making, one concern often raised by the participants was that their own interpretation of a status might differ from the meaning their partner intended for it, and this made them uncertain about what to do next. P12 commented: *"I don't know what his 'Going to be... ' means. I'm not sure if his definition of it is different from mine.* Not knowing the intent behind restrictions was also a source of anxiety, especially when the status was ambiguous: *"I'll send the message, because I don't know when it will end. But then I may become more anxious, I will probably check the conversation window every thirty minutes, and see if his [restriction] status has changed. If the status is still the same, I'll check later. If the status has changed but my message is not responded to, then I'll feel anxious. The process of waiting is what makes me anxious"* (P27).

When attempting to make sense of the restriction mechanism, participants reported higher levels of uncertainty about the operation of some restrictions than others. For example, some participants were unsure about whether the statuses "Unable to receive notifications" and "Unable to read messages" meant that the intended recipient was just temporarily prevented from seeing the notifications/messages the system received, or that the system purged itself of such notifications/messages entirely during the restriction period, such that the recipient would never be able to see them at all. When we prompted the participants to tell us how they thought the system would and/or should work, those who assumed that it would merely hide notifications/messages temporarily noted that they would prefer to send messages anyway. P23, for instance, commented: *"I will still send messages. Because he already turned off the notifications on his phone. So I don't think it matters."*

Unsurprisingly, a divergent approach was reported by those participants who perceived the system as blocking all messages and notifications. That is, they said that they would not send any messages, because their conversation partners would not see them even after the restriction ended, rendering any message-writing effort futile. P27, for example, said: *"'Unable to read messages' looks like if I send a message to him in this blocking period, he won't receive it. It's turned off. It's like there's a trash can, and everything you send between eight and ten a.m. is thrown into his trash can."* P13 said that she wanted to know how the system worked so that she would know what to do next. *"If the message upper limit being reached means the user will not receive any more, I'd not send any, since the message would not reach them.*

4.6 Concerns about Automated Integration of Attention Management into IM Apps

Several types of additional concerns about the integration of attention management into IM apps were reported by participants. First, they had divergent interpretations of how these restriction statuses were and/or ought to be generated: i.e., whether they are fully auto-generated, like IM apps' existing read-receipt and online-status features, and thus unmodifiable by users, vs. entirely manually set by users in the attention-management tool, vs. auto-generated but still user-modifiable.

Many participants mentioned that letting the system fully detect their availability, whether based on calendar events (P13, P25, P41) or on their device activity (P38), would be beneficial, i.e., *"convenient and time-saving"* (P24). Nevertheless, many doubted systems' capability to achieve this, and wondered, *"How would the machine accurately know when I could be disturbed?"* (P4) and *"Can it tell when I'm online? I don't have a regular pattern"* (P12). Some also assumed that the time of their restriction would not be recognized precisely, which would *"cause trouble"* (P15) by over-representing their availability and thus harming their autonomy. Notably, while some participants appreciated the efficiency that linking calendars to restriction statuses might achieve, they were worried about how such linkage would expose their routines: *"I don't want other people to know what I'm doing in my personal time"* (P31).

On the other hand, being too precise by strictly following the period the user set and not allowing for grace periods to accommodate unexpected incidents, would also expose incorrect availability, as P19 noted, *"Maybe I set it to end ten o'clock, and I may be running late, but the notifications would come in before I'm ready for them if the system automatically starts permitting them."* Perhaps for this reason, one desired feature mentioned by participants was that restriction statuses just display *"rough and vague periods"* (P12), but that users determine the ultimate, exact periods.

Participants also expressed concern that, if restriction-period settings were integrated into IM, there would be mismatches between the restriction statuses they set and existing IM awareness cues such as OSIs and read-receipts. P16 commented on how such inconsistency could cause attention-management efforts to backfire: *"Like I set no-response restriction between eleven p.m. and seven a.m., and for some reason someone's message's read-receipt indicator showed that I'd read it during that time. He would then call me because I did not reply on LINE, but I'm actually sleeping and he would then disturb my sleeping. It's likely to happen"* (P16).

In the Discussion section, below, we summarize the above findings and discuss their implications.

5 DISCUSSION

5.1 The Two Tug-of-Wars: Attention Management vs. Meeting Expectations, and Guarding Privacy vs. Providing Justification

The findings presented above reveal two tug-of-wars that our participants perceived when attention management was integrated into IM apps. The first was between attempting to protect their attentional resources and fulfilling their conversational partners' expectations. This tension was perceived by most participants to start from the moment communication restrictions were put in place. On one side of this tug of war, fulfilling the conversation partners' expectations was perceived to be the highest priority. The other side prioritized the participants' desires to protect their own attentional resources and to lower others' communication expectations. Somewhat paradoxically, however, some perceived that the flipside of disclosing their periods of communication restriction was implicitly to suggest that they were available during all other periods. Several participants who viewed their availability as a service or commitment, as previously indicated by Mazmanian and Erickson [78], felt it necessary to under-represent their use of restriction.

For many participants, this first tug-of-war also gave rise to the second: between providing justifications for their restriction use and guarding their privacy. We found this tension particularly interesting, because several prior studies have indicated that disclosing receptivity and status via OSIs could prompt user privacy concerns (e.g. [25, 71, 87]), leading some to wish they could hide or falsely indicate their visibility and receptivity to reduce distractions [24, 86]. However, our findings resonated with Cho et al. [24] regarding the perceived benefit of OSIs for disclosing status, in that some of our participants desired to leverage OSIs to explain their unavailability. Moreover, our study additionally shows that some of these participants expressed that they were not only willing to sacrifice their privacy in the name of publicly justifying their need to use communication restrictions, but also that they would ideally disclose even more activity information, to enhance the transparency of their availability. Interestingly, these participants could not stand emitting restriction statuses without justifying the use of those statuses to those conversation partners whom they desired to maintain good relations with.

From the sender's perspective, too, our study shows that justification was perceived by many participants as necessary; but in certain situations, or between people with certain relationships, where availability was deemed a mark of commitment and respect, it was mentioned by some participants that no restrictions should ever be used.

A further noteworthy concern likely to arise from the integration of attention-management tools into IM apps, according to our participants, involved exposing the transitions into and out of restriction periods. That is, in Cho et al. [24]'s study, in which their participants set their own statuses, transitions did not appear to have been of much concern to them; in contrast, in Wu et al [106]'s study, in which availability statuses were automatically updated by the system, their participants expressed concerns that statuses about their upcoming unavailability would likely imply they were available in the current moment. Beyond these studies, our findings further add that many participants not only shared the same concerns about this kind of transition, they also feared that the end of a restriction might trigger a flood of delayed communication, coupled with an expectation that they would respond to all of it promptly. This latter dynamic was of special concern to those participants who had greater uncertainty about their working hours, and/or who often received urgent and unexpected tasks. These factors led them to worry about making any commitments regarding their availability, as it could change at any time, thus causing disappointment among their conversation partners.

To sum up, it is interesting to see how a seemingly simple extension – exposing the use of attention-management tools into OSIs – could lead formerly submerged concerns and tensions around awareness cues to become explicit, prominent, and influential to our participants. Accordingly, we see great potential in the integration of attention-management tools into IM, but also recommend that careful attention be paid to the abovementioned tensions and concerns, as they are likely to play a large role in such integrated systems' adoption and success.

5.2 Shielded, but Not Isolated

Much like the tension between protecting attention and fulfilling expectations, the desire to restrict some communication activities and disclose such restrictions, for many participants, also involved a tradeoff between protecting attention and connectedness, which went beyond simple fears of not receiving important information [73, 88, 100] or failing to fulfill expectations [88]. That is, when these participants perceived that their uses of communication restrictions were exposed and brought to the fore, it introduced a new concern about becoming *socially* and/or *relationally* disconnected, i.e., that such a disclosure might harm their social image and thus result, albeit perhaps gradually, in bad impressions or even a loss of friendship. This concern is not farfetched: research has consistently shown that IM is an important channel for fostering and managing relationships [28, 47, 65, 94, 95], and that in such relationship development, reciprocal interaction is critical to success [17, 95]. Given that IM apps' OSIs are among the few cues conversation partners can use to gauge people's availability, activity, and image, they are perhaps particularly helpful to relationship development[7, 40]. Thus, not unexpectedly, when these participants perceived that their disclosure of restrictions might be taken as a signal that they desired isolation or a lack of interaction, they worried that this disclosure would inadvertently portray them as unreachable or unreceptive. This concern was also unsurprising insofar as they had the same reaction when they saw others' use of restrictions from the sender perspective.

Crucially, however, our found that it was not the mere revelation of the use of restrictions that was perceived by our participants as likely to result in a negative image, but also the ways restriction messages were worded and the frequency with which they were shown. For instance, within a given type of restriction, they preferred to display wording that allowed them to ascribe unavailability to *being unable to see messages, or unable to access* notifications due to the system, rather than wording that suggested unavailability was simply their own choice. This was not only because the former wordings allowed them to shift responsibility onto the system and thus avoid sounding tactless, inflexible, and inconsiderate, which in turn would tend to result, over the long term, in an image of being unapproachable, unaccommodating, or even condescending. Similarly, being "unable to respond now" sounded more tactless to some participants than being "able to respond later", as the former was thought to imply an intent to decline. In addition, the participants were concerned about the long-term negative impact that repeated disclosure of restriction use would have on their connectedness with their contacts. The participants thought that if a restriction status were displayed for too long or too often, it would cause their conversation partners to feel alienated and thus lose interest in interaction, irrespective of the status' specific wording. As a result, to keep themselves shielded from disturbances and maintain their autonomy, while at the same time sustaining their informational and relational connectedness, they felt they needed to diplomatically choose appropriate status wordings, as well as regulate the frequency with which their use of restrictions was disclosed. Finally, several participants, being diplomatic often also involved being accommodating: i.e., making exceptions to their restrictions for certain contacts, to make the latter feel they had "VIP" status.

To sum up, the dilemma between protecting attention by regulating incoming communication requests and preserving connectedness might have always been present for some participants, but it was at the forefront of their concerns when they felt the need to reveal specific restrictions. Once that happened, however, the dilemma did not merely emerge, but appeared to become the primary driver of how the participants wanted to communicate about their use of restrictions via their statuses.

5.3 Design Implications for the Integration of Attention-management Tools into IM Apps

Based on the findings presented above, we propose a provisional design space for such integration and provide some other design recommendations for addressing specific issues that users may experience after such integration has occurred.

5.3.1 A Provisional Design Space for Fulfilling Four Paramount Needs. Our proposed provisional design space focused on two dimensions: levels of restrictions and levels of disclosure. As shown in Figure 3, based on the data provided to us by the participants, we assume that different combinations of restriction and disclosure levels may lead to different degrees of fulfillment of users' four main needs: 1) to protect their attention, 2) to fulfill their contacts' communication expectations, 3) to sustain their connectedness, and 4) to guard their privacy. This figure is intended not only to exhibit probable trends in the tensions among these four needs, but also to guide practitioners' prioritization of the needs their integrated systems support. However, given the strong individual variation we observed in the tradeoffs and conflicts among the four needs, it will be highly challenging, if not necessarily impossible, to fulfill all those needs at once. Therefore, we recommend that designers identify and clarify the purposes of the integration – i.e., which of the four needs they desire or expect their respective systems to support – to help them clarify and prioritize the features it should include.

Along the x-axis in 3 are four levels of restriction, which we propose should be roughly classified into four levels, based on prior work by [72] : 1) no restrictions; 2) selective restriction (i.e., only blocking certain communications); 3) protected (i.e., only permitting certain communications); and 4) isolated (i.e., blocking communications entirely). We believe that practitioners should be able to project a specific type of restriction onto this map of the design space, given that its categorizations are relatively high-level and broad. Along the y-axis, meanwhile, are four levels of disclosure of the use of restrictions that we proposed based on our findings. These are 1) mystery, i.e., not disclosing such use; 2) opaque, i.e., disclosing only that a restriction is in place; 3) evident, i.e., disclosing not only the fact of a restriction being used but also a high-level context to justify it; and 4) transparent, i.e., disclosing context details in high granularity, to maximize the restriction's justifiability.

Figure 3: The design space of fulfilling four paramount needs, including attention protection, privacy guarding, expectation fulfillment, and connectedness sustainability.

However, this classification is highly tentative, as it is derived from the participants' reflections while envisioning a fictitious integration of attention-management tools into IM. Moreover, our findings indicate that there was also a z-axis – the desire to be diplomatic – that influenced our participants' choices about how their restriction statuses were presented.

We propose a color spectrum, ranging from orange to indigo, that illustrates the degree to which a need is fulfilled: with orange indicating the lowest degree, and indigo the highest. Generally speaking, we assume that the higher the level of the restriction, the more attention is protected, but the less connectedness there is, and the fewer communication expectations are fulfilled. A higher level of disclosure, on the other hand, is assumed to lead to less privacy but more fulfillment of expectations. It may also increase attention protection, by serving as a "Do not disturb" sign to senders; but this, by reducing the volume of communication, could also lower reachability, and thus – probably – connectedness. Accordingly, in the bottom left corner of Figure 3, reflecting no use of restrictions and no status being displayed, the IM user's attention is not protected, but s/he experiences the highest possible levels of privacy and overall connectedness. On the other hand, because his/her status is unknown and s/he can be highly selective in terms of responsiveness, senders' expectations are not necessarily fulfilled. The bottom right of the illustration, in contrast, reflects users' statuses indicating a near-total state of isolation; thus, they have top-notch attention-protection and privacy, but are entirely disconnected, and extremely unlikely to fulfill expectations. The top left reflects users not imposing any restrictions and making their activity transparent, which one of our participants indicated was likely to be the case in certain work environments. This is a good representative case of trading off privacy against expectation fulfillment. A more crucial, and arguably the most nuanced and challenging, aspect of designing such an integrated system is supporting the combination of needs in the middle area, such as at the intersection of Protected and Evident. There, we assume that the user's restriction permits some exceptions and discloses that it is in use, with some activity details added. As compared to disclosing only the restriction type, this use of activity-information-as-justification reflects the user's compromise between privacy but and expectation fulfillment. This helps to reduce the volume of communication, resulting in better attention protection; and, provided that senders accept the justification, little or no loss of relational connectedness. In another example, immediately to its left, the user is disclosing activity information and using only selective restriction. This achieves better reachability (and thus presumably also informational connectedness) and can better fulfill communication expectations, because the user is open for more communication activities, but at the expense of his/her attentional resources. However, in our opinion, the user would likely deem such restriction-disclosure to present him- or herself as discouraging interaction with the people who can see it; and as such, s/he might also perceive it as harming relational connectedness, at least with that group of people.

One final important nuance worth noting in Figure 3 is the different degree of color change between two labels, linked to changes to restrictions and the disclosure of such restrictions based on the participants' perceptions of the positive and negative influences of these two factors on fulfilling their four needs. For example, the impact of a restriction on attention protection and on connectedness is assumed to be greater than the impact of disclosure on those constructs; whereas the impact of disclosure on privacy is assumed to be greater than that of restriction, and so on. However, it is worth noting again that the degree of impact, the valence, and the correlation among these needs and the dimensions restriction and disclosure are all based on qualitative findings, and thus can only uncover the roles of these components, not their actual magnitudes and prevalence. For example, we are unsure about whether disclosure or restriction has more influence on expectation fulfillment and connectedness. Figure 3 depicts the level of restriction as having more influence on connectedness than disclosure has. However, this relation may vary depending on the situation and across individuals, given that some of our participants characterized being able to justify their restrictions and present an image of accountability as vital to sustaining relational connectedness. Future research could also usefully examine the impact of how users' valuations of being diplomatic affect their choices of status-presentation type, among other factors mentioned above. We believe that the integration of attention-management tools into IM apps will increase in the market in the near future, given the wake of recent increases in scholarly and popular interest in attention management, linked to work-life boundary issues arising from the growth in working from home [84] and other forms of remote working [105].

Therefore, we believe this paper is an important first step toward revealing several non-negligible tensions around such integration; and our proposed design space can be expected to be useful for practitioners and researchers interested in the profound challenge of supporting various kinds of users to simultaneously protect their attention, fulfill their contacts' communication expectations, sustain their relational and informational connectedness, and guard their privacy.

5.3.2 Design Recommendations for Automating Integrated Attention-management/IM Systems. Our findings also have some design implications involving specific issues that users may experience when attention-management tools are integrated into IM apps. The users of existing attention-management tools are already allowed to set their own restriction times, and we deem such customizability to be important to include; however, we recommend that their calendar events also be linked to their chosen attention-management tools, to prevent duplication of effort. In some cases, however, users may be reluctant to link all events due to privacy concerns, and/or due to a perception that it is unnecessary to expose all busy periods to their contacts. To allow users to manage their work-life boundaries and autonomy in their personal time [19], it will be crucial to ensure that systems do not create impressions that the OSI exposes all the user's events that it accesses, to the point that periods outside those marked as busy are mistakenly inferred to be times of user availability. Thus, users should be allowed to categorize events, as well as the level of visibility/granularity of their activity information for these categories, such that they can determine which categories are linked to IM apps' OSIs and with what detail, thereby enabling them to disclose information only to the minimum degree necessary for justifying their restriction usage. We also recommend including dynamic presentations of granularity when entering or leaving restriction periods, such as lowering it at transitions, as many participants pointed out that they wanted to maintain their autonomy at these transitions without feeling a need to hide or modify them at such boundaries. .On the other hand, people may be selective about which of their contacts should receive restriction information [58, 85], and thus, customizing contacts should also be supported by future integration projects.

Additionally, systems of this type should grant their users full control when it comes to addressing social nuances. Specifically, we suggest the system allow particular dyads to bypass restrictions altogether. That is, not only should the user of the restriction be able to quit it at will or set conditions for releasing it, as suggested by Lyngs et al [73]; senders should also be able to deliver emergency communication requests via the system. Users should also be able to add activity information, to increase statuses' justifiability, and to change the wordings of statuses, to tactfully communicate restriction usage. As mentioned by several participants, it may be also worthwhile to allow progressive disclosure [97], i.e., only provide detailed activity information upon request.

Given the interactive and communicative nature of the recommended features, and that the integration will take place on IM apps, such features may be delivered via a conversational user interface (CUI) [57, 100], which presumably could handle customized automatic replies. Another benefit of this integration would be to leverage the intent-recognition services (e.g. [4, 37, 48, 79]) to help classify the intent behind senders' requests, thereby determining the granularity of the activity information to disclose, and the tactfulness of the status message to be displayed. In cases where a user has not finished his/her primary task as of the moment a predetermined restriction period ends, the CUI can help coordinate that person's availability with message senders. Finally, the CUI could communicate with the users who set the restrictions, such as by reminding them of upcoming transitions, or informing them of urgent communication requests. In other words, we think there is immense scope for a CUI to serve as a coordinator of statuses and needs between members of communication dyads.

On the other hand, as suggested by prior research [5] and also observed from our participants, users may be uncertain about the mechanisms of an automated attention-management system in general, and of its restrictions in particular. Accordingly, we suggest that such systems provide explanations of their actions/mechanisms upon request, as well as quick facts about particular restrictions, which could also be delivered via CUIs.

Finally, most popular IM apps already incorporate one or both of two types of automated awareness cues that are unrelated to attention management: i.e., "last seen" flags[3] and read receipts[4]. Therefore, it is crucial to ensure that the integration of IM with attention management does not interfere with these two features

[3] About last seen and online - Whatsapp . https://faq.whatsapp.com/general/chats/about-last-seen-and-online/?lang=en

[4] How do I know if someone has seen a message I sent in Messenger? - Facebook Messenger. https://www.facebook.com/help/messenger-app/926389207386625

(or them with it), since if this aspect of the integration were handled poorly, it could readily cause misunderstandings between the members of dyads. For example, it might be necessary to hide or deactivate the read-receipt feature during restrictions, to prevent system users from accidentally and confusingly signaling that they are both available and restricted at the same time.

5.4 Study Limitations

The current study was subject to a number of limitations. First, its qualitative findings were derived from participants' reflections during their envisioning of a fictitious integration of attention-management tools into IM, which a) might not equate to their experience of real future systems, and b) might fail to capture the social nuances of their real-life settings. Second, due to the COVID-19 pandemic, this study was conducted remotely via a video-conferencing tool, with all the mock-ups displayed on an online prototyping tool; thus, the speed-dating sessions could have been less effective than those held in face-to-face meetings. Third, given that the purpose of the mock-ups was merely to inspire the participants, and not to provide blanket coverage of all imaginable restriction-status possibilities, they were rather limited in terms of quantity and diversity. Fourth, given that the study's goal was to explore a particular design space and generate insights about it, our data were qualitative, and thus we could not draw any firm conclusions about the relationships among the identified components. To obtain a full picture and in-depth understanding of the complex phenomena that were reported to us, it will therefore be crucial to collect abundant quantitative evidence via, for example, experiments; experience sampling of a preliminary integrated system [64, 68]; or an in-the-wild deployment of a real system [61]. Finally, the findings were based on the reflections from a relatively small sample in Taiwan, whose primary IM experience was of LINE Messenger and Facebook Messenger. Therefore, it is unclear to what extent our findings would be generalizable to populations using different IM apps and/or from different cultures and countries. That being said, we believe that this study has generated vital insights and implications that researchers and practitioners interested in the integration of attention management into IM apps can leverage. The generalizability of our results across various countries, occupations, and organizations should be assessed as soon as any such integrated system has been developed and deployed.

6 CONCLUSION

We envision that the integration of attention-management tools into IM apps – i.e., imposing communication limits, and exposing the use of such limits as part of such apps' online statuses – will gradually emerge in the market. There are several reasons for this: IM apps are one of the main sources of distraction in modern life; online status has become a feature of many mainstream communication apps; attention management and work-life boundary-drawing are both increasing in importance due to the proliferation of remote work; and most importantly, there is a close relationship between communication and attention management. This paper is a step toward revealing IM users' perceptions of, concerns about, and possible practices arising from such integration. Despite being seemingly intuitive and simple, this integration aroused or sharpened various tensions among our participants, including one between fulfilling expectations and protecting attentional resources, and another between protecting one's privacy and providing sufficient justification for using communication restrictions. On top of these tensions was the participants' desire to be diplomatic as a means of sustaining both positive images of themselves and their relational connectedness. Based on our findings, we offered a provisional design space with three axes, i.e., level of disclosure, type of restriction, and desire to be diplomatic, that will help practitioners and researchers decide which of the needs – among protecting attention, fulfilling contacts' communication expectations, sustaining relational and informational connectedness, and guarding privacy – they want to focus on supporting, with the important caveat that satisfying all four of these needs at once will be highly challenging. Finally, we provided a set of practical design implications for future integration of attention management into IM apps.

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