

Too Close and Crowded: Understanding Stress on Mobile Instant Messengers based on Proxemics

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ABSTRACT

Nowadays, mobile instant messaging (MIM) is a necessity for our private and public lives, but it has also been the cause of stress. In South Korea, MIM stress has become a serious social problem. To understand this stress, we conducted four focus groups with 20 participants under MIM stress. We initially discovered that MIM stress relates to how people perceive the territory in MIM. We then applied proxemics—the theory of human use of space—to the thematic analysis as the rationale. The data revealed two main themes: too close and too crowded. The participants were stressed due to design features that let strangers or crowds into their MIM applications and forced them to interact and share their status with them. Based on this finding, we propose a set of implications for designing anti-stress MIM applications.

Author Keywords

Mobile instant messaging; stress; proxemics; design

ACM Classification Keywords

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

INTRODUCTION

Mobile instant messaging (MIM) has now moved beyond email and SMS. With the popularization of smartphones, MIM applications, which feature no cost and include conveniences such as KakaoTalk, Line, and WhatsApp, have grown tremendously. Today, a great number of people interact through MIM, and it is used not only for everyday conversations but also for business communication [4]. As the use of MIM expands, the number of people who are experiencing stress from MIM is increasing. This study was conducted in South Korea, where the penetration rate of smartphones is more than 91% [14]. In South Korea, MIM is used pervasively, even in public contexts such as schools and companies, and MIM stress has become a serious social problem, referred to as *messenger syndrome* [12].

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MIM is no longer simply a tool for delivering text. People are experiencing real and practical interaction through MIM. Conversations in MIM are more natural and fluent than with SMS, and people form communities and have a sense of connection through MIM [4]. In a study that focuses on WhatsApp, O’Hara et al. [27] argue that the use of MIM is a form of dwelling in digital space, and they use the notion of dwelling [11] to explain how MIM drives the encounters of people’s relationships over time. Whereas chat rooms in the past, such as the chat rooms of PC-based IM, were regarded as temporary places to be repeatedly created and destroyed, chat rooms in MIM have become more permanent places so that people form their own virtual territory [15].

If so, why do people receive stress in this digital dwelling? To find the answer, we conducted a study to understand MIM stress. Through thematic analysis of the data from four focus groups with 20 people who were under MIM stress, we found that the participants’ descriptions of their stress included a significant number of spatial words and connotations. Based on this finding, we began to suspect that MIM stress is highly related to the stress that people experience in physical space and that spatial perception in MIM is the key factor in understanding the nature of MIM stress. Thus, we reanalyzed our data based on the concept of *proxemics*. Proxemics, as defined by anthropologist Edward T. Hall [9], is the study of how people use space and the role of space as a form of nonverbal communication. Hall argued in his book *The Hidden Dimension* that people are stressed by intrusions into their personal boundary as well as excessively high density. Hall said, “Man is an interlocutor with his environment, and planners, architects, and builders must consider man’s *proxemic needs*.” Proxemics is a well-known theory in HCI for four interpersonal distances: intimate, personal, social, and public. However, we attempted to take other advantage, that is, insights Hall mentioned about stress.

Our primary goal is to understand MIM stress. This study reports on the themes of MIM stress resulting from a thematic analysis, through which we understood the focus group data based on proxemics. In addition, today’s MIM offers a variety of design features such as read receipts, typing indicators, and contact synchronization. We wanted to determine how these MIM design features work within each theme of MIM stress. Ultimately, our research contributes to the knowledge of how to design anti-stress MIM applications and support people’s proxemic needs for better digital dwelling.

BACKGROUND AND RELATED WORK

Stress on Mobile Instant Messengers

MIM is now one of the most popular mobile applications. In South Korea, the smartphone penetration rate is more than 91% [14], and KakaoTalk, which is a dominant MIM application in South Korea, held 95% of the domestic market share as of 2016. MIM is deeply pervasive in the everyday lives of Koreans. It is expected that most people are able to make contact through KakaoTalk. Because MIM has the function of a PC-version application and file transfer [13], in recent years, MIM has been used not only for communication with family and friends but also for conversations in the workplace. With the unprecedented widespread use of MIM, people are under extreme stress. In South Korea, this is considered a serious social problem and is referred to as *messenger syndrome* [12].

MIM stress is associated with the negative aspects of smartphones. In the HCI field, a number of studies have been conducted with regard to the negative aspects of smartphones, including overuse [22, 23], addiction [22, 23], and excessive connectivity [2]. For example, Lee et al. [22] investigated how app use is related to smartphone overuse and addiction. Several implications and research cases were developed to address overuse and addiction [16, 17, 29]. Smartphone distractions, which are caused by notifications also produce a negative impact by interfering with users' behavior [18]. However, research on stress based on MIM alone rather than on smartphones has rarely been conducted. Recently, Hoyle et al. [10] noted the impact of the MIM read receipt feature on anxiety, privacy concerns, and social pressure. Our work provides a broader understanding of the underlying causes of MIM stress rather than focusing on certain features.

Territory in Mobile Instant Messengers

Even in the digital world, people form territories, just as they do in the physical world. The issue of territory in online environments has been widely studied, especially in the social media domain. Representative works are the series of studies that apply Altman's [1] concept of boundary regulation [e.g., 21, 33, 34]. If many people in the online environment are engaged in social interaction, their territory may be infringed upon and privacy issues may arise. This series of studies showed how boundary regulation is used to control the degree to which others can access users' personal information in a virtual space. Some of these studies revealed coping mechanisms to reduce stress by protecting users' space in the social network service (SNS) [21, 34]. Coping mechanism studies have identified how people maintain an appropriate level of stimulation, and some of these coping mechanisms share similar behaviors among the participants in our study in the MIM domain. Studies on the space of MIM rather than SNS are relatively few. Nouwens et al. [25] found that people use multiple MIM applications at the same time and build personal and idiosyncratic communication spaces. Kim and Lim [15] applied the concept of Altman's human territory to MIM to determine how the virtual spaces of chat rooms reflect human territoriality.

Our work draws upon these threads to advance HCI's understanding of territory in MIM. In particular, we want to understand the stress that people experience in digital territory and how MIM design features affect it.

Proxemics

Proxemics is the study of human use of space [9]. Anthropologist Edward T. Hall coined this term in 1966. In his book, *The Hidden Dimension*, proxemics aimed to solve complex urban problems through an understanding of people's culturally dependent use of interpersonal distance. Hall's theory has had a great impact on HCI. Perhaps the most cited part of the HCI field is his definition of four types of interpersonal distance: intimate, personal, social, and public. These four interpersonal distances distinguish people's behavioral patterns when they communicate. For example, personal distance is a distance of 1.5 feet to 4 feet, which is the distance one person maintains from another [9]. It is acceptable for lovers or close friends to stay within this distance; however, it is unpleasant for strangers. These four interpersonal distances have been mainly applied in the HCI field as frames for providing natural interactions in the physical environment [e.g., 7, 24, 26].

In addition to the four interpersonal distances, proxemics includes various inspirational aspects and discoveries. In this study, we do not only use the specific concepts provided by proxemics. Rather, we focus on the idea of *stress*, to which Hall frequently refers in *The Hidden Dimension*. He described in detail the stress that humans experience when they interact with others in a physical space. He was concerned about the stress that human beings would face when proper space was not provided. He said [9, p.5],

When crowding becomes too great after population buildups, interactions intensify, leading to greater and greater stress.

In his book, the causes of stress are excessively close distance and high density. Stress caused by distance occurs when personal distance is not maintained with others. Stress caused by density occurs when a person does not have enough available space and the frequency of interaction with other people exceeds a proper level. Distance and density are not separate but are closely related. Issues that are related to personal space and crowding are also mentioned in Altman's seminal work [1], which is frequently quoted in HCI.

Hall's proxemics is based on the physical environment, not digital space. However, Hall [9, p.188] argued that humans and human extensions, such as cities, automation, and computers, constitute one interrelated system, and we should pay attention to the newly created extensions and study the change in human perception caused by the extensions. MIM is one of the human extensions that accounts for a large part of modern communication. Although there are no feet and meters in MIM, we want to discover how MIM design features affect stress in terms of human perception of space. Our work contributes with an attempt to apply proxemics in digital space and to find "the hidden dimension" of MIM.

STUDY METHOD

Focus groups [19] were conducted to understand MIM stress. We expected that focus groups would be effective to establish common ground and elicit rich responses because MIM stress is a big social issue in our participants' society.

Participants

Our aim was to enable deep dialogue between participants in the context of homogeneity [19] in experiencing MIM stress. We expected that forming focus groups of participants with similar experiences with MIM stress would help the participants to talk comfortably about their stress. In order to recruit participants who had this type of experience, we used an online screening questionnaire applying the four-item version of the perceived stress scale (PSS-4) [5]. The PSS-4 is a tool for measuring a person's degree of stress using four questions. We modified the PSS-4 to fit the MIM context (e.g., "In the last month, how often have you felt confident about your ability to handle your personal problems *while using MIM?*"). In addition to the PSS-4, the questions included age, gender, occupation, the MIM applications used by the applicant, and the period of use. The questionnaire was distributed through local online communities and flyers.

A total of 45 people applied for the study. We selected the participants by preferentially considering a high PSS-4, which means that the respondents were more stressed by MIM. The applicants' PSS-4 scores ranged from 3 to 13. We excluded those with 5 or fewer points, based on the mean points (5.6 and 5.9) in the case of the study by Cohen et al. [5]. Among the applicants with scores of 6 or higher, we selected those who responded with the highest scores, considering variety in age, gender, occupation, and MIM use.

The result was that we recruited 20 participants (age 23 to 36; 8 male; 12 female). The average PSS-4 of the 45 applicants was 7.49 (SD = 2.32), and the average PSS-4 of the selected 20 participants was 8.45 (SD = 1.53), which is much higher than the reference's case [5]. Although this does not perfectly guarantee the seriousness of the stress, we believe that this measure meets our initial purpose to understand the nature of MIM stress. The participants' occupational backgrounds included office worker, school teacher, administrative staff, advertising salesman, military surgeon, researcher, freelancer, students, and unemployed. To obtain deeper insights into MIM stress in their everyday lives, we decided to conduct small focus groups of five people. We made four groups of participants with similar work experience. These included a group of individuals with teaching experience at schools, a group of undergraduate/graduate students, a group of individuals with freelance experience and a group of general office workers. This grouping led to in-depth stories of work-related MIM stress.

Procedure

One researcher moderated the focus groups, and another researcher observed and took notes. We prepared semi-structured materials for the focus group process. First, for the participants to break the ice and become deeply engaged in

the subject, we asked them to quickly write down one word that came to mind when they thought about MIM stress and then to explain why they wrote that word. Subsequently, there were two sessions.

The first session lasted approximately 90 minutes and consisted of three discussions on specified topics that lasted approximately 30 minutes each. In each discussion, we introduced the topic that we had prepared for the participants to talk about. We gathered more than 100 articles [e.g., 12] about MIM stress and identified common points to construct the topics, which were "always connected," "relationships," and "new features." We introduced the topics with example situations presented in the articles, but at the same time, we carefully abstracted the topics so that the participants were not overly guided. The discussions included how to use MIM in relation to their work, personal experiences using MIM, and positive or negative experiences with MIM use.

The second session lasted approximately 30 minutes and was spent discussing the participants' efforts to avoid MIM stress. This session was designed to obtain a more detailed description of how the participants used the design features that are currently available in MIM. All of the focus groups were audio and video recorded and transcribed.

Analysis

Thematic analysis [3] was used for the data analysis. A total of 402 quotes were collected from 8 hours of transcribed data. We coded these data based on the initial research questions: What is the cause of MIM stress? How do the design features of MIM affect stress? In the initial analysis, we found that the participants often described stress in terms of *space-related* terms. For example, P13 said, "I once wrote a status message without a special meaning, but my father-in-law called me and asked what happened to me. I live far away from him. In spite of it, I feel like he is watching me *somewhere close*." P14 said, "When I used PC messenger in the past, I could log in only when I wanted to. There was *a space of my own*, but with mobile instant messenger, I feel that *my place is gone*." Based on these statements, we strongly suspected that *spatial* perception in MIM use is the key to understanding MIM stress.

Therefore, we tried to extract the quotes that referred to space or that had spatial connotations among the recorded quotes, such as far away, somewhere close, here, there, distance, see, get out, tied, and linked. This process was inspired by Hall's approach [9, p.93] in the chapter "The Language of Space" in *The Hidden Dimension*. Through this process, we found 53 quotes that referred to space or that had spatial connotations. First, we derived the emerging themes from these quotes. Through subsequent iterative discussions, we refined the themes by adding remaining quotes that did not directly include spatial connotations but still referred to stress. The themes that were derived from the initial coding were finally abstracted into six themes through repetitive analysis, and the six themes were organized into two main themes: *too close* and *too crowded*.

Our participants had experience using MIM applications including KakaoTalk, Line, WhatsApp, Telegram, Facebook Messenger, and Slack. Because all of the participants used KakaoTalk as their primary means of communication, many of our results refer to KakaoTalk; however, all of the participants had experience using two or more MIM applications, which have different features. The participants often noted the difference in experience between them, and they described their MIM experiences in comparison to SMS, email, and SNS. These data were useful in identifying the design features that were issues for each theme.

STRESS ON MOBILE INSTANT MESSENGERS

In the following sections, we describe the themes of MIM stress and how the design features in MIM have affected users' stress and proxemic experiences.

Before analyzing the focus group data in terms of space, we discuss three background factors. First, *MIM is essential*. Because MIM plays a large part in the role of contact, it is used as an essential good, such as a phone. If it is not used, it will cause discomfort to others, so people are obliged to use it. Second, *MIM is easy and free*. People assume that there is no difficulty or cost involved in exchanging messages. These easy and free messages tend to create continuing and lasting conversations [4]. Finally, *MIM is always near*. If there is no specific reason to assume otherwise, it is assumed that everyone has a smartphone with him or her all of the time. These background factors are not directly related to spatial perception in MIM, but they can be combined with design features to cause the *too close* or *too crowded* stress described in the sections below.

TOO CLOSE

The first main theme from our analysis is *too close*. According to proxemics, humans form an invisible bubble within a certain area outside of their own bodies, and distance-related stress occurs when someone intrudes in their private sphere [9]. Stress occurs when personal distance is not maintained. The participants mentioned the stress that results from a sense of improper distance in MIM. We captured three sub-themes of “too close” as patterns of MIM stress: strangers in a dwelling place, conversations in a closed room, and sharing status beyond MIM.

Strangers in a Dwelling Place

An important factor to consider when we seek to understand MIM from the perspective of proxemics is that MIM functions as a dwelling place. As other researchers previously reported, the space in MIM serves as a dwelling place where togetherness and intimacy are enacted, unlike in other digital spaces [15, 27]. Our participants also considered MIM to be a dwelling place, and they experienced stress when people who were unfamiliar came into their MIM.

The participants talked about their experiences with stress when they received messages through MIM from people who were in business relationships. They felt that MIM was a place to communicate with intimate friends. P12 said, “MIM

feels a little lighter, and SMS has a polite feel.” They felt their private spaces were infringed upon if they received MIM messages from people they did not know well.

“When my students’ mothers send me money [for music lessons for their children], they usually send remittance messages via SMS. Sometimes, however, they do not send them via SMS and instead send them via KakaoTalk... Why send it by KakaoTalk? Even with the same notifications, I hate it. I feel like I’m being infringed upon.” (P13 – music freelancer)

In all of the MIM applications that our participants used, users could initiate a conversation via a unilateral invitation at any time because no acceptance feature exists. Therefore, conversations with strangers can be initiated at any time. The difficulty of blocking strangers, known as context collapse, is similar to that found in SNS studies [31, 32, 33]. However, we realized that, with the mobile phone, the participants could not use some of the SNS coping mechanisms, such as creating separate accounts or using a pseudonym so that others cannot find oneself [34]. This made them experience more serious context collapse problems in MIM. Specifically, the participants were stressed when they felt obliged to respond to their contacts more quickly in MIM than in SNS, as all of their contacts (both close and not close) know that the users always carry their mobile phones.

“I have been contacted by someone who is not really friendly toward me... I should reply. Anyway, the read receipt comes up, and I have to reply.” (P1 – graduate student)

The participants were stressed due to one-off interactions with strangers in MIM. Some MIM applications, such as KakaoTalk and Line, have a type of friends list feature (Figure 1(a)) that automatically synchronizes contacts on a smartphone. The friends list is wider than the smartphone contact list because even if the smartphone contacts are removed, the friends list remains. Our participants felt uncomfortable that their friends lists included people who had interacted with them only once. KakaoTalk does not provide an explicit delete feature. The participants were stressed that their interactions remained in their MIM after the one-off interaction was over.

“If someone uploads a file, I have to add a friend to download the file. I just want to use the list for that purpose and just delete it, but KakaoTalk does not provide a delete function. When I have a specific purpose, there is stress that I cannot delete a person from the messenger whom I need to talk to for a moment.” (P1 – graduate student)

KakaoTalk offers a recommended friends feature (Figure 1(b)) that allows users to easily add friends. If users save someone’s phone number and put it on their friends list, the person can see them on his or her recommended friends list. The participants were stressed when inappropriate people with whom to communicate through MIM were presented in MIM as recommended friends.

“I have many recommended friends, and all of the lists are school parents. Because they save my number... School parents from a few years ago are still on the list.” (P15 – elementary school teacher)

Interestingly, the number of friends who use a particular MIM affected the feeling of being close to the other parties. The fewer friends the participants had, the closer they felt to the others in terms of the proxemics sense. This closeness sometimes had a negative effect on the MIM experience.

“The messenger (Telegram) used by a small number of people is slightly more special and a little closer. However, the people who felt that close were not the ones I wanted. Therefore, I have not used it.” (P5 – administrative staff)

The participants used the profile picture and status message (Figure 1(c)) features to communicate their circumstances to close friends or to share pictures and phrases expressing their intimacy with their friends. However, when the participants recognized that strangers were able to see their profiles and status messages, they uploaded more conservative photos and texts, or they did not upload anything.

“On a subway, I have seen a man capture profile pictures of a woman. I knew someone could capture my profile pictures so I could not easily upload them after that. However, this is a free space; I want to upload freely.” (P17 – office clerk)

The following design features are related to this sub-theme: friends list, recommended friends, profile picture, and status message. These features made the participants feel nearer to others, so they felt awkward when they used these features with strangers in MIM. The range of strangers varied from one participant to another. This is analogous to the proxemics theory, that people have different personal distances [9]. They had in common, however, that they only wanted to allow close people in their dwelling places. The participants acknowledged that MIM makes it easy to connect with many people. However, at the same time, they tried to remove or block strangers who constantly came into their MIM.

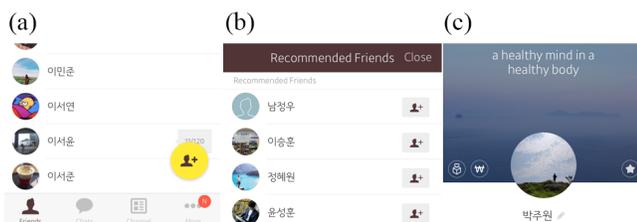


Figure 1. (a) friends list, (b) recommended friends, and (c) profile picture and status message features

Conversations in a Closed Room

In most of the MIM applications that our participants used, they could not proactively leave or enter the chat rooms. Even when it was hard to participate in conversations, they had to stay in the chat rooms the entire time because chat room leaving messages (Figure 2(a)) would show that they had left the chat rooms, and once they left the chat rooms, they would not be able to re-enter without an invitation.

People tend to remain in the chat rooms because they worry that leaving the chat rooms will be misinterpreted as ignoring the other parties [15]. Our participants also tended to remain in the chat rooms. This tendency was stronger when their superiors or elderly relatives were included in the chat rooms.

The closed structure of a chat room requires instant reactions as if people were actually in close proximity to one another. The participants were under the burden of having to answer as soon as they read messages because the read receipt feature (Figure 2(b)) showed whether they had read the messages or not. Hoyle et al. [10] further demonstrated that the read receipt feature places people under social pressure to respond quickly. Our participants felt that it was acceptable to use the read receipt feature with a close friend or a lover. However, they felt awkward when they used the read receipt feature with unfamiliar people. If they were in difficult relationships with others, in many cases, the participants tried to avoid generating read receipts. We note that KakaoTalk does not allow users to disable read receipts.

“I use the smartphone airplane mode to check messages and get out. Then, in the other party’s messenger, there is still an unread mark.” (P20 – office clerk)

In a group chat room, the closed room causes problems that are different from those that occur in a one-to-one chat room. Due to the closed structure of a chat room, everyone must listen to every conversation. When participation was difficult, the participants were constantly interrupted by ongoing conversations in the group chat room.

“Conversation is constantly coming up in the friends’ group chat room. Even if I quickly say, ‘I read it!’ and focus on my work, there is constant talk in here... I want to ignore this, but I cannot ignore it.” (P5 – administrative staff)

Although there were group chats with small numbers of intimate friends, all the participants had large group chat rooms with social connections of 20 to 30 people in each one. Such chat rooms were those used by companies, chat rooms for parents of children in the same class, and chat rooms for all university students of the same year in a department. These large chat rooms were also used daily. In the case of a group chat room, the participants often received irrelevant messages they could not avoid, which caused them stress.

“I teach music in after-school classes. The vice-principal made a group chat room and invited all of us. I am in charge of music and I had many irrelevant messages. For example, it’s for the reading essay teacher.” (P13 – music freelancer)

Some participants complained about leaving messages (Figure 2(a)). This feature shows which person leaves a chat room, and it makes it more difficult for the participants to leave a chat room. In MIM, some chat rooms were initially created for conversations but are no longer used for that purpose. Instead, they are merely used for maintaining social relationships [15]. Our participants wanted to delete these types of chat rooms from their MIM applications if the chat

rooms were not seemingly worthwhile virtual possessions. However, because deleting a chat room is the same as leaving the chat room, they could not delete the rooms.

“I hope the message ‘OO left this chatroom’ is not provided. Then it will not be easy to know who was in there, and I can leave the room a little easier.” (P19 – office clerk)

The following design features are related to this sub-theme: read receipt, and entering and leaving messages. The participants wanted to adjust their distances from others depending on the conditions. According to proxemics [9], we communicate by adjusting our distance depending on the person and the situation. For example, we talk to someone within 6 inches when we comfort him or her, we maintain 4 to 7 feet from others when we are doing non-personal tasks, and we need more than 10 feet to do our own work, being free from each other. These transitions are very natural. However, the only thing the participants could do in MIM was turn off the notifications of the chat rooms.

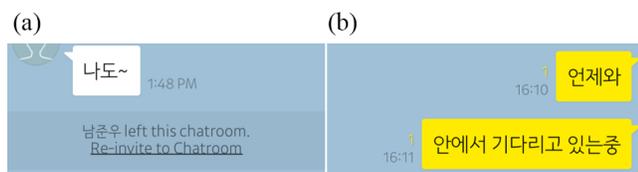


Figure 2. (a) leaving message and (b) read receipt feature

Sharing Status beyond MIM

MIM features, such as read receipts, a typing indicator (Figure 3(a)), “last seen” (Figure 3(b)), and a profile update indicator (Figure 3(c)), show the current status of each user indirectly. These types of real-time feedback can raise social pressure and privacy concerns [10, 28]. According to our participants’ arguments, these kinds of feedback made them feel as though they were close to the others in the proxemics sense. In most MIM applications that the participants used, these sharing features could not be turned off. Our participants felt stressed in their conversations with contacts with whom they wanted to maintain distance.

When the participants talked about these features, they said they felt as though someone was looking at them closely or that others were in the physically same places with them. One of the participants stated that talking in MIM seemed to infringe on her space because she would have to ask to be excused when she could not send a message for a while and explain why, as if she were asking to be excused for leaving a real conversation.

“I think I am being infringed when I go in to bathe my baby. If I use SMS, then I just spend a little while. However, this [MIM] makes me report about myself. ‘I’m going to wash up with my baby, so I will contact you soon, blah blah.’ I feel like I’m bowing my head in shame.” (P13 – music freelancer)

The typing indicator had a greater impact on the feeling of being closer to the other party than the read receipt did. With the typing indicator, the participants felt they should talk

quickly and instantly, as if the other person were in front of them.

“I think I will have to type fast if a typing indicator is added to KakaoTalk. If I type late, it seems like I’m concocting and talking about something else in front of them.” (P7 – freelance designer)

In KakaoTalk, when users update their profile pictures, the application shows that their profile pictures were recently updated with red dots (see Figure 3(c)). This feature does not share a real-time status compared with the other features mentioned above. However, some participants were concerned that the profile update indicator would expose them to others. Due to this passive information exposure, they changed their profile pictures carefully.

“The profile update indicator makes it hard for me to change the profile picture at will. I am worried that I will attract unnecessary attention if I change it.” (P6 – researcher, computer science institute)

The following design features are related to this sub-theme: a read receipt, a typing indicator, “last seen,” and a profile update indicator. The participants were stressed by the uncontrollable exposure that made them feel proximity to others. Depending on the design features, the degree of proximity each participant felt was quite different. Among the design features in our data, the typing indicator was the strongest. On the other hand, the profile update indicator was less effective. In one interesting case, a participant usually had no problem using the read receipt feature with her boyfriend, but when she was fighting with him, she tried to read his message without generating the read receipt. Just as people adjust their distances from others in the physical environment, she adjusted her distance from him in MIM in her own way. Most cases in our data reflect that current MIM design features for sharing status do not consider how people are in relation to others, and the indiscreet sharing often made the participants feel too close to others.

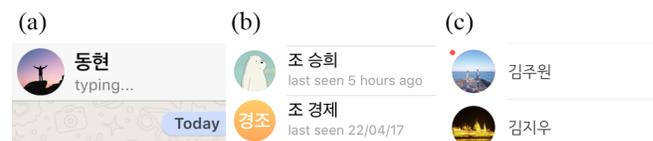


Figure 3. (a) typing indicator, (b) “last seen,” and (c) profile picture update indicator feature

TOO CROWDED

The second main theme from our analysis is *too crowded*. According to proxemics, overcrowding is a major source of stress for humans. The degree of tolerance of density may vary; however, the proxemics theory says that maintaining proper density is important. Our participants commonly experienced overcrowding in their recent MIM use. Almost all of their acquaintances can connect with MIM, and many SMS and emails have been replaced with MIM messages. The participants expressed their fatigue when they talked about the stress of a “too crowded” condition. We captured

three sub-themes of “too crowded” as patterns of MIM stress: crowd in a dwelling place, fragmented and overflowing messages, and never-ending notifications.

Crowd in a Dwelling Place

The fact that MIM functions as a *dwelling place* was also important in the stress associated with the “too crowded” condition. Our participants had a list of at least 100 friends, with some having about 500 friends in KakaoTalk. Interestingly, the participants did not mind having a large number of friends on SNS; however, they were unable to tolerate a large number of friends in MIM. The influence of KakaoTalk in South Korea has increased such that their acquaintances are able to connect to with it. The participants agreed that this connectivity was convenient, but at the same time, they discussed the stress of excessive connections.

“I changed my job several times, and when I was in college, I was very active, so the range of my acquaintances was shallow and wide. Therefore, there were many people in KakaoTalk, but it was too hard to manage. There were many tough situations.” (P4 – unemployed)

To relieve these stresses, some of the participants continually kept their lists of friends below a certain number. KakaoTalk provides a hide-and-block feature (Figure 4(a)) instead of providing a delete feature in the friends list. When a user hides or blocks certain people, the list is moved to the hidden friends list or the blocked friends list, without causing any changes to the others. The hidden friends list and blocked friends list are in a deeper submenu in the settings.

“Always hide, hide, hide or block, block, block people I do not want to see. That way, I always remove and hide them from my friends list so that I do not exceed approximately 100 people.” (P5 – administrative staff)

Some of the participants gave up due to their ever-growing lists of friends. In particular, they complained that the number of friends would inevitably increase when MIM was used in business because they continued to meet new people.

“I gave up. I just use it.” (P8 – freelance designer) “Isn’t it hard to manage a [friends] list if you use it for business? My list is totally mixed.” (P7 – freelance designer)

Some design features, such as automatic friend registration (Figure 4(b)) and recommended friends (Figure 1(b)), have accelerated the crowdedness.

“I get to know new people and numbers. However, since they all go onto KakaoTalk, I hate it. Therefore, I have completely turned off automatic friend registration.” (P4 – unemployed)

Because the current MIM does not provide effective features for managing a friends list, the participants devised their own ways of managing and erasing their friends in their lists.

“In my case, I put ‘a’ for each phone number. If I put ‘a’ for a phone number, it will be on top of KakaoTalk [friends list]. When I wanted to erase the accounts, I found “all ‘a’ [entries]” and erased them.” (P9 – advertising salesman)

Some of the participants who could not tolerate the stress tried to partially remove themselves from KakaoTalk and obtained separate spaces. Some of them tried to move their business conversations to other MIM applications with work-related people, and others moved private conversations to other MIM applications with their closest friends.

“The messages on KakaoTalk are too piled up. I proposed to the team to use a separate place for business, and now our team is using Slack.” (P2 – designer in company) “Because KakaoTalk is tough for me, I tried several apps. Now I use Telegram with only a few people. My boyfriend also has all private conversations in Telegram only.” (P4 – unemployed)

This crowdedness also stemmed from their chat rooms lists. As we described in the context of “too close” stress, it is easy for a chat room to be created, but it is difficult to leave one. Additionally, the combination of relationships in everyday conversation is highly diverse, so all of the participants have many chat rooms. The participants experience a great deal of fatigue due to the chat rooms. Figure 4(c) shows several chat rooms that similar members have formed.

“I do not have only one boss: room except the person, room except the upper man, room except the highest person. Anyway, there are various rooms. Those things make me feel tired.” (P14 – military surgeon)

The following design features are related to this sub-theme: a friends list, hide and block friends, automatic friend registration, recommended friends, and chat rooms list. The features that allow more people to enter friends lists and the features that lead to all of the data remaining have caused crowdedness in the participants’ MIM. To obtain proper density in their MIM, the participants constantly tried to reduce their growing numbers of friends by using their own various methods to erase or hide people from their MIM. They wanted to make their dwelling places cozy.



Figure 4. (a) hide-and-block feature, (b) automatic friend registration, and (c) chat rooms list feature

Fragmented and Overflowing Messages

In MIM, the unit of communication is very small and fragmented. In other media such as SNS or email, much more information is contained in one unit of communication. For example, one post in SNS satisfies people who receive notifications with long posts, likes and comments on posts compared with a short message and a single photo in MIM. In MIM, every picture and all divided messages produce notifications, even a single emoticon (see Figure 5(a)). This fragmentation increases the number of messages, which made the participants feel that their MIM is too crowded. Our participants often said that conversations in MIM overflow. Their discussions showed that the amount of text that a user

has to deal with has significantly increased. In the past, they concentrated on a particular situation, but now, they exchange texts pervasively in their everyday lives.

Based on the experience of the participants, the overflowing seems to have become more pronounced with the wide use of the PC version of MIM. Sending messages is much easier and faster through the PC version of MIM. Some of the participants talked about the inconvenience of checking a mobile phone when someone sends messages on a PC.

“When the other person talks about business on a computer, and I type on a phone outside, the messages keep coming in before I can answer.” (P11 – researcher, biology institute)

This overflowing was worse in the case of a group chat room with many people. Many messages came into their MIM applications, but sufficient features for distinguishing between important and unimportant messages were not provided. It was burdensome to try to read all of the messages, but at the same time, the participants worried that if they ignored them they would miss important messages.

“The maximum of group chat room messages is 999. There are numerous conversations, and the badge and 999 are always displayed in the morning. Should I read it all or not? It’s stressful like spam.” (P14 – military surgeon)

However, increasing the amount of conversation was not the only problem. The fact that sending messages was easy and did not cost anything allowed the messages to be fragmented. The participants said they used to send SMS messages as carefully as possible in the past, but now, they responded quickly when using MIM so that others would not wait. In a study comparing SMS and MIM by Church and Oliveira [4], the immediacy of MIM behaviors was reported, but what we highlight regarding this theme is the fragmentation, which increases the number of messages.

“In the past, there was an 80 bytes’ limit [in SMS]. I was always trying to fill it up. Nowadays, I just say ‘What’s up?’ I send messages short and fast so that others can read it quickly.” (P10 – international trade worker)

Interestingly, due to the large number of messages, our participants felt that the messages in MIM were meaningless, even the messages they sent. As a result, they had the desire to send their messages more meaningfully, especially in the case of messages exchanged on important days.

“On New Year’s, we send many messages with photos. When I first started KakaoTalk, when I was not stressed, I thought that it was a good world. I could easily share a holiday greeting with a simple photo. But there are more and more messages that seem meaningless. I do not want to reply with the same photos. I want to talk deeply.” (P5 – administrative staff)

The design feature related to this sub-theme is a message. The participants received a large number of messages, and some of them could not even read all of the conversation that

occurred in their MIM. In addition, the fragmentation of messages affected participants’ stress. According to proxemics, human stress relates not only to the average distance to others but also to the frequency of interaction [9]. The fragmentation of current messages increased the number of messages and further the frequency of interaction. Although this form of message helps people to be more social, informal, and conversational in nature in MIM [4], at the same time, it made the participants feel that their MIM space was crowded.

Never-Ending Notifications

Our participants wanted to maintain a checked state for everything in MIM. However, maintaining a checked state is difficult because notifications are created and pile up at a rapid rate. Because the new notifications generated via MIM are difficult for the participants to keep clean, they felt that MIM is crowded, and it makes them feel stressed. Many HCI studies have been done on the distraction that notifications cause [16, 18, 20], and it was also reported that users can be overwhelmed with MIM’s notifications in an early MIM study conducted with WhatsApp [4]. In this study, we highlight not the stress that distraction causes but the stress resulting from not being able to maintain and keep one’s MIM applications clean.

Negative sentiment caused by the unread messages indicator has similarly been found in a previous study on email contexts [8]. People feel overwhelmed not only by the large volume of messages but also by the unread indicator itself. The difference with mail is that, in the case of MIM, this stress is enhanced when combined with the *fragmented and overflowing messages* sub-theme. The original environment of mail is the desktop, so notifications are less frequent than with MIM. After one of the focus groups was finished, one participant said that she had 90 notifications after 2 hours, and she felt anxiety upon seeing this. Fragmented and overflowing messages constantly create a notification badge (Figure 5(b)), and for the participants, this badge made them constantly check their messages even if they knew a message was not relevant to them.

“I completely turned off the badge because even though I know the messages are not related to me, I keep going and deleting the notifications. I had a feeling that I should see if I have the badge.” (P2 – designer in company)

The desire to clear all notifications is not just for chat rooms but also for various indicators, such as profile updates (Figure 3(c)). The participants did not want to leave any type of “red dots” in the MIM. One participant said she checked the updated profile not to see it but just to remove the red dot.

“I hate red floating points. Some people may like to check, but I just don’t like the red dot. It’s an endless fight because I don’t know when that person changes [the profile picture].” (P5 – administrative staff)

MIM offers a variety of other notifications, including notices, new emoticon arrivals, and other linked services, such as

gifts and games (Figure 5(c)). Unlike other MIMs, KakaoTalk has evolved into an enormous platform that offers diverse services, such as a taxi, payment, a hair shop, and a TV, and they increase the frequency of notifications.

“I use taxis a lot. However, except for taxis, I do not use pay, TV, or hair shops at all. If there is news, when it comes out with red dots, it’s too annoying.” (P12 – graduate student)

The following design features are related to this sub-theme: notifications of messages, profile updates, notices, and other linked services. Many of the participants were stressed by the high frequency of checking due to various notifications. Hall [9] explained the need for Americans and Germans (despite their varying degrees) to have their *own* spaces. Although he did not study Koreans, our participants had difficulty maintaining the initiative for their own spaces in MIM. The space of most other applications, such as notes, clocks, and reminders, depends on the user’s actions. However, the space of MIM is constantly changed via others or service providers. Their spaces often became messy due to others, and this made it difficult for the space in MIM to become the participants’ *own* space. Because of this, the participants felt that MIM was crowded.



Figure 5. (a) banner notifications, (b) badge notifications, and (c) linked services and notifications

DISCUSSION AND IMPLICATIONS

Before we begin our discussion, we must mention the limitations of our data that are based on the participants who were recruited in South Korea. One of the main contributions of proxemics is to identify differences by culture; however, we did not find cultural differences in this study. In Hall’s study [9], the difference in culture is only a degree of difference, and the fact that humans can be stressed by distance and density applies to everyone. Therefore, in the case of MIM, although the degree may vary depending on the culture, we believe that the stress we analyze can potentially be applied to anyone. This is supported by studies that have similarly found the effects of MIM features and coping behaviors among other European and North and South American users [4, 10, 25, 28]. Nevertheless, a study of detailed cultural differences would be valuable future work.

Here, we detail the three directions for anti-stress MIM based on our findings. MIM started with text-delivering technology; however, it has become closer to real conversation. Therefore, it is time to rethink the technology toward a mode that is natural to human communication. In the focus groups, we heard about many people’s efforts to avoid MIM stress.

Based on these behaviors, we were able to identify the limitations of the current MIM and future directions for designing MIM applications that meet the proxemic needs of MIM digital dwelling. We suggest design implications based on three main elements used in the design of MIM: friends, chat rooms, and messages.

Friends—Relationships with Forward Effort

Most people want to make an effort to get close to others. We introduce ourselves, take the time to connect, and we get together to become close friends. However, in MIM, people can easily contact others and get onto their friends list, so people make an effort to get away from people and erase them from MIM. We call such effort “backward effort,” and we suggest that MIM should provide design features that enable users to build relationships with “forward effort.”

In the current MIM, it is too easy for friends to be registered, so people make backward efforts to remove them. Our participants placed a number sign (#) on their contacts to prevent them from being automatically registered (contacts that start with # are not automatically registered in KakaoTalk (see Figure 6(a))), identified the people to delete by attaching ‘a’ to their contacts, or removed friends by periodically using the hide and block feature. In these coping behaviors, people feel that they are doing unnecessary work. There are many backward efforts due to the characteristics of MIM, more relationships, and more connections; however, there are also good examples in terms of forward effort in the current MIM. One example is the favorites feature (Figure 6(b)), which provides interaction that requires effort to get close to someone. Users can place someone at the top of their friends list using this feature. None of our participants said that they were stressed by the favorites feature.

As an example of a solution, the default deletion that was studied by Xu et al. [35] with a focus on Snapchat may be a way to lead users to make forward efforts. If MIM provides more design features that allow users to bring people into their dwelling places instead of sending people out, current MIM stress will be significantly reduced.

Chat Rooms—Various Distances between On and Off

The most important place that is perceived by users in MIM is the chat room. It has been noted that these chat rooms can be differentiated according to type of relationship and function [15]. However, despite the different relationships and functions among chat rooms, the only feature that allows current users to control the distance to each chat room is turning notifications on or off (see Figure 4(c)).

We suggest that MIM should provide variety so that users can control their distance from each chat room. Our participants turned on notifications when they wanted to get close to the chat room and turned off notifications when they wanted to stay away. Currently, whether it is a one-on-one chat room or a group chat room with more than 20 people, they provide the same interaction. However, our participants needed more levels of adjustment. The keyword alert feature

(Figure 6(c)) in the current MIM, which only provides notifications when the keywords appear, is an example of a distance adjustment. This feature allows users to receive notifications selectively according to the context and to keep the proper distance by adjusting between on and off. However, although this may be an example of providing diversity of distance, none of our participants used keyword alerts. We think that it is difficult for them to predict what words will arise in future conversations, and the mechanism whereby users are notified when a registered keyword is used is not appropriate for everyday conversation.

Another option is to give the sender the authority to control the distance (that is, giving the sender the choice of whether, when, and how to provide a notification). Among the participants' discussions, there was a case in which even though the sender knew the messages would distract others, the sender had to send the messages because they would be forgotten if they were not sent immediately. One of the participants suggested a scheduling feature such as with email, but it should be considered whether such a feature is appropriate for everyday conversation.

Further to this, we might also consider a new type of chat room that is flexible enough to support a variety of relationships. An option would be to open the closed room structure by breaking with the traditional list-style chat room and the inviting and leaving room features, as we have seen in other experimental designs like BubbleQ [36].

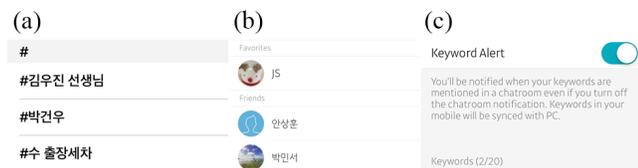


Figure 6. (a) contacts starting with #, (b) favorites feature, and (c) keyword alert feature

Messages—Grouping Messages to Provide Satiety

We suggest that MIM should provide a way to group conversations into meaningful units. As we described earlier, the messages of the current MIM are fragmented, and each provides a notification. Fragmented messages cause people to feel that their MIM is crowded. The participants were not stressed by the notifications. Rather, they were stressed when they received meaningless or unimportant notifications. Compared to one email or one SNS post, the amount of information that corresponds to one notification in MIM does not give them enough compensation for the interruption, so MIM messages annoy them. Even if a similar amount of information is received, email and SNS provide a single digit of notifications and badges, whereas MIM gives dozens or hundreds of notifications. To solve this issue, MIM should bundle the messages into larger units.

As a similar example in other services, Gmail groups emails into conversations [6]. This mail service shows the replies in a single group without being separated. This is a way to keep the inbox from being crowded when users have a large

amount of mail. We suggest that MIM could also group messages with similar contexts. As an example, MIM could recognize the context of messages by time and subject and automatically group them to reduce the number of messages in a way that users can recognize. By doing so, the meaning of the number in the red badges will change, and the number will become smaller. As another example of reducing the number of recognized messages, one participant mentioned the design feature of Slack to add emoticons and create a thread by replying to each message [30]. This certainly seems to be one way to make each message more important. However, none of the participants used Slack for everyday conversations. Therefore, a suitable grouping for everyday conversation is needed.

If MIM can group messages into meaningful units, we expect that the value of messages as digital possessions will also increase. Several studies of HCI have already highlighted that users cherish the digital possessions that are created in MIM [15, 35]. The overflow and fragmentation of the current messages leads users to feel that the messages are meaningless. Therefore, a meaningful unit of conversation will help to reduce crowding, provide satisfaction with each MIM notification, and relieve users' MIM stress.

CONCLUSION

Today, MIM is one of the most popular communication tools. During the initial growth of MIM, closeness and the large number of people connected through MIM were competitive characteristics and were the reason why our participants used KakaoTalk as their primary MIM; it had the largest number of registered users in South Korea. Closeness and a large number of friends initially provided convenience. However, it now generates stress, and it has even become a social problem. Therefore, it is time to rethink MIM design with the aim of relieving stress while maintaining its early advantages.

To begin this rethinking, we discovered, from the perspective of proxemics, two main themes: too close and too crowded. We found that the participants experienced stress with MIM that is similar to the stress people experience in physical space. We presented three sub-themes for each main theme and highlighted the related design features to understand how current MIM design features affect MIM stress. This study also provided design implications for friends, chat rooms, and messages, which are key elements of today's MIM. In this study, we applied proxemics to understand MIM stress. However, we think that proxemics can explain many more possibilities about our use of digital space. We wanted to know the specific differences the design features of MIM make in terms of human spatial perception and which design principles make those differences; however, our study did not include these aspects. This study will contribute to future HCI work that finds "the hidden dimension" in digital space.

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