Uncovering Embarrassing Moments in In-situ Exposure of Incoming Mobile Messages

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Abstract
Mobile instant messengers serve as major interaction media for everyday chats. Contrary to the belief that a message is seen only by a designated receiver, it can be accidentally exposed to someone nearby and could result in embarrassing moments, for example, when the receiver is viewing pictures together with his friend upon the message arrival. To understand the significance of the problem and core factors that cause such embarrassments, we collected 961 in-situ responses from 14 participants upon the actual message arrival and analyzed them from the perspective of the receiver's situation. The results showed that 29% of message arrivals have the potential to cause embarrassment. We found out that the relationship with a message sender and a nearby person influences the effect of participants' perception about the message exposure.

Author Keywords
Social appropriateness, Mobile message, Mobile instant messenger, Smartphone, Privacy

ACM Classification Keywords
H.1.2. Models and Principles: User/Machine Systems – Human Factors

Introduction

Mobile instant messengers (MIMs) such as *WhatsApp* and *Hangouts* serve as major interaction media to facilitate real-time distant chats. They greatly lower the bars on initiating conversations and enable people to maintain a sense of virtual co-presence via frequent interactions [1]. MIMs, however, lack the situational information that people naturally consider during a face-to-face chat: *social appropriateness* of conversation with respect to people nearby. For example, Alice would never go to Bob and say "*Is our boss bugging you today as always?*" if Bob is with his boss at the time.

One may believe that it is socially secure to have such a private chat through MIMs since a message is thought to be only seen by a designated receiver. However, a number of daily social situations make this belief wrong, embarrassing the receiver as well as the sender; people often view pictures, videos, and simple documents on their phones together [14] and leave their phones open and wide in shared life spaces [4]. For example, Bob is driving with his boss in the passenger seat. Bob's smartphone is on the dashboard, running a navigation app. Suddenly his phone rings and pops up Alice's message in the previous example. As illustrated by Figure 1, Bob's boss has certainly seen the message.

Today's best practice to prevent such problematic situations is to deactivate notifications; many MIMs allow users to disable message pop-ups or hide the content preview. However, such a '*block-all*' strategy compromises the overall convenience of MIMs in many casual situations. Without the pop-up or content preview, whenever a message arrives, a receiver has to tap the screen multiple times to reach the content. In case of spam, she must take unnecessarily long steps to find and delete the junk message.

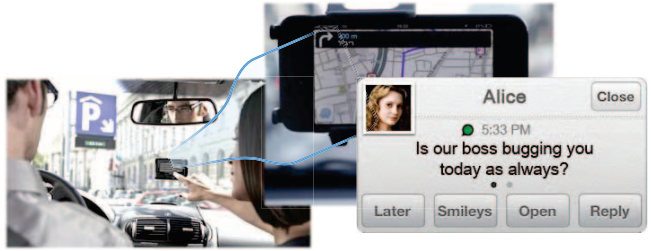


Figure 1. (Inevitable) embarrassing moment

We are working toward a situation-aware MIM that takes the *social appropriateness* into consideration. We aim at building a future MIM that pops up the preview when the user is in socially comfortable situations, and hides it in sensitive contexts, achieving both convenience and social appropriateness. For example, Bob's future MIM can automatically hide the preview of Alice's message when he is with his boss, whereas messages from other senders may still be shown for Bob's convenience. However, bringing the social appropriateness into MIMs involves a wide spectrum of challenges from understanding key contexts that cause the embarrassments for automatic detection of potentially threatening situations.

There has been an early work that studied privacy concerns on sharing of messages for desktop-based chat applications [15]. The MIM, however, has its unique characteristics compared to the desktop messengers since it is always-on and used in many uncontrolled daily social situations. It is far more possible that the MIM will cause unwanted exposures and its underlying causes are more complicated due to high diversity in facing social situations. Broadly, there

have been studies on the contexts affecting the social appropriateness in other media. Besmer et al. studied privacy concerns on the exposure of private pictures in Facebook by the friend's sharing [3]. Guzman et al. examined contexts of a recipient and how a caller naturally considers these when he makes a call [5].

As a first step to build a socially-ware MIM, we investigate users' perception on the unexpected exposure of messages; especially in terms of the degree of embarrassment felt by the receiver with respect to his in-situ social contexts. From our study, we discovered common characteristics of users' perception and key factors to incur embarrassment. For this purpose, we collected events of embarrassment as an outcome of socially inappropriate delivery of messages, using the experience sampling method (ESM). In this study, we focused on two primary factors that affect the social appropriateness of message delivery, i.e., a message sender and a potential observer, and their relationships with a message receiver. In the rest of this paper, we present the details of the user study and its key results.

User Study

In our study, we have focused on the following key research questions. In RQ1, we first try to understand the significance of the problem, i.e. the embarrassment of the receiver caused by unexpected exposure of the incoming messages. In the subsequent RQ2 and RQ3, we study the potential factors that incur the embarrassing moments.

RQ1) does the exposure of an incoming message to a nearby acquaintance actually cause embarrassment?

RQ2) how does the type of relationship with a message sender impact the degree of embarrassment?

RQ3) how does the type of relationship with a nearby person, namely *casual observer* impact the degree of embarrassment?

While there could be more questions regarding the cause of embarrassing moments, RQ2 and RQ3 are carefully determined based on the major stakeholders involved in the exposure of the messages: the message sender, the receiver, and the casual observer. They are key entities that constitute social situations regarding the message exposure. More importantly, different relationships among them diversify the situations to consider. For this purpose, when participants received a message, we collected the message sender and the person next to the participants along with the degree of embarrassment when the message was seen or assumed to be seen by the nearby person.

For the data collection, we adopted the ESM since it is advantageous to collect a participant's lively perception right at the moment that he receives a message. Usually, such perception is sensitive and subtle, and highly depends on the specific situation. Thus, it should be collected as quickly as possible before he loses detailed feelings.

We recruited 10 males and 4 females during a two-week period in May 2013; it has been reported that the quality of the ESM declines after 2-4 weeks [16]. The participants are 1) between 23 and 35 years old, are 2) all Korean, and 3) frequently use KakaoTalk, the most widely used MIM in Korea. This generational population segment was chosen because they are most active

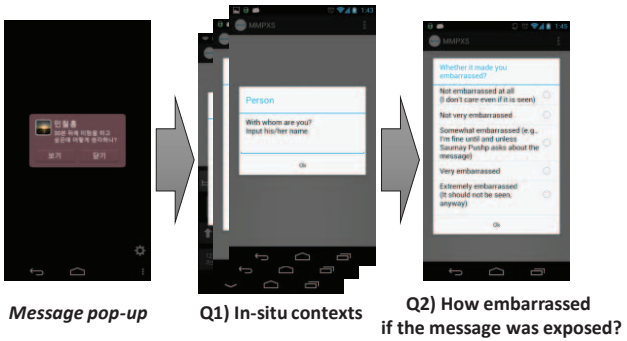


Figure 2. Screenshots of ESM application

users of smartphones. Their occupations included graduate and undergraduate students, researchers, office workers, and resident tutors. Each participant was compensated KRW 50000 (about US $49). Since we focus on specific cultural background and generation, some experiences from this study may have limited generalizability. However, we believe that the findings and lessons will be a basis to understand the social appropriateness in MIM environments.

We targeted the KakaoTalk messenger due to its wide popularity in Korea; it has a market share of over 90% in South Korea as of June, 2014[1]. Similar to many other MIMs such as WhatsApp and Facebook messenger, KakaoTalk pops up a message alert when a new message arrives. The alert dialog contains the sender's name and profile thumbnail photo, and message content (See the leftmost screenshot in Figure 2). KakaoTalk provides a few options for message dialogs. It allows users to block the alerts for incoming messages. Also, users can hide the content of the message alert; in this case, the alert just notifies the users that there is a new message.

For the effective ESM, we developed an Android application that triggers a questionnaire when a KakaoTalk message is received, which includes the following questions:

1) What is your current social situation in terms of the existence, identity, and relationship of someone nearby?

2) Suppose that the message was accidentally exposed to the person next to you. How embarrassed would you be? (5-point Likert scale (labels: 1-not embarrassed at all, 3-somewhat embarrassed, 5-extremly embarrassed)).

Figure 2 shows the screenshots of ESM applications; the questions were originally written in Korean for the experiment. The message sender was automatically identified by the application. If the participant answered that he is with somebody, then he is further asked whether the message was actually seen by the nearby person. Otherwise, a second question was asked assuming that the participant was with one of his acquaintances. The acquaintance is randomly selected from his/her acquaintance list, i.e., 15 people that the participants regularly meet, provided by the participants in prior to the study; the average range of active social relations is known to be 10 to 30 [11]. To avoid careless responses, we limited the number of questionnaires to two per hour. The questionnaire was designed to pop up only after the participants had actually checked the message. We did not record the content of the messages.

[1] http://www.koreaherald.com/view.php?ud=20140630000604

We collected a total of 961 in-situ answers during the study. After the study, we conducted free-format one-to-one interviews with each participant to gather their detailed experiences and reasons behind their answers. We directly translated all quotes from Korean.

Study Results

We first verify the daily prevalence of embarrassing moments due to unwanted exposure of messages. Then, we identify the key factors which are highly correlated with the incurrence of such embarrassing moments.

Overall, we can see that the potential situation of accidental exposure in MIM environments already prevails. In our study, 39% of the total messages were delivered when the participants were actually with their acquaintances, out of which 15% of these messages were actually seen by them. These represent potential and actual exposure situations, respectively. The results also showed that the unwanted exposure to incoming messages actually embarrassed the participants in some specific situations. A number of responses, 29%, reported being somewhat / very / extremely embarrassed; that is, the participants determined that they would feel embarrassed if 29% of such messages were seen by someone nearby. In fact, this result leads to a considerable concern considering the very frequent use of MIMs; e.g., KakaoTalk subscribers send 156 messages on average per person per day [7], yielding those 45 messages have a potential to embarrass a receiver if they are exposed.

Combined Effect of the Sender and the Observer

We first investigated the effect when two relationships that a receiver has are considered in conjunction with the message sender and the casual observer. We categorized the types according to the relationship with the receiver as follows: spouse/romantic interest, family, close friend, manager/advisor/boss, colleague, and other; we grouped spouses with romantic interest, rather than with families considering their unique romantic property out of other family members. As shown in Table 1, even for the same sender type, the degree of embarrassment largely varies according to the observer and vice versa. For example, the participants mostly felt embarrassed when the messages from their spouse/romantic interest were seen by their manager (mean=4.4, over-3=95%); "over-3" denotes the percentage of the responses that were marked as greater than or equal to 3 on the scale. On the other hand, they did not mind when such messages were seen by their colleagues (mean=2.1, over-3=25%).

Observer \ Message sender	Spouse	Family	Friend	Colleague	Others
Spouse	N/A	N/A	N/A	1.1 (0%)	1.4 (20%)
Family	**3.1 (63%)**	1.5 (8%)	2.5 (38%)	1.5 (15%)	**2.7 (41%)**
Friend	**3.4 (75%)**	**2.8 (50%)**	1.8 (18%)	1.3 (17%)	**3.1 (51%)**
Manager	**4.4 (95%)**	N/A	2.4 (20%)	N/A	1.4 (13%)
Colleague	2.1 (25%)	1.2 (0%)	2.1 (39%)	1.2 (7%)	1.3 (10%)
Others	**2.6 (47%)**	2.1 (33%)	**2.6 (58%)**	1.9 (24%)	2.1 (30%)

Table 1. Combined effect of message sender and observer; each value pair means the average scale and over-3 (in brackets).

Effect of the Relationship with the Message Sender

We investigated whether the relationship with the message sender impacts the degree of embarrassment. The chi-square test shows that the sender type impacts the degree of embarrassment statistically significantly χ^2=149.66, *df*=16, *p*<.001; that is, the relationship

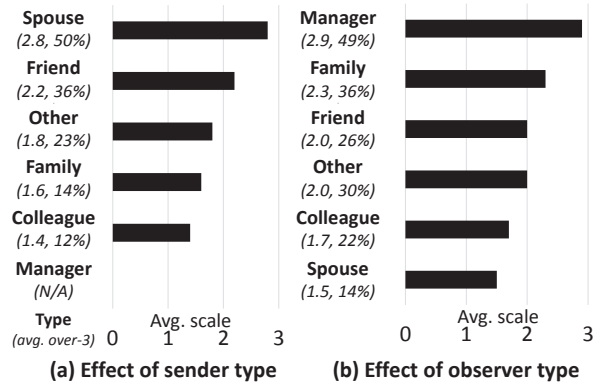


Figure 3. Avg. degree of embarrassment

with the sender is one of the most important factors to be considered to determine the degree of embarrassment as shown in Figure 3 (a).

We looked into the effect according to the sender type. The participants were especially sensitive to the messages from their spouse or romantic interest (mean=2.8, over-3=50%). A male participant said: "*I don't like anybody inquiring about my girlfriend. But it sometimes happens when somebody sees a message from her.*" The messages from close friends were also often considered to be sensitive (mean=2.2, over-3=36%). A male participant said, "*My friends and I often use slang on KakaoTalk and we do not care. But I don't want others to see these since I hardly use slang in daily life.*" A female participant mentioned, "*I share everything such as romantic / family / financial problems with my close friends. But I don't even share those with my boyfriend.*" The participants were unconcerned by the messages from their family members (mean=1.6, over-3=14%) or colleagues (mean=1.4, over-3=12%). A male participant said, "*I hardly remember sensitive situations when I got the messages from my family members.*" Another also mentioned, "*The messages from lab members are mostly about lunch or dinner, or work-related. I do not care their exposure.*"

We could not collect any responses regarding messages from the participants' managers or advisors. The interviews indicated that the participants rarely communicate with their managers or advisors via MIMs; instead, such interaction mostly occurs via e-mails or phone.

Effect of the Relationship with the Casual Observer

The type of relationship with a casual observer also impacts the degree of embarrassment significantly χ^2=95.01, *df*=20, *p*<.001. As shown in Figure 3 (b), the participants felt embarrassed especially when their incoming messages were seen by their manager or advisor (mean=2.9, over-3=49%); especially, 35% of these responses were marked as "extremely uncomfortable". The participants did not want to reveal any facet of their personal lives to this type of observers. An office worker in her 30's mentioned "*I don't want any of my messages to be seen my boss, irrespective of the message content.*" In contrast, interestingly, they did not feel embarrassed when their messages were seen by their colleagues (mean=1.7, over-3=22%). This was because many of their colleagues were close office or lab mates.

The second most influencing type of observer was a family member (mean=2.3, over-3=36%). This outcome was different from our initial expectation that

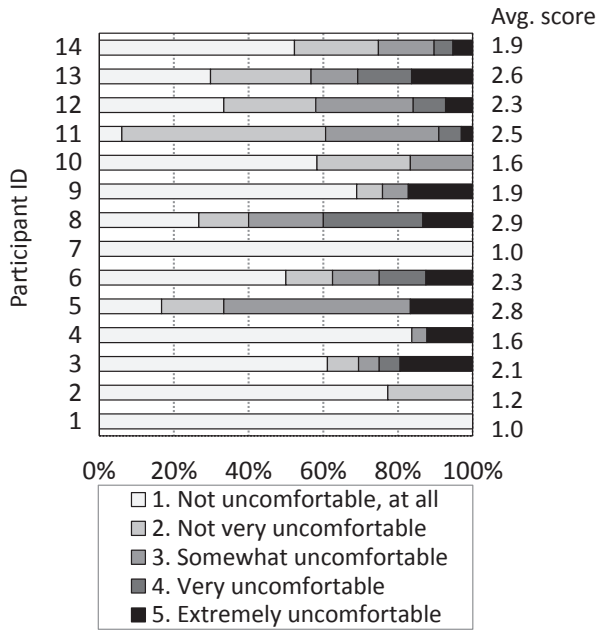


Figure 4. Individual difference of degree of embarrassment

people would feel less embarrassed because they are intimate with such close relatives. A female participant said, "*While having dinner with my mom, my phone was placed on the table. She saw a message from my boyfriend and kept asking me about him. Actually she knew him, but it was still a little annoying.*" She continued, "*But it was fine when such messages were seen by my close friends.*" However, this reaction would appear to be different for parents. Even within the same family, parents often have less privacy sensitivities than their children [6]. On the contrary, the participants did not care much about the exposure of their messages to their spouse or romantic interest (mean=1.5, over-3=14%). None of the responses in this category were marked as "extremely embarrassed", except one of a male participant, "*I was actually embarrassed when an adult ad message was shown to my girlfriend.*"

Other Factors

Individual differences: It is not surprising that user perceptions regarding the degree of embarrassment differ depending upon the individual participants. The average degree of embarrassment per participant ranges from 1.0 to 2.9 as shown in Figure 4. Participant 8 was the most sensitive one to the exposure of messages (mean=2.9, over-3=60%). Intriguingly, participants 1 and 7 did not have any concerns and marked only "not embarrassed at all". Participant 1 said, "*I rarely receive personal and important messages during the daytime via KakaoTalk. My close friends usually call me to talk about sensitive issues.*" Participant 7 reported that it might be because he did not have a girlfriend: "*The situation would have been different in case that I had a girlfriend. I definitely would have got worried about the exposure of the messages.*" The result implies that a global model would not work due to large individual differences on privacy sensitivity.

Emotional status: The receivers' emotional status when a message arrives also affected their perception in a few cases. A male participant described, "*I do not usually conceal my friends' message from my girlfriend. But, I was uncomfortable after I had a fight with my girlfriend.*" A female participant also said, "*It was different depending on my feeling at the very day. When I felt bad, the fact that my messages were seen by anyone else annoyed me.*"

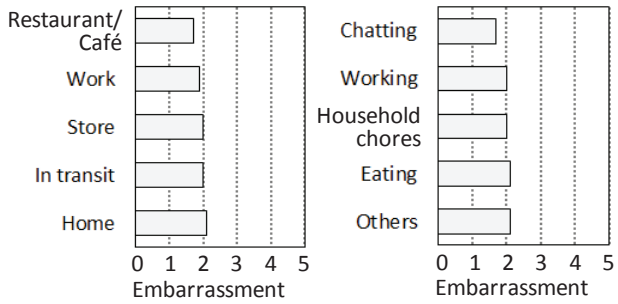


Figure 5. Effect of place and activity

Place and activity: We also examined the effect of other contextual factors: *where* they receive the message while doing *which* activity. To obtain such contextual information, we provided the major categories of places and activities, and the participants were required to manually select the proper ones in the questionnaire. Figure 5 (a) and (b) show the degree of embarrassment according to places and activities, respectively. The results show that the embarrassment hardly depends on different places and activities. Even though the participants reported a few of experiences with particular places or activities, their embarrassing moments were mainly due to the person together, rather than due to the places or activities themselves. For instance, a male participant said that "*I always put my smartphone face down whenever I'm in my room, since I share the room with my elder brother.*"

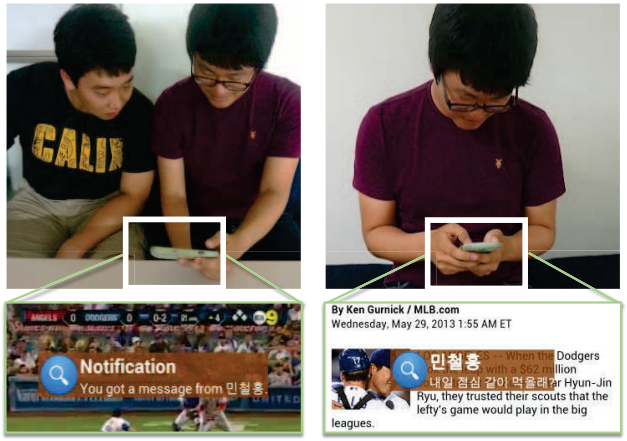
Discussion

Perception of message sender: We also observed the participants' perception from the viewpoint of the message sender. A female participant said, "*While participating this study, I realized that my messages can be also seen by others.*" She suggested, "*It may be very useful if I can determine whether or not the message has popped up on the receiver's phone.*" It would be interesting to further investigate the perception of the message sender regarding the unexpected exposure of her message to someone and its implications on the design of socially-aware MIMs.

Implications of message content: The message content can be also a factor that requires deep consideration. From the interview results, we found out that some participants felt embarrassed when messages including secrets or slang words were exposed. MIMs may be able to automatically hide messages with slang words when the user is with his family, by using content analysis techniques. However, this approach is not straightforward due to privacy concerns and complicated issues in understanding the meaning of messages and its effect in situ. We will further investigate the implications of message content and users' degree of embarrassment about content-based MIM control.

Development of situation-aware MIMs: We envision situation-aware MIMs that take the social appropriateness into consideration. Figure 6 shows a scenario of the situation-aware MIM that dynamically changes the method of the message notification depending on the user's situation.

We take into consideration two key issues to develop such a situation-aware MIM. First, we need an intuitive and expressive user configuration method to allow users to effectively specify their preference of displaying message alerts. A simple approach is to utilize a rule-based specification method. A rule includes an action and social group conditions. The action condition specifies how to deliver a new message



(a) When a user is with his colleague

(b) When he is alone; *the pop-up is shown with the sender's name and message content (in Korean)*

Figure 6. Scenario of situation-aware MIM

alert. There can be four different actions as shown in Table 2. The social group condition involves two components: one regarding message senders and one for potential observers. An example rule is 'HIDE ALL sent by *GIRLFRIEND* from *MANAGER*'. In addition, other situational conditions can be included in the rule such as group activity and social mood.

Second, it is essential to detect the user's situation to apply the user-specified message alert rule. While sender information can be easily obtained by parsing the message content and matching it to the contact list, it is still challenging to accurately identify a casual observer only with a smartphone. An easy and widely used way is to leverage the Bluetooth discovery functionality [12]. While it efficiently discovers nearby devices within about 10 meters, it usually provides coarse-grained information since such a Bluetooth-based method is based on the physical proximity. In some cases, it might be difficult to distinguish passing-by people from actual observers. We can further leverage other approaches to detect potential observers more accurately, e.g., speaker recognition techniques and fish-eye lens in front-camera.

Action	Description	Examples
SHOW	Show the sender and message	"Alex: *Let's go to beer!*"
HIDE SENDER	Hide the sender	"Somebody: *Let's go to beer!*"
HIDE MSG	Hide the message	You got a message from Alex.
HIDE ALL	Hide all	You got a message.

Table 2. Actions and examples

Besides the sender and observer information, diverse situational contexts can help the situation-aware MIMs understand the social appropriateness more deeply. We can consider social mood which can be inferred by on-going conversation monitoring [8][13]. Social activity such as dating can be a clue to determine the user's situation; it can be identified by the combination of diverse personal activities. Also, energy efficiency is an important problem because it often requires continuous sensing and processing to detect the user's diverse situations [2]. It can be handled by leveraging the previous work [9][10].

Conclusion

Based on the study results, we summarize the design implications for situation-aware MIMs. To determine the social appropriateness of the message delivery and its

notification, the MIMs should consider two relationships of a receiver as key factors: i.e., with a message sender and a potential observer. Also, it should provide a personalized and customized setting. We believe that this study is an initial attempt to build an empirical basis for situation-aware MIMs that take account into the social appropriateness in mobile messaging.

Acknowledgements

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