Exploring the Presentation of Estimated Receptivity Status for Instant Messaging

Ting-Wei Wu
National Chiao Tung University
Hsinchu, Taiwan
tingwei.cs06g@nctu.edu.tw

Yu-Ling Chien
National Chiao Tung University
Hsinchu, Taiwan
moneychien.nl06g@nctu.edu.tw

Yung-Ju Chang
National Chiao Tung University
Hsinchu, Taiwan
armuro@cs.nctu.edu.tw

ABSTRACT

Researchers have developed systems estimating mobile users' receptivity for instant messaging (IM) [4]. However, it remains unclear how users would like their estimated status to be presented to their IM contacts. We developed an Android application that estimated a user's receptivity status and conducted a mixed-method study with 37 IM users to understand how they wanted their estimated status to be presented, including ESM and semi-structured interviews. We found that participants preferred a textual presentation to show their receptivity status over both numeric and graphical presentation. Also, participants more often modified the status from showing interruptibility to showing attentiveness and/or responsiveness than the other way. It was because participants wanted their status more informative of how fast they could read and respond to messages. Participants also more often decreased their receptivity level than increased it to show that they were busy, either real or fake.

CCS CONCEPTS

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

KEYWORDS

Presence, Availability, Receptivity, Presentation status, ESM

ACM Reference Format:
Ting-Wei Wu, Yu-Ling Chien, and Yung-Ju Chang. 2020. Exploring the Presentation of Estimated Receptivity Status for Instant Messaging. In *22nd International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI '20 Extended Abstracts), October 5–8, 2020, Oldenburg, Germany*. ACM, New York, NY, USA, 4 pages. https://doi.org/10.1145/3406324.3410714

1 INTRODUCTION

Supporting awareness and presenting presence or (un)availability has been a research focus in computer-mediated communication [4]. For example, researchers have developed techniques to sense and provide a user's contextual information in the work environment [4, 10]. However, while low-level data such as location, ambient sound, and motion status have been used to show one's status, it has been argued that low-level data might cause misinterpretation of the actual status [5]. Instead, using high-level abstractions in availability-sharing systems, i.e., presenting an estimated availability status based on the aggregation of low-level data, might be more beneficial than directly showing low-level raw data [5]. Since Instant messaging (IM) became an essential channel for interpersonal communication but that the status information on existing IM applications often does not accurately reflect the user's receptivity [3], researchers have also attempted to enhance IM users' awareness of one another's receptivity to instant messages [4]. In recent years, many researchers in interruptibility research have successfully found ways to estimate different kinds of receptivity to phone notifications, including users' attentiveness to [2], responsiveness to [6, 7], and interruptibility for IM messages [9]. Yet, while estimation of receptivity may be increasingly feasible and accurate due to the advancement of interruptibility research, little research has explored what kinds of receptivity information users prefer to disclose and how they would want that estimated status to be presented to their IM contacts. In our study, we developed IMStatus, an Android app that estimated IM users' receptivity and made it visible to their IM contacts in different ways. Our primary research question was: How would IM users want to present their receptivity, and why? To answer this question, we sought to explore three dimensions in presenting a receptivity status: *receptivity type*, *presentation type*, and *receptivity level*. We examined three ways of presenting users' receptivity status: *textual presentation*, *numeric presentation*, and *graphical presentation*. We also explored different kinds of status information using one of the three receptivity notions: *attentiveness* (how quickly one can read the message), *responsiveness* (how quickly one can respond to the message), and *interruptibility* (how interruptible one is for the message). We conducted an in-the-wild study with 37 IM users to investigate how IM users would modify an estimated status and would want their status to be presented in their daily lives. In this paper, we present the preliminary results of this ongoing research.

2 METHODS

2.1 IMStatus

IMStatus is an Android application that estimates an IM user's receptivity status based on several features of the recent phone condition, including screen status, the usage time of instant message application, the elapsed time of the last typing event on the phone, and current ringer mode. These features were inspired by [6, 8]. The system continually tracked and updated the information of each feature every 10 seconds. It estimated and updated the user's receptivity status every 2 minutes. The estimation was not based on

MobileHCI '20 Extended Abstracts, October 5–8, 2020, Oldenburg, Germany

ACM ISBN 978-1-4503-8052-2/20/10.
https://doi.org/10.1145/3406324.3410714

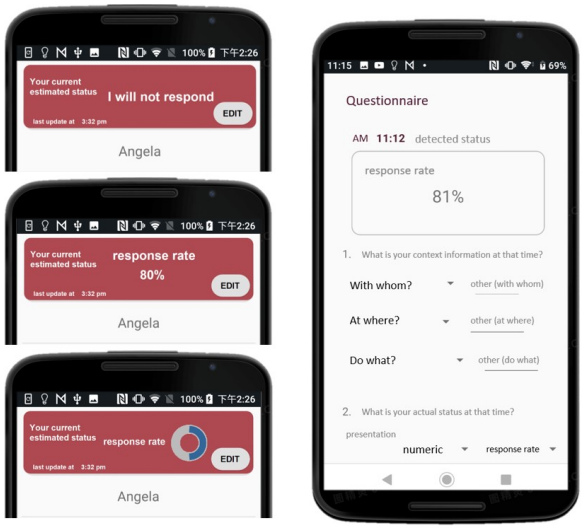

Figure 1: (a) From the upper left to the lower left shows the three formats for presenting a receptivity status in the application. (b)On the right is the ESM questionnaire

a machine learning model but a set of heuristics inspired by prior interruptibility research (e.g. [6, 9]). For example, when the user was recently typing on an unlocked phone, the users' responsiveness would increase. We chose not to use a machine learning model but a rule-based approach based on reasonable heuristics because our focus was to investigate IM users' reactions to their estimated status, as long as they believed the status estimation was inferred and contained uncertainty. The estimated status included attentiveness to, responsiveness to, and interruptibility for IM messages, respectively, which indicated different aspects of the user's receptivity to IM messages. The estimated status was randomly presented in either as a text (e.g. "high responsiveness" or a textual description such as "I will respond"), a numeric label (e.g. response rate 80%), or as a graphic, as shown in Figure 1a. As to receptivity types, the textual description mainly focused on providing responsiveness information, as we learned from both prior work [3] and the participants in our pilot study that IM users tended to interpret how fast one could respond to IM. However, as a computed receptivity level could be directly presented either by numbers and graphic, we chose to randomize all three receptivity types for both numeric and graphical presentations. Note that the status was adjustable for users at any time. That is, when the user was not satisfied with the estimated status provided by IMStatus, he or she could change it by clicking the edit button next to it. We are also particularly interested in these moments when they changed their status.

2.2 ESM Study

We used an Experience Sampling Method (ESM) [1] to study how IM users would want to present their status at different moments throughout a day. ESM Questionnaires were triggered when the estimated receptivity level was particularly high or low (higher than 90, lower than 20), or there was a noticeable difference between

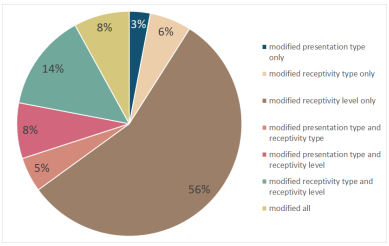

Figure 2: Shows how participants modified estimated status provided by IMStatus.

two receptivity levels in a period of time. The latter case was likely to indicate that participants had just changed their receptivity. The ESM questionnaire (Figure 1b) asked their actual receptivity status and the status they wanted to present to their IM contacts, which would also take effect after submitting the responses. It also asked the context information of the moment. The study lasted for two weeks. Participants were prompted six to nine times a day from 10 am to 10:30 pm. A minimum duration of 1 hour was placed between two ESM questionnaires to avoid overwhelming participants.

2.3 Recruitment and Participants

We recruited participants in groups who actively used Facebook Messenger and/or Line Messenger, the two most popular IM services in Taiwan, to contact each other in daily lives. We required each group to contain at least three participants and instructed them to use IMStatus during the study. Each group member was referred to as the main participant, who was encouraged to invite one to three other partial participants to use IMStatus during the study period. The purpose was to increase the diversity of contact relationships in each group. Each main participant could see his or her contact list with all group members involved, including partial participants he or she invited. We have recruited 12 groups of participants, which included 37 main participants and 16 partial participants, in a total of 53 participants. These participants aged 20 to 34 years old. 18 were females and 19 were males.

2.4 Study Procedure

The main participants in each group were first invited to a pre-study meeting for installing the IMStatus app and a tutorial on how to use the app. After the meeting, a questionnaire was sent to each main participant to report their relationship and closeness with each of the group members. If partial participants were invited, they were taught how to install IMStatus by the person who invited them. Upon the completion of the two-week ESM study, participants who were active in the study were invited to a semi-structured interview. The 18 participants who had agreed to participate in semi-structured interviews via email were provided with their ESM responses to help them recall the situations of each one. Main participants received NT$800 (approximately US$26) for the ESM study and extra compensation for each partial participant they were invited to. They received an additional NT$200 if they participated in an interview.

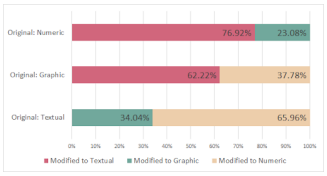

Figure 3: Shows how often the participants modified one presentation type to another. 76.92% of them modified a numeric presentation to a textual presentation. 62.22% of them modified a graphical presentation to a textual presentation.

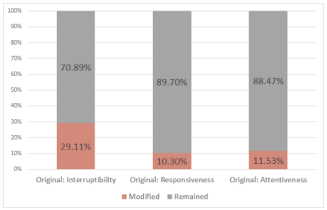

Figure 4: Shows how often the participants modified the receptivity types provided by IMStatus.

3 PRELIMINARY RESULT

Twelve groups of participants have finished the two-week ESM study. After data cleaning and processing, thus far, we have received 3,843 valid ESM responses. Of the total of all valid responses that were analyzed, 44% of the time, participants changed the receptivity status. Specifically, as shown in Figure 2, among the participants who had changed the receptivity status, up to 56% of the time participants modified receptivity level only (i.e., increasing or decreasing the degree of receptivity); 14% of the time, they modified both receptivity type and the level (e.g., changing from interruptibility rate 80% to response rate 10%). This suggested that participants seemed to more often unsatisfied with the receptivity level than the receptivity and presentation type the system generated. We present more specific results regarding presentation type, receptivity type, and receptivity level.

3.1 Presentation Type

Participants more than half (52%) of the time changed to a textual presentation, significantly more than switching to both numeric and graphical presentations, respectively. Many participants explained that it was because they thought the description could more precisely describe their current status, such as "I will not respond," and "I will not read the message." When using a numeric presentation, they were concerned with possible misinterpretation from other IM contacts. Although some participants thought a response rate of 30% was a low response rate and thus they used it to inform other contacts of his or her being unavailable, other participants thought a response rate of 30% still indicated a possibility to respond. To avoid such an inference from other contacts, they often changed from the numeric and the graphical presentation to a textual presentation, as shown in Figure 3.

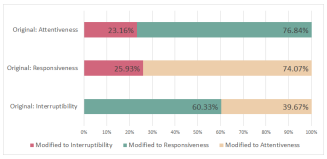

Figure 5: Shows specifically how the participants modified receptivity types.

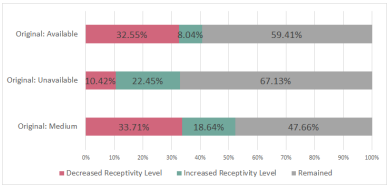

Figure 6: Shows how often the participants adjusted the receptivity level.

3.2 Receptivity Type

We first found that participants tended to keep the original receptivity type when seeing the provided receptivity status. Second, we found that participants more often wanted to present responsiveness and attentiveness than interruptibility. Specifically, as the original status provided by the app, interruptibility (29.11%) was nearly three times more often modified than responsiveness (10.30%), and attentiveness (11.53%) was, respectively, as shown in Figure 4. Also, when the participants decided to modify the receptivity type, as shown in Figure 5, participants changed from either responsiveness or attentiveness to interruptibility only roughly one-fifth of the time, respectively. According to the interviews, many of the participants preferred not to use interruptibility as their status because they were unsure about its meaning and how their contacts would interpret it in terms of how fast they would read and respond to a message.

3.3 Receptivity Level

Participants tended to lower their receptivity levels. As Figure 6 shows, while the app first provided a receptivity level of medium or high, participants tended to decrease their receptivity 33.71% and 32.55% of the time, respectively. Some participants explained that they preferred to keep their privacy; showing a low response rate could make them appear to be busy even when they were free or available. Interestingly, nearly one-third of the time, they even lower the level when the app already provides an unavailable status.

4 CONCLUSION AND FUTURE WORK

Our preliminary results have shown some interesting results regarding how IM users would prefer to present their receptivity status. After the data collection was complete, we will conduct a full analysis to validate the current results and uncover more insights.

REFERENCES

[1] Lisa Feldman Barrett and Daniel J. Barrett. 2001. An Introduction to Computerized Experience Sampling in Psychology. *Social Science Computer Review* 19, 2 (May 2001), 175–185. https://doi.org/10.1177/089443930101900204 Publisher: SAGE Publications Inc.

[2] Tilman Dingler and Martin Pielot. 2015. I'll be there for you: Quantifying Attentiveness towards Mobile Messaging. In *Proceedings of the 17th International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI '15)*. Association for Computing Machinery, Copenhagen, Denmark, 1–5. https://doi.org/10.1145/2785830.2785840

[3] Mirko Fetter. 2019. *New Concepts for Presence and Availability in Ubiquitous and Mobile Computing: Enabling Selective Availability through Stream-Based Active Learning*. University of Bamberg Press. Google-Books-ID: knqIDwAAQBAJ.

[4] James Fogarty, Jennifer Lai, and Jim Christensen. 2004. Presence versus availability: the design and evaluation of a context-aware communication client. *International Journal of Human-Computer Studies* 61, 3 (Sept. 2004), 299–317. https://doi.org/10.1016/j.ijhcs.2003.12.016

[5] Juan David Hincapié-Ramos, Stephen Voida, and Gloria Mark. 2011. A design space analysis of availability-sharing systems. In *Proceedings of the 24th annual ACM symposium on User interface software and technology (UIST '11)*. Association for Computing Machinery, Santa Barbara, California, USA, 85–96. https://doi.org/10.1145/2047196.2047207

[6] Andreas Komninos, Elton Frengkou, and John Garofalakis. 2018. Predicting User Responsiveness to Smartphone Notifications for Edge Computing. In *Ambient Intelligence (Lecture Notes in Computer Science)*, Achilles Kameas and Kostas Stathis (Eds.). Springer International Publishing, Cham, 3–19. https://doi.org/10.1007/978-3-030-03062-9_1

[7] Hao-Ping Lee, Tilman Dingler, Chih-Heng Lin, Kuan-Yin Chen, Yu-Lin Chung, Chia-Yu Chen, and Yung-Ju Chang. 2019. Predicting Smartphone Users' General Responsiveness to IM Contacts Based on IM Behavior. In *Proceedings of the 21st International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI '19)*. Association for Computing Machinery, Taipei, Taiwan, 1–6. https://doi.org/10.1145/3338286.3344387

[8] Abhinav Mehrotra, Robert Hendley, and Mirco Musolesi. 2019. NotifyMeHere: Intelligent Notification Delivery in Multi-Device Environments. In *Proceedings of the 2019 Conference on Human Information Interaction and Retrieval (CHIIR '19)*. Association for Computing Machinery, Glasgow, Scotland UK, 103–111. https://doi.org/10.1145/3295750.3298932

[9] Fengpeng Yuan, Xianyi Gao, and Janne Lindqvist. 2017. How Busy Are You? Predicting the Interruptibility Intensity of Mobile Users. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17)*. Association for Computing Machinery, Denver, Colorado, USA, 5346–5360. https://doi.org/10.1145/3025453.3025946

[10] Manuela Züger, Christopher Corley, André N. Meyer, Boyang Li, Thomas Fritz, David Shepherd, Vinay Augustine, Patrick Francis, Nicholas Kraft, and Will Snipes. 2017. Reducing Interruptions at Work: A Large-Scale Field Study of FlowLight. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17)*. Association for Computing Machinery, Denver, Colorado, USA, 61–72. https://doi.org/10.1145/3025453.3025662