Digital Love Letter: A handwriting based interface for non-instant digital Messenger

Bang So Jung, Song Yoon Ji, Kim Jaedong, Shi Chung Kon, Wakefield Graham* and Woo Sung Ju*

Graduate School of Culture Technology, KAIST, Daejeon, Korea
{sojungb,keyofsky,jaedong27,chungkon,grrrwaaa,
woo1016}@kaist.ac.kr

Abstract. The instant messenger has developed as an important communication media platform. However, because of the nature of instant communication, instant messenger services place many limitations on communicating with nuance. The instant nature of digital communications tends to weaken serious aspects of personal communication such as patience and commitment. On the basis of critical perspectives, we designed the digital messenger 'Digital Love Letter (DLL)'. It is a mobile messenger with a new form in which the expressive process of interaction is more important than the final output. The main concept of DLL is to share the process of communication using a non-instantaneous and non-multitasking interface so users can share their time in a similar way to face to face communication. Through these messenger concepts, both writing and reading messages require concentrated attention. Thus, this paper suggests a new system of digital messenger, 'DLL', which is also a new method of computer-mediated communication (CMC).

Keywords: Affective Messenger, Computer Mediated Communication (CMC), Social Presence, Instant Messaging.

1 Introduction

Instant Messaging has become an effective and convenient means to communication over a distance. Digital technology has made it easier for us to contact others immediately and instantly, however messaging services usually only focus on quick information delivery. Even if messages can be complimented with diverse emoticons and attached files, because of the nature of instant communication, it places many limitations on communicating with nuance. Many scholars have criticized communication mediated with digital technology because the instant nature of digital communications

* Corresponding author

adfa, p. 1, 2011.

tends to weaken serious aspects of personal communication such as patience and commitment.

George Myerson [1] critically analyzed mobile phone communication using the philosophical paradigms of Heidegger and Habermas. In Heidegger's approach, communication is about the hearer's understanding. For Habermas, to communicate means to make the speaker's desires understood, not to pursue their immediate fulfillment. In their terms, communicative action is shared action, such as mutual understanding which is considered to be a process of reaching agreement among the speaker and the hearer. In contrast, mobile communications are characterized as a means of quick one-sided contact. This is not a true communicative process in which people seek to share their existence.

Sherry Turkle [2] suggested that multitasking and rapid responses in online interactions can make people obsessive about their numerous connections. Quick connections mediated with digital technology are used for measuring their level of self-esteem. Walter Kirn [3] also explained how online multitasking messes with the brain in several ways with examples including brain scan experiments. These scholars criticized digital communication such as instant messaging from diverse perspectives. Nevertheless, digital communication has developed as the dominant means of communication and instant messaging cannot be ignored in modern society. If aspects of emotional interactions requiring effort and concentration can be realized through digital technology, weak points of instant connection based communication might be addressed.

There have been previous studies on improving the richness of emotional interactions in digital technology. For example, Affective Computing aims to realize emotional interaction through digital technology, but it is usually focused on improving interactions between humans and computers [4]. These systems aim to make computers recognize human emotional information. There are some digital messaging services based on affective computing which help to convey emotion effectively [5]. However, uses of an automated computing system to detect and deliver emotion are mainly limited to measuring physical responses, and this cannot be directly associated with specific emotional states. These types of interfaces can also reinforce the instant and effortless aspects of digital communication.

Human Computer Interaction (HCI) has become concerned with critical theory and reflective thought [6]. Philip Agre [7] advocated the development of "critical technical practices" in which technology development becomes a way to reflectively explore attitudes towards and premises about technology and humanity.

On the basis of these critical perspectives and theories we designed the mobile messenger 'Digital Love Letter (DLL)' which has an original concept of reflecting on digital technology and interpersonal communication. It is a mobile messenger with a handwriting-based interface in which the expressive process of interaction is more important than the final output. The main concept of DLL is to share the process of communication using a non-instantaneous and non-multitasking interface, so users can share their

time in a similar way to real world communication with empathy. Through these messaging concepts, both writing and reading messages requires concentrated attention.

We did an experimental study to see how people interact with each other through DLL. The concept of 'social presence' was used to evaluate this system for corporations. Social presence is a theoretical model used to analyze computer-mediated communication (CMC). This is usually explained as "the degree of salience of the other person in the interaction", but is also interpreted as empathy and mutual understanding in psychological involvement.

2 Literature Review

2.1 CMC with Emotion

Computer-mediated communication (CMC) is increasingly used to maintain relationships, so people need to communicate their emotion through digital technology. Although many researchers have offered a plethora of definitions about emotion, they generally define emotion as a mental process related to affective information such as sadness, anger, fear, happiness, joy, and love. The term Affect comes from the Latin word '*affectus'*, which means passion or emotion. Affective information is complementary to cognitive information which is more rational than emotion [8], [9]. Technological developments increasingly allow affective communication through electronic and digital devices, so many authors regard emotion as an important factor in CMC.

Riordan, M [10] examined how people choose specific channels for socio-emotional communication over other channels. Three channels such as email, Instant Messaging (IM) and Face to Face (FTF) were assessed. Two types of positive emotions and negative emotions were assessed depending on channel choice. This study showed that the prominent reason for choosing FTF over mail or IM was the existence of more emotional cues. It appeared that people rely on nonverbal and emotional cues when they communicate. However, Derks, D [11] suggested that there is no indication that CMC is a less emotional or less personally involving medium than in F2F. The conclusion was that emotions are abundant in CMC.

Hancock, J [12] analyzed how people express and detect emotions during text-based communication. It was found that disagreement, negative affect terms, punctuation and verbosity were used by most communication partners to distinguish between positive and negative emotion in a textual communication context. Pfeil, U [13] investigated how empathy is expressed and facilitated in an online community for older people (SeniorNet). Qualitative content of 400 messages from an online message board about depression was analyzed. It was shown that empathy is an important aspect of online communication. Harris, R [14] also studied about message cues in CMC that promoted the transfer of affective information. Emotion words, linguistic markers and paralinguistic cues were shown to be factor for higher perceptions of emotions in CMC.

2.2 Social presence

Social presence has been defined as a "sense of being with another in a mediated environment". It is increasingly known as an important factor for understanding effects of interactive media [15]. Hwang, H [16] analyzed the gratification of utility of Instant Messaging from a social presence paradigm. This study showed that social presence is an important role in communication through Instant Messaging Services. It is also shown that communication competence is positively related to CMC through social presence. Interactive media systems for a corporation can be evaluated through social presence [17]. From these perspectives, there are many researches and interpretations about social presence.

Short, J [18] first made the measurement of social presence with four items: Personal-impersonal, sensitive-insensitive, warm-cold and sociable-unsociable. High social presence is correlated to factors of how personal, sensitive, warm or sociable the presence is. Biocca, F [19] suggested social presence with a networked minded measure, and it was grouped with three areas: co-presence, psychological involvement and behavioral engagement. Co-presence is the mutual awareness, and psychological involvement is mutual understanding with empathic senses. Behavioral engagement is interdependent action. Nowak, K [20] differentiated co-presence and social presence. Co-presence is the perceived sense of being with each other, and social presence is a broader concept that concerns the consequent salience of the interpersonal relationship. However it was found that dimensions of co-presence and social presence were highly and significantly correlated.

2.3 Affective messenger

There have been many attempts to design technology and systems for communicating emotional information through media. There has been research on delivering emotional content and information through Instant Messaging aided by affective computing interfaces. Some authors have designed tactile interfaces to convey emotional contents. 'TCONs' [21] is a device that includes tactile output and input systems: vibrating motors, pin actuators, heat oil, pressure sensor, button and LEDs. The aim of this research was to support expression with an intuitive, tangible way through a Digital Messenger. 'iFeel_IM!' [22] is a system that integrates a 3D virtual world with affective computing haptic interfaces. It used automated emotion recognition from text messages, and haptic feedback, providing nonverbal communication through physical sensors. 3D avatars are visualized with automated emotion sensing by affective haptic devices, which include *HaptiHeart*, *HaptiHug*, *HaptiButterfly*, *HaptiTickler*, *HaptiTemper*, and *HaptiShiver*. 'HIM' [23] is also made by haptic instant messaging framework. They designed '*hapticons*' and haptic IO devices to augment the communication of text messages.

Besides haptic interfaces, emotion detection by computers was used for mobile messaging system such as ‘eMoto’. With eMoto users can compose messages through emotion related input, influenced by body gestures, and it renders a background of colors, shapes and animation [24]. ‘Conductive Chat’ [25] is an instant messaging system that incorporates user’s skin conductivity levels, including emotional arousal, into a dialogue interface. ‘FAIM’ [26] is a 3D avatar based messaging system for empathic communication. It is a messaging application that shows each person as a 3D character who can express emotion through facial expression.

There are some commercial online messengers that help people communicate privately and intimately. ‘Snapchat’ is a photo messaging application that allows users to set a time limit for how long recipients can view messages. ‘Paintchat’ is an online chat room that participants can draw together in real time with their partner.

3 Digital Love Letter

We made the mobile messenger application ‘Digital Love Letter (DLL)’for smart phone and tablet PC using the HTML5 standard. The interface was made to show users the whole process of writing the message in real time, so users do not just deliver information, but can focus on sharing the communication process. In order to block one-way communication and multitasking, users cannot send a message if the receiver is not actively ready to receives it. Messages are not stored in the application, so users can only see the messages once. The purpose of these features was to make an environment requiring patience and commitment. Users can also send an image and write or draw something with their hands to build multilayered communication. It also has special effects such as a blurred image so that pictures emulate a steamed-up window created from someone’s breath. When the sender draws lines, the original, underlying images appear vividly (Fig.2). The usage process outline is:

1. A sender turns on the mobile messenger application ‘Digital Love Letter’.
2. A sender chooses a receiver and awaits the receipt.
3. A sender takes or chooses an image and writes or draws on the image.
4. A receiver sees every process that a sender writes or draws.

The server developed for DLL used Flask, a python based web framework, and the client used HTML and java script. We designed ‘DLL’ for web to operate on every mobile device. If a user draws lines on web application, it sends each frame at regular intervals to the server using a web protocol to transport the image, which was compressed using the JPEG standard. The server stores the pictures of every frame and a client can request the images from the server. If a client receives the images, it can be displayed on their partner’s web application (Fig.1).

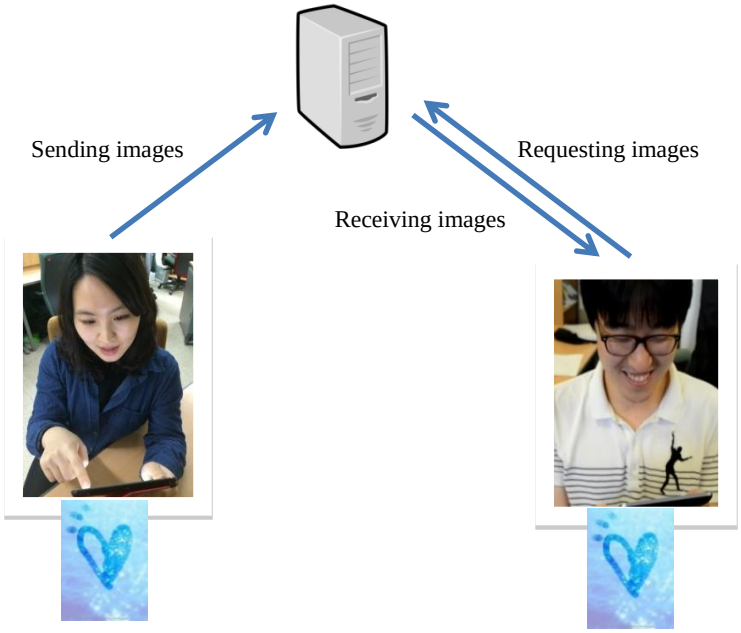


Fig. 1. System Architecture.

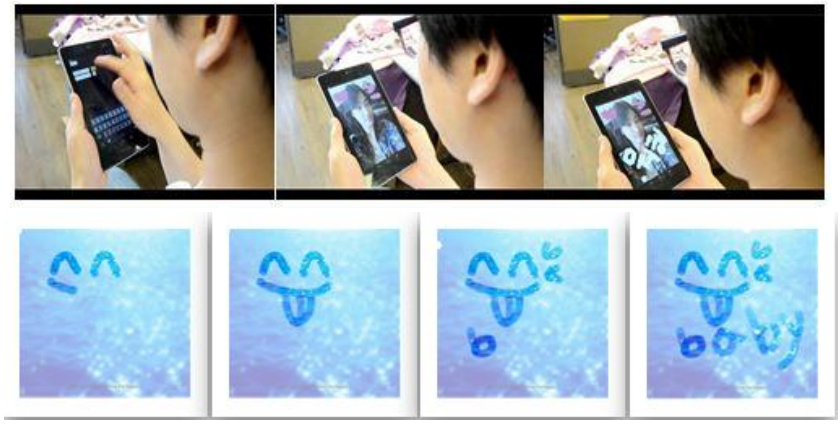


Fig. 2. Time-lapse screenshots.

4 Experimental Study

4.1 A preliminary test

We did a preliminary test with thirty people (17 female, 13male /5 undergraduate students, 20 graduate students, 5 full time employees). We let them use the 'Digital Love Letter (DLL)' once or twice with random people in a testing room and then did a

survey. The survey included 10 items of multiple-choice and 3 items of short-term answer forms. We asked people how they commonly communicate through digital technology and compared it with the way of communication through the DLL prototype. Through questionnaires, the differences between non-instant and instant communication mediated by computers were analyzed. The mostly commonly reported method of communicating emotion in other messaging services was through the use of emoticons and participants were asked to compare that with their emotion communication experience using DLL. Most people responded that sharing of the writing process is the main attraction and dominant feature of DLL compared to other messengers. The feedback on the overall experience of using DLL was generally positive.

5 User study

5.1 System setting

Based on the feedback from the experimental study we developed a hypothesis that an interface that showed the process of writing in real time would result in users having a higher perception of social presence. To test this hypothesis we developed a secondary user study using variations of the DLL system.

We compared two types of handwriting-based messenger writing interfaces that utilized a simple interface with a white screen and black pen (Fig.3). One type of messenger was a prototype of DLL that could share the process of writing with a partner in real time. Another type of messenger called 'Digital Letter (DL)'was designed where the process of writing could not be shared, so the receiver could only see the final output image.

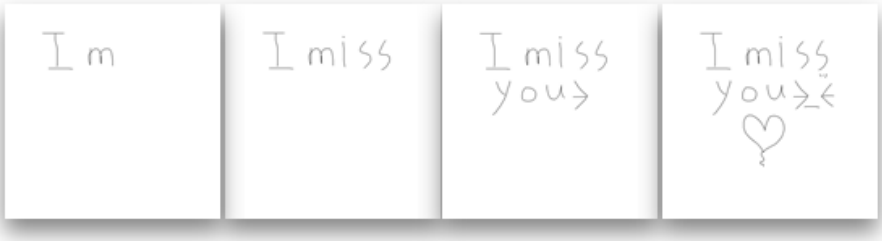


Fig. 3. Process time-lapse

5.2 Procedure

We conducted a user study with couples that identified as being in a romantic relationship to see their private and intimate communication through DLL. Ten couples were recruited using a university online message board and given cash compensation. All of the participants that took part in the experiment were university students, ranging

between 21 and 27years of age. Six couples had been in relationship for a year, two couples for two years and two couples for more than two years. Participants used the DLL and DL for ten minutes each, with their partner in a separated room, and were asked to complete the questionnaire about co-presence and psychological involvement of social presence. The task they were given was to express love to their partner by drawing affectionate figures or writing some short text. We let them suppose they were not within close range of each other. Five couples were asked to use the DL first and the other five couples to use the DLL first. The participants were requested to fill the questionnaire after they used our messenger. When one experimental session was finished, we did an interview with the couple together.

5.3 Measurement

The co-presence measurement developed by Nowak, K [20] was used to measure participant's perceptions of social presence. The twelve items of the co-presence questionnaire were measured by 5-point Likert scale (Strongly agree=5, Strongly disagree=1). The psychological involvement measurement of social presence included two sub factors: empathy and mutual understanding. The psychological involvement questionnaire had twelve items estimated by seven-point Likert scale (Strongly agree=7, Strongly disagree =1) [19]. All participants were asked to complete the questionnaire of the co-presence and the psychological involvement after they finished the task with DL and DLL.

5.4 Usability test

The usability of DLL was measured through The Post-Study System Usability Questionnaire (PSSUQ) with seven-point Likert scale. The PSSUQ includes three sub scales: System Usefulness (SYSUSE), Information Quality (INFQUAL) and Interface Quality (INTERQUAL) [27]. In this study Information Quality was not measured because DLL did not include support information or documentation as it was a prototype. Participants were asked to complete the questionnaires regarding the usability when they finished the testing process.

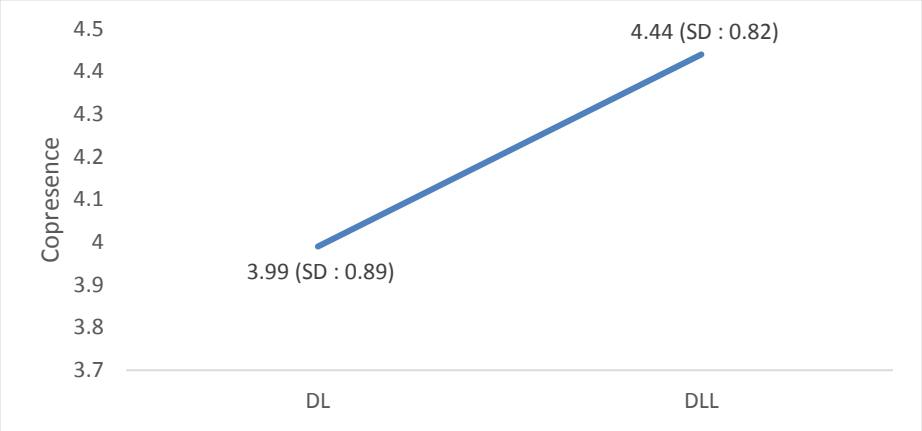
6 Result

6.1 Social presence

We conducted a Wilcoxon signed rank test with data from eighteen participants. Answers from two of the original twenty participants were deemed unreliable due to inconsistency in inverted questions. It was found that there was a statistically significant difference of perception of co-presence between DL and DLL (p-value=.017, N=18,

Wilcoxon signed rank test). However, no significant difference was found for all sub factors of psychological involvement between the two groups (mutual understanding: p-value = 0.1892, empathy: p-value = 0.1174, N=18).

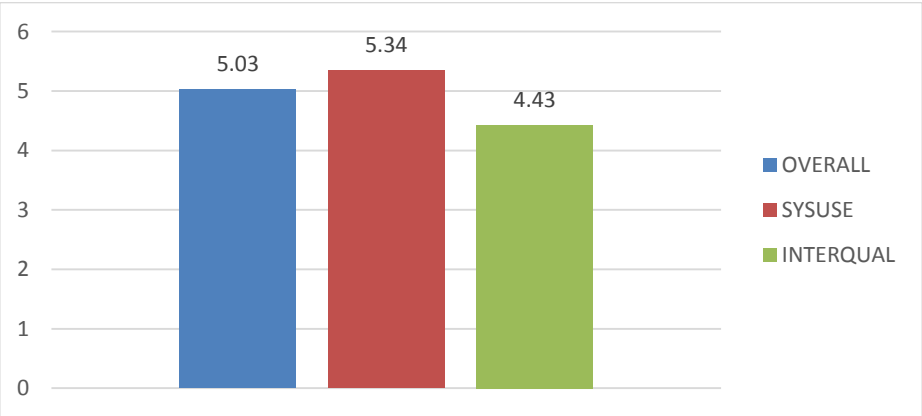
Table 1. comparison of co-presence between DL and DLL



6.2 Usability test

We measured the satisfaction of the participants through PSSUQ with a seven-point Likert scale. High scores are better than low scores due to the fixation used in the 7-point scales. Results showed that overall satisfaction score was 5.03 and SYSUSE score was 5.34 and INTERQUAL score was 4.43.

Table 2. Usability test



7 Discussion and Conclusion

We made the digital mobile messenger DLL with a handwriting based interface which shares the process of communication non-instantaneously and without multitasking. The DLL application, where messages are not stored, requires concentrated attention from users while they write and read messages. We tried to reflect on the digital messaging service and CMC through this system from a critical perspective.

We compared a DLL prototype with DL, where the process of writing could not be shared, via a co-presence and social presence questionnaire. The difference of co-presence between DL and DLL was significant, but a significant difference in psychological involvement was not found. We also did a usability test through PSSUQ. The overall satisfaction and system usefulness score was found to be high but the interface quality score was relatively low, suggesting an area of improvement for future versions.

It was found that sharing the process of writing on a messaging service was effective to perceive co-presence. However, there were limitations on measuring psychological involvement such as empathy and mutual understanding precisely because the experiment duration was too short to build emphatic and mutual communication. The reasons of low Interface quality score were explained through the users' interviews. The user interface was not designed aesthetically to support sensorial communication. Thus, there are many necessary improvements for the interface design, including an erasing function and diverse fonts and colors.

Many participants showed different attitudes when functioning as a sender to being a receiver. They felt burdened by the fact that their partner could see their entire writing process, because they had to be more cautious and conscious. In contrast, they showed much interest in seeing their partner's writing process and even tended to enjoy observing their partner's hesitations and difficulties. In future research, we plan to differentiate emotional response between sender and receiver through a longitude experiment with a more developed DLL design.

Acknowledgments. We would like to thank all the participants of the study and thanks to Park Chong Wook, Suh Kiseul, Hutchings Patrick and Bae Ar Ram who provided insights and improvement for this paper.

References.

1. Myerson, G. Heidegger, Habermas and the Mobile Phone (Postmodern Encounters). (2001).
2. Turkle, S. Can you hear me now. Forbes. com, 5(7), 07. (2007).
3. Kirn, W. The autumn of the multitaskers. Atlantic Monthly, 66-80. (2007).
4. Picard, R. W. Affective computing. MIT press. (2000).
5. Wong, M. Emotion assessment in evaluation of affective interfaces. Neuron65, 3, 293. (2006).
6. Dourish, P., Finlay, J., Sengers, P., & Wright, P. Reflective HCI: Towards a critical technical practice. In CHI'04 extended abstracts on Human factors in computing systems (pp. 1727-

1728). ACM. (2004, April).
7. Agre, P. Toward a Critical Technical Practice: Lessons Learned in Trying to Reform Al. Social science, technical systems, and cooperative work: Beyond the Great Divide, 131. (1997).
8. Konijn, E. A., & Van Vugt, H. C. Emotions in mediated interpersonal communication. Mediated interpersonal communication, 100. (2008).
9. Brave, S., & Nass, C. Emotion in human-computer interaction. The human-computer interaction handbook: fundamentals, evolving technologies and emerging applications, 81-96. (2002).
10. Riordan, M. A., & Kreuz, R. J. Emotion encoding and interpretation in computer-mediated communication: Reasons for use. Computers in human behavior, 26(6), 1667-1673. (2010).
11. Derks, D., Fischer, A. H., & Bos, A. E. The role of emotion in computer-mediated communication: A review. Computers in Human Behavior, 24(3), 766-785. (2008).
12. Hancock, J. T., Landrigan, C., & Silver, C. Expressing emotion in text-based communication. In Proceedings of the SIGCHI conference on Human factors in computing systems (pp. 929-932). ACM. (2007, April).
13. Pfeil, U., & Zaphiris, P. Patterns of empathy in online communication. In Proceedings of the SIGCHI conference on Human factors in computing systems (pp. 919-928). ACM. (2007, April).
14. Harris, R. B., & Paradice, D. An investigation of the computer-mediated communication of emotions. Journal of Applied Sciences Research, 3(12), 2081-2090. (2007).
15. Tu, C. H. The impacts of text-based CMC on online social presence. The Journal of Interactive Online Learning, 1(2), 1-24. (2002).
16. Hwang, H. S., & Lombard, M. Understanding instant messaging: Gratifications and social presence. Proceedings of PRESENCE 2006, 50-56. (2006).
17. Hwang, Y. Is communication competence still good for interpersonal media?: Mobile phone and instant messenger. Computers in Human Behavior, 27(2), 924-934. (2011).
18. Short, J., Williams, E., & Christie, B. The social psychology of telecommunications. (1976).
19. Biocca, F., Harms, C., & Gregg, J. The networked minds measure of social presence: Pilot test of the factor structure and concurrent validity. In 4th annual International Workshop on Presence, Philadelphia, PA. (2001, May).
20. Nowak, K. Defining and differentiating copresence, social presence and presence as transportation. In Presence 2001 Conference, Philadelphia, PA. (2001).
21. Shin, H., Lee, J., Park, J., Kim, Y., Oh, H., & Lee, T. A tactile emotional interface for instant messenger chat. In Human Interface and the Management of Information. Interacting in Information Environments (pp. 166-175). Springer Berlin Heidelberg. (2007).
22. Neviarouskaya, A., Tsetserukou, D., Prendinger, H., Kawakami, N., Tachi, S., & Ishizuka, M. Emerging system for affectively charged interpersonal communication. In ICCAS-SICE, 2009 (pp. 3376-3381). IEEE. (2009, August).
23. Rovers, A. F., & van ESSEN, H. A. HIM: a framework for haptic instant messaging. In CHI'04 Extended Abstracts on Human Factors in Computing Systems (pp. 1313-1316). ACM. (2004, April).
24. Sundström, P., Ståhl, A., & Höök, K. In situ informants exploring an emotional mobile messaging system in their everyday practice. International journal of human-computer studies, 65(4), 388-403. (2007).
25. DiMicco, J. M., Lakshmipathy, V., & Fiore, A. T. Conductive Chat: Instant messaging with a skin conductivity channel. In Proceedings of Conference on Computer Supported Cooperative Work. (2002, November).
26. Hong, J. H., Yang, S. I., & Cho, S. B. ConaMSN: A context-aware messenger using dynamic Bayesian networks with wearable sensors. Expert Systems with Applications, 37(6), 4680-

4686. (2010).
27. Lewis, J. R. IBM computer usability satisfaction questionnaires: psychometric evaluation and instructions for use. International Journal of Human-Computer Interaction, 7(1), 57-78. (1995).