Emoticon Recommendation for Japanese Computer-Mediated Communication

Yuki Urabe, Rafal Rzepka, Kenji Araki
Graduate School of Information Science and Technology, Hokkaido University
Sapporo, 060-0814, Japan
{y_urabe, kabura, araki}@media.eng.hokudai.ac.jp

***Abstract*—This paper describes the development of an emoticon recommendation system based on emoticons numerically categorized by emotion. The emoticon recommendation system aims to help users express their feelings in computer-mediated communication by recommending emoticons appropriate to user input. In order to develop this system, the original emoticon database, a table of emoticons with the points expressed from each of 10 distinctive emotions, was developed. An evaluation experiment showed that 71.3% of user-selected emoticons were among the top 10 emoticons recommended by the proposed system. Moreover, we compared the proposed system to the current system used in iPhone by adopting a semantic differential (SD) scale of 1-7. The results showed that the proposed system scored higher than the current system by 1.05 points in ease of choice, 0.55 points in accuracy, and 0.55 points in specificity. We plan to make our proposed method open source, so that any developer can build in their own interfaces and enhance their own input methods using these emoticon recommendation systems.**

Keywords; emoticon, emotion analysis, recommendation system

I. INTRODUCTION

CMC (Computer-Mediated Communication) has become popular in recent years as it allows people to communicate regardless of time, limitations of physical distance, and familiarity (i.e., whether or not they know each other). However, in contrast to F2F (Face-to-Face) communication, CMC lacks nonverbal cues such as facial expression, attitude, and tone of voice. These nonverbal cues have great importance as verbal cues in F2F communication, enabling humans to understand others' feelings and intentions not only from the spoken words but also from their facial expressions showing emotion and attitudes [1]. Therefore, we need to find a way to compensate for this lack of nonverbal cues in order to prevent confusion and express user intentions fully in CMC.

Emoticons, marks expressing faces or movement composed of letters and symbols, may serve as nonverbal surrogates in CMC. Emoticons are used in CMC to express one's feelings, enhance the sentence, and express humor [2]. Receivers can understand the sender's intended emotions, attitudes, and attention clearly with emoticons in the sentence rather than by receiving only words in the sentence [3]. Information conveyed by emoticons has a great importance in CMC which we should not ignore, and thus, research on emotion analysis from emoticons, and development of interfaces which support users expressing their feelings using emoticons are highly important.

Emoticons can be divided into two types: 1) Western emoticons and 2) Eastern emoticons. Western emoticons are composed of one-byte characters and are rotated by 90 degrees (e.g. ":-)"). In contrast to Western emoticons, Eastern emoticons are composed of not only one-byte characters but also 2-byte characters that are used for Japanese letters. Eastern emoticons are not rotated and are easily comprehensible to the reader. The number of Eastern emoticons found in an online dictionary[1] is more than 58,000 and this number is still increasing in recent years (conversely, a Western emoticon dictionary[2] records 260 emoticons). These large numbers of emoticons are sophisticated enough to express nuances in meaning and may richen the quality of communication in CMC if we make good use of them. However, it is difficult for users to find appropriate emoticons to express their intentions from 58,000 emoticons in the dictionary. Therefore, a method to support users in choosing appropriate emoticons that match their input is necessary. In this paper, we propose an emoticon recommendation system that helps users to easily find a suitable emoticon for their input.

The emoticon recommendation system is comprised of an original emoticon database, a table of emoticons organized according to the gradation of 10 distinct emotions, and ML-Ask [4], an emotion analysis system that analyzes the intended emotion from the emotional expressions used in the sentence. This system will assist the user in finding a suitable emoticon and easily insert it into the sentence.

The outline of this paper is as follows: In Section 2, we present related research and describe some differences between several studies. Section 3 describes the procedure of the emoticon recommendation system and the use of the emoticon database in the system. Section 4 details the steps to create an original emoticon database by conducting a survey of university students. The results of the survey are also described in Section 4. In Section 5, we describe the evaluation experiment using a semantic differential (SD) scale and the results from the experiment. Finally, conclusions and future works are presented in Section 6.

II. RELATED WORKS

In the field of artificial intelligence, an automatic emoticon analysis system, "CAO" was developed by Ptaszynski et al. based on the theory of kinesics [5]. "CAO" extracts an emoticon from the input and determines the specific emotion type. The system's coverage exceeds three million possibilities. Moreover, several tests proved that 99.5% of emoticons were correctly deduced and 85.2% of the emotions in the emoticons were correctly estimated. An emoticon recommendation

[1] http://www.kaomoji.sakura.ne.jp/
[2] http://www.techdictionary.com/emoticon_cont3.html

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method based on the estimation of emotions, communication, and action types written by users was proposed by Emura and Seki [6]. The results of this system showed that by recommending emoticons not only from emotion categories but also from communication and action types, 66.7% of the suggested emoticons were suitable; this was a significant improvement over the recommendation results that only utilized the emotion categories. The emoticons in CAO's [5] emoticon database and emoticon recommendation system [6] were both simply categorized according to such emotion types. Meanwhile, a normative table of emotions and emphasis of emoticons was developed by Kawakami, by conducting a questionnaire to university students [7]. The focus was different from the aforementioned two studies in that Kawakami concentrated on how much an emoticon expresses each emotion and investigated how much the emoticon emphasizes the sentence. The research analyzed 31 emoticons and found that some emoticons strongly express more than one emotion.

The idea of the normative table of emotions expressed by emoticons was helpful in developing a more accurate emoticon recommendation system. Creating a database of emoticons showing a numerical expression of each emotion could be a step toward the creation of a system that can recommend emoticons that express the user's complicated emotional state.

III. EMOTICON RECOMMENDATION SYSTEM

The system utilizes two main procedures (Figure 1). First, the system analyzes the emotion in the user input. We used an affect analysis system, ML-Ask [4], which was previously developed in our laboratory. ML-Ask separates emotive utterances from non-emotive utterances and specifies the specific emotion types in the emotive utterances. Secondly, the system rearranges the emoticon database in the order of emotion type specified by ML-Ask and recommends the top 5 emoticons to the user (e.g., if ML-Ask analyzed the input as "happy", the system reorders the data according to the score for "happy" from each emoticon). The original emoticon database was created by taking a survey of Japanese university students. The system continues to recommend the next five emoticons until the user chooses one for the sentence. Lastly, the system outputs the user input with the chosen emoticon.

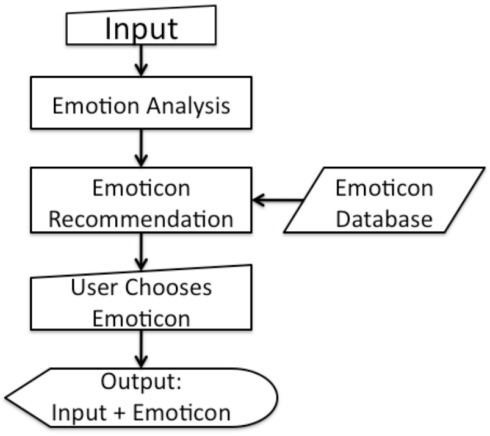


Figure 1. System procedure

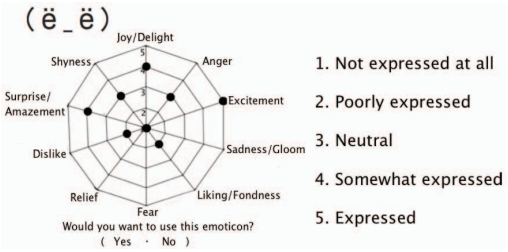
IV. EMOTICON DATABASE

We created an original emoticon database that helps the system recommend suitable emoticons to the user. We chose 59 emoticons from 140 registered emoticons in Apple's iOS[3] 5.0. The condition for the chosen emoticons is those with no symbols outside of brackets (i.e. "(^0^)" qualifies, but "\ (^0^) / " is excluded. In these emoticons, "^" and "0" represent the eyes and mouth of a face, respectively. Also, two slashes outside of brackets symbolize the arms of a human body.) The symbols inside of "()" form a facial expression which we chose as a main focus in order to discover what kind of emoticons users choose based on the difference in the facial expression. After we find a pattern for which emoticon expresses which emotion types for emoticons without symbols outside of brackets, we will expand the database by also rating emoticons that have symbols outside of brackets. As for the classification of emotions, we adopted 10 different emotion types that are appropriate for Japanese language and culture [8]. These are: "joy/delight", "anger", "excitement", "sadness/gloom", "liking/fondness", "fear", "surprise/amazement", "shyness", "relief", and "dislike". We conducted a survey in Japanese and rated 59 chosen emoticons using those emotion types.

The reason why we chose to conduct a questionnaire to create an emoticon database rather than collecting data automatically from social media is that emoticons are mostly used to enhance the sentence and to express the user's feelings [2]. Most of the words in sentences that have emoticons do not use emotional expressions, so it is difficult to analyze the emotion from the sentence and investigate which emotion is expressed by the emoticon. CAO [5] is able to classify the emotion from the emoticon, but does not calculate how strongly the emoticon expresses the emotion. Therefore, we conducted a questionnaire to 60 Japanese university students and collected their perceptions of the power of the emotion expressed in each emoticon.

A. Survey

We conducted a survey in July 2012 towards 60 Japanese university students. The group consisted of 22 men and 38 women. Thirty-three students belonged to liberal arts courses while 27 students belonged to science courses. The average of their ages was 20.71 (*SD* = 1.21). On a 5-point scale, respondents were asked to rate 59 emoticons in 10 emotion categories and answer whether they were likely to use the emoticon.



[3] iOS is a registered trademark of Cisco in the U.S.

Figure 2. Example of emoticon ratings in each of the 10 emotions

TABLE I. CORRELATION COEFFICIENTS OF 10 EMOTION TYPES

Emotion	1	2	3	4	5	6	7	8	9	10
1. joy/delight		−0.540**	−0.694*	−0.641*	0.989**	−0.825**	0.973**	−0.900	−0.515**	−0.615*
2. anger	−0.540**		0.560**	0.169	−0.528**	0.239	−0.548*	0.686**	0.034	0.234*
3. excitement	−0.694*	0.560**		0.256	−0.701	0.594**	−0.754	0.700	0.623*	0.728
4. sadness/gloom	−0.641*	0.169	0.256		−0.641	0.867**	−0.643	0.645	0.059	0.391
5. liking/fondness	0.989**	−0.528**	−0.701	−0.641		−0.830*	0.968*	−0.893	−0.527	−0.595
6. fear	−0.825**	0.239	0.594**	0.867**	−0.830*		−0.842*	0.796**	0.463	0.651**
7. relief	0.973**	−0.548*	−0.754	−0.643	0.968*	−0.842*		−0.884	−0.542	−0.640
8. dislike	−0.900	0.686**	0.700	0.645	−0.893	0.796**	−0.884		0.351*	0.643
9. surprise/amazement	−0.515**	0.034	0.623*	0.059	−0.527	0.463	−0.542	0.351*		0.459
10. shyness	−0.615*	0.234*	0.728	0.391	−0.595	0.651**	−0.640	0.643	0.459	

Significance level **:p<1% * :p<5%

We phrased the question as follows: "On a 5-point scale, please rate how well the emoticon expresses each of the 10 emotions. (1. Not expressed 2. Poorly expressed 3. Neutral 4. Somewhat expressed 5. Expressed). Please answer "Yes" or "No" to whether you are likely to use the emoticon as well." We also demonstrated an example of the rating (Figure 2) and indicated words that embody each emotion.

B. Results

We calculated the average rating value of each emotion for 59 emoticons and created a database (Table I; minimum is 1.00, maximum is 5.00). The system uses this database to rearrange emoticons in order of the emotion type analyzed by ML-Ask and recommends emoticons from the top. The correlation coefficient of the emotion was computed by 59 emoticons (Table I; "*" shows a significance level less than 5.00%, "**" shows a level less than 1.00%).

From the average rating value of each emotion for 59 emoticons, 35 out of 59 emoticons scored more than 3.00 in at least two emotion types, which means those emoticons indicate plural emotion types. For example, the emoticon "(*^◯^*)" scored 4.85 in "joy", 4.24 in "fondness", and 3.55 in "relief" while the other seven emotion types were below 2.00 (Figure 3).

We discovered some rules for emoticons that contain plural emotion types. For example, emoticons that are scored highly for "joy" tend to be scored highly for "fondness" and "relief" at the same time and receive low points for "anger", "sadness", "fear", and "dislike". When emoticons are scored highly for "sadness", they often also score highly for "dislike" and "fear" and receive low points for "fondness", "joy", and "relief". These characteristics indicate that some emotion types are polarized.

From Table I, three emotion types ("joy", "liking/fondness", and "relief") scored extremely high positive correlations (r=0.989: "joy" and "liking/fondness", r=0.975: "joy" and "relief", r=0.971: "liking/fondness" and "relief") and high negative correlations with "anger" and "fear". "Fear" scored a relatively high positive correlation to "dislike". However, we could not confirm statistical significance under 5.00% from "fear" and "dislike" against other emotion types at the same time.

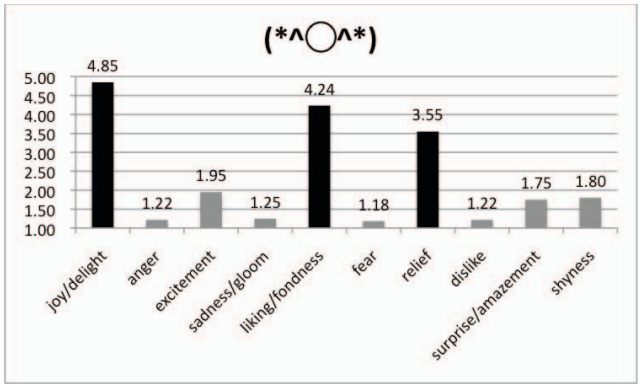


Figure 3. Example of average rated values for an emoticon

The overall results show that these three emotions, "joy", "liking/fondness", and "relief" are relatively close to each other. "Fear", "dislike", and "sadness/gloom" also demonstrated closeness to each other and appeared as the opposite emotion types from "joy", "liking/fondness", and "relief". "Excitement" showed a positive correlation with "anger", "fear", and "surprise/amazement"(r=0.563: "excitement" and "anger", r=0.575; "excitement" and "fear", r=0.617; "excitement" and "surprise/amazement"). "Excitement" can be defined as an emotional feeling with an association to other feelings. For example, the emotion from this sentence, "I got violently angry

when he spilled tea on me", can be analyzed as "anger" (from "angry" in the sentence) and "excitement" (from "violently" in the sentence) follows this emotion.

The 59 emoticons we used for the database were unequally balanced as there were no emoticons that scored highly against "excitement" and "fear". There were only a few emoticons that scored highly against "anger", "surprise/amazement", and "relief" (Figure 4). We believe that this emoticon database will be more reliable after we collect more emoticons. Adding new emoticons not only formed by symbols inside "()" that reflect a facial expression, but also using symbols outside of "()" that reflect gestures, to the database will help the system to recommend more appropriate emoticons to users. The expansion of the emoticon database would also add detail to the range of emotional expression available to users, making it a good starting point for further research into the relationships between emotions. This emoticon database was created manually for this research, however, we plan to implement it as a website that automatically calculates the rating of the emoticons from the input of volunteers through the Internet.

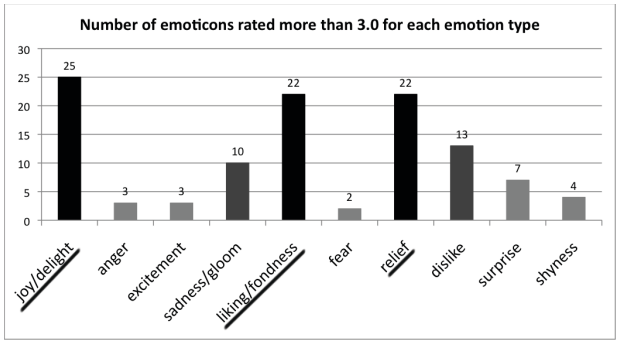


Figure 4. Number of emoticons rated more than 3.0 for each emotion type

V. Evaluation Experiment

Comparative experiments were performed to confirm that the proposed emoticon recommendation system is superior to the current system, which recommends emoticons from users' chosen emoticons in the past. This system can be seen on iPhone[4]'s Japanese keyboard (Figure 5). By touching "あ(a)"," か (ka)"," さ (sa)"," た (ta)"," な (na)"," は (ha)"," ま (ma)"," や (ya)"," ら(ra)", and "わ(wa)" buttons, users can type Japanese letters. The bottom left button which is circled on the left side of the figure is an emoticon button. When the user touches the emoticon button, a sequence of emoticons appears. Emoticons are ordered according to the users' chosen emoticons in the past. In order to coordinate the proposed system and interface, we independently developed a system using the same method as the current system used on the iPhone. The experiment was performed for 10 days from 22nd Oct 2012 to 31st Oct 2012 with the cooperation of 20 Japanese undergraduate and masters students. The students consisted of 8 men and 12 women; 10 students each belonged to liberal arts courses and science courses.

[4] iPhone is a registered trademark of Apple Inc.

The experiment employed the semantic differential (SD) scale for the evaluation of the system. We also measured the length of time the participants took to choose each emoticon.

A. Semantic Differential Scale

The SD scale created by Osgood et al. [9] is one of the most frequently used procedures for investigating users' perceptions of a system. In this method, the subject's perception of the system is quantified on a 7-point scale. Twenty-three image word pairs were selected for the experiment (Table II).

TABLE II. 23-IMAGE WORD PAIRS

23-image word pairs	
Unenjoyable	Enjoyable
Boring	Fun
Disappointing	Amusing
Unfriendly	Friendly
Not interested	Interested
Unpleasant	Pleasant
Uncomfortable	Comfortable
Common	New
Inferior	Superior
Useless	Useful
Ordinary	Special
Slow	Fast
Lazy	Quick
Heavy	Light
Difficult to choose	Easy to choose
Inconvenient	Convenient
Limited	Freedom
Unreliable	Reliable
Selfish	Caring
Complicated	Simple
Difficult	Easy
Unkind	Kind
Inaccurate	Accurate

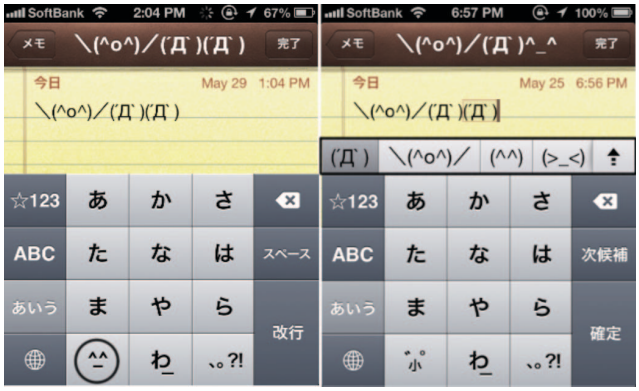


Figure 5. Example of the current method of recommending emoticons

B. Procedure

The procedure of the experiment was as follows:

(1) Respondents were asked to fill out basic information: their grade, sex, faculty, and whether they use emoticons when sending messages daily.

(2) Respondents tested either the proposed system or the current system. The order in which a participant tested the two systems was chosen by random selection in order to examine

the difference between participants using either of these at the beginning.

(3) On a 7-point scale, respondents rated the system by 23 image-word pairs.

(4) Respondents tested the other system.

(5) On 7-point scale, respondents rated the system by 23 image-word pairs.

For each system, participants were given a list of emotive words (in Japanese) and asked to create and input sentences for each word. The list consisted of 15 emotive words selected from the "Emotive Expression Dictionary" [8]. Emotive words were selected as follows:

(1) The top five most used emotive words from each of the 10 emotion types in Google Search[5] which contained only one emotion type. We limited this in order to investigate what kind of emoticons tend to be chosen for each emotion type.

(2) We randomly chose the selected emotive words from three emotion types and created the lists.

C. Time Measurement

We measured the length of time taken by the participants to choose an emoticon for each sentence and examined the time difference between two systems. The timer was set in the system; it starts right after the user inputs the sentence and ends after the user chooses the emoticon and outputs on the display.

VI. Results and Discussions

A. Participants' Perception from SD Scale

We calculated the average of the participants' perceptions from each system using the SD scale (Figure 6). In Figure 5, numbers close to one have the strong impression of the words on the left, whereas those close to seven are better characterized by the words on the right.

Four image-word pairs in the proposed system scored much higher than in the current system: "difficult to choose" - "easy to choose" (1.05 points), "ordinary"- "special" (0.55 points), "inaccurate" - "accurate" (0.55 points), and "unreliable" - "reliable" (0.50 points). However, the current system scored higher than the proposed system in two image-word pairs: "unfriendly" - "friendly" (0.40 points), and "complicated" − "simple" (0.30 points).

From participants' perceptions as recorded by the SD scale, the proposed system is superior to the current system for recommending an emotionally appropriate emoticon to the user. Moreover, the difference in characteristics can be attributed to the unfamiliarity of the proposed system. The participants had never experienced a system which recommends emoticons by the emotions given by the affect analysis system. However, according to the results, participants appeared to feel that the proposed system was unfriendly and complex. Contrary to the current system which makes emoticon recommendations based on users' choices in the past, which makes the system eventually recommend only limited emoticons, it is assumed that users are affected by the complexity and unfriendliness of the drastic change of the recommended emoticons by the emotion types analyzed by ML-Ask. Moreover, it is assumed that users will not choose the emoticons that are recommended at the top of the list if they do not prefer them. Therefore, the emoticon recommendation system needs to be able to correspond to the users' emoticon preferences.

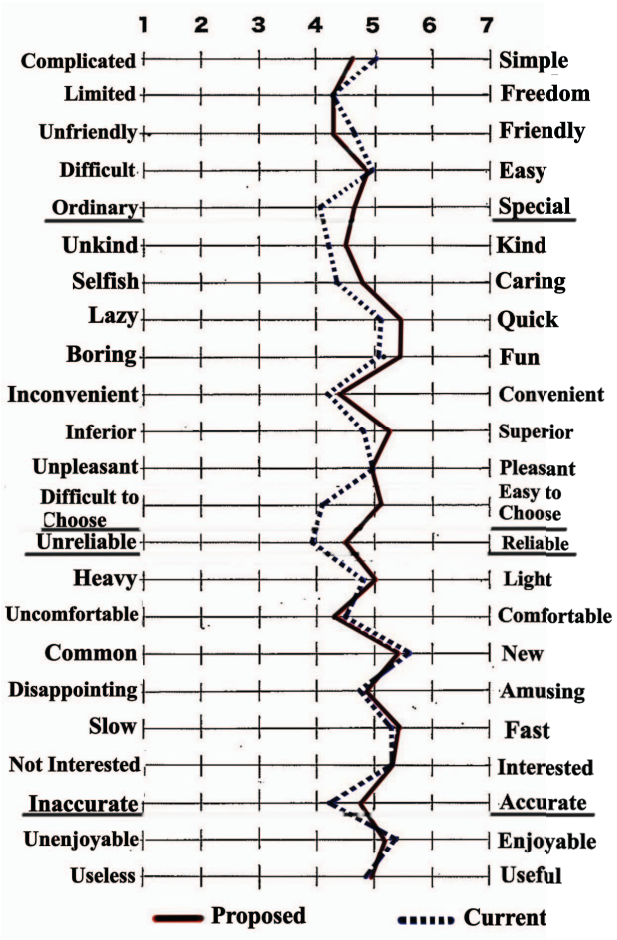


Figure 6. Results of the SD Scale

The averages showed that participants were able to choose emoticons from the proposed system faster than from the current system by 0.40 seconds (current system: 11.97 seconds, proposed system: 11.57 seconds). The difference in averages is not considered to be large, and we can still say that each system has its own advantages. That is, users who only choose specific emoticons have an advantage when using the current system. However, contrary to the current system, the proposed system is useful for users who prefers to choose diverse emoticons and try to express their feelings clearly.

We also examined the results organized by each emotion type alone. We found large differences in four emotion types: "anger", "dislike", "excitement" and "fear". When the participants input sentences that express "anger" and "dislike", they appeared to choose an appropriate emoticon from the proposed system relatively faster than from the current system by 3.66 seconds and 3.82 seconds, respectively. This relates to

[5] http://www.google.com/

the result of the chosen emoticons in that the correct emoticon is among the top 10 recommended emoticons from the proposed system, which helps the participants to choose the emoticon easily.

It appeared to be relatively easier to choose using the current system when participants type sentences that express "excitement" and "fear" by 2.12 seconds and 2.09 seconds, respectively. The chosen emoticons examined in "excitement" showed that the most selected emoticon ranks 23rd in the database and the second most selected ranks 30th, which explains the longer selection time taken by the participants. We believe that we can solve this if we combine the proposed system and the current system together.

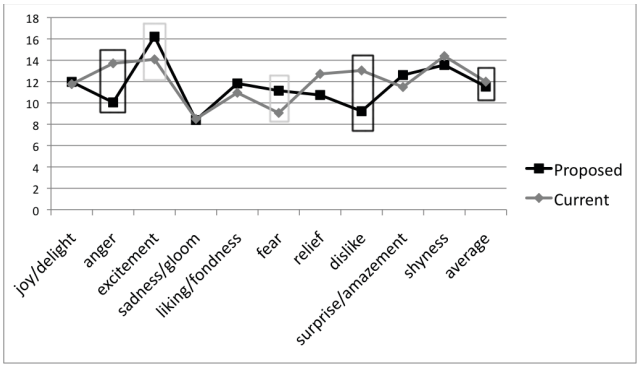


Figure 7. Length of time taken by participants to choose each emoticon

B. The Emoticons Chosen by the Participants

We examined the emoticons chosen by participants from both systems. Figure 8 and Table III show the number of varieties of emoticons that were chosen by the participants from each system. In Figure 9 and Table IV, we can see how many emoticons were chosen from the top 10 in the emoticon database (the database is reordered into each emotion type according to the result from ML-Ask).

In Figure 8, we can see there is no significant difference between the current and proposed system. However, Figure 9 and Table IV showed that 71.3% of the chosen emoticons were among the top 10 in the database when participants used the proposed system, compared to 45.0% achieved by the current system. From this result, we can reasonably state that people are motivated to choose emoticons to express their feelings, and the proposed system can assist them in choosing more suitable emoticons than the current system. We can also consider that participants may procrastinate when choosing emoticons, meaning that they tend to choose an emoticon in the higher-listed options rather than carefully looking for the most appropriate one in the recommendations from the result. The current system may be useful for people who choose a limited variety of emoticons; however, we consider that the system will become more useful and more user-friendly, enabling the user to more easily choose an appropriate emoticon if we integrate the current system and the proposed system.

VII. CONCLUSIONS

In this paper, we presented an emoticon recommendation system based on emoticons numerically categorized by emotions. This emoticon recommendation system analyzes emotions from user-entered sentences by using the affect analysis system ML-Ask and recommends an appropriate emoticon from the originally created emoticon database. Sixty respondents rated 59 emoticons on how well they express each of 10 emotions, and the average points were registered in the database. The results of the experiment showed that 71.3% of the selected emoticons were among the top 10 emoticons recommended by the proposed system. From these results, we have confirmed that people are motivated to choose an emoticon that expresses their emotions. Moreover, the results using the SD scale showed that the proposed system is suitable for users who especially value expressing their feelings in CMC, while the current system is suitable for users who tend to stick with a limited number of emoticons.

Our future work will be to integrate the proposed system and the current system in order to make the system more useful to a wide range of users. Moreover, methods for learning which kinds of emoticons are preferred for which words and learning users' preferences regarding emoticons are necessary. Expansion of the emoticon database is also required. More emoticons in the database will be helpful for discovering the types of symbols that articulate each emotion type, and in order to create a system to generate emoticons suitable to the user input.

At present, the system only works on terminal emulators such as Terminal in Mac OS X[6]. However, because using a system via a terminal emulator is uncommon in the general public, and smartphone users are significantly increasing in recent years, we will develop an application for smartphone users and investigate how the system appeals to such users. Moreover, we plan to make the proposed method open source for developers, so that anyone can build in any kind of communicative interface and enhance their own input methods using these emoticon recommendation systems.

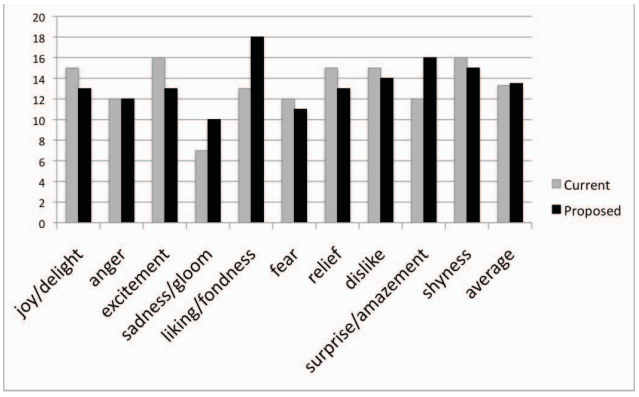


Figure 8. The number of the varieties of chosen emoticons from each system

[6] OS X is a registered trademark of Apple Inc.

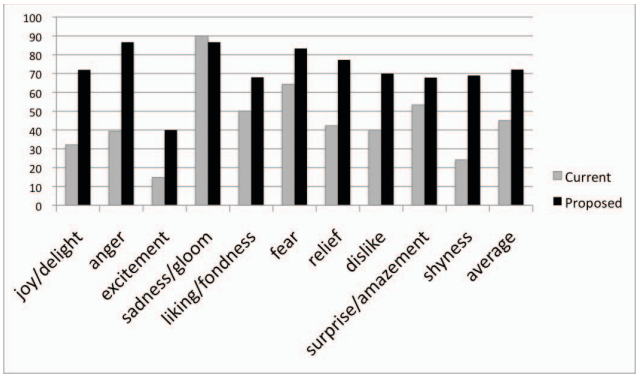


Figure 9. The percentage of chosen emoticon ranked top 10 in the database

TABLE III. THE NUMBER OF THE VARIETIES OF CHOSEN EMOTICONS FROM EACH SYSTEM

The number of the varieties of chosen emoticons from each system		
Emotion	***Current***	***Proposed***
joy/delight	15	13
anger	12	12
excitement	16	13
sadness/gloom	7	10
liking/fondness	13	18
fear	12	11
relief	15	13
dislike	15	14
surprise/amazement	12	16
shyness	16	15
Average	13.3	13.5

TABLE IV. THE PERCENTAGE OF CHOSEN EMOTICON RANKED TOP 10 IN THE DATABASE

The percentage of chosen emoticon ranked top 10 in the database		
Emotion	***Current***	***Proposed***
joy/delight	32.1	72.0
anger	39.2	86.7
excitement	14.8	40.0
sadness/gloom	90.0	86.7
liking/fondness	50.0	64.0
fear	64.3	83.3
relief	42.3	77.3
dislike	40.0	70.0
surprise/amazement	53.3	64.3
shyness	24.1	69.0
Average	45.0	71.3

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