Emotion Teaching Interfaces Using Emoticons and Emojis for Finger Braille Emotion Teaching System

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Abstract. Some deafblind persons utilize Finger Braille, a communication medium using tactile sense, to communicate each other. Deafblind persons can communicate words, if they are trained in Finger Braille, and also communicate varied emotions by Finger Braille. In this work, the emojis and emoticons were applied to the emotion teaching interfaces in order to develop Finger Braille emotion teaching system. Two novel emojis for joy, anger and sadness were selected, respectively. The best depicted emoticons for joy, anger and sadness were also selected, respectively. Then we designed six emotion teaching interfaces with the emojis and three ones with the emoticons. We conducted the evaluation experiment which evaluate the associable emotion teaching interfaces for joy, anger and sadness, respectively. As a result, the emojis Anger D and Sadness D were associated the best with anger and sadness, respectively; the emoticon Joy 1 was associated the best with joy.

1. Introduction

Verbal communication is a large barrier for deafblind persons. Many kind of media of communication are utilized by deafblind persons, determined by their available vision, hearing abilities and other senses. Deafblind persons commonly use tactile sense for communication because tactile sense is their available sense. Some deafblind persons utilize Finger Braille, a communication medium using tactile sense. The aspects of Finger Braille are pictured in Figure 1. Figure 1 left shows two-handed Finger Braille. Braille code (words) are dotted on the index finger, middle finger and ring finger of the receiver by the sender just like typing on a Braillewriter. The receiver is willing to interpret the dotted Braille code. Figure 1 right shows one-handed Finger Braille. First, the left column of Braille code is dotted on the distal interphalangeal (DIP) joints of the index, middle and ring fingers of the receiver, and then the right column is dotted on the proximal interphalangeal (PIP) joints. Deafblind persons can communicate words, if they are trained in Finger Braille, and also communicate varied emotions by Finger Braille [1]. There is the prosody of Finger Braille and it helps the receiver recognize the emotions expressed by sender and syntactic structure of the dotted words. Deafblind people usually communicate with the assistance of interpreters of Finger Braille, because most of the non-disabled people aren’t trained.

Finger Braille teaching systems have been developing on the tablet PCs (Microsoft Windows devices), tablets and smartphones (Android devices) [2]–[5]. The aspect of communication using the Finger Braille teaching system is shown in Figure 2. A speech of the non-disabled sender is recognized and converted to the Braille code. Dot patterns of the Braille code are displayed on a teaching interface. The non-disabled sender is able to dot Finger Braille on the deafblind receiver’s
fingers by looking at the teaching interface. Therefore both deafblind receiver and non-disabled sender are able to communicate using conventional Finger Braille without the interpreters.

![Figure 1. Aspects of Finger Braille. (left is two-handed and right is one-handed)](image)

**Figure 1.** Aspects of Finger Braille. (left is two-handed and right is one-handed)

Emotional communication is another barrier for deafblind persons. Emotion is an important factor of communication. We intend to assist emotional communication using Finger Braille emotion teaching system. The emotion teaching system intends to recognize the emotions spoken by the non-disabled sender and teach the way of emotional dotting of Finger Braille. The emotion teaching sentences for neutral, joy, anger and sadness were previously developed [6]. The following were the emotion teaching sentences.

Neutral: Dot slowly and politely in a steady rhythm.

Joy: Dot rhythmically.

Anger: Dot a little quickly and strongly.

Sadness: Dot slowly and weakly.

Additionally, emotion teaching interfaces were designed by changing of their dot patterns and background colors [7], [8]. Our design concepts are the following: (1) “the short and long dot patterns can be associated with short and long durations of dotting, respectively;” (2) “the narrow and wide dot patterns can be associated with weak and strong dotting, respectively;” (3) “the background color of the emotion teaching interface can be associated with the specified emotion.”

Emoticons are strings of one-byte characters to depict certain emotions. Emoticons are popularized in short messaging service (SMS), e-mail and chat. Recently emojis spread among people all over the world. Emojis are two-byte pictograms and originally used on Japanese mobile phones. Because emojis and emoticons can be associated with the specified emotions, we have to apply them to the emotion teaching interfaces.

It is our goal to develop the emotion teaching interfaces that assist expressing emotions. In this work, the emojis and emoticons were applied to the emotion teaching interfaces. Then, we conducted an evaluation experiment which evaluate the associable emotion teaching interfaces.

2. Design of emotion teaching interface

The emotion teaching interfaces were designed in our previous studies [7], [8]. The emotion teaching interfaces using the combinations of the dot patterns and background colors are shown in the Figure 3.
Joy: The dot pattern is small circle and the background color is yellow.
Anger: The dot pattern is large circle and the background color is red.
Sadness: The dot pattern is long and narrow and the background color is blue.

Previous (without emotion): The dot pattern is middle circle and the background color is beige.

Figure 3. The emotion teaching interfaces using the combinations of the dot patterns and background colors. The displayed sentence is “Rain has fallen” (“Ame / futte / kita”).

The emoticons and emojis were also applied to the emotion teaching interfaces in our previous research [9]. First, two emoticons which were the best depicted emoticons and the second well depicted ones for joy, anger and sadness were selected, respectively [10]. Second, an emoji for sadness and two emojis for joy and anger were selected, respectively [11]. The emojis were facial expressions and designed by KDDI Corporation with approximately 30% market share for Japanese cellular phones. The emoji of neutral was also selected, and the emojis were switched between neutral and each emotion at intervals of one second, just like an animation. These emojis and emoticons were positioned in the picture boxes of the previous emotion teaching interfaces at the end of sentences and clauses, because people usually placed emojis and emoticons at the end of sentences or clauses in e-mails or SMSs. The subjects’ responses of the evaluation revealed that the emotion teaching interfaces with emoticons could be associated with the concerned emotions better than the ones with emojis. Figure 4 shows the selected emoticons associated with joy, anger and sadness. In the previous study, the emojis were smaller and less visible than the emoticons. Because the emojis were switched between neutral and each emotion per second, the subjects could not associate with the emotions, especially when the subjects focused on the emoji of neutral. The previous teaching interfaces with the emoticons are shown in Figure 5.

Figure 4. The previous selected emoticons associated with joy, anger and sadness.
In the present study, two novel emojis for joy, anger and sadness were selected, respectively [12]. These emojis are simpler and larger than the previous emojis and designed by NTT DOCOMO, Inc. which has approximately 40% share of the market for cellular phones in Japan. The novel selected emojis for joy, anger and sadness are shown in Figure 6. These emojis are positioned in the picture boxes at the end of sentences and clauses without any switching. The novel designed teaching interfaces with the emojis are shown in Figure 7. We developed these interfaces using Visual Basic (ver. 6.0, Microsoft Japan Co., Ltd.).

3. Evaluation experiment

3.1. Methods
An evaluation experiment was carried out. The objective was evaluation about the emotion teaching interfaces which are more associated with joy, anger and sadness, respectively.

The subjects were twelve male and female students at college. All subjects weren’t trained in Finger Braille and had normal vision and hearing ability. At the beginning, the subjects received from a tester the explanation of Finger Braille, the Finger Braille teaching system, assistance for emotional communication and the objective of this experiment. After the tester obtained the subjects’ informed consent, the experiment was started.
In the experiment, the teaching interface without emotion (refer to Figure 3 Previous) was displayed for the subject, and then one teaching interface with the emoji or emoticon (refer to Figures 7 and 5) was displayed. The subject observed the displayed emotion teaching interface and responded one emotion, with which the subject associated, from six emotions (“joy”, “sadness”, “anger”, “surprise”, “disgust”, “fear”, “not available (N/A)”). The tester gave a permission to watch the displayed emotion teaching interface and Previous over and over. After the subject responded the associated emotion, the Previous was displayed again, and then the second emotion teaching interface was displayed by the tester. The subject responded the emotion with which the second emotion teaching interface was associated. The display order of the nine emotion teaching interfaces was predetermined and randomized. After all emotion teaching interfaces were displayed, the subject responded the emotion teaching interfaces which are more associated with joy, anger and sadness, respectively.

A laptop (ProBook 4515s/CT, HP Japan Inc.) was operated by the tester. A 14 inches external liquid crystal display (ThinkVision LT1421, Lenovo Japan Corporation) was positioned in front of the subject and connected to the laptop. The tester displayed the emotion teaching interfaces on the display.

3.2. Results
The rate of response of the associated emotions was illustrated in Figure 8. As a result, the responses of all subjects are that the emoticon Joy 1, the emoji Joy C and the emoji Anger D were associated
with the joy and anger, respectively; the responses of 75% of subjects are that the emoticon Anger 1 and the emoji Sadness D were associated with anger and sadness, respectively.

The rate of response of the assignable emotion teaching interface was illustrated in Figure 9. The responses of 83% of subjects are that the emoticon Joy 1 was associated the best with joy. The responses of 58% of subjects are that the emojis Anger D and Sadness D were associated the best with anger and sadness, respectively. The responses of 42% and 25% of subjects are that the emoticons Anger 1 and Sadness 1 were associated the best with anger and sadness, respectively.

Figure 8. Rate of response of the associated emotions.

3.3. Discussion
According to Kawakami’s research, the emoticons Joy 1, Anger 1 and Sadness 1 expressed the best joy, anger and sadness, respectively [10]. In the present result, the responses of 83%, 42% and 25% of subjects are that the emoticons Joy 1, Anger 1 and Sadness 1 were associated the best with anger and sadness, respectively. These results were similar to Kawakami’s research. It was considered that these emoticons were well associated with joy, anger and sadness.

In the previous study [9], the emojis were smaller and less visible than the emoticons. The previous emojis were switched between neutral and each emotion every one second, then the subjects could not
associate with the concerned emotions. In the present study, the emojis were larger than the previous ones and not switched, then the present emojis were more visible and selected as the associative emotion teaching interfaces for anger and sadness.

Thus, the following are our conclusion about the emotion teaching interfaces which were associated the best with joy, anger and sadness.

Joy: Emoticon Joy 1 and the background color is yellow.
Anger: Emoji Anger D and the background color is red.
Sadness: Emoji Sadness D and the background color is blue.

4. Conclusion
In this paper, the emojis and emoticons were applied to the emotion teaching interfaces in order to develop Finger Braille emotion teaching system. Two novel emojis for joy, anger and sadness were selected, respectively. The best depicted emoticons for joy, anger and sadness were also selected, respectively. Then we designed six emotion teaching interfaces with the emojis and three ones with the emoticons. We conducted the evaluation experiment which evaluate the associative emotion teaching interfaces for joy, anger and sadness, respectively. As a result, the emojis Anger D and Sadness D were associated the best with anger and sadness, respectively; the emoticon Joy 1 was associated the best with joy.

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