

Urgent Information Presentation Using Listed Sign Language

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Abstract. This paper proposes a listed sign language system that combines written expressions in table form with sign language fragments. The system generates urgent video style messages that offer rapid, certain, and easy understanding for environments such as railway carriages. We developed a prototype of the system and conducted an evaluation experiment. The results show that the system improves the level of understanding urgent messages. Participants confirmed that the messages scored highly in terms of ease of understanding, high accuracy, rapid understanding, and sense of security.

1 Introduction

It is an important social issue for minimizing disaster damage that urgent information should be surely and rapidly passed to the public when a disaster such as a large-scale earthquake occurs. For instance, what happened?, where should I take shelter?, what means do I have to move?, etc. Even if the train operation has become disrupted, the announced message may not be heard due to high background noise levels. This may prevent the public from taking the appropriate steps. Voice announcements are completely ineffective for the hearing impaired. In order to support maximum number of people in public spaces, a universal information presentation system that uses sign language in addition to written expressions is needed. However, only a few people understand sign language, and there is individual variation in the proficiency of sign language. Moreover, there is individual variation in the understanding level of written expressions.

This paper proposes a listed sign language system that combines written expressions in table form with sign language fragments. The system generates urgent video style messages that offer rapid, certain, and easy understanding for environments such as railway carriages. We developed a prototype of the system and conducted an evaluation experiment. The results show that the system improves the level of understanding. Participants confirmed that the messages scored highly in terms of ease of understanding, high accuracy, rapid understanding, and sense of security.

2 Message Generation by Listed Sign Language

2.1 Design Concepts of the Listed Sign Language

The listed sign language aims at reducing the impact of personal variation on discernment of alert messages. We aim to achieve an interface that can present an urgent

message easily and promptly. The design concepts of the listed sign language are summarized by the following four points.

- (1) Present written expressions and sign language video images at the same time.
- (2) The written expressions are displayed in table form for conciseness and easy understanding.
- (3) All written expressions are shown from the beginning. As the sign language fragment is shown for each expression, the expression is highlighted in yellow.
- (4) The written expressions and the sign language fragments are displayed on the same screen.

Figure 1 shows the example of a message based on the listed sign language. The written expressions are displayed in table form at the left side of the screen. Sign language movie is arranged at the right side of the screen. The proficiency of sign language and the individual variation concerning the understanding levels of Japanese sentences could be overcome by using listed sign language.



Fig. 1. An example of listed sign language message

2.2 Expression of Sign Language in Fragmented Form

The sign language fragments for the five written expressions in Fig. 1 are shown below. H means the hand is in the home position, and P means a temporary stop. Word inside the parenthesis is sign language expression.

- Title: H < report >< train >< moment >< stop >H
- The second line: H < train >< start >< expectation >P< time >< 17 >< 40 >H
- The third line: H< substitute >< substitute ><method >P< nothing >H
- The fourth line: H< reason >< why >P< shine >< break >H

- The fifth line: H< stop >< section >P< from / to >< HINOKI >P< train >< station >< name >< KEYAKI >< place >< KAEDE >< place >< section >H

The following description is an expression of the same content by the long sentence form.

- H:< HINOKI >< line >< station >< name >< KEYAKI >< station >< from >< KAEDE >< station >< section >< moment >< stop >< reason >< why? >H < MOMIJI >< station >< place >< shine >< break >< train >< start >< expectation >< time >< 17 >< 40 >< moment >H.

3 Experiment 1: Subjective Evaluation

3.1 Participants

In order to verify the effectiveness of the listed sign language, a subjective evaluation was done. Eight messages on train status, generated by the proposed system and the straight sentence equivalents, were presented to 17 subjects who were mostly hearing impaired (used sign language in daily life); their subjective opinions were collected and evaluated.

3.2 Questionnaire

The subjective evaluation examined eight items; Q1. accuracy, Q2. promptness, Q3. ease of understanding, Q4. suitability for emergency use, Q5. sense of security, Q6. sense of incongruity, Q7. irritation, and Q8. efficiency. Each items for the questionnaire were as following.

- Q1: I think that the content of the message is accurately transmitted.
- Q2: I think that the content of the message is promptly transmitted.
- Q3: I think that the content of the message is easily understood.
- Q4: I think that this method of the display is suitable for the presentation of an urgent message.
- Q5: I think that there is a sense of security in this method of the display.
- Q6: This method of the display has the sense of incongruity.
- Q7: In this method of the display, there is impatience (feeling to get irritated).
- Q8: I think that this method of the display is suitable for seeing both sign language and written sentences.

3.3 Results

Figure 2 shows the results of the evaluation. The participants thought that the listed sign language was superior in terms of "Accuracy", "Promptness", "ease of understanding", and "sense of security";. The difference was significant at the 1% level as confirmed by ANOVA. In addition, it was found that the listed sign language was highly rated for the presentation of urgent messages. The long sentences created more irritation and incongruity. Five participants were queried as to their understanding of the messages. Their average correct answer rates were 0.95 for the listed sign language messages and 0.80 for the long sentence messages. Therefore, the listed sign language messages could be well understood.

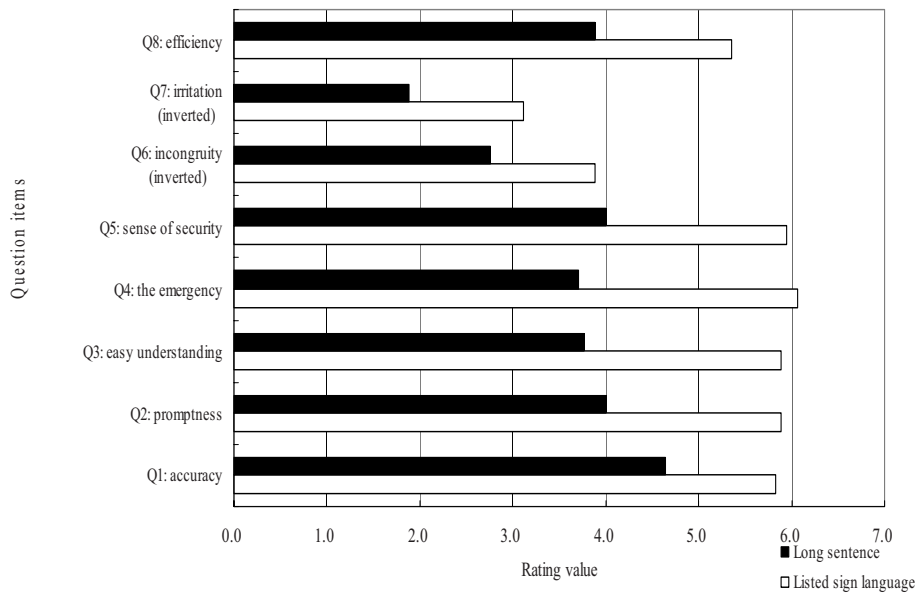


Fig. 2. Results of the subjective evaluation by 17 participants

4 Experiment 2: Performance Evaluation

4.1 Participants

In order to verify the performance of the listed sign language, an evaluation experiment was done. Five subjects from 26 to 45 years old participated in Experiment A. All of them were hearing impaired and used sign language in daily life.

4.2 Procedure

Vehicle operation information was presented by using sign language (real video)

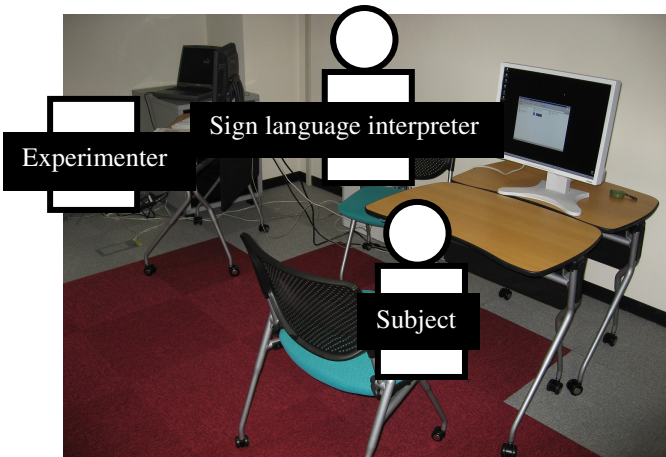


Fig. 3. Configuration of experimental apparatus

and Japanese sentences for the subjects. Afterwards, the recognizing tests concerning the vehicle operation information was done. The subjects read the experimental message displayed on the PC screen set up on the desk in the laboratory, and answered the question presented immediately after the message display. Read out time of the displayed message and the correct answer rate of the recognizing test

were measured. The subjects were made to assume the situation that the train stopped suddenly and the message was displayed on the screen in the train. Figure 3 shows a configuration of experimental apparatus. Figure 4 shows a screen example of performance test.

4.3 Results

(1)Time to read message

Results of the performance test are shown in figure 5. Figure 5 shows an average read time rate for each display format. Read time rate is defined as equation 1. As shown in figure 5, the read time rate was 1.39 in the list sign language and 0.83 in the long sentences form. Read time rate for the listed sign language form is higher than the long sentence form. Significant difference was detected between two forms($f(1, 38) = 18.84, p = 0.00 < 0.001$) with ANOVA.

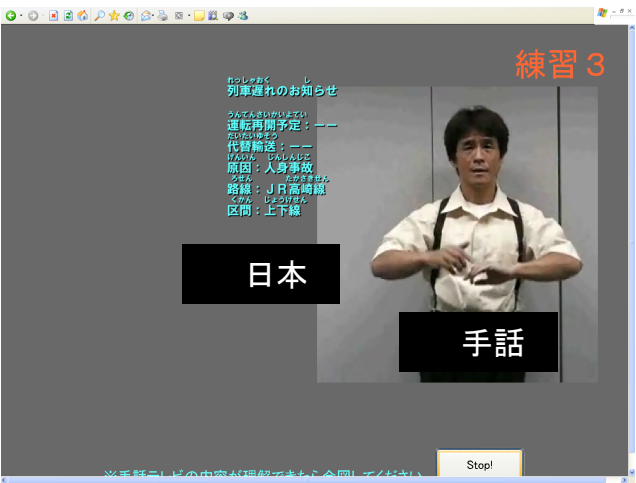


Fig. 4. Screen example of performance test

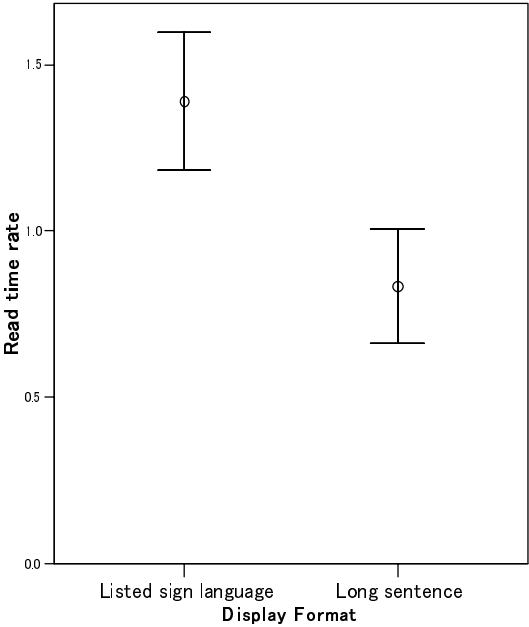


Fig. 5. Average time rate for message reading

(2) Correct answer rate of message understanding

Figure 6 shows the average correct answer rate of message understanding for each display format. As shown in figure 6, the average correct answer rate was 0.95 in the Listed Sign Language form and 0.80 in the Long Sentence Form. The result reveals that the subjects could be able surely to understand the content of the message with the List Sign Language Form rather than the Long Sentence form. However, no significant differences($f(1, 38) = 2.06, p = 0.16 > 0.05$) were detected between two forms.

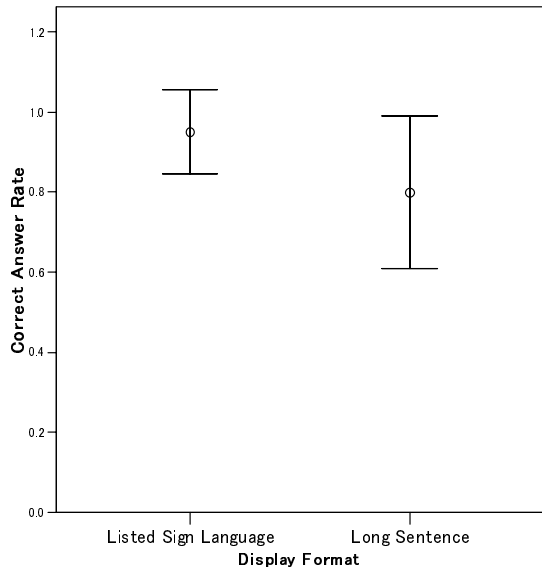


Fig. 6. Correct answer rate of message understanding

5 Conclusion

In this paper, we propose a listed sign language system that combines written expressions in table form with sign language fragments. The system generates urgent video style messages that offer rapid, certain, and easy understanding for environments such as railway carriages. We developed a prototype of the system and conducted an evaluation experiment. The results show that the system improves the level of understanding. Participants confirmed that the messages scored highly in terms of ease of understanding, high accuracy, rapid understanding, and sense of security.

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