Comparison of Multisensory Display Rules in Expressing Complex Emotions between Cultures

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Abstract

Previous studies have suggested that there are cultural differences in display rules and decoding rules of the emotions. In this study, we examined the cultural differences in the multisensory display rules of the six basic emotions (happiness, anger, disgust, sadness, fear, and surprise) and the six complex emotions (interest, contempt, embarrassment, shame, guilt, and envy) between Japanese and Dutch. In the experiment, we used the six kinds of faces and voices showing the six basic emotions. Japanese and Dutch participants were asked to create audiovisual movies expressing each of twelve emotions by combining one of the six faces and one of the six voices. Our results showed cultural differences in expressing complex emotions. Specifically, there are two ways to express complex emotion by combining a face and voice showing the basic emotions: connection or substitution. Japanese participants tend to use the way of connection and combine the face and voice showing different emotions. On the other hand, Dutch participants tend to use the way of substitution and combine the face and voice showing the same basic emotions. Our findings indicate differential display rules and decoding rules between cultures in expressing complex emotions.

Index Terms: facial expression, vocal expression, complex emotions, display rules

1. Introduction

In everyday life, we human perceive the emotions of others and express the emotions of one’s own according to the situation. There are many different emotions in human communication ranging from the basic emotions like happiness and anger to complex emotions like envy and guilt. A previous study suggests that at least six emotions (happiness, anger, disgust, sadness, fear, and surprise) are basic because these emotions are identified distinctively from their characteristic facial expressions in all human cultures [1]. Whereas the six emotions are assumed to be universal, it has been shown that there are cultural differences in display rules as well as decoding rules of the emotions [2-4]. Hence, it is important to examine the expression and perception of many kinds of emotions including both basic and complex emotions and its cultural differences.

Studies of the concept of the emotions have propounded the theories of the relation between the basic emotions and complex emotions [5-10]. Several studies have proposed that the complex, non-basic emotions are produced by connecting some of the basic emotions. For example, Plutchik [9] suggested that connecting two or more basic emotions produced a new, complex emotion that may be quite different from original basic emotions. To take a simple example, the emotion remorse is produced by connecting sadness and disgust. Izard [6] also suggested that connecting some basic emotions produce a new, complex emotion and it retains the original qualities of the basic emotions. For instance, connecting fear with two or more basic emotions produce shame or guilt. These studies indicated that there is a relation between the basic emotions and complex emotions at conceptual level. Mixed emotions are similar to, but different from complex emotions. Mixed emotions indicate that expressing more than one emotions at the same time. For instance, people feel happy and sad at the same time at graduation ceremony. Thus people can feel positive emotion and negative emotion simultaneously [11, 12]. However, complex emotions are not necessarily the same as the mixed emotions. In this study, we focused on complex emotions.

In behavioral level, mixed expressions were frequently displayed in everyday life. Mixed expressions in the face have been examined by using morphed face [13], blends face [14], and hybrids face [15]. Mixed expressions might also be expressed by a combination of a face and a voice. de Gelder and Vroomen [16] examined how people perceive two different basic emotions expressed in the face and voice. They conducted experiments in which participants were asked to judge the emotion of congruent and incongruent face-voice combinations showing two opposing emotions (happiness and sadness) on a two-alternative, forced-choice task. de Gelder and Vroomen [16] found that accuracy of emotion judgment was higher for congruent face-voice combinations than that for incongruent face-voice combinations. That is, though participants understood that they should ignore the affective
information from a certain modality, the emotion judgment was impaired by the affective information from other modality. Furthermore, Tanaka et al. [17] conducted similar experiment and revealed that there are cultural differences between Japanese and Dutch in how multiple sources of affective information are combined in emotion perception. In their experiment, congruent and incongruent face-voice stimuli showing two opposing emotions (happiness and anger) were presented. The result revealed that Japanese are more attuned than Dutch to vocal processing in the multisensory perception of emotions. That is, there are cultural differences in audiovisual integration between Japanese and Dutch. However, it is not yet clear whether complex emotions are produced by connecting the basic emotions expressed by face and voice and whether there are cultural differences in the way of connecting the basic emotions to express complex emotions.

In the present study, we focused on the display rules of complex emotions and its cultural differences. The purpose of this study is to examine cultural differences in multisensory display rules when complex emotions are expressed. For this purpose, we conducted an experiment in which participants freely create audiovisual movies expressing complex emotions by combining a face and voice showing the basic emotion. In addition to complex emotions, we examined the expressions of the basic six emotions to check the validity of the methodology we employed in our experiment and compare the differences of the expressions between the basic and complex emotions.

2. Materials and Methods

2.1. Participants

Twenty-two native speakers of Japanese living in Japan (age: 19 - 47) and twenty-three native speakers of Dutch living in The Netherlands (age: 18 - 42) participated in the experiment. All participants had normal or corrected-to-normal visual acuity. The study was approved by the local ethics and all participants gave their written informed consent prior to inclusion in the study.

2.2. Stimuli

We selected four Japanese (2 male and 2 female) and four Dutch (2 male and 2 female) speaker’s emotional utterances from a set of audiovisual stimuli [18]. Speakers uttered two short phrases with neutral meanings in each native language, Japanese or Dutch. Two short phrases means “What’s going on?” and “Is that so?” in their languages. Each phrase was uttered with the basic six emotions (happiness, anger, sadness, disgust, fear, and surprise). The mean accuracies of Japanese stimuli in emotion judgment for each emotion were shown as follows: happiness (face 98.64%; voice 61.62%), anger (face 80.27%; voice 64.35%), sadness (face 69.69%; voice 62.37%), disgust (face 73.02%; voice 49.30%), surprise (face 83.67%; voice 80.03%), and fear (face 21.31%; voice 32.83%). The mean accuracies of Dutch stimuli in emotion judgment for each emotion were shown as follows: happiness (face 97.82%; voice 28.22%), anger (face 94.61%; voice 79.53%), sadness (face 89.01%; voice 80.05%), disgust (face 70.65%; voice 31.50%), surprise (face 84.87%; voice 60.94%), and fear (face 68.28%; voice 58.86%). We used these six faces and six voices of these audiovisual stimuli for each culture as stimuli in the experiment.

2.3. Procedure

The experiment was conducted individually in a quiet experimental room. In the experiment, Japanese and Dutch participants were asked to create audiovisual movies expressing each of twelve emotions (the six basic emotions and the six complex emotions) by combining one of the six faces and one of the six voices. The faces and voices by Japanese actors were used for Japanese participants, and the faces and voices by Dutch actors were used for Dutch participants.

Figure 1 shows the sample display used in the experiment to create audiovisual movies. In this case, participants create audiovisual movie expressing interest. The phrase by actor was presented on the top of the display with the label of the indicated emotion. On the display, the six kinds of face icons were presented in the left side and the six kinds of voice icons were presented in the right side. Each silent face movie and voice sound was played by clicking the “Play movie” or “Play sound” button after choosing a face or voice with radio button under each icon. The six silent face movies and six voice sounds expressed any one of the six basic emotions. The labels of emotions expressed in each silent movie or voice sound were not informed to participants because it prevented participants from being dependent on the label of emotions for combining a face and voice. The participants could play face movies and voice sounds as many times as they want. After choosing a face and a voice with radio button, the audiovisual movie combined the face and voice was played by clicking the “mix” button. The participants could also try to combine faces and voices as many times as they want. When the participants decided the best combination, they entered the face and voice combination into the text box in the center of the display. Then, pressing the “Next” button, the display changed to that for next trial. There were 96 trials (4 (models) × 2 (sentences) × 12 (emotions)). The experiment took from 45 min to 75 min.

Figure 1: Sample display used in the experiment to create audiovisual movies. In this case, participants asked to create audiovisual movie expressing interest by combining one of the face movie and one of the voice sound.
3. Results

In the present study, we examined the cultural differences in multisensory display rules of the six basic emotions (happiness, anger, sadness, disgust, fear, surprise) and the six complex emotions (interest, contempt, embarrassment, shame, guilt, and envy) between Japanese and Dutch people. The cultural differences of the expressions based on similarities of the combinations among these twelve emotions were also examined. We describe the results according to these purposes in the following sections.

3.1. Patterns of multisensory display rules between cultures

3.1.1. Expressions of the basic emotions

First, we examined the expression of the basic emotions to check the validity of the methodology we employed in our experiments and compared with the expressions of complex emotions. We counted the combinatorial number according to the pair of emotions by the face and voice.

The most frequent combinations of emotions by the face and voice in expressing the six basic emotions were shown in Table 1. In Table 1, the combinations by Japanese participants were shown in bold letter, and the combinations by Dutch participants were shown in italic letter. Table 1 shows that Japanese participants combined a face and voice showing the same emotion as the emotion indicated on the top of the display. Dutch participants also combined a face and voice showing the same emotion as the emotion indicated on the top of the display except for happiness. To compare these patterns between Japanese and Dutch participants, we calculated the proportions of the combination of a face with a voice showing the same emotion. The proportion in Japanese was 58.7% and that in Dutch was 60.7%. The equality of proportions test showed that the difference of proportions between cultures is not significant (z = 0.96, n.s.).

Table 1. Most frequent combinations in the expressions of basic emotions. Proportions of the combinations were shown in parentheses

(Bold letter: Japanese, Italic letter: Dutch)

<table>
<thead>
<tr>
<th></th>
<th>Voice</th>
<th>Happy</th>
<th>Sad</th>
<th>Dis</th>
<th>Ang</th>
<th>Sur</th>
<th>Fear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Happy</td>
<td></td>
<td>75.6%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sad</td>
<td></td>
<td>75.6%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dis</td>
<td></td>
<td></td>
<td>67.6%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ang</td>
<td></td>
<td></td>
<td></td>
<td>69.4%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sur</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>62.2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fear</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>67.3%</td>
<td></td>
</tr>
</tbody>
</table>

3.2. Cluster Analysis based on the similarities of emotions of a face and voice

In the previous section, we examined the cultural differences in the patterns of multisensory display rules in terms of the most frequent combination of the face and voice. Here, we examined the similarities of the expressions among twelve emotions in terms of facial expressions and vocal expressions in the combinations.

We conducted cluster analysis to classify twelve emotions based on the similarities of facial expressions and vocal expressions selected for each modality. For example, if the combination in which the face expressed happiness and the voice expressed surprise was frequent for the audiovisual movies expressing for surprise and interest, the expression of the basic emotion “surprise” and the complex emotion “interest” may be similar to each other. Ward’s method was used to calculate the cluster solution. The dendrogram for each culture suggested five-cluster solutions to be suitable. Figure 2 reflected a dendrogram for Japanese participants corresponding to the clustering solution. Figure 3 reflected a dendrogram for Dutch participants corresponding to the clustering solution. Dot line boxes on Figure 2 and Figure 3 mean each cluster. Figure 2 shows that the combinations for “surprise” and “interest”, those for “shame”, “sadness” and “guilt”, those for “fear” and “embarrassment”, and those for “anger”, “disgust”, “contempt” and “envy” were grouped into the same cluster in Japanese participants. Figure 3 shows that the combinations for “fear” and “guilt”, those for “sadness”, “embarrassment” and “shame”, those for “surprise” and “interest”, and those for “happiness”, “disgust”, “contempt” and “envy” were grouped into the same cluster in Dutch participants.

Japanese participants combined a face and a voice showing the same emotion in only three of the six complex emotions. However, Dutch participants combined a face and voice expressing the same emotions for all of the six complex emotions. Then, the proportions of the combination of a face and a voice showing the same emotion were calculated. The proportion in Japanese was 33.9% and that in Dutch was 39.1%. The equality of proportions test showed that there is significance between cultures (z = 2.53, p < .05). The proportion of the combination of a face with a voice showing the same emotion in Dutch participants was higher than that in Japanese participants when the indicated emotions were complex emotions.

Table 2. Most frequent combinations in the expressions of complex emotions. Proportions of the combinations were shown in parentheses

(Bold letter: Japanese, Italic letter: Dutch)
The present study examined the cultural differences in multisensory display rules of the six basic emotions and the six complex emotions. We conducted experiments in which Japanese and Dutch participants create the audiovisual movies expressing twelve emotions by combining a face and voice showing the six basic emotions. Our result revealed that both Japanese and Dutch participants combine a face and voice showing the same emotion in expressing the six basic emotions. However, in expressing the six complex emotions, there are cultural differences in the pattern of combinations. In expressing complex emotions, Japanese participants tend to combine a face and voice showing different emotions whereas Dutch participants tend to combine a face and voice showing the same emotions.

4.1. Pattern of multisensory display rules

As shown in Table 1, to express the basic emotions, Japanese participants combined a face and voice showing the same emotion as the indicated emotion in creating audiovisual movie. The results in Dutch participants showed the same pattern except for happiness. The proportions of the combinations showing the same emotions were different between cultures. These findings showed that both Japanese and Dutch participants combine a face and voice showing the same emotion in expressing the six basic emotions.

As shown in Table 2, in expressing complex emotions, the patterns of the combinations had a little in common between cultures. Both Japanese and Dutch participants combined angry face and angry voice to express envy, and combined surprise face and surprise voice to express interest. However, the patterns of the combinations were different between cultures to express contempt, embarrassment, guilt and shame. In expressing these complex emotions, Japanese participants tend to combine a face and voice showing the same emotion whereas Dutch participants tend to combine a face and voice showing the same emotion. The proportions of the combinations showing the same emotions in Dutch were higher than that in Japanese. Therefore, there were cultural differences in expressing complex emotions. Such cultural differences may reflect the differences in expressing the various aspects of complex emotions. For example, in expressing contempt, Japanese participants combined an angry face and disgust voice whereas Dutch participants combined a happy face and voice. Plutchik [9] suggested that the complex emotion “contempt” is composed of the basic emotion “anger” and “disgust”. Izard [6] also suggested that the complex emotion “contempt” is close to the basic emotion “anger” and “disgust”. Ekman and Friesen [19] showed a similar view of “contempt” as disapproving of someone simultaneously with feeling morally superior to someone. The feeling morally superior to someone is similar to happiness. That is, one complex emotion has the various aspects composed of some basic or complex emotions. Our results might suggest that Japanese participants expressed “contempt” by connecting “anger” and “disgust” and these basic emotions was dispersively expressed using different modalities. On the other hand, Dutch participants substituted “happiness” for “contempt” and emphasized one of the aspects of “contempt” by using the face and voice showing the same emotion “happiness”. That is, there are two ways for expressing complex emotions: connecting different basic emotions or substituting one of the basic emotions for complex emotion. It is assumed that which one is used is different between cultures to express certain complex emotion.

Note that Dutch participants most frequently combined happy face with surprise voice to express happiness (See Table 1). It can be explained by the fact that Dutch tend to confuse happy voice with surprise voice in the emotion judgment of vocal expression [20]. The experiment by Takagi et al. [20] used the same voice stimuli as the current study. Dutch participants might intend to combine happy face and happy voice to express happiness even in this case though they combined happy face and surprise voice.

In this experiment, we examined the expressions of the basic emotions in addition to complex emotions. One of the reasons for this is to check the validity of the methodology we employed in our experiment. For the purpose of this study, we conducted the experiment in which participants freely combine a face and voice to create the audiovisual movie expressing the indicated emotions. We assumed that this methodology solved the response bias in the six-alternative forced-choice task because participants have more choices than six choices. In our experiment, participants can have a maximum of thirty-six choices (6 faces × 6 voices). However, it is not well understood whether participants figure out the method for approaching their experimental task. Our result of the basic six emotions revealed that both Japanese and Dutch participants combined a face and voice showing the same emotion as the indicated emotion in creating audiovisual movie expressing the basic emotions (See Table 1). Participants selected the same emotions as indicated emotions appropriately even though the labels of emotions expressed by the face and voice.
were not informed. The participants figured out the methodology of our experiments. This result means that the methodology we employed in our experiment has the validity to examine the display rules.

In summary, in the case of expressing complex emotions by faces and voices, there are cultural differences. Specifically, Japanese express complex emotions by connecting some of the basic emotions using face and voice dispersively. On the other hand, Dutch substituted one basic emotion closed to intended complex emotion for complex emotion using a face and voice showing the same single basic emotion. One reason for this might be that Japanese are more attuned than Dutch to vocal processing in the multisensory perception of emotion [26]. Therefore, it is likely that Japanese try to express the various aspects of intended complex emotion using a face and voice showing different emotions.

4.2. Similarities of the expression by face and voice among emotions

The cluster analysis was conducted to examine the expressions of emotions based on the similarities of facial expressions and vocal expressions in the combination. The result demonstrated culture-general as well as culture-specific patterns between Japanese and Dutch.

One of culture-general pattern is that the complex emotion “interest” and the basic emotion “surprise” were grouped into the same cluster. That is, the combinations expressing these emotions are similar to each other both in Japanese and Dutch participants. Table 1 and 2 also showed that the most frequent combination to express interest and surprise is the combination of surprise face and surprise voice. Therefore, the cultural-general pattern in terms of the most frequent combination was supported by the result of cluster analysis. These findings suggest that when we judge these emotions from the expression by face and voice in cross-cultural communication, a misunderstanding may rarely occur because how to express these emotions by face and voice is similar between cultures.

One of culture-specific pattern is that the complex emotion “contempt” and “envy” and the basic emotion “anger” were grouped into the same cluster in Japanese participants, whereas these complex emotion and the basic emotion “happiness” were grouped into the same cluster in Dutch participants. That is, the combinations to express these emotions are not similar between cultures. Table 2 also showed that, in expressing contempt, the most frequent combination is the combination of angry face and disgust voice in Japanese participants, and the combination of happy face and voice in Dutch participants. Therefore, the cultural-specific pattern resulted from the most frequent combination was supported by the result of cluster analysis. These findings suggest that, in expressing complex emotions, Japanese connect different basic emotions by using the face and voice showing different emotions whereas Dutch substitute a single one basic emotion for complex emotion by using the face and voice showing the same basic emotion. It is suggest that these culture-specific patterns are one aspect of multisensory display rules. If such cultural differences in multisensory display rules were not revealed, a misunderstanding between cultures may occur. Specifically, even though Dutch show contempt toward Japanese, Japanese may interpret it as happiness or joy. To avoid such misunderstanding, it has been needed to examine the cultural differences in multisensory display rules in expressing other complex emotions.

5. Conclusions

In conclusion, our results indicate differential display rules using the face and voice between cultures. There were cultural differences in expressing complex emotions using face and voice showing the basic emotions. Specifically, our results showed that there are two ways to express complex emotions by combining a face and voice showing the basic emotions: connection or substitution. Japanese tend to combine a face and voice showing different basic emotions because they use the way of connection to express complex emotions. On the other hand, Dutch tend to combine a face and voice showing the same basic emotions because they use the way of substitution. These cultural differences in the way of expressing complex emotions were supported by the results of cluster analysis based on the similarities of face-voice combinations. The results of cluster analysis revealed that the similarities of face-voice combinations to express emotions are different between cultures. These findings are useful to avoid the misunderstanding in cross-cultural communication.

In this study, we focused on how people express complex emotions by a combination of a face and a voice. Apart from these multisensory display rules, another important display rules include social and cultural standards of how and when people express emotions. That is, social context information is an important determinant of display rules [21]. In our experiment, no constraints existed and no social context information was provided that limit the type or quality of the shown expression while participants combined a face and voice. Further research is required to examine display rules extensively by presenting various cover stories about social context information. Another residual problem is that the accuracies of emotion judgment for stimuli used in this study were not the same between Japanese and Dutch stimuli. For example, the accuracies of emotions judgment for Dutch faces were moderately higher than that for Japanese faces [18]. Hence, a part of our findings could be explained by the type of stimuli rather than by the cultural idiosyncrasies of the participants. It is required to control the accuracies of stimuli carefully. After that, it remains to be investigated how other complex emotions are expressed by face and voice using this methodology of our experiment. In this study, we limited the number of complex emotions for convenience of planning of the experiment. We still have more complex emotions which are difficult to interpret with each other in cross-cultural communication. Therefore, further research is required to examine other complex emotions.

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7. References


