Analysis of an Actor's Emotions and Audience's Impression of Facial Expressions

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ABSTRACT

Facial expressions are an important medium of relaying emotions in face-to-face or video communication. In this study, our purpose was to examine whether facial expressions could accurately convey emotions to another person. To prepare facial expression images as stimuli, an amateur actor was instructed to express eight types of emotions via her face. The actor and participants (as audience) evaluated the valence and arousal of each image. We defined the differences between the actor's and audience's evaluation as the degree of disagreement of emotion conveying. There was a significant difference in the degree of disagreement between acquainted and unacquainted people with the actor.

Keywords: Facial expression, Communication, Emotion, Visual impression

INTRODUCTION

Nonverbal information is an important component of all types of communication. According to Mehrabian's study, the face has 55% of the information that people receive, while the voice has 38%, and the verbal content has 8%. Computer-mediated communication technology promotes communication that does not need face-to-face communication (e.g., e-mail). Recently, however, a video communication system that enables face-to-face conversations via a screen is on the rise, and understanding the impressions conveyed by facial expressions is becoming increasingly important.

It is well known that facial expressions as a medium of emotion are universal (Ekman & Friesen, 1971). Fullwood *et al.* (2007) reported that impression formation via video communication makes people each other as perceive less likable and intelligent. Recently, automatic recognition of emotions from facial expressions has been developed using image processing and advanced machine learning technologies (Yang *et al.*, 2018). However, Sato *et al.* (2019) illustrated that Ekman's theory is not suitable for the Japanese population. That is, Ekman's theory is roughly universal, but a gap between the general concept and each case may exist. Therefore, it is necessary to consider facial expressions as a medium of emotion in various situations.

Our purpose was to examine whether facial expressions can accurately convey emotions to another person. First, we prepared bust shots of an actor

Figure 1: Examples of stimulus images. The left is excited, and the right is bored. All photographs are shown without black bars in the actual experiment.

showing facial expressions of instructed emotional keywords. The actor evaluated her own emotions using a Likert scale for valence and arousal. Second, other participants as audience evaluated the actor's emotion by looking at the photographs using the same scales. Finally, we compared the evaluations of the actor and audience to investigate how accurately facial expressions convey emotions. Our study used emotion words as evaluation terms and compared evaluations between audiences acquainted and unacquainted with the actor.

METHODS

In the experiment, we created images of the actor's face corresponding to an emotional keyword and showed them to the participants (audience). The actor was a female volunteer in her 20s. The participants were 15 male and 15 female volunteers in their 20s. Out of these, 15 were acquainted with the actor, and the rest saw the actor for the first time through this experiment.

The actor was instructed to create facial expressions for eight emotions: "surprised," "frustrated," "excited," "guarded," "relaxed," "angry," "fear," and "bored." Stimulus images were bust shots (photographs of the upper body) of the actor creating facial expressions corresponding to the emotions. Examples of the images are shown in Figure 1. After taking the photos, the actor was instructed to evaluate her own emotions in the images using two 10-point Likert scales ranging from displeasure (0) to pleasure (10), and from deactivated (0) to activated (10). Similarly, the audience evaluated the emotions after looking at images on the same two scales. All questionnaires were created using Google Forms and were administered via an online survey.

In the analysis, we assumed that differences in evaluations of the actor and audience indicate gaps in emotions that the actor expressed and the audience felt. We examined the significance of the difference using a two-sided t-test (significance level = 0.05) to investigate the degree of the gap.

RESULTS

Figure 2 shows that while the evaluations by the actor herself (N = 1) and by audience (N = 30) were generally similar, there were significant differences in valence and arousal (p<0.05) for frustrated, guarded, relaxed, angry, fear,
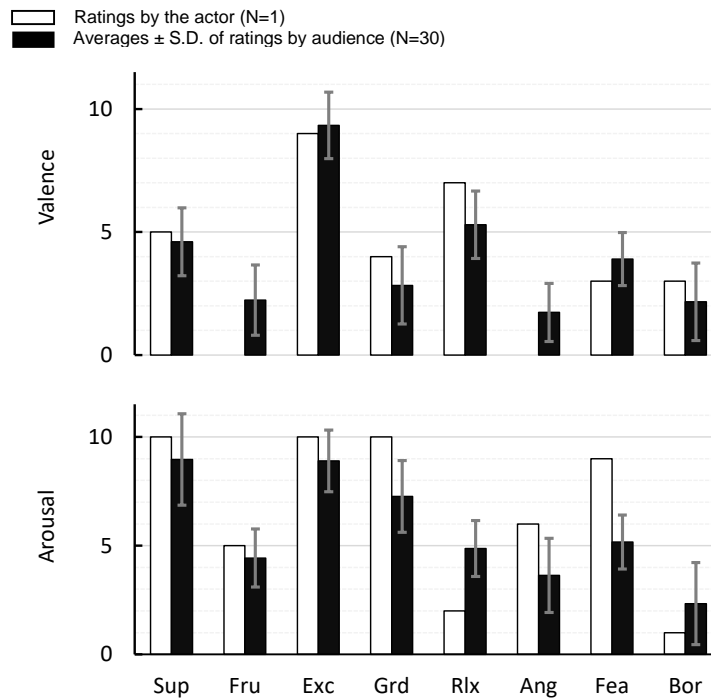
Figure 2: Valence and arousal of each emotion evaluated by actor (white bars) and audience (black bars and error bars indicating averages and standard deviations). Abbreviated words on horizontal axis are "surprised," "frustrated," "excited," "guarded," "relaxed," "angry," "fear," and "bored" from left to right.

Table 1. Distances in ratings between actor and audience. Meanings of abbreviated words on the header row are same as in Figure 2.

	Sup	Fru	Exc	Grd	Rlx	Ang	Fea	Bor	Average
All audience	1.65	2.70	1.82	3.44	3.60	3.37	4.10	2.74	2.93
Male	1.07	2.28	1.87	2.99	3.49	3.27	4.12	2.62	2.71
Female	2.22	3.12	1.78	3.89	3.71	3.46	4.08	2.85	3.14
Acquainted	2.04	2.13*	1.61	3.12	3.40	2.87*	4.12	2.69	2.75
Unacquainted	1.25	3.27*	2.04	3.75	3.80	3.86*	4.08	2.78	3.10

*Significant difference (p<.05)

and bored. These results show that the actor's emotions were conveyed to the audience, but the degree of the emotions was not communicated accurately.

We assumed an emotional plane that consisted of two axes of valence and arousal using Russel's circumplex model (Russell and Barrett, 1999) as a reference and calculated the distances of the actor's emotion point and the audience's impression point on the plane to compare the difference by sex and acquaintance. The calculated distances are listed in Table 1. The average distance was 2.93 in the audience overall, 2.71 in males, 3.14 in females, 2.75 in acquainted, and 3.10 in unacquainted audience members. Male audience members could evaluate the actor's emotion relatively more accurately than female ones, but a significant difference by sex (p>0.05) was

not found for any images. In contrast, acquainted audience members could evaluate the actor's emotion more accurately than unacquainted ones, and there were significant differences in evaluating frustration ($p = 0.029$) and anger ($p = 0.029$).

CONCLUSION

We explored whether people can convey their emotions accurately through facial expressions. We hypothesized that evaluations of the actor and audience would be similar if the emotions were conveyed precisely. Significant differences were found in valence for frustrated, guarded, relaxed, angry, fear, and bored; and in arousal for all emotions. This suggests incorrect communication of emotions. Distances between the actor's emotion and the audience's perception were larger in audience unacquainted with the actor than in those who were acquainted. The results suggest that conveying emotion via facial expressions is not reliable, especially with unfamiliar people. In the new era of video communication, caution should be exercised. Additionally, the difference may be more significant in communication with foreign people. To communicate emotions correctly, we need to construct a model explaining the differences, and support communication on the basis of the model. However, the effect of emotion conveying we showed is limited because we employed female actor for the experiment. Although we showed that the effect does not depend on audience's sex in this study, it is possible that actor's sex can affect the accuracy of emotion conveying. An effect of actor's sex should be discussed in our future work.

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