Preliminary Evaluation Between Conscious Feeling and Unconscious Emotion Estimated by Bio-Signals Applied to CMC Comparison

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Abstract. Emotional communication is part of our life. However, it is not easy for humans to understand each other's feelings. Computer-mediated communication (CMC) technologies can help us with emotional communication. However, when we are having a misunderstanding or expressing our emotion, it arises the doubt that the receivers can receive the correct emotion of senders. Since expressed emotion can be arbitrarily changed, they can be said to lack objectivity, which is necessary for emotion estimation. There is a method of emotional analysis using biological signals such as heartbeat and brain waves has been studied. Biological information cannot be changed arbitrarily, therefore can be said to be objective, meaning more suitable for unconscious emotion estimation on CMC context.

In this paper, we describe our experiment of comparison of the unconscious emotion that is estimated by bio-estimated emotion method, with the conscious feeling at the communication of CMC. The results show that unconscious emotion obtain the lowest evaluation. Also, the unconscious emotion obtains the highest evaluation at using the self-understanding. In this paper, we describe the experimental process and results in detail, and discuss the results and future research directions.

Keywords: Emotional communication · Bio-emotion estimate method · Conscious feelings · Unconscious emotion

1 Introduction

Emotional communication is part of our life. However, it is not easy for humans to understand each other's feelings. Feelings are often fueled by a mix of emotions, and last for longer than emotions [1]. Normally emotional communication sometimes facing misunderstandings because of inappropriate expressions.

Derks' research described that people show more explicit emotional communication willingness in computer-mediated communication than in face to face communication [2]. With the development of computer-mediated communication (CMC), we can have emotional communication not only by text, video, voice but also by emoji, sticker, etc. With all these emotional communication tools, we are getting closer to understand the other's emotion, however, it causes more misunderstanding [3]. Since these computer-mediated communication tools requires the sender to choose an appropriate expression to

express their emotion correctly to the receiver. There are sometimes differences between the expressed emotion and actual emotion by the sender. It would cause the misunderstandings. To most people, it is difficult to choose their emotion correctly. In the psychology area, some researches pointed out that the choose emotion based on the subjectively choice by themselves, is not entirely correct.

To solve this situation, we consider if the senders understand their own emotion correctly, they can choose correct expression based on the recognition of the real emotion. Then, it reduces misunderstandings of the other's emotion. To know the actual emotion, we focus on the emotion that estimated from the biological signals from the people. James Lange [4] suggest that emotion occurs as a result of a physiological reaction to some events. Therefore, we assume if we collect the data from biological signals as to know the physiological reaction for some event, we could know the actual emotion correctly include unconscious feelings. Song et al. and Ikeda et al. present methods of estimating emotion based on biological information [5, 6]. We call this method as bio-emotion estimate method. The method is based on psychological and cognitive science models. With psychological and cognitive science models, biological signals can be used to classify emotion roughly [6] (Discuss in chapter 3). At the same time, bio-emotion estimate method can be unaffected by human subjective thinking and can avoid errors caused by subjective thinking (language choices, excessively exaggerated expressions, etc.) and thus we consider it will estimate emotion more objectively. However, they dose not evaluate that the objectively estimated emotion can be applied to the computer meditated communication.

To clarify this point, we propose a method to compare the methods to communicate the people through computer-mediated communication, that one uses the objectively estimated emotion, the other uses the subjectively choose emotion to expressed emotion to the other. We assume the objectively estimated emotion can exclude the influence of subjective thinking on emotions. To achieve this, we use bio-emotion estimate method that is proposed by Ikeda [6] and set up the situation whether the receivers would prefer to know senders' bio-emotion estimated emotion than the subjective conscious feeling choice by the sender in computer-mediated communication. In this paper, we found that it is not appropriate to use the unconscious emotion in computer-mediated communication directly. On the contrast, we understand this unconscious emotion was evaluated higher using at self-understanding. In the future, it is better to apply the unconscious emotion to self-understanding.

This paper organized as follows. In Sect. 2, introduce the discussions the different definitions of conscious feeling and unconscious emotions. Then in Sect. 3, we introduce the bio-emotion estimate method based on the psychological emotion model. In Sect. 4, we described the experimental design and results. In Sect. 5, we discussed the problems of experimental design, and results.

2   Related Work

In this chapter we discussed about some major theories of emotion.

2.1   Emotion Theories

In this section, we will discuss emotion theories [7].

The Cannon-Brad theory is discussing emotion by physiological view. It suggests that people can experience physiological reactions linked to emotion without actually feeling those emotion. Also, the physical and psychological experience of emotion happen at the same time that one does not cause the other [8].

The Schachter-Singer theory, known as two-factor theory of emotion is an example of a cognitive theory of emotion. It suggests that the physiological occurs first, and then the individual must identify the reason for this arousal to experience and label it as an emotion [9].

The James-Lange theory of emotion is suggested by psychologist and physiologist. It suggests that emotion occurs as a result of physiological reaction to event [10].

2.2   Conscious Feelings and Unconscious Emotion [11]

Prinz et al. present evidence in support James-Lange theory. They said that emotions are perceptions of patterned changes in the body. When such perceptions are conscious, they qualify as feelings. But the bodily perceptions constituting emotions can occur unconsciously [12].

Based on this opinion, we use conscious feelings for subjective emotional expression, and unconscious emotion for bio-emotion estimated emotion.

3   Bio-emotion Estimate Method

James Lange [4] suggest that emotion occurs as a result of a physiological reaction to event. Therefore, sensors can detect physiological reaction as biological information. Ikeda proposed a bio-emotion estimate method using EEG and pulse sensor [13].

3.1   Method

Bio-emotion estimate method is based on 2-D arousal and valence model (Fig. 1).

EEG shows the alpha wave and beta wave of brain on horizontal axis, positive direction as arousal and negative direction as sleepiness. Pulse shows the valence mapped to the vertical axis, which positive direction as pleasure and negative direction as unpleasant.

Fig. 1. 2-D Arousal and valence model

4   Experiment

In the experiment, 56 subjects were asked to experience one of three patterns in remote communication randomly, and a questionnaire was conducted on the result.

4.1   System Design
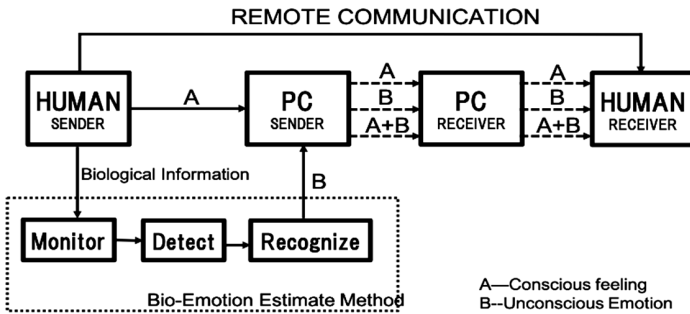
System design shows as below (Fig. 2):

Fig. 2. Experiment system

Sender and receiver were separate in different place, sender input their conscious feeling to computer. At the same time sensors collected sender's biological information. With these biological information, bio-emotion estimate method can estimate sender's unconscious emotion. At last system will send three patterns (depends on experiment procedure) of result to receiver.

4.2   Experiment Procedure

We asked 56 subjects to attend this experiment. Subjects were asked to take enough sleep before experiment. Then we divided subjects divided into 4 groups (1 group 14 Subjects). All groups would be sender and receiver.

Three types of emotional transmission patterns are sent out in different orders by group.

- Sender group:
    - Sender subject had EEG sensor, pulse sensor attached
    - Recalled emotions with videos (Table 1)
    - Send emotion in 3 patterns
- Receiver group:
    - Receive emotion in three patterns
    - Compare three types of emotion patterns:

    a. Conscious feeling
    b. Unconscious emotion
    c. Conscious feeling + Unconscious emotion

As for emotion recall we prepared four videos:

Table 1. Emotion recall video

No.	Title of video	Emotion recalled
1	PACIFIC RIM - Introducing Gipsy Danger	Excitement
2	The dog who grew a new face – Kālu's astounding recovery (graphic)	Distress
3	Hachi: A Dog's Tale (Serio)	Sad
4	Hawaiian view: With waves sound and piano	Relaxation

4.3   Questionnaire

Questionnaire is taken among receivers. In questionnaire we set four items and asked about impressions of each pattern impressions.

We take 5-point scale (Table 2): 1 score for strongly disagree, 2 score for disagree, 3 score for neutral, 4score for agree, 5 score for strongly agree.

For items we use shortening only on papers.

Table 2. Check table for Questionnaire

Item	1s	2s	3s	4s	5s
A. Self-understanding	☐	☐	☐	☐	☐
B. Conscious feeling	☐	☐	☐	☐	☐
C. Unconscious emotion	☐	☐	☐	☐	☐
D. Unconscious emotion + Conscious feeling	☐	☐	☐	☐	☐

A. Self-understanding: As sender I find unconscious emotion is helpful.

B. Conscious feeling: As receiver I find only conscious emotion is helpful.

C. Unconscious emotion: As receiver I find unconscious only emotion is helpful.

D. Unconscious emotion and Conscious feeling: As receiver I find unconscious emotion + Conscious feeling is helpful.

5   Result

As a result, the evaluation that only conscious feeling information was evaluated gave the result that it is easy to understand the other's emotion that only the evaluation of living emotion (Fig. 3).
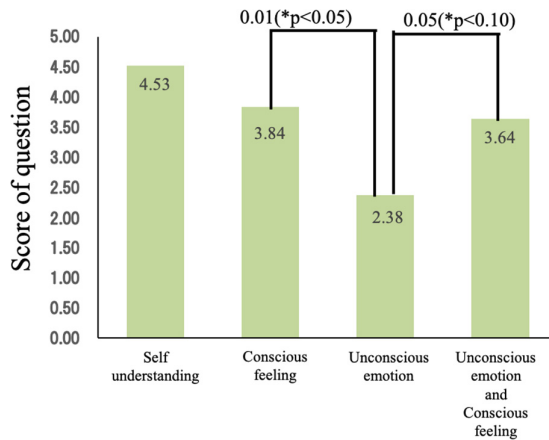

Fig. 3. Average value of questionnaire

Average value of conscious feeling is higher than unconscious emotion (p < 0.05). In this research, we are aiming to compare the evaluation of three patterns of remote emotional communication which include conscious feeling, unconscious emotion, and conscious feeling + unconscious emotion. We assume a result that unconscious emotion is most acceptable for subjects. On the opposite unconscious emotion got the lowest evaluation. With this result, we are considering use conscious feeling + unconscious emotion pattern to remote communication.

As a reminded problem, we have not considerate about the relationships between sender and receiver (such as couples, friends, strangers). For future work, we would design an experiment to find out acceptance of unconscious emotion under human social relationships.

Average value of conscious feeling & unconscious emotion is higher than unconscious emotion only ($p < 0.10$).

With the interview, we find out that conscious feeling is the classic way to understand others feeling ($p < 0.05$). Also, users would rather hear other's feeling from themselves. Moreover, this also shows suspect others' privacy.

Users who prefer the conscious feeling + unconscious emotion pattern showed they are interested in this novelty way. Moreover, advocate that unconscious emotion is helpful to understand senders' emotion (Fig. 4).
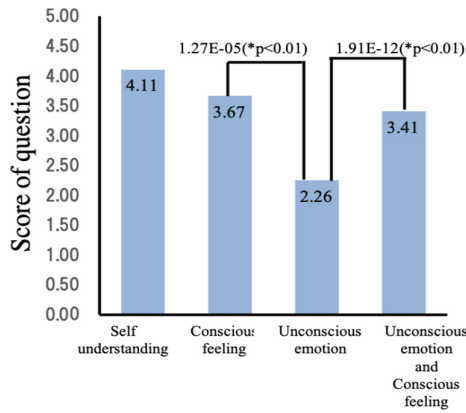

Fig. 4. Average value of male

For male's result, Average value of conscious feeling & unconscious emotion is higher than unconscious emotion only ($p < 0.01$).
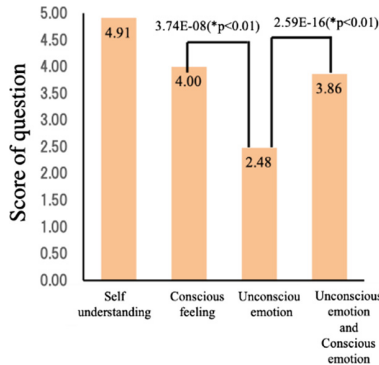

Fig. 5. Average value of female

Average value of conscious feeling & unconscious emotion is higher than unconscious emotion only ($p < 0.01$) (Fig. 5).

For female's result, Average value of conscious feeling & unconscious emotion is higher than unconscious emotion only ($p < 0.01$).

Average value of conscious feeling & unconscious emotion is higher than unconscious emotion only ($p < 0.01$).

Generally, difference of gender does none affect to this result. But from hearing result male claim that this new technical way of communication is interesting. Female is more interested in overall understanding can help them to understand other well.

6   Discussion

In this chapter we discuss about remained problems during this research.

6.1   Interpersonal Relationships

As for inter personal relationships, normally there are kinds like: Friendship relationships, family relationships love relationships online-only relationships workplace relationship. Different type of relationships causes different motivations of communication. First of all, Subjects of this study is randomly picked. We have considered about the relationship between subjects.

6.2   Questionnaire

In this research, we are aiming to compare the evaluation of three patterns of remote emotional communication which include conscious feeling, unconscious emotion, and conscious feeling + unconscious emotion. We take questionnaire after experiments. In questionnaire we set four items and asked about impressions of each pattern impressions.

We assume a result that unconscious emotion is most acceptable for subjects. On the opposite unconscious emotion got the lowest evaluation. With this result, we are considering use conscious feeling + unconscious emotion pattern to remote communication.

7   Conclusion

In this research, we compare emotional communication methods in computer meditated communication, that is the conscious feeling and the unconscious emotion. In the evaluation, according to three patterns of emotions to send from the senders, and compared which include conscious feeling only, unconscious emotion only, and conscious feeling + unconscious emotion.

We assume the result that unconscious emotion would be better acceptable for subjects. Since this emotion is objectively recognized by the sensors, and the receiver can correctly understand the sender's emotion, it will make them reduce the

misunderstandings. However, the result shows the opposite. Unconscious emotion obtains the lowest evaluation. We conclude that it is not appropriate to use the unconscious emotion in computer-mediated communication directly. On the contrast, we understand this unconscious emotion was evaluated higher using at self-understanding. In the future, it is better to apply the unconscious emotion to self-understanding.

As a reminded problem, we have not considerate about the relationships between sender and receiver (such as couples, friends, strangers). For future work, we would design an experiment to find out acceptance of unconscious emotion under human social relationships.

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