Analysis of Relationships between Atmosphere and Smiley during Plain Text Chat

Junko ITOU[†], Ayumu KIDO[†], and Jun MUNEMORI[†]

[†]Faculty of Systems Engineering, Wakayama University, Japan
{itou, s095016, munemori}@sys.wakayama-u.ac.jp

Abstract - In this research, we analyze the relationships among smiley, user's mental states, nonverbal expressions, and atmospheres during text chat aiming to apply to embodied character chat system. Smiley plays an important role in text communication to express user's emotions and dialogue atmosphere. We performed an experiment to get messages with smiley and investigated the relationships.

Keywords: Chat, Smiley, Emotion, Atmosphere, Dialogue, Embodied Character

1 Introduction

Online communication is widely spreading and tools of online communication become diverse, for example e-mail, chat system, remote meeting system, distance learning, and so on. There are also varieties of proposed tools on chat system from conventional text-based one to graphical one that agents in place of users talks in virtual 3D space.

By using embodied character in chat system, the users can obtain messages by watching embodied character's actions as well as by reading plain texts. A character in the chat systems plays a role as an agent of a user not only to express the user's emotional states or intentions which cannot be displayed by a chat message, but also to make the chat alive. As the result, it becomes clear what meaning the user implies for the chat messages.

In order to employ embodied characters for chatting users, we need to control their nonverbal expressions which include gestures, eye-gazes, noddings, and facial expressions, and so on. And also we should recognize the meanings of smiley which are used mainly to express the user's emotional state by text, furthermore we should reflect the meanings in nonverbal expressions.

Previous work on controlling nonverbal expressions of embodied characters mainly discusses the consistency of nonverbal expressions with the speech utterances or the goal of conversation for each agent [1][2]. However, when we consider dialogues between a pair of embodied characters, we need to consider interdependences between nonverbal expressions displayed by those two characters. As explained in more detail in the next section, it is reported in the field of social psychology that nonverbal expressions given by humans during their talks are not independent with each other[3]-[6].

In the remainder of this article, we focus on the relationships between atmosphere and smiley. Then we will discuss the chat atmosphere in terms of relationships among nonverbal expressions.

This paper is organized as follows: in section 2, we will describe the knowledge about the interdependences between nonverbal expressions in human communication reported in the previous work on social psychology. In section 3, we will define the "atomosphere" and the amount of nonverbal expressions in text chat. We will show the experimental result on the way of smiley and the association between smiley and atmosphere in chat in section 4. Finally, we discuss some conclusions and future work in section 5.

2 Nonverbal expressions observed in human conversation

In order to employ embodied characters for chatting users, we need to control their nonverbal expressions. As far as characters have their own faces and bodies in order to be "embodied", their users read various meanings in the nonverbal expressions displayed by the faces and the bodies of the characters even if the characters are not actually designed to send nonverbal expressions to their users but only to speak. Thus, for any embodied characters, we need to control their nonverbal expressions properly so that they convey appropriate meaning to the users. For example, it would be strange if a character does not smile at all although the user tells a funny story. As another example, when one character talks or smiles to the partner character, if the partner character freeze with no response to the action, it looks also strange.

It has been investigated in social psychology what features are found in nonverbal expressions given by humans during their conversation. Through those investigations, it is known that nonverbal expressions given by humans in real conversation have some interdependences and synchronicity.

For example, it was reported that the test subjects maintained eye contact with their partners in lively animated conversation, whereas they avoided eye contact when they are not interested in talking with their partners [3][4]. In the experiments by Matarazzo, noddings by the listeners in conversation encouraged utterances of the speakers, and as the result, animated conversation between the speakers and the listeners is realized [5]. In another experiments by Dimberg, fa-

Table 1: Interdependences between nonverbal expressions by different persons during conversations

		person A			
		gaze	smile	nodding	speech
person B	gaze	*			*
	smile		*		*
	nodding				*
	speech	*	*	*	*

cial expressions of the test subjects were affected by those of their partners[6]. The subjects smiled when their partners gave smiles to them, whereas they gave expressions of tension when their partners had angry faces. Table.1 illustrates these positive correlations by *.

These results implies positive correlations or synchronicity between the nonverbal expressions given by the conversation partners for eye gazes, noddings and facial expressions. On the other hand, these interdependences are general tendencies in the usual conversation situation and can change by the second according with the conversation. Therefore, we can say that the strength of these interdependences are different by the atmosphere of the scene of talks.

However, it is difficult to convey these nonverbal expressions and relationships in plain text communication. To express their emotions and intentions, people substitute smiley for nonverbal expressions in the text communication. We focus on this smiley in chat messages.

3 Chat text and nonverbal expression

3.1 Definition of atmosphere function

We consider chat messages as utterances in face-to-face communication and define variables as follow:

- Utterance: the number of words in one message

- Thinking: the time for reply

- Emotion: the kind and the intensity of smiley

We define "atmohsphere" as a level of "chat liveliness" by the amount of above variables. When the two persons' "Utterance" is high, "Thinking"is short, and "Emotion" appears frequently, we regard the atmosphere level is high, that is "the chat is lively". On the other hand, when "Utterance" is low or "Thinking" is long or "Emotion" rarely appears, the level of atmosphere is low. Additionally, we consider the chat atmosphere level is low if two persons' total variables don't have similar value, because of the incoherent state.

In order to estimate the state of atmosphere, we define some variables and functions. We denote each value of Utterance, Thinking and Emotion, which the chat message of person P at the time t by $e_P^u(t), e_P^h(t), e_P^s(t)$, and we formulate atmosphere contribution function $A_P^u(t), A_P^h(t), A_P^s(t)$ with these variavles as eq.(1) ~ eq.(3).

$$A_P^u(t) = \begin{cases} 0 & (e_P^u(t) < m_P^u) \\ 1 & (e_P^u(t) \geq m_P^u) \end{cases} \qquad (1)$$

$$A_P^h(t) = \begin{cases} -1 & (e_P^h(t) \geq 60 sec) \\ 0 & (e_P^h(t) \geq m_P^h) \\ 1 & (e_P^h(t) < m_P^h) \end{cases} \qquad (2)$$

$$A_P^s(t) = \begin{cases} 0 & (e_P^s(t) < 1) \\ 1 & (e_P^s(t) \geq 1) \end{cases} \qquad (3)$$

eq.(1) means the atmosphere contribution function for Utterance A_P^u has the value of 1 when $e_P^u(t)$ that is the number of words in one message of person P is bigger than m_P^u that is the average of the number of words in one message of person P. In the same way, eq.(1) means the atmosphere contribution function for Thinking A_P^h has the valeu of 1 when $e_P^u(t)$ that is the time for reply from person P is shorter than m_P^h that is the average time for the reply in one message of person P. The atmosphere contribution function for Emotion A_P^s has the value of 1 then person P uses one or more smiley in each mesage.

We introduce one more atmosphere contribution function $A_P^i(t)$ for "Interdependences" as shown eq.(4).

$$A_P^i(t) = \begin{cases} 0 & (A_Q^u(t) + A_Q^h(t) + A_Q^s(t) < 3) \\ 1 & (A_Q^u(t) + A_Q^h(t) + A_Q^s(t) \geq 3) \end{cases} \qquad (4)$$

where person Q is the chat partner of person P.
Finally, We formulate atmosphere function $A_P(t)$ as eq.(5).

$$A_P(t) = A_P^u(t) + A_P^h(t) + A_P^s(t) + A_P^i(t) \qquad (5)$$

Consequently, $A_P(t)$ has a discrete value and which range is $[-1, 4]$. If $A_P(t)$ has a high value, the chat dialogue is liveliness, and if $A_P(t)$ has low value, the chat is not smooth or the person P and his/her pertner are not interested in their chat topic.

3.2 Groups of smiley

Smiley is categorized previously into 10 groups for example *delight, grief, and amazement* and define the strength of the emotion. Table. 2 shows a part of the smiley.

Table 2: Example of smiley

delight	(*^o^*)	＼ (^o^) ／	o(▽)o
grief	(T_T)	(；ω；)	(ノД`;)
angry	＼(`Д)	(＿＞)	(o Д o)

These 10 groups consists of the 5 basic feelings frequently appered in plain text chat [7] and some behaviors such as greetings or apologizing.

4 Experimental results

We performed a chat experiment to get messages with smiley and to evaluate the valid of the atmosphere function.

Experimental subjects were 8 college students divided into 4 groups. We indicated each groups to chat for 10 minutes. Moreover, we asked the subjects to write down the intense of the chat dialogue atmosphere every 1 minute. Figure. 2 shows the chat winodw.

The subjects used a supporting tool to input smliley shown in Figure. 2. The subjects can register new smiley into each categories. We instructed to use this tool when they felt some kind of emotions in chat.
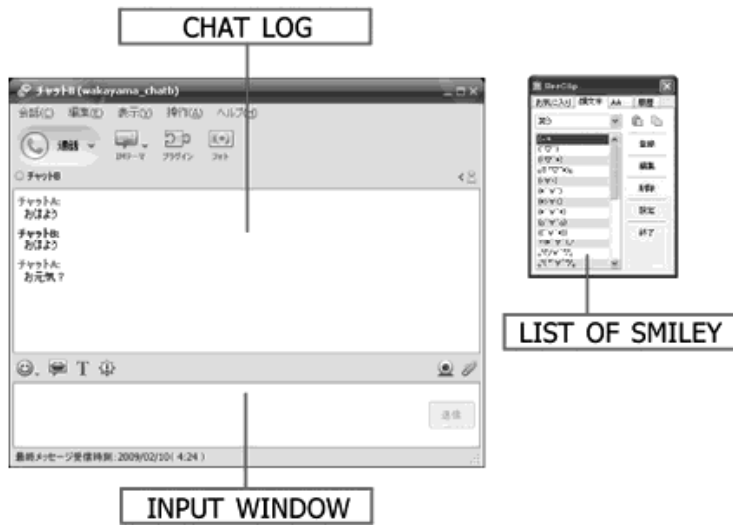
Figure 1: Chat window

Figure 2: Smiley input tool

Table 3: Average number of words, seconds for a reply and the number of smiley in all messages

Group	Subject	Average (per message) word (number)	Average (per message) time (second)	Total smiley (number)
A	a1	17.4	34.9	10
	a2	25.7	35.9	9
B	b1	16.9	31.1	3
	b2	19.2	26.9	0
C	c1	4.7	10.8	11
	c2	13.4	17.1	16
D	d1	7.7	20.3	7
	d2	10.0	13.8	9

Figure 3: Graph of $A_{a1}(t)$ and $A_{a2}(t)$ in Group A

Table. 3 shows the average number of words m_P^u, seconds for a reply m_P^h, and the number of smiley in all messages m_P^s.
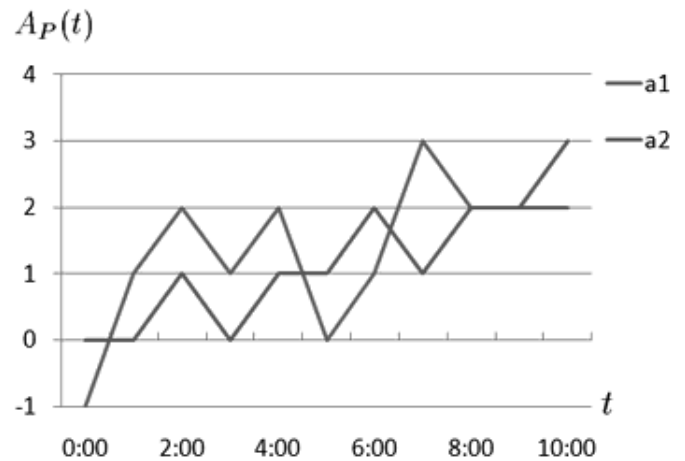
All subjects are familiar with computer. The correlation coefficient between $e_P^u(t)$ and $e_P^h(t)$ is 0.87 so the more it took time for reply, the more the subjects input words.

Figure. 3 illustrates the transitions of $A_{a1}(t)$ and $A_{a2}(t)$ in Group A. Each transition of atmosphere function are similar and the correlation coefficient is 0.48. The average of the correlation coefficient between the value of atmosphere function of person P and one of person Q in Group A $\sim$ D is 0.40. This result means two suites of each persons' atmosphere function tend to be similar transition, that is the subjects feel similar atmosphere from their chat. In other word, this atmosphere function can represent the positive correrations or synchronicity between two persons.

Furthermore there are some comments from test subjects that their mental state or nuance of the chat message can exchange more easily because of smiley. It was revealed that the categories of smiley are enough to communicate a user's emotion and atmosphere what he/she feel in their dialogue.

As a second step, we produced cartoons based on the chat text and the kind of smiley, to validate the definition of the atomephere function.

We produced three kind of animated cartoons from the chat log of the previous experiment. Figure. 4 is an example of cartoons. In these cartoons, two character are allocated at the bottom to make them have a conversation. The chat message log are displayed at the top of the cartoons.

The facial expressions of these characters changed according to the kind of smiley of original chat messages. A degree of the change of facial expressions is determined by the value of $A_P(t)$. When $A_P(t)$ has high level value, the character acts hammily. In contrast to this, the charater displays an expressionless face when there is no smiley in one message.

Experimental subjects were 6 college students. Four of its subjects were also subjects in the previous experiment. We asked them to watch the three cartoons and to write down the

Figure 4: An example of cartoons

Figure 5: A scene of this experiment

atmosphsere level from -1 to 4 which they feel from the cartoons. In the end of the experiment, we asked some questions. Figure. 5 shows a scene of this experiment.

We totally obtained fine rating for the three questions in Table. 4. The subjects answered that they could identify the difference between atmosphere levels and feel an equivalent atmosphere level from an original chat scene. In conclusion, the atmosphere function can express a certain level of a chat atmosphere.

However, the subjects said sometimes the atmosphere level didn't change properly in the cartoons, for instance, when the level went down. They also said it was necessary to introduce a more minus exspressions.

5   Conclusion

In this article, we defined the atmosphere function and investigate a relevance of this function to apply character chat system. Considering the relationships between nonverbal expressions and smliey, we represented the atmosphere function with some variables of nonverbal expressions. This function

Table 4: Questionnaire specifics

questionnaire item	average
You can feel some atmosphere from cartoons?	3.9
These cartoons express the original scene?	3.7
The atmoephere level is represented properly?	3.2

(1:no - 5:yes)

outputs high value when the number of words in one message. the time for reply if short, and a chatting person use smiley frequently.

In the experiments, we collected chat log with smiley and produced animated cartoons baesed on the chat log. In these cartoons, facial expressions of characters who played a role of agent of chat users changed according to the value of atmosphere function.

We totally obtained fine rating for the questions which are "You can feel some atmosphere from cartoons?" and "These cartoons express the original scene?".

There are some comments from test subjects that their mental state or nuance of the chat message can exchange more easily because of smiley.

Meanwhile, the atmosphere could not be expressed properly in some scene. We should investigate the cause.

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