Throwing a Smile: Using Smile Icons to Design Social Interfaces

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Abstract. A social interface is defined as that which allows for the visualization of potential social relationships between a human and an object, or between humans. In this study, we focus on facial expression, because it is an important source of non-verbal information. We aim to apply this study in designing a social interface. More specifically, we are concerned with the functions of smile. We have designed a "smile icon" as a way of carrying the visual information that the sender is smiling , and developed an experimental system. We have conducted an experiment of conversation between two persons, using TalkWithSmile. The results of the experiment show that the use of smile icons leads participants in a conversation to form the impression that the conversation is more active than otherwise. In the near future, we will expect more experimental trials and investigate the boundary between the condition in which the smile icon facilitates a conversation and the condition in which it does not.

Keywords: Smile icon, social interface, interface design, conversation, tabletop.

1 Introduction

Recently the concept of social interface has been widely investigated in the study of human interfaces[1][2][3][5][4][6]. A social interface is defined as that which allows for the visualization of potential social relationships between a human and an object, or between humans.

In this study, we focus on facial expression, because it is an important source of non-verbal information. We aim to apply this study in designing a social interface. More specifically, we are concerned with the functions of $smile$[7][8][9][10][11]. Smile is a facial expression and has distinctive emotional and social meanings. The social functions of smile are important for designing social interfaces. A smile often facilitates a conversation or interac tion, but it only exists in a moment. It is then desirable for a good social interface to emphasize and preserve that messages are sent with a smile. There are some related studies on social interface[12][13][14]. We develop a system on which users can send and receive messages with the information that they are smiling, and the system can emphasize this information. We call the 'sender' the person who presents a smile facial expression and the 'receiver' his or her interlocutor.

Fig. 1. A smile icon

2   A Proposal of Smile Icon for Social Interface Design

2.1   Utilization of Smile Icon

We have selected the use of smile icon (Fig.1), on the basis of considerations provided in the previous studies[15][16][17][18]. As for the utilization of smile icon, the followings are considered:"Timing for the presentation of smile icon" and "Additional moving of smile icon."

As for the timing for the presentation of smile icon, a smile icon is presented immediately after a sender expresses smile. It would lead to the receiver's awareness of the message that the sender sends.

As for the additional moving of smile icon, a reference, TableTalkPlus, reports that an animation moving could affect the users' actions and the impressions on conversation.

In this study, the place for the presentation of smile icon is set on the table, for it is one of the common places for conversation.

2.2   Design and Development of an Experimental System

We have designed a *smile icon* as a way of carrying the visual information that the sender is smiling , and developed an experimental system, consisting of a smile detection subsystem and a smile icon presentation subsystem . When two persons sit at a table and have a conversation, the system shows a smile icon on the table immediately after a person makes a smile and the system detects it. We name the system "TalkWithSmile."

For the hardware setting, a monitor is set on the table, as the simulation of a table. The experimental settings of face-to-face and voice situations are shown respectively in Fig. 2 and Fig. 3.

As the software setting, a smile detection subsystem recognizes a user's smile via the movie captured by a video camera; this is; on the basis of the coding of 'pleasure' facial expression by JACFEE[19]. The user sets three markers on the face (Fig. 4) and the camera for smile recognition periodically detects the smile angle in each 33 ms.

The threshold value for smile recognition is decided from two values, $\alpha(SA = 0\%)$ and $\beta(SA = 100\%)$ on the basis of the previous study[20].

$$T = \frac{\alpha + \beta}{2}$$

Fig. 2. Face-to-face situation
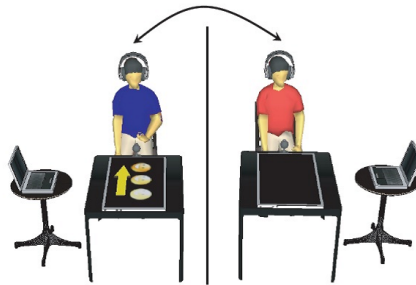
Fig. 3. Voice situation

The time chart (from the recognition of smile to the presentation of smile icon) of both subsystems is shown in Fig. 5.

3 A Conversation Experiment with TalkWithSmile

3.1 Purpose

We analyze how the place of smile icon (moving) affects the users and consider whether the smile icon presentation can be a kind of social interface. In order to consider which stimulus in the smile icon affects users and what influences it has on users, we design a comparison experiment. The ways of stimulus are two points: with a smile icon or without a smile icon, and a moving or a resting smile icon. In this experiment, we have two situations as *face-to-face* and *voice*. Taken together, there are six conditions in the experiment. (Fig. 6) Each condition includes a condition of presentation and a condition of the state of smile icon. The conditions are shown in Table 1.
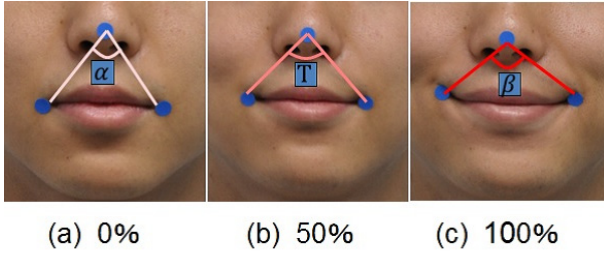
(a) 0%   (b) 50%   (c) 100%

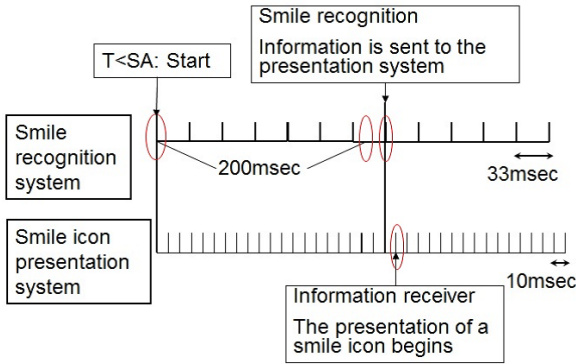**Fig. 4.** Smile angle and threshold value

Fig. 5. Timechart from smile recognition to presentation of a smile icon

3.2 Analysis

We design three points for the analysis.

(A) How the presentation of the smile icon affects the impression on the conversation

(B) How the presentation of the smile icon affects the users' facial movements

(C) How the moving of the smile icon affects the users' thoughts on the conversation

With regard to (A), we use factor analysis by Semantic Differential Method[21] to concretely capture the common semantic space by users' evaluations with paired adjectives. Forty nine paired adjectives[22][23] are used in the evaluations (Seven point-Rickard scale; -3 to +3). Excluding the paired adjectives whose scores are under 0.4, the factor analysis is repeatedly computed. With regard to (B), it is assumed that the smile icon would lead the change of users' facial expression actions. The number of *smile* facial expressions is counted as the number of *smile* that is kept over T and longer than $200ms$. The *smile* expression keeping time is counted as the period between when SA is over T and when SA
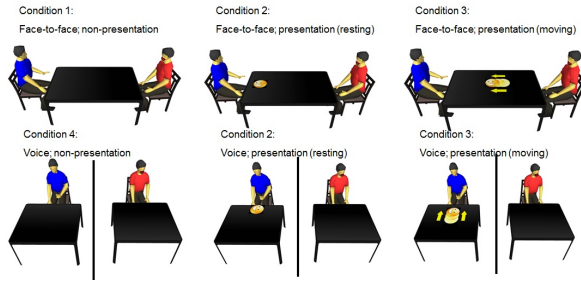
Fig. 6. Six conditions of the experiment

Table 1. Each condition's stimulus

#	Situation	Ways of presentation of smile icon	User's own smile	Interlocutor's own smile	Smile icon presented by interlocutor	Moving of interlocutor's smile icon	Smile icon presented by the user	Moving of user's smile icon
1	Face to face	No	×	○	×	×	×	×
2	Face to face	Resting	×	○	○	×	○	×
3	Face to face	Moving	×	○	○	○	○	○
4	Voice	No	×	×	×	×	×	×
5	Voice	Resting	×	×	○	×	×	×
6	Voice	Moving	×	×	○	○	×	×

○ : comfirmable by sight,   × : non-comfirmable by sight

is under T. With regard to (C), in order to analyze whether the users could feel the difference between the moving smile icon and the resting one, the users are asked after the six conditions, "Did you feel the difference between the moving and resting?" The answer is entered in the free statement.

3.3   Method

– **Participants**
Thirty students (16 men and 14 women, ages from 20 to 28) participate in the experiment. The students are divided into 15 groups. The interlocutor is not a complete stranger to the students and it is the first time for them to user TalkWithSmile.

– **Task**
The task is set as a 'joint remembering dialogue' [24][25] about the video they watch. The content of the video is 'Usavich' [26], which is a movie about the rabbits. A movie takes about 1 minute and 30 seconds. Six movies are ready for the experiment. A user watches all six movies in the same order.

– **Experimental flow**

(i) **Explanation:** Users hear the outline of the experiment.

(ii) **Initial Settings:** Users set three makers on their faces, and the value of the threshold T is set.

Table 2. Factor loadings after Varimax rotation

	Adjective pairs	Activeness	Preferability	Familarity	Tidiness
	inactive - active	0.679	0.400	0.156	0.019
	introspective - sociable	0.663	0.255	0.170	0.227
	unhealthy - healthy	0.660	0.235	0.190	0.279
	modest - gaudy	0.658	0.375	0.253	-0.228
	static - dynamic	0.658	0.388	0.028	-0.097
	passive - active	0.641	0.372	0.231	0.249
	negative - positive	0.619	0.406	0.270	0.023
	boring - funny	0.589	0.519	0.292	-0.131
Activeness	weak - strong	0.582	0.345	0.065	0.186
	weak-minded - strong-minded	0.578	0.306	-0.110	0.180
	quiet - noisy	0.571	0.240	0.099	-0.323
	lonely - social	0.570	0.510	0.176	0.030
	quiet - talkative	0.520	0.324	0.223	0.026
	gloomy - sunny	0.475	0.434	0.260	-0.166
	insensitive - sensitive	0.462	0.078	0.231	0.381
	tired - energetic	0.458	0.313	0.333	-0.058
	unsociable - sociable	0.457	0.369	0.251	0.153
	focused - distracted	0.443	-0.291	-0.072	-0.390
	unreliable - reliable	0.421	0.193	0.285	0.376
	cowardly - brave	0.415	0.309	0.205	0.051
	bad - good	0.298	0.753	0.210	0.136
	hated - liked	0.257	0.685	0.346	0.021
	uncool - cool	0.358	0.663	0.366	0.027
	unsatisfied - satisfied	0.484	0.655	0.217	0.074
	unfree - free	0.295	0.651	0.065	0.084
Preferabiility	uncomfortable - comfortable	0.347	0.618	0.401	0.074
	unfunny - funny	0.375	0.602	0.224	0.000
	unfriendly - friendly	0.278	0.573	0.313	0.059
	hard - soft	0.331	0.565	0.223	-0.137
	cold - warm	0.364	0.554	0.476	-0.021
	unstable - stable	0.188	0.552	0.169	0.360
	stubborn - open	0.194	0.542	0.124	0.288
	obstinate - flexible	0.224	0.458	0.151	-0.227
	glum - cheerful	0.407	0.434	0.221	-0.071
	harsh - kind	-0.005	0.352	0.695	0.178
Familiarity	unkind - kind	0.252	0.312	0.608	0.149
	selfish - compassionate	0.218	0.285	0.608	0.400
	unhappy - happy	0.276	0.483	0.545	-0.158
	annoying - pretty	0.142	0.266	0.528	0.070
	ugly - beautiful	0.099	0.048	0.488	0.256
	lazy - serious	-0.132	-0.030	0.020	0.733
	untidy - tidy	0.144	-0.008	0.176	0.710
Tidiness	dirty - clean	-0.016	0.236	0.398	0.581
	irresponsible - responsible	0.297	0.096	0.247	0.547
	imprudent - prudent	-0.079	-0.143	-0.028	0.545
	dull - bright	0.426	0.056	-0.019	0.440
	Sum of squares of factor loading	8.346	8.148	4.234	3.747
	Contribution of factor ()	18.144	17.714	9.205	8.145
	Cumulative contribution ratio ()	18.144	35.858	45.063	53.208

(iii) **Practice:** Using TalkWithSmile, users practice the use of the system and have a free conversation.

(iv) **Watch a Movie:** Users watch a movie.

(v) **Conversation:** Users converse on the story of the movie for five minutes.

(vi) **Answer a Questionnaire:** Users are asked to answer a questionnaire to describe the impression on the conversation with 49 paired adjectives.

(vii) **Give the Users' Thoughts:** Users repeatedly conduct from (iv) to (vi). After the sixth condition, users answer the question: of "Did you feel the difference between the moving and the resting smile icon?" in a free statement.

A user talks about a movie in all the six conditions and the order effect is offset by counterbalancing the order. The condition in which a user watches a movie is randomly set.
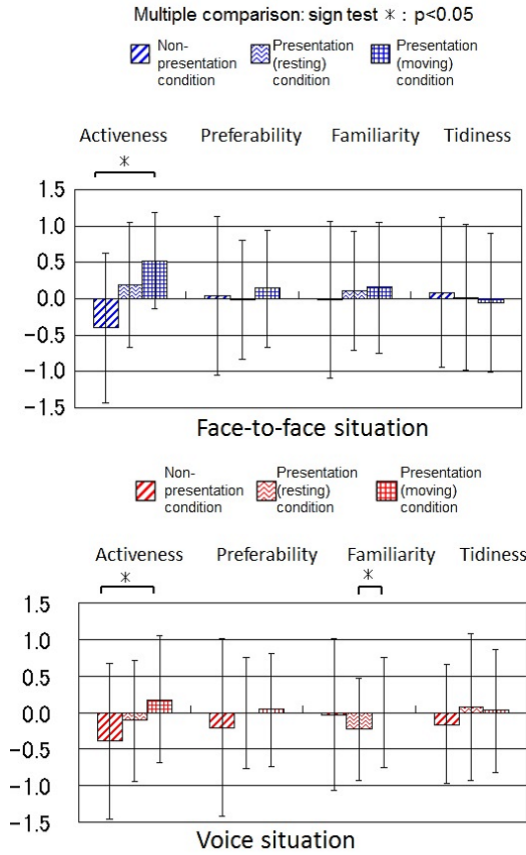
**Fig. 7.** Factor scores in both situations

3.4   Results

(A) How the presentation of the smile icon affects the impression on the conversation

– **Factor Loadings**
  Table 2 shows the results of factor analysis. Four factors are regarded as valid values and a simple structure is made on the basis of the factor loadings. The cumulative contribution ratio is 53.2%. We call the first, second, third and forth factors 'activeness', 'preferability', 'familiarity' and 'tidiness'.

– **Factor Score**
  As for the factors extracted by the factor analysis, Fig. 7 shows the results of the average score in the face-to-face and voice situations. In the face-to-face situation, the score for 'activeness' increases in the order of non-presentation, presentation(resting) and presentation(moving). 'Familiarity'
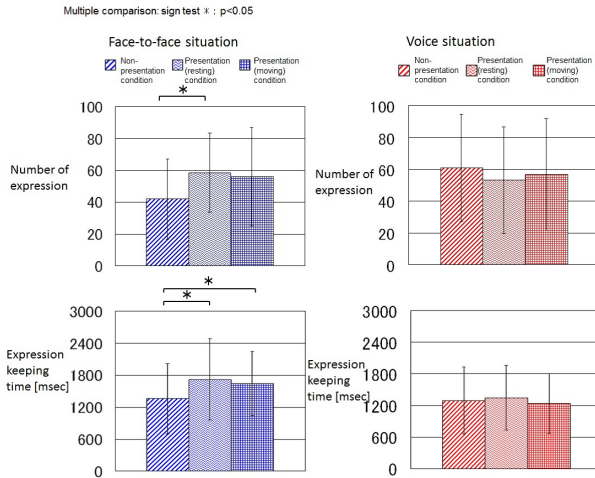
Fig. 8. Number of expression and expression keeping time in both situations

seems to increase in the same order as 'activeness' does. In the voice situation, 'activeness' increases in the same way as in the face-to-face situation. 'Preferability' seems to increase in the same order as 'activeness' does.

'Activeness' show patterns, and 'preferability', 'familiarity' and 'tidiness' show different patterns, between the face-to-face and voice situations. In both situations, the smile icon (moving) could amplify the impression of 'activeness.'

(B) How the presentation of the smile icon affects the users' facial movements

Fig. 8 shows the number of 'smile' facial expressions and the expression keeping time.

In the face-to-face situation, users share the table and directly see their own smile icon. As a result, users might try to present their own smile icon and increase the number of facial expressions and the expression keeping time. On the other hand, in the voice situation, users do not see the interlocutor's face and their own smile icon. As a result, the number of facial expressions and the keeping time might not dynamically increase or change.

(C) How the moving of the smile icon the users' thoughts on the conversation

The results of the free statements imply that; twenty four users out of thirty have more positive impressions on the presentation of the moving smile icon than those of the resting one. Many have said "felt more familiar", "could receive the interlocutor's feelings", "felt the presence", "felt the enjoyment", and so on. The moving smile icon might lead to stronger awareness of the sending of message and increase the familiarity of and a sense of unity with the interlocutor.

4   Conclusion

We have proposed the use of 'smile' as a future type of social interface in this study.

We have designed a "smile icon" as a way of carrying the visual information that the sender is smiling , and developed an experimental system consisting of a smile detection subsystem and a smile icon presentation subsystem . When two persons sit at a table and have a conversation, the system shows a smile icon on the table immediately after a person makes a smile and the system detects it. We name the system "TalkWithSmile."

We have conducted an experiment of conversation between two persons, using TalkWithSmile. The number of participants is thirty, and they are divided into fifteen pairs. Each pair is asked to perform the task of "joint remembering dialogue": they watch a one-minute movie, and then discuss about it with TalkWithSmile. On the basis of the results of the questionnaire, it is shown that the use of smile icons led the participants to have the impression that their conversation was active.

The results of the experiment show that the use of smile icons leads participants in a conversation to form the impression that the conversation is more active than otherwise. Thus, we have confirmed an important social function or meaning of smile: activating a conversation. The method we have proposed in this study increases the quantity of messages by emphasizing their active aspect, i.e., the information that it is sent with a "smile." It also helps a person to recognize that the interlocutor shows a positive attitude to her. In the near future, we will expect more experimental trials and investigate the boundary between the condition in which the smile icon facilitates a conversation and the condition in which it does not. A person does not always want to be in the condition where her conversation is activated. The ultimate goal of our study is to figure out what interface is best suited for sending and receiving different non-verbal information in different conditions, with reference to other studies[28][28][29][30][31].

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