

Development of Communication Support System at Mealtimes Using Tabletop Interface

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Abstract. In this research, we aim to develop a system to support communication during meal times. It is reported that the communication skills of young people have declined because of decrease of opportunity to speak face to face. We focus on the meal that is essential for everyday life as a place for face-to-face communication. The proposed system uses tabletop interface as a dining table to provide intuitive control without additional burden. Users can decorate the table and dishes with several digital items by only touching the surface of the table. Furthermore the system displays various visual events randomly on the table according to the condition of the items. By using visual effects, we realize the support to provide improving communication and enhancing the enjoyment of the meal. From the result of experiment, it was cleared that users could take a cue of conversation through use of the system.

1 Introduction

We propose a system that people can enjoy communication during their meal using table top interface. The research for approximately 400 college and high school students by the Ministry of Health, Labor and Welfare[1] reported the decline in communication skills of Japanese young people. One-third of the target of the research felt that the ability to communicate was insufficient. As the main cause, the report pointed out the spread of mobile phones and the advancement of information networks.

In face-to-face communication such as daily conversations, people convey linguistic information with non-verbal information including gestures and facial expressions. On the other hand, the only verbal information is exchanged in communication via networking tools. It is not necessary to meet other people and it will reduce the opportunity to express and to construe the nonverbal expressions. This situation is one of factor of decline in communication skills. Therefore the support of face-to-face communication is a very important issue. In order to support making an opportunity of face-to-face communication and activating the communication, we focused on the meal that everyone always do in daily life.

We adopt a table top interface as a dining table to support communication during meal times. The table can provide intuitive control so users can use the system easily

while eating. The existing researches[2][3] provide the fun of mealtime communication by sharing photographs or decoration items using cameras and a projector. However, it is limited to operate the table because the user's head or his/her hand blocks the camera's view and only one person controls the table at a time. We realize an interactive table which many users can control freely and easily at a time so that the users enjoy their meal times by viewing visual effects. E-Table[4] is an interactive ordering system that diners can order food and drinks directly from a menu projected on to their table in their hands in a restaurant and bar. Diners also can search and browse information of the dishes or the local neighborhood of the restaurant until a wait staff serves, and call a taxi during their meal times using this table. Whereas E-table focuses on rationalization in business and fun to pass the time until dishes are served, our system support to make opportunity to speak face to face among diners by displaying visual effects including accidental visual events on the table.

This paper is organized as follows: in section 2, we will describe the related services on support of mealtime communication and interactive systems for dinners using table top interface. In section 3, we explain our system that supports to initiate the conversation starter and enhancing the enjoyment of meal time communication. A validation test of our system will be given in section 4. Finally, we discuss conclusions and a future work in section 5.

2 Related Research on a Support System of Meal Time Communication

There have been a number of communication support systems at mealtimes using a camera, a projector, a meal plate and a table. We discuss an effective approach to support meal time communication aiming to make an opportunity to speak face to face in this section.

pHotOluck[2] is a mealtime communication support system that consists of dishes, a projector and a camera. The projector mounted to the ceiling displays photographs that users have taken previously, on a meal plate on a dining table. The camera recognizes three markers on the plate and estimates the position to project an image even if users change the plate's position and its direction. However, this system has a problem with operability because users cannot act in such a way as to cover the markers on the plate from the camera by their hands or heads. Furthermore, people hold chopsticks, a knife, a fork and a spoon in their hands during meal time so it is necessary to achieve more intuitive interface that users don't have to pay mind to operate.

Mori et al. has proposed an augmented reality system in order to make meal time fun[3]. This system takes a movie of a dish on a dining table with a video camera. The system analyzes its colors and calculates colors to make the dishes look more delicious based on the analysis. The result is projected onto the dish as a decoration of its rim. In addition, the image that a cock designs with illustrations and messages to decorate the dining table, the meal plate and the dish in the kitchen is also projected. The cock can change the contents which the projector shows according to remaining

amount of the dish. This research concluded that the visual effects improved palatability and pleasure during meal time. On the other hand, the eater itself cannot change the rim decorations and the illustrations. Furthermore it is limited that the meal plate the image is projected on is only one. Therefore this system is unsuitable for the situation that several persons sit around the dinner table and communicate face to face.

Comparants Ltd. has released an interactive ordering system 'E-table' with a table top interface[4][5]. Dinners can order foods and drinks directly touching the surface of the table where an illustrated food and drinks menu is displayed on. Dinners also can set their table ambience and watch information on the ordered dishes or the local neighborhood of the restaurant until the ordered dishes are served. Anyone can operate the system intuitively by adopting table top interface. As just described, E-table helps dinners and the restaurant staffs in the point of rationalization in business and service. On the other hands, this system doesn't play a role strongly in supporting face-to-face communication rather E-table decreases the opportunity for conversation among diners and staffs because the dinners can enjoy the meal time on his/her own.

Based on the researches and services on support of meal time communication, we aim to develop an interactive system that makes users enjoy a meal time and communication. For support face-to-face communication during meal time, we employ table top interface and several visual effects so that several users can operate at the same time and the system trigger a conversation between them.

3 System

3.1 Goal

Our goal is development of communication support system that users can operate easily and intuitively while they eat. The system also provides opportunities of conversations and makes users enjoy the mealtimes. In order to achieve this goal, we design the system as follows. First we adopt a table top interface as a meal table to reduce user's burden in term of use during a meal. Secondly, the system projects various kinds of visual effects on the table including in digital decorations with motions, a background image and a topic presenting character. Users can move freely the digital decoration items within the table even if on the dishes. Finally, several kinds of special events occur randomly based on the state of the digital decoration items displayed on the table so that the event livens up the table and it gives an opportunity of conversation among users.

3.2 System Structure

In this system, we use Diamond Touch Table (hereinafter referred to as 'DTT') as a table top interface[6]. DTT can identify up to four persons at a time. In addition, cameras and markers are not required for recognition of users' action on the table. Fig.1 shows the overview of our system. An image from the projector is displayed on the screen that is the surface of DTT. Users treat DTT as a dining table and sit around

DTT as shown Fig.2 and Fig.3. Employing DTT which provides intuitive controls reduces users' burdens and makes it possible to project many types of visual effects on the dishes and the table.

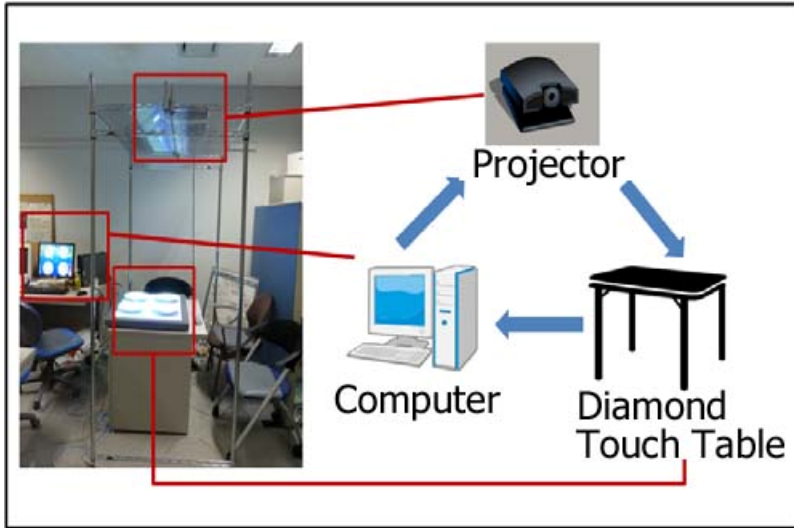


Fig. 1. Overview of proposed system



Fig. 2. Dishes and DTT as a meal table



Fig. 3. The table and users during meal times

3.3 Contents of Visual Effects

Fig.4 illustrates the image on the table. Users can manipulate the DTT by touching the surface of this table. The four white circles in Fig.4 mean the positions of meal plates. This system is considered to be used by up to four persons at same time so the buttons for operations are placed in each four corner of the table. Users can press the buttons only in front of themselves. This system provides several types of operations.

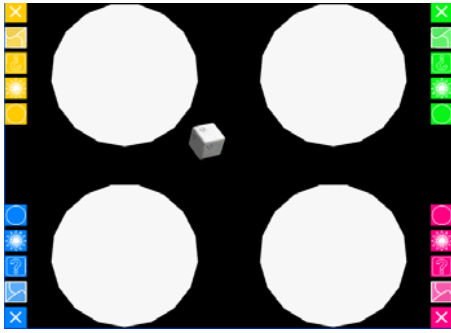


Fig. 4. An example of a projection image



Fig. 5. Decorations with flower items



Fig. 6. Change of a background image and projection of an image on a dish directly

Decoration Function

Users can decorate the table and dishes with flowers and circles. After touching the corresponding button and any position on the table, then a flower item is displayed. Any users can move the items freely by drag on the table. The color of these items is fixed depending on the seat. When a user wants to use the other color item, the user asks for the other users to produce the item and to move it. An example of a decorated dish with various color flowers and circles are shown Fig.5.

Background Image

Users can select the background image of the table from black to 10 different patterns as if they change the table cloth. We aim that the users will communicate when they want to change the background, and that the background image enhances the mood of their meal. The sunset image is used as a background image in the left image of Fig.6. As shown in the right image of Fig.6, the image is directly projected on the dish. Users can switch the display if the background image has an overlap with the dish.

These operations are performed by only touching the surface of the table so users can control even if with non-dominant hand.

Topic Presenting Character

The white cube object displayed in the center of Fig.4 is a character that provides topics of conversation. The character shows today's news and trivia in its balloon and it has 25 patterns of the message. The character constantly moves and rotates within the table as all users can read the message.

Visual Event Based on Items

Various events may occur at random according to the condition such as the item number of each color circles and flowers that are displayed on the screen. The visual event has three types. The first one is the event that special items are displayed. An example of this event is shown in Fig.7. Four big flowers are blossoming at the center of dishes in the left lower image of Fig.7. Users can move these items as with the other normal items.

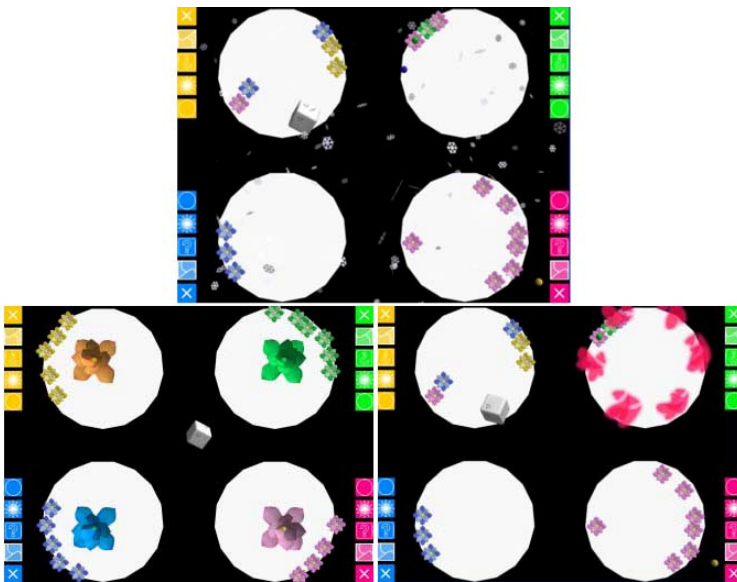


Fig. 7. Examples of visual events



Fig. 8. Projections of visual events on a dish and the table

The second type of the visual event is that some decorations with motions are displayed around the rim of the dishes. There are 27 kinds of patterns in this event. The right lower image of the Fig.7 is an example of this visual event. The result of the projection on a dish is shown in Fig.8. Some big hearts are projected in blinking and rotating around the rim of the dish.

The third type of the visual event is shower of blossoms or snow crystals. This effect covers the whole table top and it has four patterns. The top image of Fig.7 shows the shower of snow crystals on the table. The example image of projection of this event is the right image in Fig.8. The all sizes snow crystals are displayed on the table and the dishes.

By using these visual effects and decorations, we realize the support to provide opportunities of communication and enhancing the enjoyment of the meal.

4 Experimental Result

We performed an evaluation experiment using proposed system to investigate how our system effects on communication during meal times. The experimental subjects were 24 persons in their twenties divided into six groups. The three groups are consisted of people who had met for the first time. We instructed each subjects to sit at the table and to eat spaghetti and fruits. The meal time is 30 minutes. The subjects could talk freely during their meal. The conversation topic was not limited. We recorded the scene of the meal by a camera.

The result of a questionnaire on uses of the system is described in Table 1. The numbers of the Table 1 means the number of subjects who answered the each degree. The number 1 means strongly disagree and the number 5 means strongly agree. By comparing the result of item (i) and item (ii), we obtain higher value in proposed system than the usual meal. According to (iii), it is cleared that most subjects more enjoyed their meal using our system than usual meal even contains first meeting persons. The five subjects who answered “I don’t have any idea” or “It is troublesome” for the question “What do you think for your daily meal? Do you enjoy it?” selected the number 5 on the questionnaire item (i).

Table 1. Questionnaire result on use of the system

Questionnaire item	1	2	3	4	5
(i) You enjoyed your meal using the system.	0	0	0	7	17
(ii) You enjoy your usual meal with your friends.	0	0	1	10	13
(iii) This meal was more enjoyable than usual meal	0	0	0	12	11

Table 2. Questionnaire result on the support of communication

Questionnaire item	1	2	3
(iv) This system provided conversation material.	1	9	14
(v) You enjoyed this meal with first meeting persons.	1	6	5

Table 3. Analysis result of video data

	Group	With friends			With strangers		
		A	B	C	D	E	F
During eating	Time (minute)	16	10	28	28	23	18
	Time without speaking (second)	47	8	5	59	20	13
	Number of conversation triggered by the system	4	8	18	22	23	16
	Number of operation of the table	73	48	121	252	128	63
After eating	Time (minute)	14	20	2	2	7	12
	Time without speaking (second)	32	0	0	0	0	5
	Number of conversation triggered by the system	6	23	0	0	10	12
	Number of operation of the table	39	174	8	18	81	77

Table 2 is the result of the questionnaire on the communication support. The number 1 means 'not at all', the number 2 corresponds to 'sometimes' and the number 3 means 'many times'. As shown in Table 2, 23 subjects answered that they could get the conversation material more or less. In addition, 92% of the subjects whose group consisted of first meetings answered that the meal became enjoyable by using this system as shown in Table 2 (v).

Table 3 shows the analysis result of video data. The group A, B and C consists of friends and the group D, E and F consists of first meeting persons. The 86% of subjects who answered they felt gap in a conversation during the mealtimes could resolve the situation by using this system. Totally the time without speaking after eating is shortens the time during eating in all groups. On the other hand, the first meeting groups tended to operate the table more frequently after eating. Group C took time to eat their meals as much as Group D did, however the time without speaking and the number of operating the table totally differed. By comparing group C and group D, the members of the first meeting groups often touched the table and tended to devote themselves actions meanwhile declining speaking time. They also answered that this system made the opportunity to speak by providing the topic materials such as exchanging flower items and displaying random events. So we can confirm this system support the conversation among the subjects.

An important thing to note, by analysis of video images taken in several groups, it revealed that users often moved flower items and decorated dishes of their partners with conversations. Especially, the person who finished his/her meal decorated the plate of a user who still ate. They had conversation about the action and the result of the decoration.

5 Conclusions

In this article, we proposed a support system for communication at mealtimes aiming to support the activation of face-to-face conversation. We applied DTT as a table for meals and designed the system to provide an enjoyment of meals. From the experiment, it was cleared that users could take a cue of conversation through user of the system and responses from the system even contains first meeting.

References

1. The Ministry of Health, Labor and Welfare : Youth Employability Support Program (2009) (Japanese site), <http://www.mhlw.go.jp/bunya/nouryoku/yes/>
2. Nishimoto, K., Amano, K., Usuki, M.: pHotOluck: A Homeuse Table-ware to Vitalize Mealtime Communications by Projecting Photos onto Dishes. In: Horizontal Interactive Human-Computer Systems (TABLETOP 2006), pp. 9–16 (2006)
3. Mori, M., Kurihara, K., Tsukada, K., Siio, I.: Dining Presenter: Augmented Reality system for a dining tabletop. In: Supplemental Proceedings of the 11th UbiComp 2009, pp. 168–169 (2009)
4. Compurants Ltd. : “E-Table”, <http://www.e-table-interactive.com/index.html> (accessed February 19, 2013)
5. Compurants Ltd. : inamo restaurant, Soho, London - interactive oriental fusion restaurant and bar, <http://www.inamo-restaurant.com/> (accessed February 19, 2013)
6. Dietz, P., Leigh, D.: DiamondTouch:A Multi-User Touch Technology. In: Proceedings of UIST 2001, pp. 219–226 (2001)