Face-to-face Single Display Groupware Encouraging Positive Participation

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ABSTRACT

This paper describes an prototype of a face-to-face, pen-based single display groupware that encourages its users' positive and cooperative participation without blocking the stream of spontaneous activity in a meeting. We designed a novel circular frame in that each participant can input positively and grasp the focus of an argument easily. We demonstrated the effectiveness of our proposed interface by comparing it with a general parallel input interface.

ACM Classification: H5.3 [Information interfaces and presentation]: Group and Organization Interfaces - Computer-supported cooperative work.

General terms: Design, Human Factors

Keywords: face-to-face meeting, positive participation, single display groupware (SDG), pen-based, awareness.

INTRODUCTION

We need to pay careful attention to support for face-to-face communication. A new SDG development brings about both positive and negative effect on the face-to-face communication. For example, not a few SDG environments provide the users not only new functions, but also troublesome operations to use those functions. When the users operate such functions, it must cause some changes in the communication environment. Even if those changes are not so much, there are possibilities that those operations rob the participants of the concentration on face-to-face attention and awareness in a meeting. While we have to take such negative effects into consideration, we have focused on a possibility that new SDG would have positive effects. We studied a face-to-face meeting environment that encourages an animated discussion without blocking the stream of a spontaneous behavior in a meeting.

FEATURES

Considering present circumstances and previous studies [1, 2] about SDG, some problems are clear. Based on them, we propose the following concepts to support positive participation in face-to-face SDG.

Positive input: a user should be able to input positively. To write positively on an SDG, it is important for a user to be able to easily adjust the position, range, and timing of her/his writing. During a meeting, a user of an SDG has to plan not only "What do I say?" but "When do I start writing?", "Where do I write?", and so on. A general serial input system has a tendency to fixate a person to write and inactivate an argument, but to concentrate participants' attention. A general parallel input system, on the other hand, has a tendency to produce various opinions, since more than one user can write at the same time, but to distract their attention. Our approach aims to create a best mix of the advantages of those two interfaces.

Focus of argument awareness: a user should be able to grasp the focus of an argument easily. To activate a discussion, it is important that participants always be able to grasp the focus of an argument or shared attention among participants. If participants don't concentrate their attention on a common issue, even if various opinions are expressed, they will not reach an agreement based on mutual understanding.

Behavior awareness: a user should be able to easily perceive change in another's behavior. To throw in words of agreement or reply positively to a question from a person who is writing or speaking, it is important that a user be able to promptly perceive and check the meaning of letters or utterances expressed by others. Gutwin et al. [3] proposed that awareness, especially "workspace awareness – the up-to-the moment understanding of another person's interaction with a shared workspace–" is important.

Historical awareness: a user should be able to easily survey how he and others have been participating. In activating a discussion, enabling participants to look back at their behavior is important. If a user is aware of who is negative, the user can encourage that person to write or speak. If users are aware of who is participating too much, the over participator may refrain from speaking. With such control of behavior, it is expected that a group will have an animated discussion expressing various viewpoints.

INTERFACE DESIGN

We designed a user interface that addresses the four concepts described in the previous section. The features are a circular frame and added multiple pointers (Figure 1).

With the concept "focus of argument awareness" in mind, we designed a circular frame whose center is the center of balance of all users' pen pointer locations on the display. The frame as a visual appearance calls the user's attention. The frame interlocks with the movements of each pointer.

With the concept of "positive input" in mind, we designed a parallel input interface which limits the input range within the frame. Users whose pointers are inside the frame can all write in the frame of the display at the same time.

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That would make it unnecessary for users to operate by taking turns writing and would make the interaction of writing active between users.

Our research deals with the activities of writing and speaking as observable users' behavior in SDG. With the concept of "behavior awareness" in mind, we represented a user's writing or speaking behavior visually, using the transparency of an object on the shared display. A user's writing and speaking behavior correspond respectively to the transparency of a multiple pointer and the transparency of the user's arc in the circular frame. The circular frame consists of a different colored arc for each user.

With the concept of "historical awareness" in mind, we visually represented a continuous ratio of the user's writing or speaking participation, starting from the beginning of meeting. We did this using the size of objects on the shared display. A user's respective percentages of the writing and speaking done in the meeting correspond to the scale/size of the user's pointer and the angle of the user's arc in the circular frame.

Thus, using these objects which the user is looking at makes it even easier for the user to perceive them without paying particular attention to a particular region.

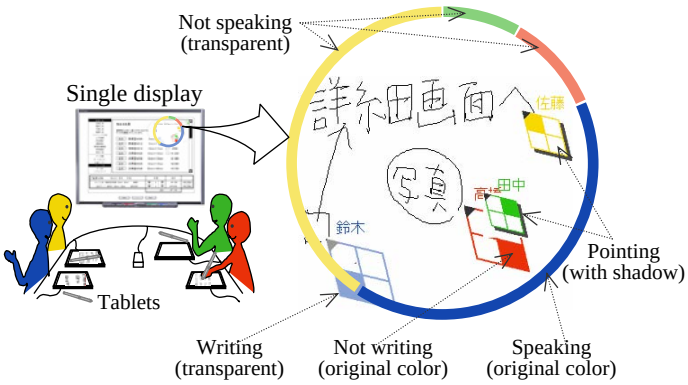

Figure 1: Circular frame and multiple pointers.

EXPERIMENTS

We developed our prototype system and evaluated it in two kinds of experiments. The aim of the experiments is to compare our proposed system (frame mode) with a general parallel input system (parallel mode). Thirty-two people were randomly assigned to 8 four-person groups. Each user used a tablet device and wore a microphone.

Experiment A: To test the interface's usability, we prepared a simple task. The group put down the locations, names, and marks of 12 stores on a blank map looking dealt information sheets to each subject.

Experiment B: We posed a task on the assumption that there is a difference between a participant's knowledge and memory. Subjects were shown a flow chart for 1 minute and the subject group then reproduced the chart.

Results

Group task accuracy. We evaluated how well the figure

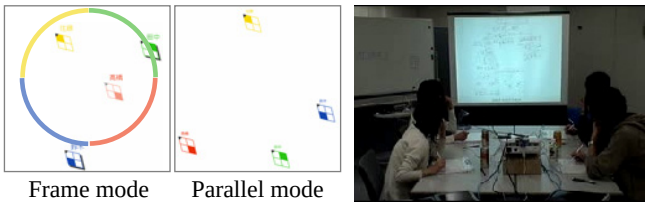

Figure 2: Screenshots of experimental display mode.

Figure 3: Subjects participating in experiment.

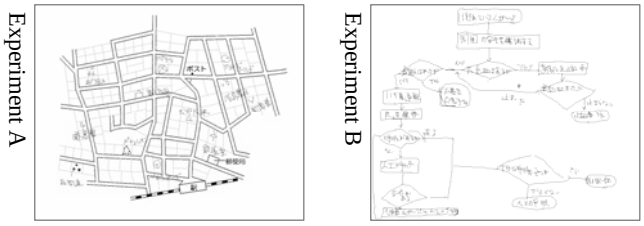

Figure 4: Screenshots the task group completed.

that each group wrote is consistent with the original one. In experiment A, the groups for both modes completed the map perfectly. In exp. B, the frame mode groups reproduced the flow chart with a significantly higher degree of accuracy than the parallel mode group.

Participants' memory accuracy. After the group work, participants answered questions about the contents of the task the group completed. In both experiments, the frame mode enabled participants to memorize the contents with a significantly higher degree of accuracy than the parallel mode.

These results show that the users in our interface concentrate the argument and are aware of the others' behavior.

	Exp.	Frame		Parallel		One-tailed t-test	
		Mean	Std	Mean	Std		
Task accuracy	Exp. A	100.00	0.00	100.00	0.00	–	–
	Exp. B	93.33	8.16	78.00	17.89	t=1.891	**p<0.05**
Task time (minutes)	Exp. A	7.75	1.56	6.29	0.78	t=1.444	p=0.111
	Exp. B	fixed time (twenty minutes)					
Memory accuracy	Exp. A	26.62	17.98	12.04	7.97	t=2.568	**p<0.01**
	Exp. B	67.15	29.64	44.17	22.34	t=2.246	**p<0.05**

Table 1: Task accuracy and Memory accuracy.

DISCUSSION

The following changes of conversation were observed in the experiments: utterances meant by a user to control her/his own or others' behavior and utterances whose aim was for a user to gain common understanding or grounding between users. If we can measure qualitative and quantitative changes in these utterances, it will be useful as a future means of evaluating the usability of SDG.

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