THE IDEA-COLLECTOR: A DEVICE FOR CREATIVE FACE-TO-FACE MEETINGS.

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ABSTRACT

This paper presents the design of a prototypical system to support creative group discussions, like brainstorms. The central concept of this design is the Idea-collector: a tangible input device that is used to organize information displayed on an electronic whiteboard. A working prototype of the Idea-collector was made, following a range of early prototypes. Initial user tests are encouraging with regards to the potential of the device.

Keywords

Brainstorm, tangible interfaces, graspable user interfaces, electronic whiteboards.

1. INTRODUCTION

This paper describes the design of the Idea-collector, a device designed to support the manipulation of idea descriptions on an electronic board, during brainstorming meetings. Brainstorming and, more generally, creative group meetings are a complex and fragile activity: they can easily break down in unproductive critical discussions. This fragility places high importance on the transparency of any information appliance that would be used to support this activity. For general issues regarding brainstorming, see e.g. [4].

In the last years, electronic whiteboard hardware and software applications have proliferated, including several low cost solutions, such as the Mimio input device, by Virtual Ink, that enables a computer to capture the writing on standard white boards used in class-rooms and meeting rooms. Apart from the baseline issue of how to capture user writing, electronic whiteboard applications traditionally focus on the editing task that the user might wish to perform during a presentation. Seminal work in this field has been the Tivoli [2] system developed at Xerox Park and Flatland [3].

While such work has addressed fundamental issues for supporting interaction on a white board (e.g., segmentation of pen input, list editing, etc.) they aspire to be generic regarding the activity for which the whiteboard will be used. Rather than creating a generic editing system we aimed for designing an information appliance. For example Norman [4] defines them as embedded information access devices that support a very *specific* human activity. Therefore to design such devices we have to address two issues: firstly tightly scoping the functionality and secondly designing a purpose specific interaction style. The term interaction style here is used as in De Vet and De Ruyter [6], i.e., as a combination of input/output devices, interaction structure (e.g., conversational, menu based, etc.) and finally the mapping from task to input actions.

A wide design space was explored for this study. We considered very socially intrusive, very off the ground and very simple and straightforward solutions. Section 2 describes the study of user requirements. Then we describe the process of the design and the solution we came up with (section 3 and 4) as well as the implementation of the prototype (section 5). Although our initial user tests (section 6) of the current prototype revealed several usability problems they suggest that we have come up with an elegant and powerful tool for creative meetings that deserves further development.

2. USER REQUIREMENTS

Our design focused on supporting brainstorming meetings with a medium number of professional participants, e.g, 6-7. The performance indicators we have considered for such a brainstorm meeting are the number of ideas recorded, their diversity and the degree of involvement of all participants. Furthermore, during such a session the group must assess the ideas to come to a conclusion, e.g., to choose a few ideas for further work or discussion. We assume that our users are familiar with the brainstorm protocol. But we do not make any assumptions concerning the type of profession or computer experience.

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The size of the group suggests that a shared display of the form factor of a whiteboard should be used. We do not try to address smaller meetings that could be done over a notebook.

An extensive needs analysis was performed, involving a questionnaire based survey with 15 respondents and interviews with 10 professional designers that have creative sessions on a regular basis. Moreover we consulted 2 experts in the brainstorming process. The problems unveiled were clustered as follows:

Social Interaction Issues: Criticizing ideas, different backgrounds, lack of shared knowledge.

Clarifying and representation of ideas: Bad organization of ideas, messy handwriting and drawing difficulties.

Process Issues: Lack of structure, lack of schedule, bad time-keeping.

Personal problems: Lack of motivation, inhibition to come to the board, personal traits such as shyness, dominance etc.

Sharing: Ideas get lost before they get to the board (delayed access), ideas get lost after they have been on the board.

Physical / Tools: The pen performs badly or lighting is poor.

External conditions: Uncomfortable or uninspiring environment, noise levels, etc.

3. CONCEPTUAL DESIGN

3.1 Video prototyping

For a fast trial of some design concepts, video prototypes [7] were developed for those concepts that appeared more interesting to the team. We foccused on two problem areas: social interaction issues and clarification and representation of ideas. The concepts were evaluated by a focus group consisting of 8 persons with various backgrounds. 8 video prototypes were discussed. We tried out design concepts involving: basic editing tools, shape recognition, tangible interfaces and perceptive rooms.

The focus group expressed the following requirements:

- The system should accommodate different personalities. People perform roles when working in a group; a device that interferes with normal social relationships will probably not improve the brainstorm.
- Do not go for high fidelity drawing support or character recognition; low fidelity is good for creativity, high fidelity directs ideas too much.
- It is important to have the proper meaning of things; given a nice interface, a dictionary on the board would be useful.
- It is a good idea to have a parking lot for ideas that are under heavy discussion. Deleting is not a good idea; people do not want ideas to get lost.
- The idea of a physical token for storing and organizing ideas is nice: it is conceptually good to store and organize ideas in a physical token.
- Use a private and public space, both are important especially when you want ideas to be expressed and recorded immediately.
- Do not hinder the interaction between people.

The idea of a physical token for organizing ideas appeared to be the most promising concept. We elaborated on that taking the other requirements in to account.

3.2 Design Description

The concept of the brainstorm supporting system was envisaged as follows.

The system has a private space for all the participants, in the form of a tablet PC, with special software. For the group there are two public spaces in the form of two vertical whiteboards. One is for expressing the ideas and organizing them; the other is for sharing general knowledge, problem statements etc.

The board for expressing and organizing goes with a number of Idea-collectors; these are tangible tokens that work as a capturing device for ideas. A lot of ideas can be selected by touching them on the board. There are “copy” collectors and “cut” collectors. A part of the board is dedicated to “parking ideas”.

A dynamic mind map and synonyms map can be implemented on the tablet PC or the second board. A mind map consists of a central word or concept, around witch related concepts are drawn. The related concepts act as central concepts for new related concepts and so on. A dynamic mind map also is browse-able. Selecting an idea makes it appear in the middle of the diagram. Related ideas are shown around this idea. The synonyms map is organized in the same way. It is filled with synonyms from a dictionary.

4. DETAILED DESIGN

Priority for us in our detailed design was to make the device behavior as simple as possible and therefore more transparent. However this can also result in longer action paths for complex tasks.

The functionality of the device is limited to storage of idea representations, displaying and releasing them.

The interaction-style is as follows:

- Ideas can be collected, by touching them with the Idea-collector.
- When the (magnetic) Idea-collector is attached to the board, it displays the ideas it contains as a bulleted list.
- When the displayed ideas overlap ideas that are already on the board the overlapped ideas turn gray.

We designed and implemented two interaction styles for releasing the ideas

Button interaction style: By pressing a button on top of the collector ideas are released. The ideas are on the board, the token is empty. There are cut, and copy collectors with different colors.

Non button interaction style (see figure 1).

- Moving the collector above the list selects all ideas, which stay on the board when taking the collector off.
- Moving the collector to the left of the ideas would select one idea, which stays on when taking off the collector. The rest stays in the collector.
- Moving the token somewhere else would not select any idea. The ideas stay in the token.

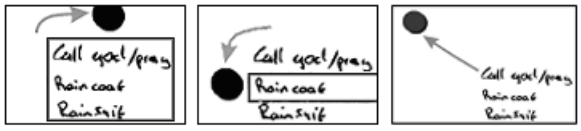

Figure 1: The arrow indicates how the collector has to be moved for dropping all ideas (left), dropping one idea (middle) and dropping none (right).

5. IMPLEMENTATION

In our current implementation we use InterSense™ IS-600: that is a hybrid acoustic-inertial 6-degree of freedom position and orientation tracking system [8]. The IS-600 can track position of up to 8 SoniDiscs in 3D co-ordinates. The SoniDisc is an essential part of our Idea-collector. Beside SoniDisc the Idea-collector consist of a small battery, a button and a magnet. We used a magnet to allow users to leave the Idea-collector on white-board. When button is released the SoniDisc is connected to the battery and can be tracked. By pressing the button the user disconnects the SoniDisc from the battery and the IS-600 system loses track of the SoniDisc.

The IS-600 is connected to a PC through a serial port. The PC receives data from the IS-600 system and displays graphics on the white-board using a video projector. The PC also generates sounds when certain events (such as collecting an item from the white-board or dropping an item on the white board) occur.

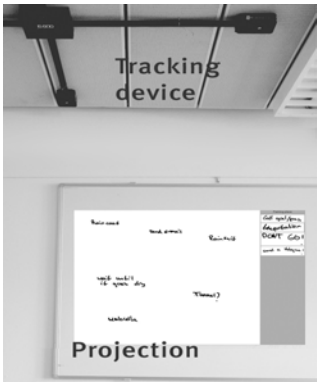

Figure 2: Attached to the roof is the device that tracks the SoniDisc, the ideas are shown with a projector.

We have implemented our prototype to run as a multi-threaded application on the PC with Windows Me™ operation system. The main thread configures the system and updates the graphics projected on the white-board (see figure 2). The communication thread receives the data about position and status of the Idea-collectors from the IS-600 and generates events when new data arrive. Each Idea-collector is represented by a separate thread and receives 'new data' events independently from other Idea-collectors. Further, the Idea-collector thread updates its state and send update requests to the main thread if necessary. This allows the system to respond quickly, because the threads are active (processed) only if users are manipulating the corresponding Idea-collectors. The response time of the system degrades gracefully with the increasing number of simultaneously active (manipulated) Idea-collectors.

6. EVALUATION

An informal evaluation of the prototype was conducted involving two pairs of participants. One of the authors acted as a facilitator for the experiment and the other as an observer. The facilitator provided a short demonstration of the system. The participants were presented with a scenario of a hypothetical meeting where several ideas had already been scribbled on the whiteboard. They were then requested to conduct a series of organizational tasks that the system supports: the tasks were clustering ideas, prioritise them and move some of them to the parking space (see figure 3).

Both pairs tested both interaction styles. After this trial session an open ended interview was conducted

aiming to record their impressions and to gauge whether they perceived the system as interfering with their tasks.

The results of the evaluation can be summarized as follows:

- All subjects were able to operate the collector and complete their tasks after the first demonstration.
- Participants where reluctant to use the copy token.
- When ideas were flushed onto the board from the Idea-collector, these could overlap other writing. Participants wished for an automatic reallocation of the ideas to free space.

Figure 3: A test user drops a number of idea's on the board with the button interaction style.

- All participants expressed a preference for the button interaction style. We hypothesize that the affordance of the button is more fitting for the task at hand.
- Participants found the feedback from the Idea-collector not sufficient. They wished for direct feedback on the collector (e.g. an indication of its contents).

7. CONCLUSIONS

Our work focused upon the organization of materials scribbled on the board during a brainstorm session. The Idea-collector is a simple tangible device that was welcomed by the people participating in the focus groups and was appreciated by our test users.

The Idea-collector seems to support fast organization of materials, and does not interfere with social relationships within the brainstorm group. Clearly, the latter contention needs to be further tested in realistic settings with a fully working system, that will support all the editing and information management functionalities required to support a meeting electronically. Further we see great potential in using it for other applications were lots of materials have to be organized in a fast and intuitive way, and perhaps by special categories of users who would benefit most from a simple and intuitive operation of their input device.

The current hardware may not be ideal to implement this design, it suffers from sound reflections at the board and the calibration is not easy.

Future development of this system should render it rich and robust enough to support real brainstorm sessions. The true success of our design and the interaction styles developed can only be assessed in the context of the actual activities it aims to support.

A broader research question that arises is whether a tangible user interface, such as the token, has an advantage over interaction styles based on pointing with the finger (such as through a wall sized touch screen or a computer vision based implementation like that of Magiboard [1]). We conducted tests with a touch screen. These show that users typically move one idea at the time. Our current hypothesis is that the concept of an idea container is more easily attributed to a graspable device, than to a part of your own body. Such a generalization of our findings could be an interesting avenue for future research.

8. ACKNOWLEDGEMENTS

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