CaptuRing: A Tangible Imaging Tool for Brainstorming

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ABSTRACT
This paper introduces CaptuRing: an adjustable tangible tool for designers to support and augment their brainstorming process. The tool enables selective capturing of required information from a table-top surface meant for brainstorming, storing it and accessing the stored information using intuitive interactions. This provides a framework to relook and reinvestigate upon previous brainstorming sessions to creatively build on each other's ideas while eliminating the need of everyone being present at the same time.

AUTHOR KEYWORDS
Tabletop Interfaces, Imaging, Brainstorming, Fiducials, Creativity Support

ACM CLASSIFICATION KEYWORDS
H.5.2. [User Interfaces]: interaction styles, User-centered design

INTRODUCTION
Research shows that face to face brainstorming meetings in a group leads to productivity loss [4][8] and people tend to be less efficient in generating ideas as compared to working individually[7]. [12][1] suggests that there is decline in creative thinking when people brainstorm in a group In group interactions some participants get uncomfortable and anxious which plays a role in productivity loss [2]. Apart from this

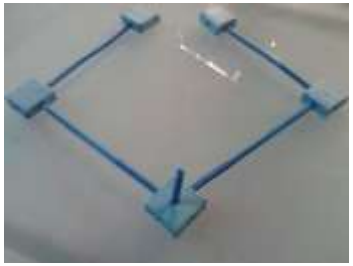

Figure 1: The blue CaptuRing (parent ring) top view

Figure 2 (a): The red CaptuRing top view

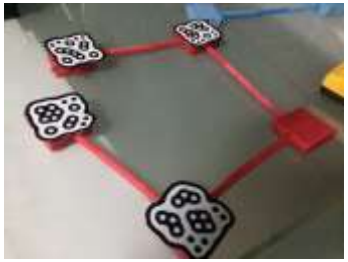

Figure 2 (b): Bottom view of capturing with tagged fiducials

adverse leadership styles, lack of confidence due to low proficiency in language skills, inhibitory influences due to hierarchical structure followed in an organization and socio-cultural factors may also prevents some participants from actively participating in group brainstorming sessions[9].

Brainstorming, an imperative step in a design process, especially in a corporate set-up, is typically carried out on whiteboards by multiple stakeholders. This pool of ideas is generally documented by digitally storing images of the whiteboard, which makes editing and adding to it a chaotic task. The paper talks about an effective brainstorming tool using tangible rings that aids storing and editing ideas.
There exist methods of Collective brainstorming and Co-design. There also exist physical and digital brainstorming tools. Multiple projects and works have been done to enhance brainstorming. Crowdboard [11] is one such project which comes close to our own line of work. Crowdboard is an augmented whiteboard to support large scale Co-Design that enables many potential stakeholders to provide real-time input. Local design teams develop ideas on a standard whiteboard, which is augmented with annotations and comments from online participants.

Various projects also involve using tangible tools to capture and edit images. For example, Tangicam [6] – or tangible camera is a simple tangible and wireless controller that remotely controls a video player. However, Tangicam does not allow selective capturing and editing of images. Presenting CaputRing - an interactive tangible setup to effectively capture brainstorming sessions through easy storing, editing and sharing. 3 different colored rings, connectors and indication markers are used to support brainstorming sessions. Images of brainstormed contents are captured inside rings' perimeters.
System components are presented in CaptuRing Framework section, followed by proposed scenario and prototyping section to demonstrate the technology infrastructure. We conclude this paper by explaining the advantages of proposed system and aim to test this system in future.

CAPTURING FRAMEWORK

CaptuRing provides a platform for collective brainstorming for designers to participate in brainstorming activities with or without their physical presence and involvement at the same time. CaptuRing setup consists of (i) a table top (brainstorming surface) (ii) three types of CaptuRings - blue CaputuRing (the 'Parent ring')(Fig. 1), green CaptuRing (the 'child ring') and red CaptuRing (the 'negation ring') (Fig. 2) (iii) a bunch of connectors and indication markers.

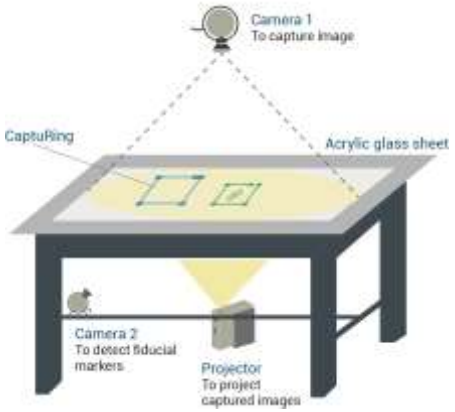

Figure 3: The tabletop setup of CaptuRing

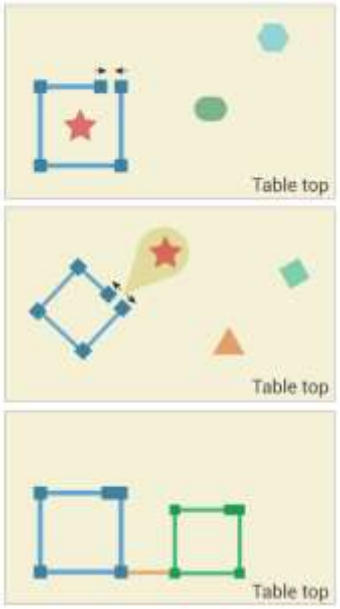

Figure 4: (From top to bottom) i) An idea (content) is captured from the board from parent ring, ii) Ring is opened and the stored image is projected on the table top, iii) A green CaptuRing containing supporting idea is connected to blue CaptuRing through connector.

Scenario

The scenario is of a corporate design office working collaboratively on a project. 'Designer A' individually starts brainstorming on this project by delineating his ideas on a tabletop (a brainstorming surface). Designer is free to bring any object on the surface to support his idea. To store a particular idea from a bunch of ideas on the table top, he adjusts the blue CaptuRing (fig 1), which is flexible and can be elongated, so as to completely enclose the idea. Once ring is closed, enclosed area is captured and mapped (stored) to the ring and a visual feedback 'Image is captured' is projected on the tabletop (fig. 4).

Subsequently, 'Designer B' wishes to contribute to the brainstorming. He opens the blue CaptuRing on the tabletop to see the stored idea. The image which was mapped to that ring is projected on the surface at the same location where the ring is opened. After seeing the idea, he closes the CaptuRing. On doing so, the image goes away and a feedback 'Image is hidden' is projected. He wants to build upon this idea. To do so, he writes the supporting ideas, captures it with a green CaptuRing and connects it to the parent CaptuRing with the help of a connector. He also puts an indication marker (fig 5) in stack of blue CaptuRing to indicate that someone has reviewed this particular idea. These indication markers helps in keeping track of how many people have actually contributed to an idea while still maintaining the anonymity.

'Designer C' is interested to see the progress in brainstorming. He opens the existing CaptuRings to see the captured ideas (fig 6). He writes his critiques on the tabletop, captures it with a red CaptuRing and connects it to the existing Blue CaptuRing. Additionally, he adds one more indication marker in the stack. This allows everyone in the team to collaboratively build up and comment on the ideas of their peers.

Prototyping

We implemented our system using the Processing language. (fig 3) An overhead camera captures the image of the tabletop (the brainstorming surface) using JMyron library for processing. Additionally, we used the reacTIVision technology [5] to identify the position of the rings (tagged with fiducials) on the table top. The fiducials are tracked by an additional camera kept at the bottom. Thus the system uses two cameras and a projector for displaying the cropped image when the ring is opened. We have defined the coming together of the two fiducials on the open ends of the ring as the trigger for the second camera which captures the relevant data, thus using the analogy of enclosing or capturing interaction in real-life to capture the image. When the user brings the two open ends together over the target area, an overhead camera is triggered and the image of the entire board is captured. The third fiducial acts as a reference for the width of the required image the enclosed area and the fourth fiducial refers to the height. We thus calculate the rectangular area enclosed within the ring and the image is cropped accordingly. Hence, dimensions of the CaptuRing can be altered orthogonally which directly affect the X-Y co-ordinates of the fiducials, thus allowing a flexible cropping system.

CONCLUSION

CaptuRing as a tool allows for temporal discontinuity in brainstorming sessions, which can be of vital essence especially in busy environmental settings where it is not always possible for all the members to be available for

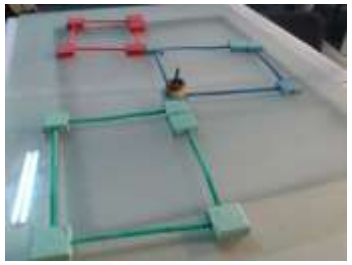

Figure 5: CaptuRings connected via connectors and stacked with indication markers

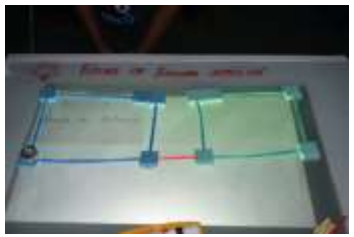

Figure 6: Brainstorming using CaptuRing (the images are projected on the brainstorming surface)

discussion at the same time. The tool itself supports a workflow wherein the participants can have access to previous information, contribute ideas and opinions, and store it with ease for other participants. Thus, flexibility is provided in terms of time.

Anonymity is another aspect which CaptuRing succeeds to address when it comes to generating, reviewing and critique of ideas. Research suggests that anonymous brainstorming produces more nonredundant ideas than nonanonymous brainstorming[3]. CaptuRing supports anonymity in brainstorming which can bring out the best out of even the most introvert person in the group. A major principle of brainstorming is that individuals should generate initial ideas and groups should be used to refine those ideas[10] and CaptuRing supports this principle. It should be noted that the main essence of brainstorming still remains intact, which is to build up on each other's ideas by referring to information already stored.

Another advantage that CaptuRings provide is the flexibility of space. Instead of a conventional whiteboard where space is limited, multiple CaptuRings can be used to account for a larger number of ideas, which can then be easily brought into the active frame of the table top as and when required for viewing. In future, we aim to test the prototype across designers to evaluate on its acceptance and effectiveness.

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