

Magic Boards

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1 Introduction

Augmenting a video with special effects can produce visually compelling and interesting results. For example, the television newscast of a weatherman often contains graphics and animation. To create such mixes of live and synthetic media, the presentation must be carefully planned. By contrast an interaction using a marker or chalkboard (eg. a lecture or meeting) can be more spontaneous and requires a lesser amount of planning. While it is simple to capture such an interaction with a video camera, that video is often unsatisfactory. For example the board may be difficult to read because of low resolution or sloppy writing. Or the video itself may just be boring. We want to be able to augment the board with special effects (such as in the weatherman example) without giving up the flexibility of traditional board interaction.

In order to achieve our goal, we propose creating and adding the special effects as an off-line/post-process after the interaction has been recorded. One direct approach is to repaint the board in every frame. This method is unattractive, because it is tedious and time consuming. Instead, our *Magic Boards* system is designed to augment video of an event where one or more people write on a board, without requiring nearly as much work. The system allows the spontaneity and collaboration found in this type of interaction while producing a video that contains special effects on the board, such as videos and type written text.

The input to Magic Boards is a pre-recorded video of some interaction around a chalk or marker board, where the camera is not moving. Someone who is familiar with the interaction, who we refer to as the “author,” is presented with a small set of images retrieved from the video. Each image represents a single idea written on the board. The author then replaces each image with a picture, video or animation, to better represent each idea. The author also indicates when to expose (or hide) different parts of each new image. A new video is rendered using the replaced pictures and videos in place of the writing on the board. The new material is kept at the bottom layer of the video, meaning that anyone who walks in front of the board will always remain in front.

2 Regions

The central concept of Magic Boards is the *Region Object*, introduced in [1; 2]. A region is a group of writing on the board that represents a single thought or idea. We treat regions as an atomic unit, that is the smallest amount of writing that makes sense to work with, during repainting or other processing.

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Figure 1: (Left) Original Region, a list of writing. (Right) Region replaced with type written text.



Figure 2: (Left) Original region blocked by presenter. (Right) Replaced region still blocked by presenter.

The regions are automatically extracted from the video. Part of the region finding process is to segment the foreground (presenter and other obstructions) and background (the board). Holes in the background are filled using future information. A single image taken from the background after the region has been completely drawn is used by the author for repainting the video.

3 Repainting and Rendering

To create the final video the author replaces each region with a new image and determines when parts of the replacement image will be phased into the final video. The new images may be created using any painting tools. In our experiments, we have used Adobe Photoshop along with a Wacom Tablet. We have found several useful strategies for replacing the region. First, the author may simply trace over all of the lines in the image; this can change the color of the drawing or make the writing appear bolder. Another option is to replace handwriting with type written text. A diagram can be replaced with a high resolution image or video. Whenever a video is used, the author may specify a time warp so that the audio of the original video corresponds with the video being inserted.

Once the author specifies all of the replacements for the regions, a new video is rendered. The regions are faded into the video, so as not to jar the viewer. To ensure the instructor is kept above the repainted regions, the foreground is placed on top of the new video.

Acknowledgements This work is supported by NSF Grants IIS-0097456 and IIS-0416284. Michael Wallick is funded by a fellowship from Microsoft Research.

References

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- [2] Michael N. Wallick, Rachel M. Heck, and Michael L. Gleicher. Chalkboard and marker regions. In *Mirage 2005 - Computer Vision/Computer Graphics Collaboration Techniques and Applications*, March 2005.