Blue Eye – Making Mood Boards in Augmented Reality

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We describe the conceptual design of an augmented reality system for making mood boards. The main features of the proposed system are: the ability to integrate pictures of real objects and digitally retrieved pictures in an intuitive way, the ability to enrich mood boards by adding movements (and sounds), and the ability to control the system by means of hand gestures. The system can be realized by integrating available technology.

Interaction techniques, augmented tabletop systems, mood boards, design support.

1. INTRODUCTION

Mood board making is a widely accepted and used technique in design processes [1]. Mood boards aim to capture the atmosphere of experiences by means of photographs or other expressive aids [2]. They provide a mechanism for designers to respond to perceptions about the brief, the problem as it emerges and the ideas as they develop [3]. Traditional mood boards are assembled by gluing different types of analogue media (pictures from magazines, photographs, fabrics, objects, etc.) on a mounting board. Digital mood boards can be created by collecting similar media in a digital format and assembling them with the help of graphics software, such as Photoshop, Illustrator or Freehand.

Within a student project at the Industrial Design department of our university we explored how mood boards could be created in augmented reality [4]. The design goal was to create a system that would combine advantages of the physical and the virtual (or digital) world. Six projects teams received the same project brief and worked simultaneously on alternative product designs. Within this paper we present the most promising product concept, which was created in the form of a video prototype. This prototype clarifies the major product characteristics and the relevant human-computer interactions, while paying less attention to the technologies required for realizing these functionalities.

After presenting the design process and the designed product, we discuss its relationship to existing work in human-computer interaction, in order to clarify both similarities and differences with existing designs. This relationship to existing work is also made to clarify that the product concept can be realized, based on available technology that has already been demonstrated elsewhere. The next obvious step is to actually build and deploy the system, in order to perform experiments with it that can inform a next design cycle.

2. DESIGN PROCESS

The six first-year industrial design (ID) students (authors 3-8) that were the members of the project team that created the conceptual design of the “Blue Eye” system did not possess advanced knowledge on how to create and use mood boards. In order to build up relevant expertise, they were first provided with a theoretical introduction on the subject by the second author, based on existing literature [2,3]. Under the supervision of experienced industrial designers who use mood boards in their design practice, the students were asked to individually create three types of mood boards: traditional, digital and in augmented reality. During the first week of the project, students created traditional mood boards by cutting out pictures from magazines and gluing them onto mounting boards. During the second week, they created digital mood board by retrieving images from the Internet and by using commercial software packages such as “Photoshop” for editing the pictures into a one-page composition. Last but not least, in the third week students created a mood board in augmented reality by using the Electronic Paper prototype (EPP) [5] which was implemented on an existing augmented reality system called the Visual Interaction Platform [6]. This EPP was designed to simulate, within a digital environment, early design activities such as sketching with pen on paper and arranging images. Its aim is to combine the naturalness of physical media with the flexibility of digital media. Although the EPP is not a mature design, in the sense that it is still undergoing improvements in terms of usability, it provided a means for students to gain hands-on experience with augmented reality.

For each of the three mood board creation techniques, students formulated what they perceived as main advantages and disadvantages.

Using “traditional” tools (i.e. scissors, glue) for making mood boards felt very natural, and the result remains (physically) available at all times. By its non-obtrusive presence, the mood board can remind designers of their own

design goals, and invite others, such as clients or colleagues, to discuss it. The major obstacles were finding good input materials, such as suitable magazines, and keeping order of the mess of discarded material that easily arose in the workspace.
Using “digital” technology for creating mood boards provided access to a very large database of pictures (the Internet) and a wealth of editing functionalities. The main observed disadvantage was the difficulty of maintaining overview, both of available pictures and the global composition. Access to a suitable output medium, such as a print of sufficient size and quality, is required to make the mood board available to the designers and their environment in the remainder of the design process.
The EPP offered a large workspace which provided overview and in which (digital) pictures could be manipulated in a natural way. The fact that images were projected from the top onto the workspace was experienced as a drawback, since the hands were sometimes casting unwanted shadows. The functionality offered by the EPP was in no way comparable to that available in commercial software packages such as Photoshop, and some features, such as the ability to create layers, were duly missed. Some existing usability problems within the EPP, such as the observed latency between input actions and visual feedback, made it difficult to appreciate the full potential of the system. The use of the Internet as a resource for collecting images, and the need to print the resulting mood board for future use, were characteristics that were shared with the “digital” mood board.

2.1 Design Requirements

After analysis of the gathered experiences, it was decided to base the concept of a new mood board creation system on the following requirements:

- It should be possible to introduce physical pictures of arbitrary shapes, and pictures of actual objects, next to Internet pictures and digital photographs, into the digitally-stored and displayed mood board.
- The interaction should feel natural, in the sense that there should be a one-to-one correspondence between where the actions are performed and where the visual feedback is provided. This is inspired by the intuitive look and feel of the current augmented reality system.
- Instead of using external interaction elements, (two-handed) gestures should be used to control all operations. This would create a digital tool with an affordance that comes close to that of physical tools.
- The mood board prototype should provide functionality that can motivate the migration from analogue to digital media. Within the proposed prototype this was translated into the possibility of creating motion within the mood boards in a natural way. Other extensions such as adding sound were considered but are currently not included, in order not to overload the product concept.

3. SYSTEM DESCRIPTION

The hardware components of the system, see Figure 1, are a table with a large display surface, and two cameras that are mounted above the table, i.e., a low-resolution video camera for tracking hand gestures and a high-resolution digital camera for capturing still images (with newer digital cameras, see http://www.canon.co.uk/, both camera functionalities might be integrated into one camera). We currently use a video projector and a mirror underneath the table to create an image on a transparent plate, but other means for creating a large display surface might also serve the purpose. The table has a height of 90 cm (rather than 75 cm for a standard table) in order to allow for easy operation while standing up. Several people can easily gather around the table and cooperate in the mood board creating activity and associated discussion.

FIGURE 1: The Blue Eye system with the camera(s) mounted on top and the display integrated into the table surface.

There are different ways for creating images on the table. One is through digital means, i.e., by sending digital images to a dedicated “input” folder. Such images may for instance be acquired by a digital camera that sends pictures wirelessly to this folder (such as the Nikon Coolpix P1, see http://www.nikonusa.com/). The other way, see Figure 2, is by putting physical pictures or objects on the table and pressing the camera capture button. The back-projection allows using the well-known and developed Blue Screen technique (see *The Blue Screen Page* at

http://www.seanet.com/Users/bradford/bluscrn.html) to capture images of the objects (and their outline) on the table. While a high-resolution image is captured, the projected background is changed into a uniform (and known) colour, so that the actual physical object can be easily segmented from the background (especially if we assume that we are looking for a single connected component on an otherwise uniform, or slowly varying, background). In case automatic segmentation is not to the user's liking, or the user wants to extract a part of a digitally imported image, hand gestures may be used to cut out a (non-rectangular) region of an image.

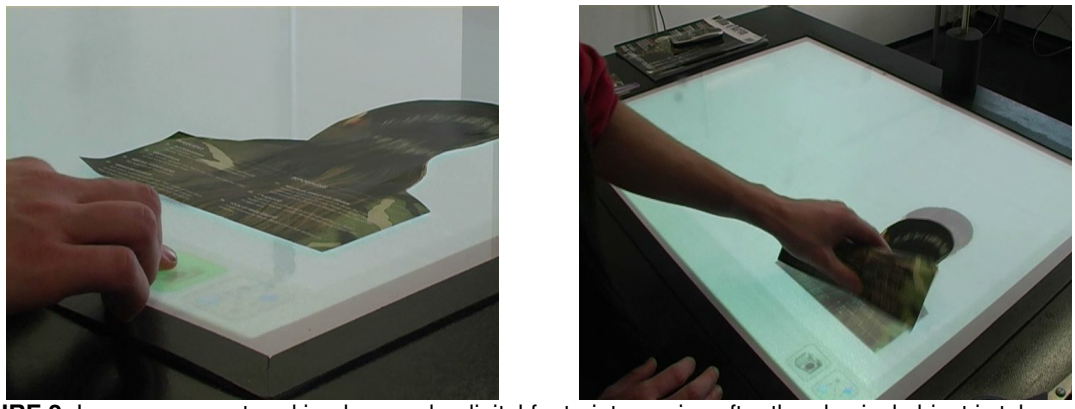

FIGURE 2: Images are captured in-place and a digital footprint remains after the physical object is taken away.

The Blue Eye system has a second mode of image capture that is set by a toggled button. The images that are captured while this button is active are considered to form a sequence and are interpolated to create a smooth and circular motion sequence (i.e., the last image of the sequence is linked to the first one). Most frequently, the sequence is created by capturing the same physical object in a number of positions.

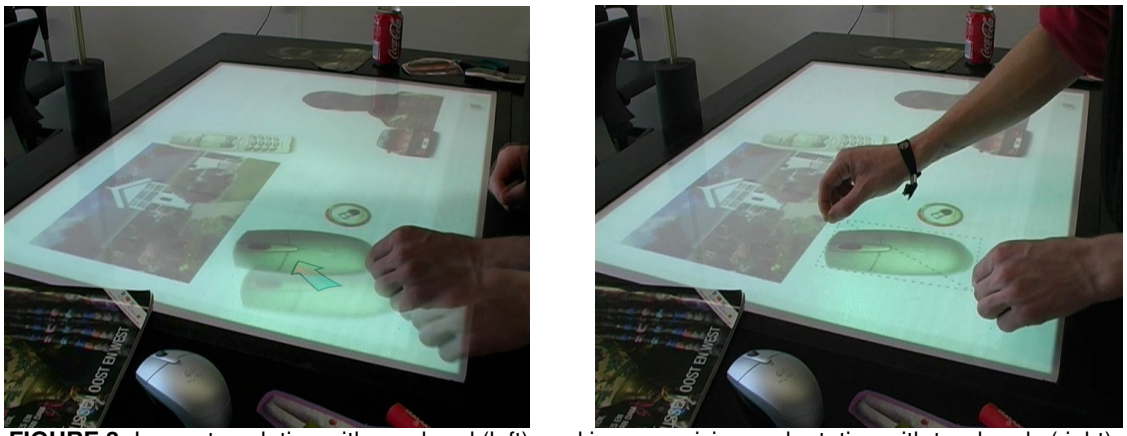

FIGURE 3: Image translating with one hand (left), and image resizing and rotating with two hands (right).

A video camera (i.e., a firewire camera with a spatial resolution of 640x480 pixels, capturing 60 frames per second) is used to track the gestures that are needed for operating the system. An obvious advantage of optical tracking is, amongst others, that several users can interact at the same time, using both hands. The interaction gestures could either be executed by means of tagged interaction elements, which allows for a robust and easy solution from a technology perspective [5], or using human hands, which is obviously the most flexible solution from the point of view of the end user. The feasibility of performing real-time tracking of arm and hand motions, and of using them for human-computer interaction, has been demonstrated earlier [7], and some software solutions are publicly available (see http://ilab.cs.ucsb.edu/projects/mathias/handvu_ilab.html). The requirements for the Blue Eye system are limited since only few gestures need to be distinguished. For instance, closing the index finger and thumb (of one hand in case of translation; of both hands in case of resizing and rotation) could signal a re-positioning event to the system, as shown in Figure 3. Translation and rotation might also be integrated in a single-hand gesture using the technique proposed in [8]. An extended index finger might be used to draw on the display, while an extended middle finger might be used to cut out parts of an image. Such hand gestures are expected to be natural and easy to learn.
The mood board output is an image that can at any stage be retrieved from a designated "output" folder and imported into other applications.

4. RELATIONSHIP TO EXISTING SYSTEMS AND FUTURE WORK

The idea of capturing information from the real world in an intuitive and compelling way has also been expressed in other recent designs [1,9]. The "I/O Brush" [9] is a paintbrush with an integrated camera, light source and touch sensors that can pick up colors, textures and short motion sequences from its environment. The physical size of the I/O brush limits the physical elements that can be "picked" to object details rather than complete objects. These picked elements are used as brushes for drawing, hence creating interesting and compelling pictures. A similar functionality is feasible within the proposed system. An important difference is that both larger objects and object

details (by cutting out a region of a captured object) can easily be captured in the Blue Eye system. The possibility of creating motion sequences from a series of captured still images is another obvious extension.
The “Cabinet” prototype is an augmented reality system for managing photo collections [1]. It can photograph physical objects on the table surface and replace them by a digital footprint in place. The captured picture however represents the entire workspace and only a rectangular region of interest can be specified by the user to crop the image. Interactions within the Cabinet system are performed by means of a pen on a digital tablet, which has the consequence that images need to be projected from the front, rather than from the back, as is done in our case.
Our own Electronic Paper prototype (EPP) [5] demonstrates how image handling and drawing can be used so support early design activities. The EPP has much more extensive functionality than the proposed system, but uses only digitally generated images. It does not possess the natural and seamless interaction with physical objects that is proposed in the Blue Eye system. The use of a digital pen and the physical construction of the EPP also limit it to be single user.
The next step is to actually implement and test the system. The picture capturing requires a computer-controlled digital camera (such as Canon PowerShot S80 with http://www.breezesys.com/PSRemote software). Motion tweening (morphing), i.e., creating image frames in between specified key-frames, is available, for instance in commercial packages such as Flash. The biggest obstacle to the system realization is most likely the hand tracking and gesture recognition. As an intermediate solution, the available tracking technology within our VIP system [6], based on using an infrared-sensitive camera and infrared-tagged objects, can be used. This might be implemented by mounting infrared-reflecting dots on both hands of the user. Using this technology, we can start gathering end-user experiences before we have gesture recognition available.
Once the system has been realized, the extension with additional functionality can be explored. One potentially interesting idea arose in one of the other student projects. They proposed to assign colours to different parts of a soundtrack and to associate (for instance by means of dragging) the different colours to different parts of the mood board. Not only can this be used to add sound to a mood board, but it also provides a means for sequencing through the different components of a mood board. Of course, such interactions need to be tested in order to decide whether or not they are truly useful.

REFERENCES.

[1] Keller, I. (2005) For Inspiration Only: Designer Interaction with Informal Collections of Visual Material, Ph.D. thesis, Technische Universiteit Delft.
[2] Muller, W. (2001) Order and Meaning in Design, Lemma Publisher, Utrecht, the Netherlands.
[3] Garner, S. and McDonagh-Philp, D. (2001) Problem Interpretation and Resolution via Visual Stimuli: The Use of Mood Boards, The Journal of Art and Design Education, 57-64.
[4] Milgram, P. and Kishino, F. (1994) A Taxonomy of Mixed Reality Visual Displays, IEICE Transactions on Information Systems, 1321-1329.
[5] Aliakseyeu, D., Martens, J.B. and Rauterberg, M. (2006) A Computer Support Tool for the Early Stages of Architectural Design, accepted for publication in Interacting with Computers, see also: http://authors.elsevier.com/sd/article/S0953543805001128.
[6] Aliakseyeu, D., Martens, J.B., Subramanian, S., Vroubel, M. and Wesselink, W. (2001) The Visual Interaction Platform, in: Proceedings of Interact 2001, IOS Press, 232-239.
[7] May, R. (2004) Towards Directly Mediated Interaction in Computer Supported Environments, Ph.D. thesis, University of Washington.
[8] Kruger, R., Carpendale, S., Scott, S.D. and Tang, A. (2005) Fluid Integration of Rotation and Translation, in: Proceedings of CHI 2005, ACM Press, 601-610.
[9] Ryokai, K., Marti, S. and Ishii, H. (2004) I/O Brush: Drawing with Everyday Objects as Ink, in: Proceedings of CHI 2004, ACM Press, 303-310.