Mood Boards: Industrial Designers' Perception of Using Mixed Reality

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ABSTRACT
Developments in mixed reality systems in the last decade have provided proof-of-concepts by means of technology-tailored usage scenarios. Instead of focusing on the technology required for implementation, we have shifted our focus towards users, investigating the potential impact of such techniques on the actual work practice of industrial designers. Specific activities have been identified during a full ethnographic study conducted by means of Cultural Probes and Workshops with representative participants. We have identified an important task, the creation of mood boards, and have explored how industrial designers perceive the use of mixed reality to support their work by asking them to create a mood board on an existing mixed reality prototype. Participants were enthusiastic about the idea of creating mood boards in mixed reality.

Keywords
Mixed Reality, User-Centered Design

INTRODUCTION
The last decade has witnessed the development of a number of mixed reality computer systems [9]. Most of the developments and progress made so far have concentrated on the technology required, and have provided proof-of-concepts by means of technology-tailored usage scenarios. As far as such systems have been tested, it has been mainly on well-contained tasks and applications that have been specifically developed for these platforms. This means that the question of whether or not such systems can effectively complement current practices in real-world situations remains largely unexplored.

Some examples of these systems have been developed in our Visual Interaction Platform (VIP) [1] research lab. The Electronic Paper (EP) prototype uses mixed reality techniques, such as optical tracking, two-handedness, tablets and transparency, to integrate traditional pen and paper with computer functionalities (such as for creating, handling, storing and retrieving images and sketches). Although this prototype was used to perform usability tests, it did not reach the maturity needed to prove its effectiveness in the architectural design process where it was applied. With the experience gained in past projects, we are now at a point where we can shift our focus from pure implementation issues to investigating how mixed reality systems can better support professional users in their daily activities. This means that we feel that extensions to our prototypes with new functionalities need to be increasingly guided by end-user requirements.

We decided to focus our work on industrial designers for several reasons. First, it seemed only natural to work with this class of users as the VIP lab is part of a department of industrial design, where we have many existing contacts with practicing designers. Second, designers rely on a large number of different techniques to create and shape their ideas. Many of these techniques involve ways of depicting / visualizing / communicating their ideas, both to themselves and to others. Creating and manipulating visual objects in both 2D and 3D space is hence an important activity in industrial design. Third, because of the visual nature of many industrial design tasks, there seems to be ample opportunity for supporting specific activities, provided of course that the tools created enhance rather than obstruct the design process. Existing bottlenecks in industrial design practices need to be identified and new mixed reality solutions need to be compared to existing solutions with respect to efficiency, effectiveness and appreciation.

USER STUDY
In its entirety, this project will consist of three design cycles. The primary goal of this first cycle was to identify specific activities or tasks that are important for industrial design which could be better supported by mixed reality interaction techniques. A task may be important for several reasons: being real, i.e., related to actual user practice, frequent and/or critical [13]. In order to identify these tasks, the research was conducted in two phases, namely a Cultural Probe Study and a Workshop. The main research question of the user study was 'how would industrial designers use mixed reality in their design studio?'

Participants

Based on ethnographic design research, we aimed at studying a small number of users in depth rather than a large number shallowly, obtaining a richer, deeper and textured understanding of user needs [5]. We recruited ten practicing industrial designers for our study to ensure different viewpoints.

We decided to invite practicing Industrial Designers as opposed to Industrial Design students because we wanted to find problems and opportunities for mixed reality in the real context where industrial designers work. We tried to obtain a rich mix between industrial designers either working in private companies or doing freelance work. In this way, we would obtain a wider variety of contexts, ranging from an office in a large company, to freelance work performed at home. We wanted to see how people arrange their working spaces both at home and at the office.

Cultural Probes

The first part of the study took place in the participants' design studios and looked into what people do there, their activities, places and objects they use in the practice of industrial design. In this part of the study, initial requirements on current use of technology and on mixed reality were also gathered. We wanted to know whether participants had had any previous experience with mixed reality or augmented reality systems.

Cultural Probes [4] were used for this stage. The probes consisted of a Diary, which contained questions, a timeline for tracking their activities, and assignments such as drawing and describing what their ideal design studio would be like. The probes also included a disposable camera to allow participants to take pictures to visually support and highlight some of the experiences they had while filling-in the diaries (Figure 1). The probes were introduced during an interview in the participants' design studios, where a brief explanation of what they were expected to do with the probes was given.

The main advantages of this way to elicit requirements include collecting data from participants over a period of time (one week), something that formal interviews do not allow. A one-week period allows them to reflect on what they are being asked in the diaries as well as on the answers they provided on the previous days.

Figure 1. Pictures made by participants showing differences in how designers arrange their work space.

Figure 2. Two-and-a-half dimensional mood board. Exploration for a "Movement mediated display".

Findings

Most of the conclusions we reached at this point were connected to the early stages of the design process where most work is performed outside the computer and where inspiration is an important factor. Participants said they prefer more flexible and intuitive ways of interaction, such as the use of pen and paper, for these creative activities.

Most participants mentioned mood boards as an important activity for their work. Mood boards are a commonly accepted design technique in most design processes [7]; they capture the atmosphere of experiences by means of photographs or other expressive aids [10]. Mood boards provide a mechanism for students and practicing designers to respond to perceptions about the brief, the problem as it emerges and the ideas as they develop [3]. Traditionally, mood boards are assembled by gluing different types of analog media (pictures from magazines, photographs, colours, fabrics, etc.) on a mounting board. Digital mood boards can be created by collecting the same type of media, but on digital format and assembling it on computers with the help of graphic software (i.e. Photoshop, Illustrator, Freehand, etc.). Two-and-a-half dimensional mood boards can be obtained by combining real objects and traditional media on the mounting board (Figure 2).

The creation of mood boards summarizes many of the conclusions we reached in the Cultural Probe study as reported by our participants. Mood boards are mostly created in the early stages of the design process, specifically in the Creation phase where most of the work is done without the need of a computer. Pen and paper are mostly used at this stage of the design process. Instead of forcing the transition of an existing computer tool from the vertical screen (computer) onto the horizontal workspace (table top), we decided to focus our attention for this first design cycle on the creation of mood boards that is now naturally performed on the horizontal workspace with physical media, in order to explore how this natural feeling can be kept (and hopefully expanded) with the use of mixed reality interaction techniques.

Considering the work that has been previously done on the VIP, we saw similarities between the functionalities of the EP prototype and the creation of mood boards. The EP prototype integrates traditional pen and paper with computer functionalities (such as for creating, handling,

storing and retrieving images and sketches). In the Workshops, we looked further into how industrial designers create mood boards by asking them to create one using the EP prototype.

Although at this point we emphasized the creation of mood boards, other interesting ideas from the Cultural Probe study that were reported by participants were also presented and discussed during the workshops.

Workshops

The second part of the study took place in the VIP lab at the Eindhoven University of Technology, in Eindhoven, the Netherlands, through a series of Workshops.

First, participants were shown a presentation on mixed reality which included several videos of other related projects that present the latest advances and future visions of mixed reality in different contexts (i.e. "Kickass Kungfu" [6], "I/O Brush" [11], and "The Invisible Train" [12]). The idea here was to show examples, trigger their imagination and start building a discussion around how these technologies could better support the work of industrial designers in the context of their design studio.

Second, the main findings from the Cultural Probe study were discussed with participants, going in depth on specific aspects of their individual diaries. At this point, participants were asked whether they could foresee industrial design activities that could be better supported by mixed reality interaction techniques.

Third, a mixed reality prototype developed in the VIP lab was shown: the Electronic Paper with Visual Interaction Enriched Windows (VIEWs) [8]. This prototype, was originally targeted at the early stages of architectural design, but is sufficiently general to also be of interest to industrial designers. The main purpose of showing this prototype was to explore how industrial designers perceive the use of mixed reality to support their work with a concrete example. Figure 3 shows the workshop setup. After an interactive tutorial explaining the main aspects of the system, participants were asked to create a mood board. Scenarios [2] were used to provide a context for the activity that they were being asked to perform. Participants had two options: the first was to choose a project that they were currently working on and create a mood board showing the atmosphere and direction of the design. The other option was to choose a personal design project they had in mind for the future or a hobby (Figure 4). Figure 5 shows examples of the mood boards created by participants on the VIP system during the Workshops.

Finally, the session was concluded with an open discussion on the workshop experience. Participants were asked at this point if the creation of mood boards or other activities could be supported by mixed reality. A brainstorming session took place where new ideas were discussed.
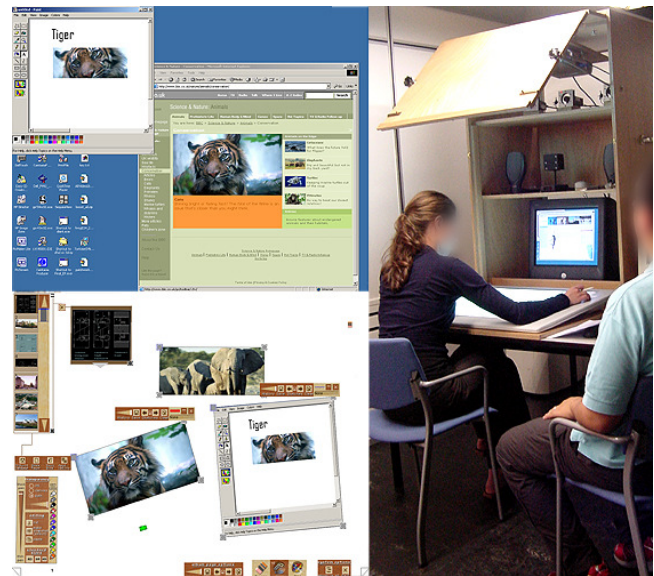

Figure 3. Workshop setup on the Visual Interaction Platform (VIP). On the left, vertical screen (top) and projection on horizontal workspace (Wacom tablet) (bottom). On the right, Workshop setup with observer.
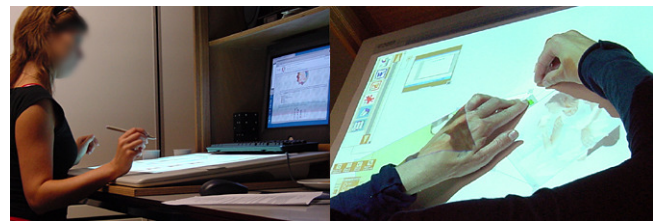

Figure 4. Participants creating mood boards on the VIP system during the Workshops.

Figure 5. Two mood boards created on the VIP system during the Workshops.

Findings

After completing the Workshop, all participants agreed that making mood boards should be supported by mixed reality interaction techniques. Participants were enthusiastic about the experience of creating mood boards on the VIP system, although they said the interaction could be improved. For instance, participants suggested a more direct approach in controlling the (virtual) images. Images can now be moved and rotated with an ITT (Infrared Tagged Tangible) element on the non-dominant hand, together with a pen on the dominant hand. They proposed having two-handed interaction without the need of using a tool (the pen).

Participants also mentioned how the horizontal nature of the task felt very natural with the VIP system. Some comments made by the participants include:

- "I like the feeling of grabbing the (virtual) images, that you are connected to moving and rotating images. I like that it is a horizontal activity".

- "I have a better grip on what I am doing because I am doing things in the real world. It is more realistic than on computers. I feel I have something under my hands as opposed to a virtual object that is on a screen".

Discussion
Designers collect visual material that they can later use in the design process for reference and inspiration. While Cabinet [7] is a mixed reality tool to collect and organize visual material, the EP prototype [8] is most suitable for manipulating and creating images and sketches. Combining the functionalities within these two prototypes would not only support the collection and organization of visual material, but also the creation and retrieval of mood boards.

The next step will be to use Cabinet for an experiment where practicing industrial designers will be invited to create mood boards. The purpose of this is to explore their perception of using mixed reality for creating mood boards by using a system that incorporates different interaction styles, interaction elements and functionalities. The outcome of the two evaluations will not be a "wish list" of functionalities taken from both systems (VIP and Cabinet). Instead, the idea is to find the essence of creating mood boards, defining what mood boards are about. Once the basic concepts that make mood boards what they are have been identified, we will be able to think about exploring new interaction styles to create novel ways of making mood boards. We can already foresee some ideas such as moving from 2D to 3D, and even to 4D if we incorporate movement as a new dimension. Other ideas include adding sound and movies to mood boards, as well as making them interactive.

CONCLUSION
An important first step towards designing a mixed reality interaction concept that supports the work of industrial designers has been taken. Instead of looking for a technology-tailored usage scenario that would fit a mixed reality application, we have used user-centered design techniques to ask designers how these systems can better support their work in their design studios. We have identified an important task, the creation of mood boards, to focus our future work on. Our next step will be to conduct further studies on how designers create mood boards on another mixed reality system (Cabinet), trying to find the essence of creating mood boards. Once the studies on Cabinet are completed, we will proceed to design and implement new interaction styles for creating mood boards that keep (and hopefully expand) the natural feeling mentioned by our participants.

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