# Photochromic Canvas : Drawing with Patterned Light

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**Figure 1:** *Writing with light*

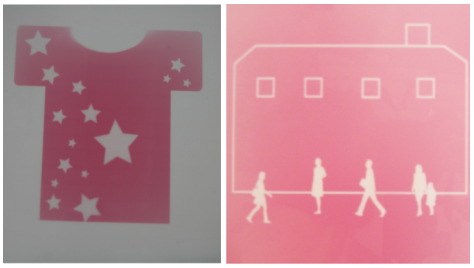

**Figure 2:** *Effects of patterned light*

**Figure 3:** *Effects of periodic light*

## 1 Introduction

Drawing tools using digital technology can stimulate creativity in people. For example, the Wacky Brush tool in KidPix can produce effects (such as a line of dripping paint or a line of shapes) that cannot be obtained using ordinary paper and brushes [Hickman 1991]. This feature makes it easy for people to draw pictures having a combination of patterns. Such software, however, has so far been used only with electronic displays such as LCDs and PDPs. In this paper, we propose a mechanism that would allow the user to draw such pictures while using paper as a canvas instead of electronic displays.With this mechanism, a variety of patterns can be made to appear along lines traced out by the user by moving an electronic paint brush over paper. The advantages of using paper in this way include a high degree of freedom in shape and size as well as portability.

## 2 Photochromic Canvas

To achieve the above objectives, we focused our attention on photochromic material in which the appearance and disappearance of color can be controlled by light. In this regard, KAMI CHAT has been proposed as a means of controlling the generation of color by placing paper coated with photochromic material over an array of LEDs [Osada et al.2008]. We here adopt photochromic material that can maintain a color-forming state and propose a system that does not place limitations on where the paper is placed. In this system, moving a handheld projector like a paint brush over paper coated with this photochromic material results in a reaction between the material and the projected light and a change in paper color. Effects like those of Wacky Brush can be obtained by projecting patterned light from the handheld projector. We call our system “ Photochromic Canvas. ”

The photochromic material used here is diarylethene (DAE-BT, YAMADA CHEMICAL CO., LTD.)[Irie et al.1988]. Shining ultraviolet light on DAE-BT changes it color to pink and shining visible light on DAE-BT makes it transparent. Thus, if we coat white paper with DAE-BT and expose it to ultraviolet light to make it pink, we can move a handheld projector connected to a personal computer over the paper like a paint brush to make the DAE-BT transparent and reveal the white paper underneath according to the pattern of projected visible light. This process makes for many possibilities. For example, the user can create a line combining different motifs even when tracing out one simple line through the synergetic effect achieved by changing the rhythm or speed of the drawing hand and the pattern of the projected light over time.

## 3 Experimental Results

Experimental results are shown in Figure1. These results show that the color of the paper changes due to a reaction with the light emitted from the projector.

The results of using patterned light are shown in Figure2. Here, the shape of a T-shirt and the outline of a building were prepared as preliminary sketches and the projected pattern (star of certain size/orientation, human silhouette, etc.) was changed every second. Thus, by moving the projector once a second, the user can draw patterns as if using a stamp.

The results of periodically projecting simple patterns from the projector are shown in Figure3. The letters shown here consist of circles of the same diameter formed by switching between ON and OFF every second and circles that alternate between two diameter values. Thus, while the user need only draw simple characters, the end result is characters with embellishments.

## 4 Conclusion

We proposed and implemented a photochromic canvas. This system, in principle, requires no detection of projector position or paper alignment and allows the user to draw as desired anywhere on paper making it intuitively easy to use. In future research, we plan to expand photochromic material to real-world-oriented interfaces.

## Acknowledgements

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## References

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