

# The Information Curtain: Creating Digital Patterns with Dynamic Textiles

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## ABSTRACT

We are exploring ways to bridge the gap between traditional interior-design materials and digital media. At a time when computers become ubiquitous we think it is important to explore alternative display materials that can be better integrated in the human environment. The *information curtain* is a seemingly ordinary textile that can change color and pattern dynamically according to some input data. This was achieved by creating a special textile based on fibers that change color according to the amount of ultra-violet (UV) light. A color will appear on the surface when exposed to UV light and then slowly fade away when the light is turned off. By connecting the fabric to a computer-controlled UV light we will be able to use textiles as an output for digital media.

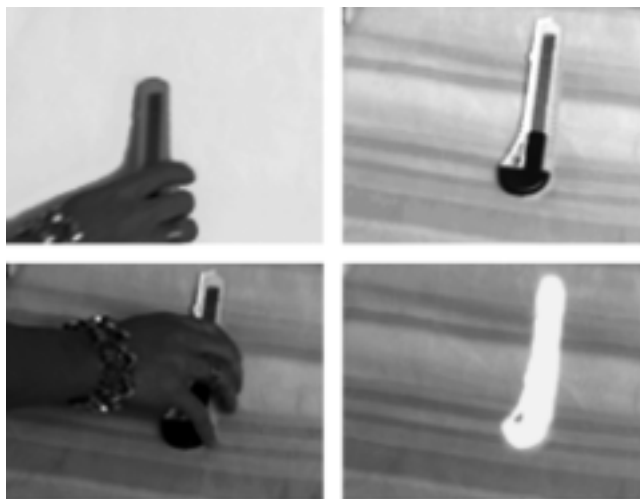
## Keywords

Alternative computer displays, ubiquitous computing

## INTRODUCTION

In a time when we are becoming surrounded by computers in our daily life, there is an ever-growing need for new channels to communicate electronic information. At the same time, textile seems to have lost its place and status in interior design. Once textiles were used as a way of communicating information—a wall hanging might be a reflection of a person's lifestyle or status, perhaps even showing the owner's beliefs, cultural history or political standing. Furthermore, textile is a traditional material with many beneficial properties, for instance the ability to create a comfortable atmosphere both acoustically and aesthetically. It is also a material that can easily give a room a new character—making it for instance cozier or more inviting.

Many of these positive properties are missing in other interior-design materials such as wood, plastic or stone. These properties are also completely missing from current computer design—computers and computer displays are still mainly anonymous boxes in gray or beige. If we are going to let computers take up more and more of our public and private spaces, we will need to design them to fit into our current environment. Some computers are already being designed as "lifestyle products" encased in colorful shells (e.g. the Apple *iMac* range), but we feel that there should be other ways to approach the problem.



**Figure 1.** The information curtain changes color after exposure to UV light, except where an object has covered the material

We have constructed the *information curtain*, a curtain that reveals a new color or pattern after being exposed to ultra-violet (UV) light. The color-changing properties of the information curtain will make it possible to display information in a way that fits better with the environment, while taking advantage of the positive properties of textiles as an interior-design material.

## THE FABRIC

Our first prototype of the information curtain was constructed out of a polypropylene fiber with photocromic properties. SolarActive ([www.solaractiveintl.com](http://www.solaractiveintl.com)) supplied the embroidery yarn, which changes color when exposed to UV light. The thread is white when not exposed to UV light, and turns into one out of seven available colors upon exposure. The color change is effective for about 1-3 minutes depending on the light intensity and time of exposure, and on the color and construction of the fabric. After UV exposure the original white color gradually returns. The lifetime of the colored fiber is currently limited, since the color-changes will become progressively less intense over time. By weaving a fabric out of Solaractive's yarn, we have been able to create color-changing textiles with a variety of properties and patterns.

## Experiments with constructions and colors

When starting to weave with a new material, it is important to make a variety of samples in the loom. The way the textile is constructed affects the color, the density and the

hang of the final fabric. We have tried 15 different constructions such as single weave, twill, satin, panama, wefttrib, cr pe, and honeycomb. When creating a fabric out of the SolarActive yarn we mixed the seven available colors in the warp and weft during weaving in various different ways, creating a number of samples of possible color mixtures. This gave us an extended number of color shades and possible patterns in addition to the seven basic colors. The examples were woven on a computer-controlled handloom with sixteen shafts. The amount of shafts controls the possibility to make different constructions; the more shafts the more different ways to make constructions. These initial samples have given us a wide variety of possible patterns and aesthetic expressions to use for further experimentation.

### THE INFORMATION CURTAIN

For our first experiment in color-changing textiles, we did not use any computer input, but instead utilized the UV light of the sun. We created a shaft-woven curtain —the *information curtain* — that was white during the night, but would turn into a colorfully striped curtain when the sun rose. The information curtain was exhibited publicly at the Bor s Textile Museum for three months. We found that the curtain attracted a new public that had previously not paid much attention to the possibilities of textile design.

We are now experimenting with using artificial and computer-controlled UV light-sources to call forth patterns woven into the fabric. When the UV light is turned on it can create a colorful pattern on a single-colored textile, or reveal a pattern hidden in an originally white fabric. The change will be effective for several minutes after the light is turned off. The fabric thus becomes a kind of limited "display", with patterns that can be recalled by short flashes of UV light. By directing the light at different parts of the fabric, we might call forth many different types of patterns that have been woven into the material. We can thus create different types of custom-made "displays" for different varieties of information.

### NEW DESIGN OPPORTUNITIES

Since we can reveal different patterns in our fabric using UV light, by connecting the UV light-sources to different types of input data, we can create different pattern in the fabric dynamically. The UV exposure could be controlled in different ways: we might have a matrix of many individually controlled lights that shines on different parts of the fabric; or we could have a single lamp mounted on a motor-controlled arm that can be directed towards different parts of the fabric. We could also create different cut-out masks that the light shines through, making a temporary imprint much like a stencil. This creates a new design opportunity, in that we can construct information displays that can be better integrated into the environment, while also retaining the many positive qualities of traditional textiles. Here are some sample applications:

#### *A weather station*

The textile might show weather information in an aesthetic and ambient way, as an alternative to a traditional digital

weather display. By connecting the UV light-source to a weather station we could make a bright and colorful pattern appear during a sunny day, while during a dull day a soft pastel color might appear.

#### *Activity at work*

By using the opening and closing of the front door to a workplace as an information source, we might create a curtain that will get more and more colorful as more and more people pass through the door. Since the color will fade after a while, this could show if a large number of people have passed the door recently.

#### *Showing presence over distance*

Which of my colleagues are on-line? This can be shown by weaving specific patterns for specific persons on different parts of a large curtain, and letting the UV light selectively bring forth the patterns according to which persons are on-line. When all colleagues are on-line at the same time, the whole surface will be covered by a complete pattern.

### RELATED WORK

Relevant work has been done in combining computing and textiles, but mainly for integrating electronic circuitry into textiles [2]. *Ambient displays* have been introduced as a way to introduce information in the architectural space, but these have not for the most part employed textiles [1, 3].

### CONCLUSIONS AND FUTURE WORK

Next, we plan to implement and evaluate some of the applications described previously. We are also trying to find alternative ways to illuminate the textile. Instead of pointing an external UV light to the textile, we will try to weave fiber optics into the material to be able to lead the UV light directly into the fabric.

With the information curtain we have shown that there is an opportunity to use new design materials with digital media, and make displays that can fit better into the human environment. By using textiles to construct an information display, we can combine the positive properties of a traditional material with the dynamic possibilities of digital media.

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