Digital lace

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Digital Lace: A Collision of Responsive Technologies

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Abstract
Designing with properties such as colour-change and light using electronics and digital control brings new challenges within art and design, and a range of new possibilities for aesthetics, tactility and functionality. Heimtextil 2014 (accessed April 2014) [1] promotes emerging materials and technologies as one of four trends which highlight the increasing demand for unique products utilizing novel material properties and digital making. However, there is still limited insight into the creative potential of these materials that are fundamental to the exploitation of 'smart' material properties, the development of new 'responsive' surfaces and digital tools that facilitate designing with colour-change and light-emitting properties specific to textiles. This submission to the Fiber arts category presents new material concepts as Digital Lace: a novel, multifaceted textile which will be presented as an interactive table runner for a digitally manufactured console table. Digital Lace explicitly pools together the digital-craft skills base and disparate expertise of printed textile practitioner and thermochromic specialist, (name) and constructed textile practitioner and light-emitting optical fibre specialist, (name). Within the context of 'smart', material development and experimentation, Digital lace exploits and amalgamates the responsive technologies of dye and fibre with digital-control.

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Introduction

(name) and (name) are design practitioners working in the area of smart, colour-change and light-emitting textiles. Their research interest focusses on the exploration of new aesthetics exploiting responsive materials within cloth using digital technologies to realize and control design effects. At the heart of their work lies a passion for material experimentation. (name's) research in the area of smart materials for textiles focuses particularly on the application and aesthetic potential of chromic materials and has extensively explored thermochromic dye systems. (name's) research lies in the exploration of light within cloth. Her work exploits the light-emitting properties of optical fibre within woven fabric and textile-based artwork in conjunction with digital technologies to create novel, time-based aesthetics. Digital Lace presents a design collaboration by (name) and (name) and will be presented as an interactive table runner in a digitally manufactured console table. The collaborative project was selected for an Expert Workshop as part of the experimental project, 'Rejuvenating Craft' funded by the European 'Crysalis Project' hosted at Plymouth College of Art in May 2014. The workshop presented an opportunity to develop a product through the use of new technologies and to explore hand craft processes alongside digital technologies.

Digital Lace (2014)

Digital Lace combines traditional (black Holland Linen) with cutting edge materials using (newly developed) white-scattering liquid crystal thermochromic dye and polymer optical fibres. The responsive materials are activated through the use of specially designed light-emitting diodes (LED) devices and heat control mechanisms and uses micro-controllers to sequence and activate light and colour-change in the following ways: using *liquid crystal thermochromic dyes* which change from opaque (white) to transparent (or coloured) on temperature change; using *optical fibre* to create light loss along the fibre length; and, using *colour and lighting control* to trigger a collision of light, colour and tonal effects within the material to create novel light and shadow interplay.

Digital Lace (86cm= length x 13cm width) Console table (75cm = height x width = 130cm x depth = 40cm).

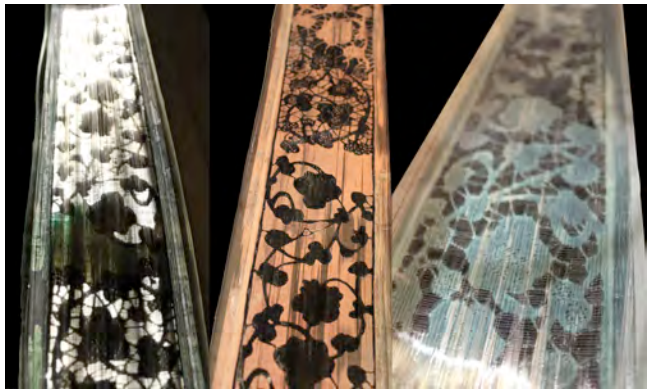

Figure 1. Digital Lace: colour-change and light phases.

Design concept

Digital Lace takes inspiration from rare, 17th century lace samplers held at the National Museums' Collection, Scotland. The qualities observed in the samplers have been instrumental in prompting new materiality concepts and design ideas for this work. For example, in fig 2, the subtle layered effects of visible stitch work

from the reverse of the sampler (right) and the dynamic change of background (left).

One of the four Heimtextil themes was 'Generate Collision'. This inspired us to think about ways of generating 'a collision of craft and technology' in order to create dynamic and unexpected visual effects with handmade and technology sensibilities and at the same time create 'a collision of disparate responsive materials' – how would they respond? In addition to this, we planned to use new, white-scattering liquid crystal dyes which are not commercially available. Traditional leuco thermochromic dye systems change from colour to colourless on temperature change (black to white). These new, white-scattering liquid crystal dyes do the reverse (white to black). Given this function, Robertson was able to design using a combination of temperature thresholds to create a heightened illusion of (printed) lace effects shifting from positive to negative and disappearing and reappearing when heated, as shown in fig 3. We were motivated to see how we could use, apply and realize these non-traditional material properties within textiles in order to showcase unique, multifaceted visual effects as a novel material concept and bring about new understanding and insight for aesthetically-focused products.

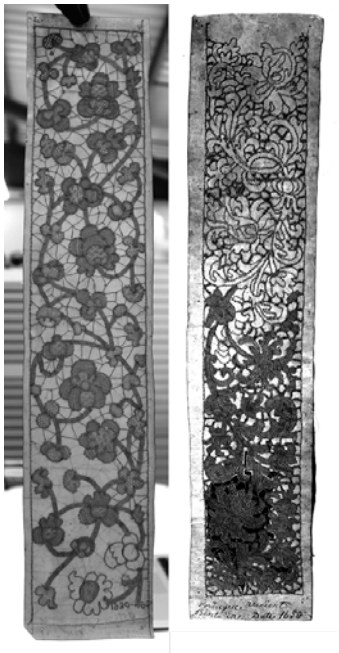

Figure 2. 17th Century lace samplers (NMS Collection)

Figure 3. Screen printed white-scattering liquid crystal dyes

Technological Innovation

By combining traditional hand printing, a weave preparation process and fibre etching techniques, we were able to craft the responsive materials in ways which produced unexpected results. For example, the white scattering liquid crystals appeared to change the white light emitted by the etched optical fibres to green, as shown in Fig 4; the fibre optics magnified the woven structure of the linen fabric below and created the illusion of a light emitting woven cloth, also shown in Fig 4; aligning the fibre optics and adhering to the liquid crystal printed linen intensified a colour shifting surface from white, to green and soft pink as evident in fig 5. Although we anticipated that certain functions would create different visual effects within the textile, we couldn't have anticipated the unusual and unexpected results that were achieved by this interaction of colour-change and light interplay.

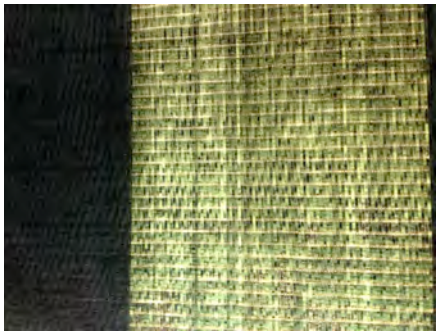

Figure 4. Optical fibre white light turns to green and the woven linen structure is magnified by the adhered optical fibre.

Figure 5. Shifts of surface colour as a result of the fibre optics on the liquid crystal printed linen.

Summary

The combination of materials processes, techniques and design have been realized as a new, responsive material which shows the potential of using and designing with new colour properties and surface light effects, as shown in figure 6. The uniqueness of Digital Lace is its capability to create multifaceted aesthetics as dynamic and unexpected visual effects in response to its environment as well as through digital control. It shows a glimpse of new design possibilities and the potential developments for creative exploitation within this field. It promotes new ways of experiencing and viewing responsive materials and archive-inspired work through the medium of textiles. Digital Lace would be suitable in both a gallery setting and within a home environment and would be of interest to both design and maker communities as well as material enthusiasts and educationalists.

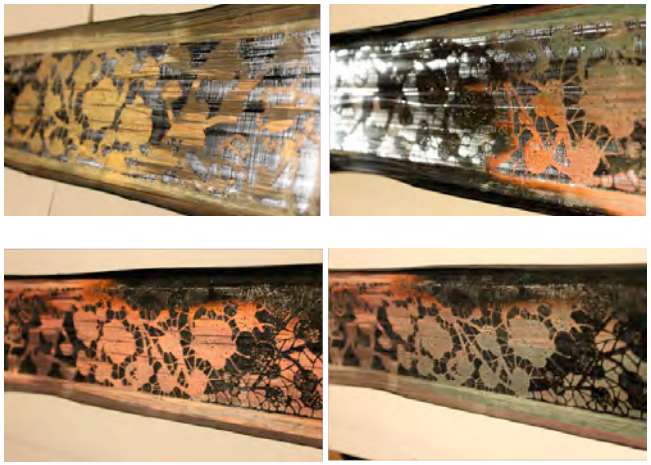

Figure 6. Images show the multifaceted aesthetics as dynamic and unexpected visual effects of Digital Lace.

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References

[1] Heimtextil: http://heimtextil.messefrankfurt.com/frankfurt/en/besucher/trend/heimtextil-trends-2014-15/generate-collision.html