An Investigation of the Design Potential of Thermochromic Textiles used with Electronic Heat-Profiling Circuitry

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Abstract

The research documented in this thesis is based on a practice-led PhD study funded by the AHRC, supported also by LCR Hallcrest, manufacturers of thermochromic dyes. In addition to the written thesis, the research outcomes also include a range of fabric samples and prototype pieces that explore the design potential of thermochromic dye systems on textiles when used in combination with electronic heat-profiling circuitry. A particular ambition of the research was to highlight and exploit the complexity of a wide range of thermochromic dye systems within the area of textile design. The research was multidisciplinary in nature, bridging design, colour chemistry and power electronics. A number of electronic heating systems, some digitally-controlled, were designed and constructed as a means to activate and control the colour change effects on thermochromic fabrics. Both leuco and liquid crystal types of thermochromic systems were explored. However, a significant focus developed on liquid crystal dye systems which offered particular opportunities in their application to textiles, including the previously unexploited design potential of their ability to change through a spectrum of colours, facilitated further by access to some unique materials made available by the industrial collaboration. The research contributes to knowledge in several ways:

- it demonstrates the additive colour mixing properties of liquid crystal dye systems when layered on textiles, which have not previously been exploited in textile design.
- the electronic systems that have been developed within the research offer tools for visualising colour-change, controlling, and mixing colour on a textile surface.
- the approach through textile design exploited combinations of thermochromic effects with pattern, for example using laser technology, to enhance further the colour changing surfaces. It demonstrates a diverse range of thermochromic effects.

The research described in this thesis not only adds significantly to knowledge and practice-led exploitation of design using thermochromic dye systems on textiles but also presents a diverse range of opportunities for new design research directions.

Dedicated in loving memory of Rubina and Frank Robertson.

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