

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

Sara Robertson

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Heriot-Watt University

School of Textiles and Design

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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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Table of Contents

Chapter 1 Introduction	1
1.1 Introduction.....	1
1.2 Research Problem	2
1.3 Aims and Objectives of the Research.....	2
1.4 Design Research Methods.....	3
1.5 Overview of Chapters	4
Chapter 2 Literature Review.....	6
2.1 Chromic Materials.....	6
2.2 Thermochromic Dye Systems	7
2.2.1 <i>Leuco and liquid crystal dye systems</i>	8
(a) <i>Leuco encapsulated thermochromic dye system</i>	9
(b) <i>Liquid crystal thermochromic dye systems</i>	10
2.3 Thermochromics in Art and Design	12
2.3.1 <i>Historical context</i>	13
2.3.2 <i>Current practice</i>	17
2.4 Chromic Materials as used in Art and Design	24
2.5 Related Colour/Lighting Technologies.....	26
2.6 Conductive Materials.....	28
2.6.1 <i>Metals</i>	29
2.6.2 <i>Conductive technologies</i>	31
2.7 Discussion.....	35
Chapter 3 Application and Finishing Methods	40
3.1 Introduction and Objectives	40
3.1.1 <i>Design decisions</i>	40
3.2 Fabric Selection.....	41
3.2.1 <i>Fabrics and related materials for leuco dye application</i>	41
3.2.2 <i>Fabrics and related materials for liquid crystal dye application</i>	41
3.3 Application of Leuco Dye Systems	42
3.3.1 <i>Screen-printing</i>	48
3.4 Application of Liquid Crystal Dye Systems	48
3.4.1 <i>Multiple colour change liquid crystal samples</i>	52
3.4.2 <i>Liquid crystal films</i>	54
3.4.3 <i>Single colour change liquid crystal films</i>	55
3.5 Summary.....	55
Chapter 4 Development of Heat-Profiling Electronic Systems	56
4.1 Introduction and Objectives	56
4.1.1 <i>Design decisions</i>	56
4.2 Heat-Sink Technology	57
4.2.1 <i>Heat-sink concept development</i>	57
4.3 Circuit Optimisation and Testing	58
4.3.1 <i>Test 1: star shaped heat-sink and grid circuit</i>	58
4.3.2: <i>Test 2: optimisation of heat-sink size and spacing</i>	60
4.3.3 <i>Test 3: Optimised star shaped circuit</i>	66
4.3.4 <i>Test 4: Optimised star shaped circuit combined with liquid crystal films</i>	68
4.4 Prototype Development using the Heat-Sink Concept.....	72
4.4.1 <i>Test 1: Hand-made heat-sink design</i>	72
4.4.2 <i>Test 2: Handmade heat-sink star</i>	73
4.4.3 <i>Prototype design</i>	74
4.4.4 <i>DMX digital mix system</i>	77
4.4.5 <i>Prototype testing and results</i>	78

4.5 Exploring the Creative Flexibility of the Hand-applied Heat-sink	80
4.5.1 Results of designers' heat-sink exploration	80
4.6 Track Resistors.....	82
4.6.1 Results of flexible circuit testing.....	83
4.6.2 Minco heat pads (track resistors).....	83
4.6.2 Testing a temperature controlled system	84
4.6.3 Results of the temperature controlled system.....	90
4.7 Other Circuit Experiments.....	91
4.7 Summary	94
Chapter 5 Design Informed by Colour and Light.....	95
5.1 Introduction and Objectives	95
5.1.1 Design decisions.....	95
5.2 General Colour Observations and Inspiration	95
5.2.1 Coloured light.....	97
5.3 Design Exploration Through Pattern.....	99
5.3.1 Results of screen-printed pattern	100
5.3.2 Laser etched patterns	102
5.2.1 Results of laser etched patterns: Additive colour mixing	104
5.2.3 Colour comparison of the liquid crystal films.....	108
5.4 Final Design Prototypes 'Transitional Stripes'	111
5.4.1 Prototype development	111
5.4.2 Prototype one	116
5.4.3 Prototype two.....	118
5.4.4 Prototype three.....	121
5.5 Summary.....	123
Chapter 6 Conclusions and Suggestions for Future Work.....	125
6.1 Overview	125
6.2 Summary of The Main Research Conclusions.....	127
Appendix A	135
Appendix B.....	156
Published Papers	161
References.....	Error! Bookmark not defined.