

COMPOSITE

October 2013



The future of
patterned
textiles?



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COMPOSITE

The future of patterned textiles?



This thesis is submitted to:
Auckland University of Technology for the Degree of Master of Art & Design
(Fashion & Textiles).

RICHARD MCCOY - OCTOBER 8th, 2013

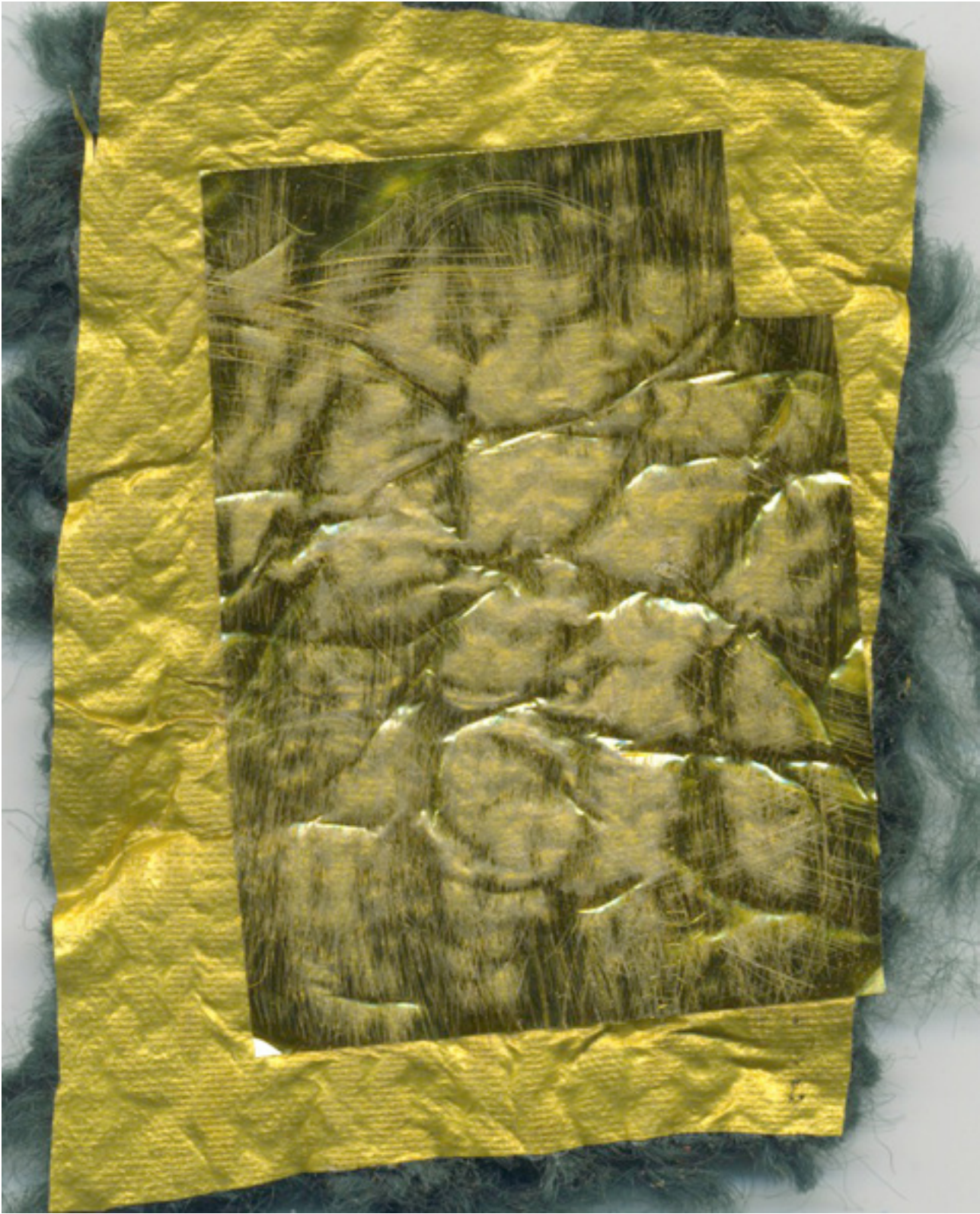


Figure 3: Gold foil on knitted base prototype textile

CONTENTS

I	Attestation of authorship	7
II	Acknowledgements	9
III	Abstract	11
IV	Intellectual property rights	13
V	Table of images	14
VI	Introduction	19
PART ONE: CONTEXT		
1.1	Heat transfers	
	A. Introduction	21
	B. Vinyl transfers	21
	C. Foils	22
	D. Flock	23
	E. Heat transfers together	24
1.2	The sportswear/fashion divide	25
1.3	Hybrid printing/patterns	
	A. Introduction	26
	B. Publishing and commercial printing	26
	C. Composite patterned textiles	27
PART TWO: METHODOLOGY		
2.1	Introduction	33
2.2	Action research	33
2.3	Methodology and methods	35
2.4	Knowledge creation and context	35
2.5	Implicit knowledge and heuristics	36
PART THREE: THE PROCESS		
3.1	Textile investigation	
	A. Introduction	37
	B. Initial exploration	39
	C. Focused exploration	42
	D. Chosen fabrics	50
3.2	Design collection	
	A. Introduction	55
	B. The design focus	55
	C. Colour and print composition	73
	D. Work in process	81
CONCLUSION		83
REFERENCES		85
APPENDIX I: 3D printing on fabric		86
APPENDIX II: Final work		97
	A. The collection	105
	B. The relationship of the garments to the body	106
	C. Commercially producing hybrid textiles	106
APPENDIX III: Costings & development		113
APPENDIX IV: Textile breakdown		120
Table of images		133



Figure 4: Vinyl transfer and screen printed flock prototype textile

I: ATTESTATION OF AUTHORSHIP

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of a university or other institution of higher learning, except where due acknowledgement is made in the acknowledgements.

Richard McCoy
October 8th, 2013

* Small parts of this written work first appeared in my unpublished honours exegesis. As a result aspects of this might be picked up by electronic copying software.



Figure 5: Laser cut, digitally printed, foil textile prototype

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II: ACKNOWLEDGEMENTS

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Figure 6: 3D printed, laser cut felt textile prototype

III: ABSTRACT

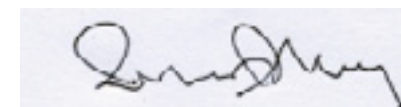
COMPOSITE is a fashion and textiles investigation that looks at creating hybrid patterned textiles that combine heat transfers and the latest technology. By using older and overlooked products – like vinyl transfers, foils and flock – with newer techniques, we can create the next generation of patterned textiles. There is design potential in utilising heat transfer's propensity towards rigidity and corrugation, and combining it with the uniformity and predictability of digital design technology to create a new surface pattern aesthetic. These textiles are in line with the trend for composite patterns in contemporary fashion, a movement that has strong analogies with the commercial print and publishing industries, which are also becoming increasingly hybridised. The textiles created during the course of this research were used in a range of garments and accessories and exhibited to show their potential. A multi-method action research approach was used to investigate this topic, which also extended my abilities as a textile designer and broadened my understanding of technology and technique.



Figure 7: Double heat-set vinyl transfer/laser cut prototype textile

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Richard McCoy
October 8th, 2013

V: TABLE OF IMAGES

Figure 1. McCoy, R. Prototype textiles. CAD drawing, 2013

Figure 2. McCoy, R. Prototype textiles. Digital photograph, 2013

Figure 3. McCoy, R. Prototype textile. Digital photograph, 2013

Figure 4. McCoy, R. Prototype textile. Digital photograph, 2013

Figure 5. McCoy, R. Prototype textile. Digital photograph, 2013

Figure 6. McCoy, R. Prototype textile. Digital photograph, 2013

Figure 7. McCoy, R. Prototype textile. Digital photograph, 2013

Figure 8. McCoy, R. Prototype textiles. Digital photograph, 2013

Figure 9. McCoy, R. (2012). Look 4 from honour year collection. Retrieved on September 11, 2013, from <http://www.eyeseyeseyeseyes.com/2012/11/foureyes-on-aut-rookie-2012-part-two.html>

Figure 10. Barlow, L. (2013). The Style Insider. DIY t-shirt image. Retrieved on June 12, 2013, from <http://www.thestyleinsider.co.nz/graduate-with-honours-at-glassons/#.UbeYlhkXYTN>

Figure 11. World. (2012). Look 51 Worldman Flash T Black from Autumn/Winter 2013 Collection. Retrieved on June 12, 2013, from <http://www.worldbrand.co.nz/autumn-winter-2013/mens#item-53>

Figure 12. McCartney, S. (2011). Look 21, Fall/Winter 2011 Collec- tion. Retrieved on August 15, 2013, from <http://www.style.com/fashionshows/review/F2011RTW-SMCCARTN>

Figure 13. Acne Studios. (2013). Look 9 from Resort Collection 2014. Retrieved on June 11, 2013, from <http://www.style.com/fashionshows/review/2014RST-ACNE>

Figure 14. Sid’s Restaurant. (1950’s). Flocked bowling t-shirt. Re- trieved on September 11, 2013, from <http://magsrags.myshopify.com/products/50s-60s-vintage-classic-bowl-ing-shirt-m-flocked-logo>

Figure 15. Burch, T. (2013). Flocked Skirt, Look 13 from Pre-Fall 2013 Collection. Retrieved on August 18, 2013, from <http://www.style.com/fashionshows/complete/2013PF-TBURCH>

Figure 16. Paco Rabanne. (2013). Look 7 Fall/Winter 2013 Collec- tion. Retrieved on June 12, 2013, from <http://www.style.com/fashionshows/complete/F2013RTW-PRABANNE>

Figure 17. Bottega Veneta. (2012). Leather hobo flocked bag. Detail of Look 18, Fall/Winter 2012. Retrieved on May 23, 2013, from <http://www.style.com/fashionshows/review/F2012RTW-BVENETA>

Figure 18. Pelle Pelle. (2000). Leather jacket with flock back. Re- trieved on June 12, 2013, from <http://www.monstermarketplace.com/hip-hop-clothing-and-accessories/pelle-pelle-black-rebellion-leather-jacket>

Figure 19. Opening Ceremony. (2013). Neoprene t-shirt, Look 5 Spring/Summer 2014 Collection. Retrieved on September, 16, 2013, from <http://www.style.com/fashionshows/complete/S2014RTW-OPENCER>

Figure 20. Wang. A. (2012). Neoprene dress, Look 9 from Resort 2013 Collection. Retrieved on September 16, 2013, from <http://www.style.com/fashionshows/review/2013RST-TAWANG/>

Figure 21. Cacharel. (2013). Neoprene coat. Look 2. Spring/ Summer Collection. Retrieved on October 6, 2013, from <http://www.style.com/fashionshows/complete/S2014RTW-CACHAREL>

Figure 22. Rocha, S. (2013). Neoprene skirt suit. Look 28 Spring/Summer 2013 Collection. Retrieved on October 6, 2013, from <http://www.style.com/fashionshows/complete/S2014RTW-SROCHA>

Figure 23. Watanabe, J. (2012). White Mesh Inset Long Sleeve Blouse. Taken from Spring/Summer 2013 Collection. Retrieved on August 15, 2013, from <http://www.lyst.com/clothing/junya-watanabe-mesh-inset-long-sleeve-blouse-white/>

Figure 24. Splurge VS Steal: Digital Prints. (Photograph). 2012 Retrieved on October 1, 2013, from <http://www.realstylenetwork.com/blogs/fashion-and-style/2012/07/splurge-vs-steal-digital-print-dress-es-shirts-and-pants/>

Figure 25. Giles. (2013). Look 8. From Spring/Summer 2013 Col- lection. Retrieved on July 23, 2013, from <http://www.style.com/fashionshows/complete/S2013RTW-GDEA CON>

Figure 26. Club L. (2013). Lazer Cut Skater dress, sold on ASOS for NZ\$46.93. Retrieved on August 15, 2013, from <http://www.asos.com/Club-L/Club-L-Lazer-Cut-Skater-Dress>

Figure 27. Erdem. (2013). Look 14 Fall/Winter 2013 Collection. Retrieved on March 24, 2013, from <http://www.style.com/fashionshows/review/F2013RTW-ERDEM>

Figure 28. Erdem. (2013). Detail of Look 14 Fall/Winter 2013 Collection. Retrieved on March 24th 2013 from <http://www.style.com/fashionshows/review/F2013RTW-ERDEM>

Figure 29. Proenza Schouler. (2013). Look 30 from Fall/Winter 2013 Collection. Retrieved on April 22, 2013, from <http://www.style.com/fashionshows/review/S2013RTW-PSCHOULER>

Figure 30. Proenza Schouler. (2013). Laser-cut dress detail Fall/ Winter 2013 Collection. Retrieved on August 15, 2013, from <http://www.barneys.com/Proenza-Schouler-Laser-cut-Sheath-Dress/502832873,default,pd.html>

Figure 31. Peter Pilotto. (2013). Look 18 from Resort 2013 Collec- tion. Retrieved on August 18, 2013, from <http://www.style.com/fashionshows/complete/2014RST-PPILOTTTO>

Figure 32. Peter Pilotto. (2013). Look 21 from Resort 2013 Collec- tion. Retrieved on August 18, 2013, from <http://www.style.com/fashionshows/complete/2014RST-PPILOTTTO>

Figure 33. Peter Pilotto. (2013). Look 22 from Resort 2013 Collec- tion. Retrieved on August 18, 2013, from <http://www.style.com/fashionshows/complete/2014RST-PPILOTT>

Figure 34. Peter Pilotto. (2013). Detail of Look 22 from Resort 2013 Collection Retrieved on June 19, 2013, from <http://modaoperandi.com/peter-pilotto/resort-2014/rtw-1675/item/lydia-dress-209769>

Figure 35. Peter Pilotto. (2012). Look 8 from Spring/Summer 2013 Collection. Retrieved on April 22, 2013, from <http://www.style.com/fashionshows/review/S2013RTW-PPILOTTTO>

Figure 36. Peter Pilotto. (2012). Look 23 from Spring/Summer 2013 Collection. Retrieved on April 22, 2013, from <http://www.style.com/fashionshows/review/S2013RTW-PPILOTTTO>

Figure 37. Peter Pilotto. (2012). Close up of Look 23 Skirt, Spring/ Summer 2013 Collection. Retrieved on September 16, 2013, from <http://www.parlourx.com.au/styles/skirts/peter-pilotto-elena-embroidered-skirt-red.html#>

Figure 38. Peter Pilotto. (2013). Look 12 from Fall/Winter 2013. Retrieved on June 12, 2013, from <http://www.style.com/fashionshows/review/F2013RTW-PPILOTTTO>

Figure 39. Piem Wirtz. (2012). Crafting the Future Workshop - DEAF 2012 (Video file). Retrieved on September 26, 2013, from <http://vimeo.com/43023078>

Figure 40. ClothBot Designs. (2012). 3D printing on fabric paper. Digital photograph. Retrived on September 26, 2013, from <http://www.flickr.com/photos/plsea/8066364278/>

Figure 41. McCoy, R. Action research diagram. CAD drawing, 2013

Figure 42. McCoy, R. The researcher at work. Digital photograph, 2013

Figure 43. McCoy, R. Drawing as problem solving. CAD drawing, 2013

Figure 44. McCoy, R. Action research with intensity diagram. CAD drawing, 2013

Figure 45. McCoy, R. Methodology and methods diagram. CAD drawing, 2013

Figure 46. McCoy, R. Context diagram. CAD drawing, 2013

Figure 47. McCoy, R. Action research and heuristics diagram. CAD drawing, 2013

Figure 48. McCoy, R. Early print workbook. Digital photograph, 2013

Figure 49. McCoy, R. Workboard image. Digital photograph, 2013

Figure 50. McCoy, R. Later textile workboard. Digital photograph, 2013

Figure 51. McCoy, R. Vinyl transfer process. Digital photograph, 2013

Figure 52. McCoy, R. Screen printed flock process. Digital photo- graph, 2013

Figure 53. McCoy, R. Vinyl transfer on leather sample. Digital pho- tograph, 2013.

Figure 54. McCoy, R. Vinyl transfer and flock on deer leather. Digital photograph, 2013

Figure 55. McCartney, S. (2011). Look 21, Fall/Winter 2011 Collec- tion. Retrieved on August 15, 2013, from <http://www.style.com/fashionshows/review/F2011RTW-SMCCARTN>

Figure 56. McCoy, R. Vinyl transfer on knit. Digital photograph, 2013

Figure 57. McCoy, R. Vinyl transfer on knit. Digital photograph, 2013

Figure 58. Kane, C. (2010). Vinyl Clutch from Spring/Summer 2011 Collection. Retrieved on August 13, 2013, from <http://junechriscole.blogspot.co.nz/2011/05/christopher-kanes-laser-cut-neon-bags.html>

Figure 59. McCoy, R. Vinyl clutch copy. Digital photograph, 2013

Figure 60. Gucci. (2012). Black flocked leather clutch. Detail of Look 10, Fall/Winter 2013 Collection Retrieved on May 23, 2013, from <http://www.style.com/fashionshows/review/F2012RTW-GUCCI>

Figure 61. McCoy, R. First flocked leather sample. Digital photo- graph, 2013

Figure 62. McCoy, R. Flocking on pigmented leather. Digital photo- graph, 2013

Figure 63. McCoy, R. Screen printed flock on roll cut flock. Digital photograph, 2013

Figure 64. McCoy, R. Vinyl bonded to knitted wool. Digital photo- graph, 2013

Figure 65. McCoy, R. Flock over foil. Digital photograph, 2013

Figure 66. McCoy, R. Vinyl on cable knit wool. Digital photograph, 2013

Figure 67. McCoy, R. Flock on vinyl, bonded to knitted wool. Digital photograph, 2013

Figure 68. McCoy, R. Knitted leather with vinyl transfer. Digital photograph, 2013

Figure 69. McCoy, R. Vinyl bonded to knit, then laser cut. Digital photograph, 2013

Figure 70. McCoy, R. Flock, digital print, laser cut composite. Digital photograph, 2013

Figure 71. McCoy, R. Laser cut vinyl and leather. Digital photograph, 2013

Figure 72. McCoy, R. Sanded foil/vinyl transfer prototype. Digital photograph, 2013

Figure 73. McCoy, R. Screen printing on vinyl transfer prototype. Digital photograph, 2013

Figure 74. McCoy, R. Sanded foil with laser cut inset leather. Digital photograph, 2013

Figure 75. McCoy, R. Digital print with sanded foil and laser cutting. Digital photograph, 2013

Figure 76. McCoy, R. 3D printing on felt. Digital photograph, 2013

Figure 77. McCoy, R. Digital print, laser cut, 3D printed sample. Digital photograph, 2013

Figure 78. McCoy, R. 3D printed felt with laser cut center and foil transfer. Digital photograph, 2013

Figure 79. McCoy, R. Laser cut foil and flock composite. Digital photograph, 2013

Figure 80. McCoy, R. Crinkled digital print, flock and laser cut sam- ple. Digital photograph, 2013

Figure 81. McCoy, R. Crinkled vinyl transfer and flock sample. Digi- tal photograph, 2013

Figure 82. McCoy, R. Silver roll cut foil. Digital photograph, 2013

Figure 83. McCoy, R. Heat press. Digital photograph, 2013

Figure 84. McCoy, R. Laser cutter. Digital photograph, 2013

Figure 85. McCoy, R. Flocked and foiled felt. Digital photograph, 2013

Figure 86. McCoy, R. Crinkled flocked and foiled felt. Digital photograph, 2013

Figure 87. McCoy, R. Pocket sample. Digital photograph, 2013

Figure 88. McCoy, R. Flocked and foiled felt, laser cut, front. Digital photograph, 2013

Figure 89. McCoy, R. Flocked and foiled felt, laser cut, back. Digital photograph, 2013

Figure 90. Textile Design Lab. (2011). Digital printer and example. Retrieved on September 25, 2013, from <http://www.tdl.ac.nz>

Figure 91. McCoy, R. Black roll cut flock. Digital photograph, 2013

Figure 92. McCoy, R. Heat press. Digital photograph, 2013

Figure 93. McCoy, R. Laser cutter. Digital photograph, 2013

Figure 94. McCoy, R. Flocked crinkled digital print. Digital photograph, 2013

Figure 95. McCoy, R. Flocked laser cut digital print. Digital photograph, 2013

Figure 96. McCoy, R. Vinyl transfer and flock sample. Digital photograph, 2013

Figure 97. McCoy, R. Crinkled Vinyl transfer and flock sample. Digital photograph, 2013

Figure 98. McCoy, R. Roll cut flock. Digital photograph, 2013

Figure 99. McCoy, R. Screen printed flock sheet. Digital photograph, 2013

Figure 100. McCoy, R. Concept drawing. CAD drawing, 2013

Figure 101. McCoy, R. Concept drawing. CAD drawing, 2013

Figure 102. McCoy, R. Concept drawing. CAD drawing, 2013

Figure 103. McCoy, R. Concept drawing. CAD drawing, 2013

Figure 104. McCoy, R. Miniature prototypes. Digital photographs, 2013.

Figure 105. McCoy, R. Virtual prototypes. CAD drawings, 2013.

Figure 106. McCoy, R. Bag prototype. Digital photograph, 2013

Figure 107. McCoy, R. Gold bag prototype. Digital photograph, 2013

Figure 108. McCoy, R. Jacket prototype. Digital photograph, 2013

Figure 109. McCoy, R. Jacket and hat prototype. Digital photograph, 2013

Figure 110. McCoy, R. Skirt prototype. Digital photograph, 2013

Figure 111. McCoy, R. Gold sculptures. Digital photographs, 2013

Figure 112. McCoy, R. Concept drawing. CAD drawing, 2013

Figure 113. McCoy, R. Hat concept drawing. CAD drawing, 2013

Figure 114. McCoy, R. Bag prototype. Digital photograph, 2013

Figure 115. McCoy, R. Bag prototype with print. CAD drawing, 2013

Figure 116. McCoy, R. Bag prototype. Digital photograph, 2013

Figure 117. McCoy, R. T-shirt development. CAD drawing, 2013

Figure 118. McCoy, R. Working drawings, CAD drawing, 2013

Figure 119. McCoy, R. Miniature prototypes. Digital photographs, 2013

Figure 120. McCoy, R. Textile prototype. Digital photograph, 2013

Figure 121. McCoy, R. Textile prototype. Digital photograph, 2013

Figure 122. McCoy, R. Textile prototype. Digital photograph, 2013

Figure 123. McCoy, R. Miniature prototypes. Digital photographs, 2013

Figure 124. McCoy, R. Miniature prototypes. Digital photographs, 2013

Figure 125. McCoy, R. Textile prototype. Digital photograph, 2013

Figure 126. McCoy, R. Garment prototypes. Digital photographs, 2013

Figure 127. McCoy, R. T-shirt drawings. CAD drawings, 2013

Figure 128. McCoy, R. Prototypes. Digital photographs, 2013

Figure 129. McCoy, R. Prototypes. Digital photographs, 2013

Figure 130. McCoy, R. T-shirt prototypes. Digital photographs, 2013

Figure 131. McCoy, R. Zip samples. Digital photographs, 2013

Figure 132. McCoy, R. Hat prototypes. Digital photographs, 2013

Figure 133. McCoy, R. Laser cutting template. CAD drawings, 2013

Figure 134. McCoy, R. Hat prototypes. Digital photographs, 2013

Figure 135. McCoy, R. Hat prototypes. Digital photographs, 2013

Figure 136. McCoy, R. Sleeve prototype. Digital photograph, 2013

Figure 137. McCoy, R. Digitising process. Digital photograph, 2013

Figure 138. McCoy, R. Digitising output. CAD drawings, 2013

Figure 139. McCoy, R. Pattern development. CAD drawing, 2013

Figure 140. McCoy, R. Pattern development. CAD drawing, 2013

Figure 141. McCoy, R. Pattern development. CAD drawing, 2013

Figure 142. McCoy, R. Pattern development. CAD drawing, 2013

Figure 143. McCoy, R. Paper template. Digital photograph, 2013

Figure 144. McCoy, R. Garment prototypes. Digital photographs, 2013

Figure 145. McCoy, R. Bag pattern development. CAD drawings, 2013

Figure 146. McCoy, R. Bag prototypes. Digital photographs, 2013

Figure 147. McCoy, R. Bag prototypes. Digital photograph, 2013

Figure 148. McCoy, R. Bag prototypes. Digital photograph, 2013

Figure 149. McCoy, R. Snakeskin print. CAD drawing, 2013

Figure 150. McCoy, R. Snakeskin print purse. Digital photograph, 2013

Figure 151. McCoy, R. Print ideas. Digital photographs, 2013

Figure 152. Wellcome Images (2012). Blood cells. Retrieved on October 7, 2013, from <http://bhavanajagat.com/tag/red-blood-cell/>

Figure 153. McCoy, R. Print development. CAD drawing, 2013

Figure 154. McCoy, R. Print development. CAD drawing, 2013

Figure 155. McCoy, R. Print development. CAD drawing, 2013

Figure 156. McCoy, R. Print development. Digital photograph, 2013

Figure 157. McCoy, R. Prototype textile. Digital photograph, 2013

Figure 158. McCoy, R. 3D print design. CAD drawing, 2013

Figure 159. McCoy, R. 3D printed textile. Digital photograph, 2013

Figure 160. McCoy, R. 3D printed textile. Digital photograph, 2013

Figure 161. Layoutsparks.com (2013) Cherry blossoms pink flowers picture and wallpaper. Retrieved on July 5th 2013 from <http://www.layoutsparks.com/pictures/flowers-7>

Figure 162. McCoy, R. Blossom design. CAD Image, 2013

Figure 163. McCoy, R. Blossom design. CAD Image, 2013

Figure 164. McCoy, R. Blossom design. CAD Image, 2013

Figure 165. McCoy, R. Textile prototype. Digital photograph, 2013

Figure 166. McCoy, R. Textile prototype. Digital photograph, 2013

Figure 167. McCoy, R. Textile prototypes. Digital photographs, 2013

Figure 168. McCoy, R. Perforated designs. CAD Images, 2013

Figure 169. McCoy, R. Prototype textiles. Digital photographs, 2013

Figure 170. McCoy, R. Print development. CAD drawings, 2013

Figure 171. McCoy, R. Print development. CAD drawing, 2013

Figure 172. McCoy, R. Prototype textile. Digital photograph, 2013

Figure 173. McCoy, R. Prototype textile. Digital photograph, 2013

Figure 174. McCoy, R. Prototype textiles. Digital photographs, 2013

Figure 175. McCoy, R. Prototype garments. Digital photographs, 2013

Figure 176. McCoy, R. Prototype garments. Digital photographs, 2013

Figure 177. McCoy, R. Prototype garments. Digital photographs, 2013

Figure 178. McCoy, R. Prototype garments. Digital photographs, 2013



Figure 8: A variety of composite textiles.

VI: INTRODUCTION

As the digital world increases its scope and renders so many industries redundant, the specialised print industry is proving buoyant (Print: Alive and printing, 2007). When the print medium is being utilised, it is now with greater demand for specialised finishes, glosses, textures and foils (Smyth, 2005). This movement towards a greater combination of print methods is known as hybrid printing; a name that reflects the way that printers are beginning to incorporate multiple print methods into their production lines and machines.

For different reasons, a similar movement is taking place within the fashion industry in terms of printed textiles. The mass-market adoption of once specialised techniques like digital printing and laser cutting, has meant that contemporary designers are having to find new ways of making exclusive fabrics (MaCalister-Smith, 2012).

This study seeks to add to this movement by exploring overlooked heat-set media, in combination with newer technology, with the aim of creating hybrid textiles and garments, that demonstrate what the next generation of patterned textiles may look like.

The highly textured, irregular and imperfect quality of the hybrid textiles that I have developed, are made with the help of heat transfers such as flock, foils and vinyl transfers. These out-dated products were composed with the normally flat, perfect and hyper-real digital printing and laser cutting methods to give the latter a more natural and organic quality. The resulting worn and strongly textured aesthetic is new for digital fabric printing technology, as well as for transfers.

This project is an extension of my honours year work, which focused exclusively on vinyl transfers. This study seeks to go beyond this limited area while also extending my working practice in textile design.

Two key conversations happening in contemporary fashion are explored through this work; the aforementioned escalation in complexity of patterned textiles, and the increased integration of sportswear and fashion. Heat transfers – long associated with t-shirts and sportswear – sit at the crossroads of both these movements.

Designers at the forefront of the composite textile trend are using an array of new and adapted techniques to make their textiles unique, distinctive and hard to emulate (MaCalister-Smith, 2012). Combining multiple methods and techniques within a single form has become a way of creating new textiles. These methods range from the highly technical to the more old-fashioned, often mixed within a single fabric.

Fabric development and innovation is also behind the sportswear/fashion movement (Lee & Jones, 2008). This movement sees a decrease in the distinction between the two fields; where sportswear fabrics and styles are being used more and more in the fashion realm (Salazar, 2008). Both sportswear and nature have been creative inspiration behind this study.

This thesis is divided into four parts. Part One will look at Context, Part Two; Methodology and Part Three will explore The Process before moving on to the Conclusion.



Figure 9: My honours year work demonstrated that vinyl transfers are not the out-dated technique they have been labelled. There is immense possibility for innovation with this medium (and heat-set media in general) by investigating it as a textile and exploring its contextual boundaries.

PART ONE: CONTEXT

1.1 Heat transfers

A. Introduction

Although heat transfers have been used commercially for decades within the sports and casual-wear domain, there is limited literature about this use, or their origins and development.

To put boundaries on this study, a decision was made to focus on three types of transfers: vinyl transfers, foils and flock.

All of these techniques utilise variances in heat and pressure to bond to a chosen base. There are many variations in types of products, and each has their own specific bonding process. Some are achieved with computer-aided design (CAD), and others rely on screen-printing methods.

Currently heat transfers are regarded as an out-dated practice (Potter, 2008), and amateurish (Winters, 2009). This media is readily available and can be found in most sign or screen-printing operations. Outside their application within branding and sportswear, they are used very little. Heat transfers' placement in such a disposable, mass-produced and throwaway context means that they have a low aesthetic value.

Even within the t-shirt context, foils and flocking are often shied away from due to their cost. Adding a foil accent to a run of t-shirts can add up to US\$3.50 per unit, and multiple or large foils are often difficult to repeat for mass production (Corcoran & Corcoran, 2009). This has also limited their aesthetic and technical development.

B. Vinyl transfers

Vinyl transfers are a plastic media used mainly on cotton and polyester t-shirts, cut-out using a plotter and applied with heat and pressure (Winters, 2009). Figure 10 demonstrates the traditional use of vinyl transfers in today's market.

Vinyl transfers as we know them today have their commercial origins in the 1980s (McGugain, 2000). In 1983 the Gerber Signmaker was introduced; a method which used computer technology, took an image and cut it out in this medium (McGugain, 2000). Prior to 1983, silkscreens were used to produce images on t-shirts, but with this new development, the silkscreen process could be bypassed (McGugain, 2000).

My honours project exclusively explored this media, and showed how transfers' overlooked qualities of stiffness and texture could be utilised to move the medium forward. An image of this work is shown in Figure 9.

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Figure 10: The traditional use of vinyl transfers

C. Foils

Similar to transfers, and also used predominately for t-shirts; foils are a decorative metallic medium applied with a CAD process or by screen-printing.

Foils are most often used for small details in decorative designs to give them a ‘wow’ factor (Corcoran & Corcoran, 2009). However, foils in themselves are considered an unreliable product; most sources suggest using them as accents only and for less than permanent decoration, or with a design that suits a distressed appearance (Corcoran & Corcoran, 2009). This is due to their natural propensity to crack and flake after a number of washes (Corcoran & Corcoran, 2009).

An example of a traditional foil design is show in Figure 11. Foils have recently been explored in a fashion context but without the addition of other techniques. Some examples are shown in Figures 12 and 13.

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Figure 11 (Top): This ‘World’ example demonstrates the traditional usage of foils.
Figure 12 (Left): Stella McCartney used foils recently with a knit base and explored uniform texture.
Figure 13 (Right): Acne Studios employed the cracked quality of foils in a recent look.

D. Flock

Flock or flocking is another technique often used as an accent in t-shirt prints. However, its employment extends wider, to use within the automotive industry and for other industrial applications (Kosloff, 1981, p.193).

Flocking itself is a technique where small fibers are applied to the surface of a textile or object through a number of methods, which results in a pattern, words or all over effect that is raised, soft and textured (Ortolanti, 2002).

Flocking became a popular way of embellishing t-shirts in the 1950s and 60’s, and has remained a mainstay for amateur and sportswear decoration ever since (Ortolanti, 2002, p.34).

Interestingly enough modern flocking techniques actually pre-date the introduction of plastisol inks (Ortolanti, 2007, p.76), as well as vinyl transfers and foils.

Flock has also been used recently within the contemporary fashion context, – but like foils – without additional techniques.

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Figure 14: A traditional example of flock, used here in a bowling t-shirt from the 1950s.

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Figure 15: In this Tory Burch example an all-over flock pattern has been used in a skirt.
Figure 16: This Paco Rabanne design uses flock on the inside of the mesh garments like a lining, and a counter texture on the outside.
Figure 17: Bottega Veneta developed an exclusive leather flock to act as a counter texture in their bags.

E. Heat transfers together

Exploration of different heat transfer products together has occurred, yet mainly within the sportswear/t-shirt context. However, this experimentation is relatively new. According to Wilder (2003, p.81) the first documented combination of plastisol ink and flock only occurred in 1998. Since then an array of combinations of this media has been undertaken (Geber, 2006, p.42).

Hip-Hop street brand Pelle Pelle were one of the first labels to use this multimedia approach, using a variety of techniques such as flocked motifs on top of their leather jackets. Figure 18 shows an example. All of these explorations have been limited to the context of sports or street-wear, and have been used without the addition of newer technology.

The reason behind this so far has been economic. Exploring more advanced technology with these sportswear techniques would be very costly and labour intensive. As mentioned earlier, even foils and flock are shied away from within the sportswear context, due to their cost (Corcoran & Corcoran, 2009).

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Figure 18: An example of a Pelle Pelle leather jacket with flock details

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Figures 19, 20, 21 and 22: Some examples of the use of neoprene in contemporary fashion.

1.2 The sportswear/fashion divide

By using the predominately sportswear oriented heat transfers with more fashion related techniques – and within a fashion context – we can add to the sportswear into fashion conversation that is currently taking place.

Sportswear and fashion are frequently seen as at opposing ends of the clothing spectrum. But in the last few decades the distinctions have dissolved (Salazar, 2008).

Salazar (2008, p.9) regards the current relationship between fashion and sportswear as a ‘culmination of a long-standing interaction’, reiterating that this connection is nothing new, merely intensifying.

Others have gone on to stress that the distinction between the two fields is fiction, speculating that the difference only exists in the linguistic sense; as they are both simply product (Nakamura, cited in Salazar 2008).

It is not surprising that the realms of fashion clothing and sports clothing have intertwined. As product that is worn on the body, their developing interests and histories have constantly overlapped (Breward, 2008, p.38).

Today leading designers and thinkers believe that using sportswear fabrics and techniques will become increasingly part of the fashion vocabulary (Lee & Jones, 2008). The development and adoption of highly technical fabrics is believed to be the reason that the relationship between the two fields has changed and evolved (Lee & Jones, 2008).

Fabrics once developed for sportswear are finding their way into the fashion realm (Salazar, 2008). Neoprene – traditionally used for wetsuits – has appeared again and again on catwalks all over the world, and is beginning to be explored in more formal garments. Examples are shown in Figures 19-22. Another example is shown in Figure 21 where perforated sports mesh is used in a formal white shirt.

By using transfers with fashion techniques and within a fashion context we are adding to this discussion. The sportswear movement informed some of the aesthetic inspiration behind this work, such as silhouette and pattern styles.

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Figure 23 : This example by Junya Watanabe uses sports mesh within the context of a formal white shirt.

1.3 Hybrid printing/patterns

A. Introduction

Heat-set media can be part of another trend taking place in contemporary fashion. This new direction concerns the increasing complexity of surface pattern, and it is not limited to fabric design.

The hybrid print movement is talking place at all levels of the print sector; from publishing to commercial print, packaging to labels (Smyth, 2005). The primary reason behind this concerns the development and adoption of new technology.

B. Publishing and commercial printing

The publishing and commercial printing sector is seeing the rise of what is known as hybrid printing. This is where a number of different techniques, methods or finishes of print are being composed in a single document or job (Smyth, 2005).

The Internet is making the print industry redundant (Stott, 2007 cited in Print: Alive and printing, 2007). As a result of this, when print media is being utilised, there is greater demand for more specialised, combined and process heavy printing effects (Toth, 2011). It has been said,

‘[Multimedia printing] may even be flourishing under the threat of digital redundancy, as designers strive to add extra detail and rediscover traditional methods to make their print stand out for clients whose audiences still want something tangible.’

(Stott, 2007 cited in Print: Alive and printing, 2007).

In response to this changing demand, printers are adapting their print lines to accommodate multiple printing methods, and new printing machinery is being used and developed that do the same (Toth, 2011). These are known as hybrid printers, some of which being used today incorporate almost a dozen different methods (Smyth, 2005).

A similar movement is happening in the field of textiles.

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Figure 24: The quick adoption of new technology by the mass-market means that once expensive and specialised techniques are now cheaper and less exclusive. The digitally printed example on the left is by Mary Katrantzou and retailed for US\$949. Whereas the garment on the right is by H&M and sold for US\$40.

C. Composite patterned textiles

Just as in the commercial printing and publishing sector, there is a movement towards patterned textiles that are highly processed and composite in nature (MaCalister-Smith, 2012). Designers all over the world are starting to use a greater combination of techniques in the creation of their patterned textiles. The designers of most interest to my investigation incorporated strong aspects of texture in their compositions.

There are parallels with commercial publishing trends in that these textiles are also technology driven. No doubt perpetuated by the speed and immediacy of the internet; the fast adoption of new design technology like laser-cutting and digital printing by the mass-market, has meant that these techniques are no longer as exclusive or remarkable (MaCalister-Smith, 2012). Figures 24, 25 and 26 demonstrate this.

Not surprisingly many of the designers who are developing composite patterned textiles originally made their name with digital printing. These and other like-minded designers are attempting to find new ways to make their garments stand out, amid a market saturated with their past innovations (MaCalister-Smith, 2012).

While experimenting with my own textiles and investigating this context, I became drawn to the idea of using transfers and newer techniques with a strong focus on texture. I became aware that designers who use digital printing and laser cutting have neglected a strong textural focus in their investigations.

This strong textural element is also missing in the use of heat transfers. Aesthetically, both of these areas have a strong focus on perfection, mathematically exact lines, motifs and hyper-real or iconised images. Aspects of chance, history and a ‘natural’ quality have been missing.

My contextual focus then became more specific, and looked at designers who are using hybrid techniques with a focus on texture and composing their designs in a harmonious or integrated way.

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Figure 25: This laser cut dress by Giles is very flat and untextured.
Figure 26: Similar designs are being explored at much lower price points.

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Figure 27: The soft and subtle texture of the composite textile by Erdem was of interest to this study.
Figure 28: A close up of this textile, where neoprene is used in a more formal setting.

British label Erdem produced an interesting example. For their Winter 2013 Collection this label featured a digitally printed silk that was bonded to neoprene and laser-cut with a polka-dot pattern. Shown in Figures 27 and 28, the fabric was utilised in a formal dress and coat. This textile was of immediate interest because of the soft and subtle handle created by the relationship between the neoprene and the printed silk. This textural element was subtle – something I could only imagine – yet would have given the digital print another aspect; a stronger textural focus.

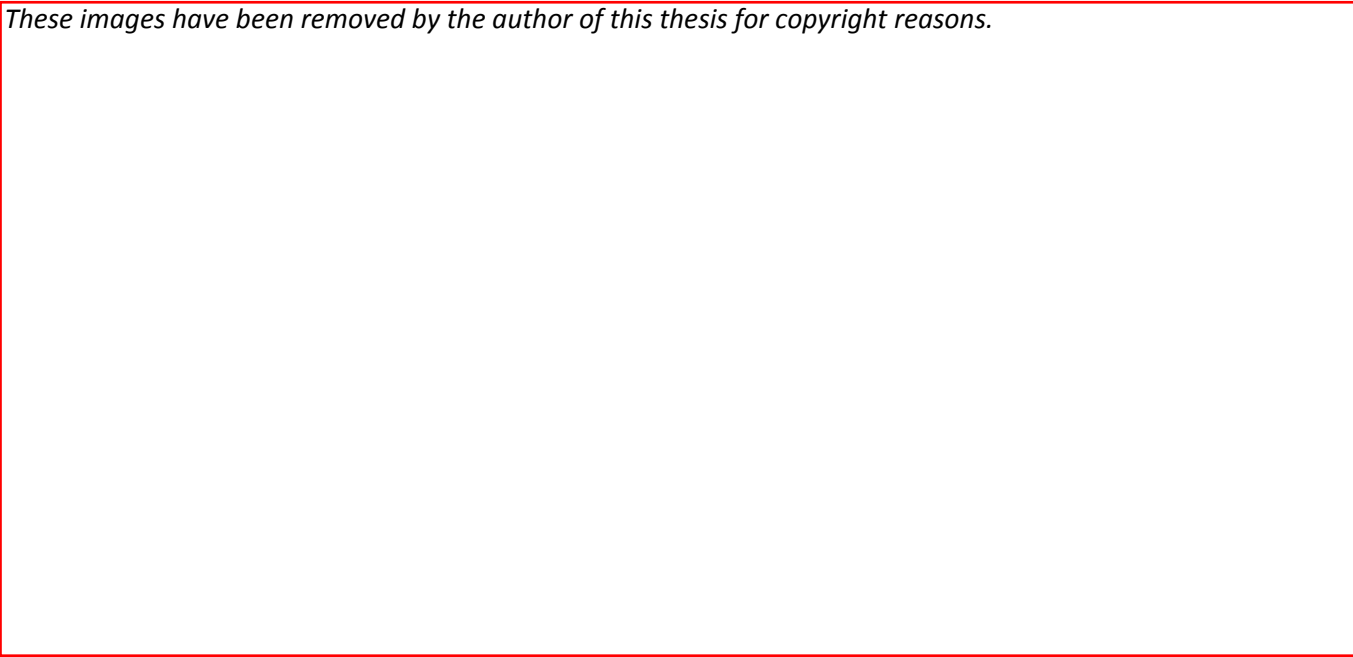
The use of laser cutting in combination with digital printing was also of interest. These techniques have been explored extensively by themselves, but using them together is new. The Erdem example is let down by the incohesive nature of its composition. Instead of using laser cutting as a counter motif, it would have been more integrated if the cut motifs were made in relation to the digital print. This avenue was explored in my own research.

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Figure 29: Proenza Schouler's neoprene/leather hybrid textile was highly organic looking.
Figure 30: A close-up of the alternative colour way of this hybrid textile.

Also utilising neoprene, American brand Proenza Schouler used the sportswear fabric in a series of dresses, handbags and shoes. Shown in Figures 29 and 30 this combination appeared like camouflage, or plastic lace. It was in fact produced by laser-cutting neoprene and leather then fusing them together, through a process known as ultrasonic welding. Even though the processes were very technology driven, the aesthetic it achieved was strangely natural, textured and recalled something alive.

What also interested me in this example was how integrated the two techniques were. The laser cutting and the ultrasonic welding were so heavily combined, making it appear like a new textile rather than a combined process.



Figures 31, 32 and 33: Peter Pilotto's use of laser cutting was incorporated in a number of looks in varying levels of integration.

British label Peter Pilotto also used laser cutting and bonding in composite textiles. Shown in Figures 31, 32 and 33 from Resort 2013, these looks incorporated laser-cut leaves which were bonded to a variety of fabric bases.

Instead of producing perfect and precise cuts, and working in the negative as is traditionally done with laser cutting; these examples appear more natural and organic. The positive is used and combines a number of different colours. Having the textiles in varying levels of integration across a number of looks was also interesting, and showed the evolution of the idea, and the possibilities of the textile.

Differing levels of integration was explored in my own work.

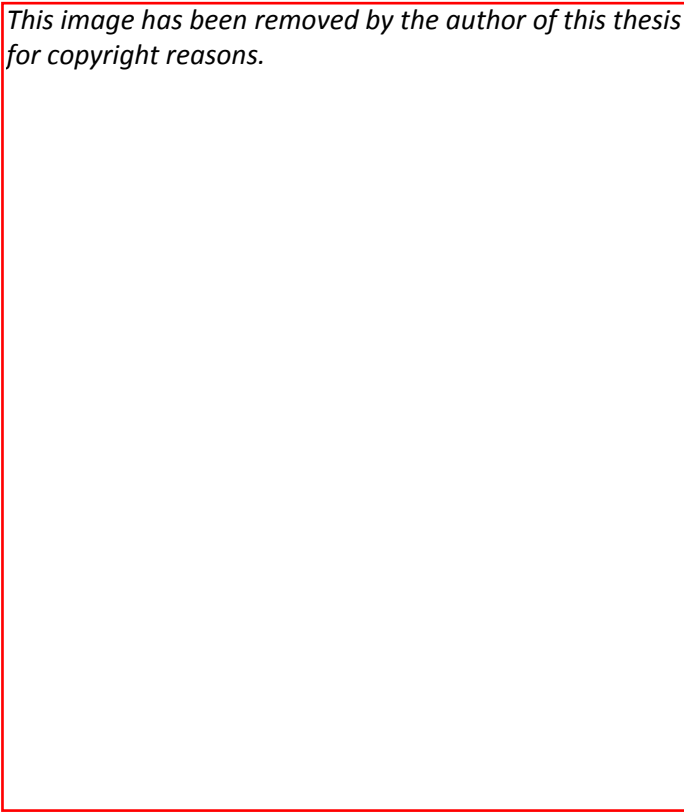


Figure 34: A close up of the laser cut leaves from Peter Pilloto's collection.

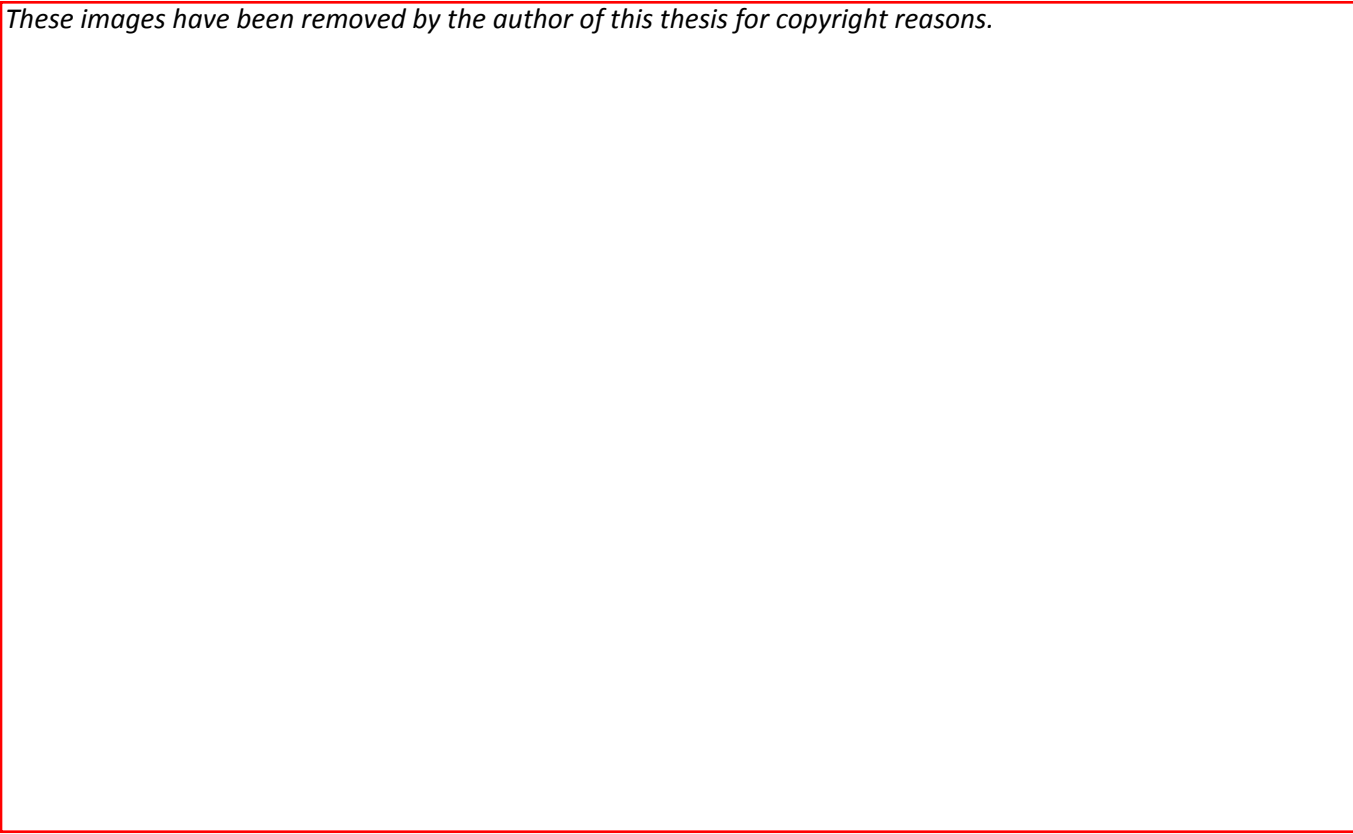


Figure 35 and 36: Two looks by Peter Pilotto that incorporated embroidery with digital printing.

Peter Pilotto's Spring/Summer 2013 collection was also of interest. For this range the designers used highly textured embroidery in combination with their trademark digital prints. Combining embroidery and digital printing gave the designs a strong textural quality, and was a catalyst for my own experimentation with 3D printed fabrics. But, as with the Erdem example I wished there was greater integration of the embroidery with the digital prints. Composing the two techniques in a harmonious way would have been more natural and compelling.

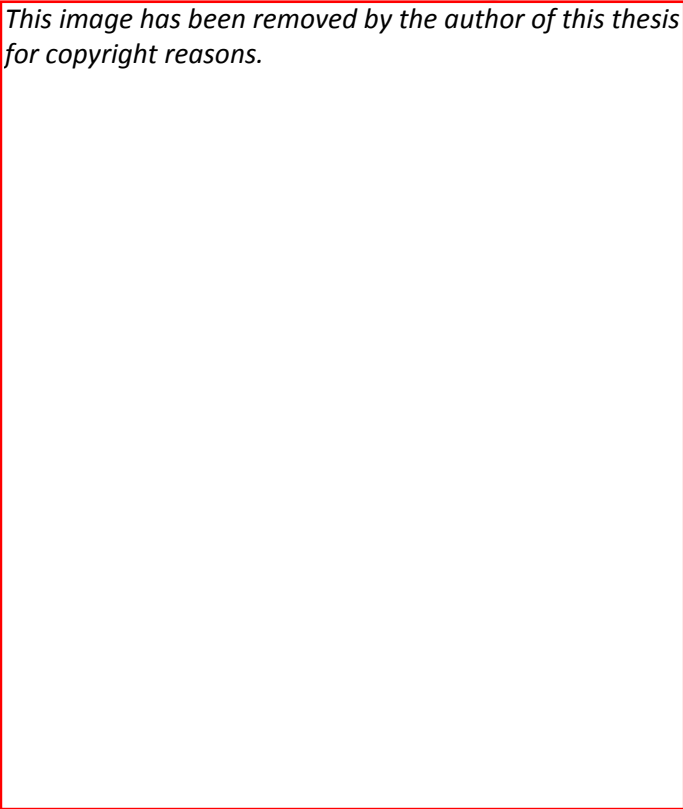


Figure 37: A close-up of the heavily embriodered skirt by Peter Pilloto.

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The move towards complex patterned textiles is also starting to include 3D printing software to design 2D patterns, and even the use of 3D printing on top of fabric.

Peter Pilloto's use of 3D printing software in drafting two-dimensional patterns, and manipulating garment shapes was explored in their Winter 2013 collection. In this range the designers used the 3D modelling software 'Blender' to experiment with elongated and extruded shapes that were applied to their pattern and garment designs (Battista, 2013). Figure 38 shows an example.

3D printing software was employed in my own textile investigation for creating design motifs. An attempt to take this further and actually combine 3D printed patterns with textiles was also undertaken.

Following this 3D printing on fabric direction, I found an example of a recent Dutch workshop dedicated to exploring fabric and 3D printing. Figure 39 shows a video still of a textile created in this workshop. Very little additional information about this textile or the processes that underlie could be found.

Another example of 3D printing onto fabric was found by Clothbot Designs. The example shown in Figure 40 uses a clear plastic filament printed on top of an open weave fabric. As with the previous example, little information could be found about this textile. My exploration of 3D printing on fabric is shown shortly and in greater detail within the Appendix.

There are many examples of 3D printing used within the fashion context, yet the vast majority of the explorations use the process in isolation and not on fabric. Designers such as Iris van Herpen, and Threearfour may have recently used a combination of fabric and 3D printing, yet there is currently no documentation or consensus on this.

All of these examples were catalysts for my own experimentation with composite patterned textiles.

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Figure 39: This video still shows a recent 3D printed design on fabric.
Figure 40: This example produced by ClothBot Designs also incorporates 3D printing on fabric.

PART TWO: METHODOLOGY

2.1 Introduction

Methodology plays an important role in research and design studies. Understanding the way these aspects can work together is important for product creation, and vital for effective knowledge creation.

Over the course of this fashion and textiles study a variety of methodologies have been investigated. Action research played the strongest part, and suited my topic for a number of reasons.

As this study progressed, readings outside the paradigms of action research were looked into and combined to create my own research practice. These readings looked at theories of knowledge creation and heuristics.

A multi-method approach to research was used in this study. These methods included literature and contextual reviews, sampling of ideas, drawing and creating physical and virtual prototypes; all of which were important in my design process.

2.2 Action research

The primary methodology for my study has been Action Research. Based on the principles proposed by Donald A. Schon in *The Reflective Practitioner* (1983), this framework acted as a guide and an analogy for my own creative process.

The course of this study from beginning to end has been guided by this overarching model. It was uncertain and confusing at times, but action research captured this uncertain process as it was happening and helped rationalise it.

A key reason I used action research was due to its similarities with my own design approach. My personal method of design was cyclical and iterative in nature, something shared with the action research model. I read or gathered contextual information, then designed or experimented with it in mind, before reflecting on the outcome, and moving on with more research. This cycle is shown in Figure 41.

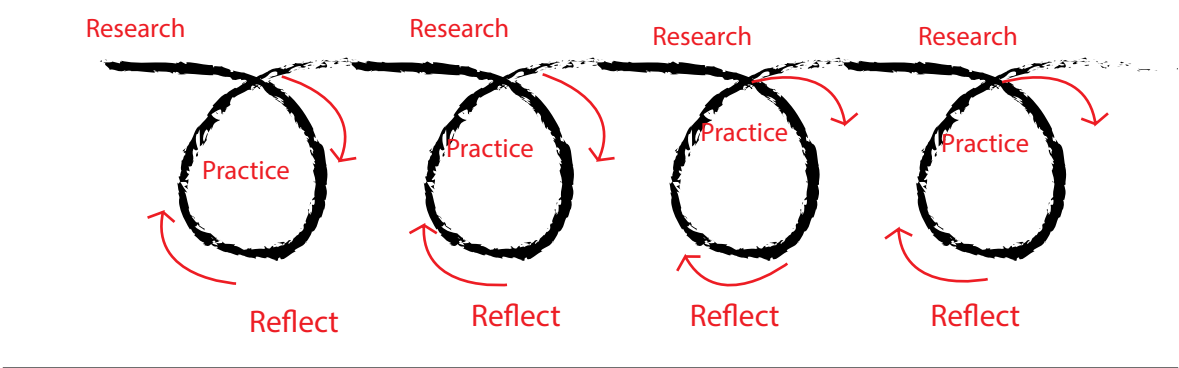


Figure 41: My research process.

Schon (1983, p.80) describes this process as starting off with 'tentative exploration' and ending with 'commitment'. This analogy fit perfectly with how my creative journey took place, where a wide and unsure textile study slowly led to a clear and committed design direction.

Action research includes set principles on how this type of research can be completed effectively. A key principle is the notion of 'enhancing' everyday working practices (Stringer, 1999, p. 13). In my case this involved making my traditional design tasks more effective. This was accomplished by reviewing which tasks were most effective for me, particularly with regards to problem solving. By increasing and enhancing my most effective strategies – in my case sketching and writing – the problems I faced were minimised. An example is shown in Figure 43.

However, it was not enough for me as a designer or a researcher to just record what I was doing, and evaluate its effectiveness. A lot of thought, contextualising and commitment needed to take place. As Stringer (1999, p.7) reiterates, the researcher has to be involved and committed to the process.

Intensity is another aspect of this 'enhancing' principle. As I worked I found that my research and design focus changed and evolved, and so did the intensity. At the beginning of the textile investigation the work level and focus was light, but as the work developed so did the intensity. The changing intensity of my research and design work is shown in Figure 44.

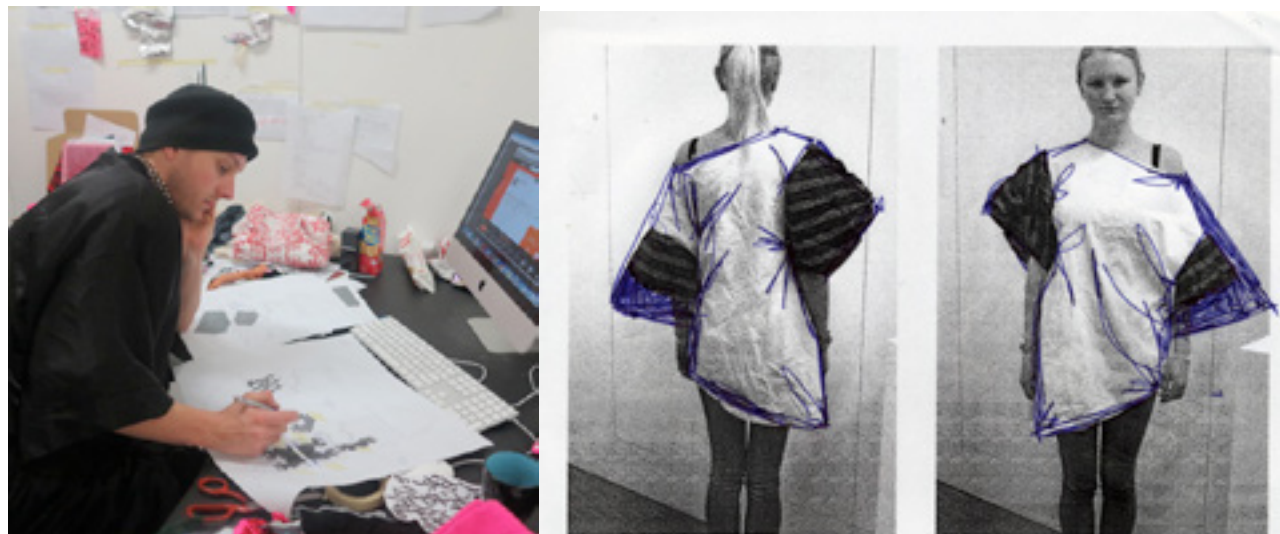


Figure 42: The designer at work.

Figure 43: Sketching and writing were effective methods of problem solving during this study.

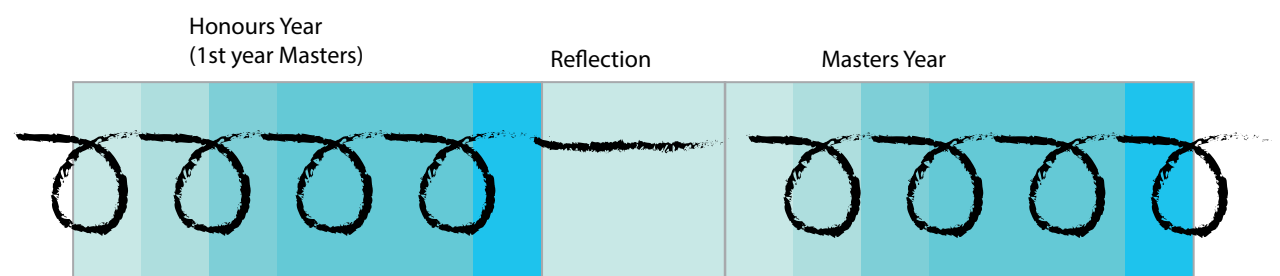


Figure 44: My extended research process. The gradient shows the changing intensity of the work.

2.3 Methodology and methods

Action research provided the methodology for this study. The methods themselves can be seen as tools for achieving the project's aims.

Each stage of this framework (Research, Practice, Reflect) has specific methods associated with them. These are described in Figure 45, and will be explored in greater detail within the Process section of this work.

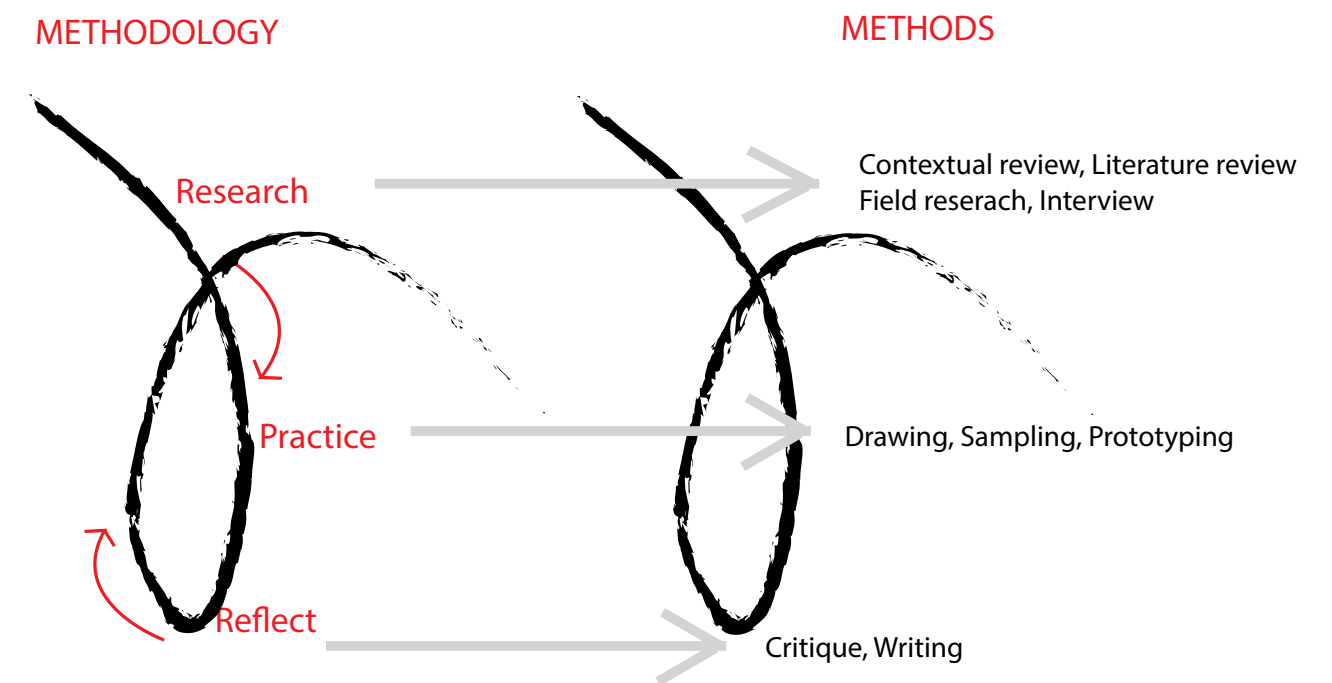


Figure 45: The relationship between methodology and methods in my work.

2.4 Knowledge creation and context

As shown within the first section of this study, context played a vital role in the research and design process. As a result, further readings into the role that context plays in creative research was undertaken.

For my study I found that there were many different types of context having an enabling impact on my work. The most immediate context concerned the place that my practical work sat; which was with patterned textiles and women's wear. It has been suggested that there is a strong causal relationship between context and knowledge creation (Von Krogh, Ichijo & Nonaka, 2000). As a result, understanding the different levels of this context was important.

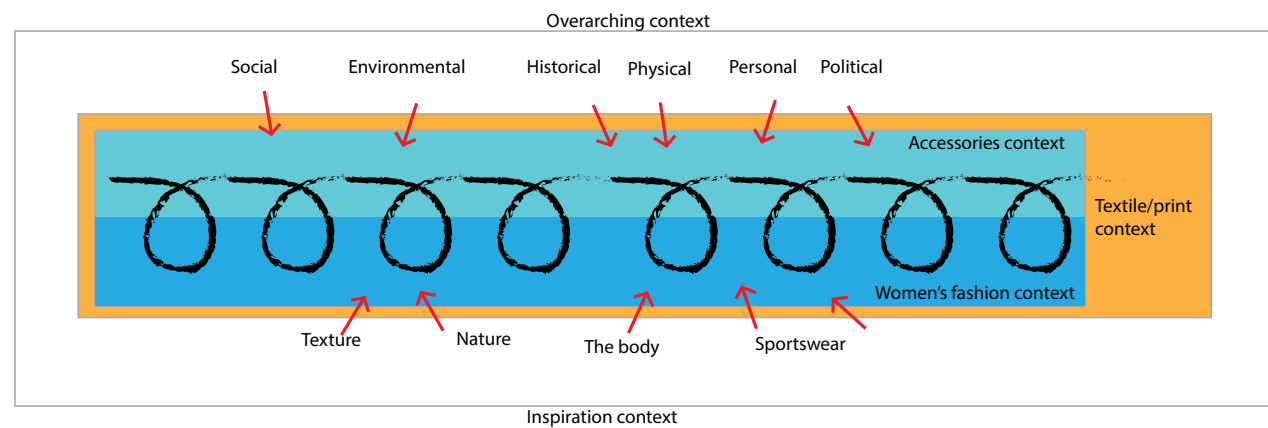


Figure 46: My research process and its relationship to the different levels of context.

2.5 Implicit knowledge and heuristics

Another facet of my research that I felt was missing from the original action research framework was the distinction between explicit and implicit knowledge. This distinction was clarified by looking at heuristic methods.

As this study progressed, and the physical research grew, so did my explicit and implicit knowledge of transfers. The traditional action research framework does not include implicit paradigms like perception and intuition.

Explicit knowledge can be put down on paper, in the form of sentences or drawings. Yet implicit knowledge is not so clear, as it is tied to the senses (Von Krogh, Ichijo & Nonaka, 2000, p.6). Theories of heuristics helped clarify this area.

Heuristics is understood as a personal process that searches out conditions or pathways that underlie a fundamental question (Moustakas, 1990, p.11). Moustakas (1990, p.23) goes on to elaborate that intuition acts as a bridge between explicit and implicit knowledge. Intuition connects you with the structure or processes that underlie a topic (Moustakas, 1990, p.23).

From this I was able to rationalise intuition into my own overarching design framework. Figure 47 describes the relationship between action research and heuristics in my study. This model shows how intuition and 'hunches' helped move my work forward, without the use of the explicit structure. Moustakas (1990, p.23) supports this, indicating that often the in-between steps of logic and reason can be skipped.

The relationship between action research and heuristics

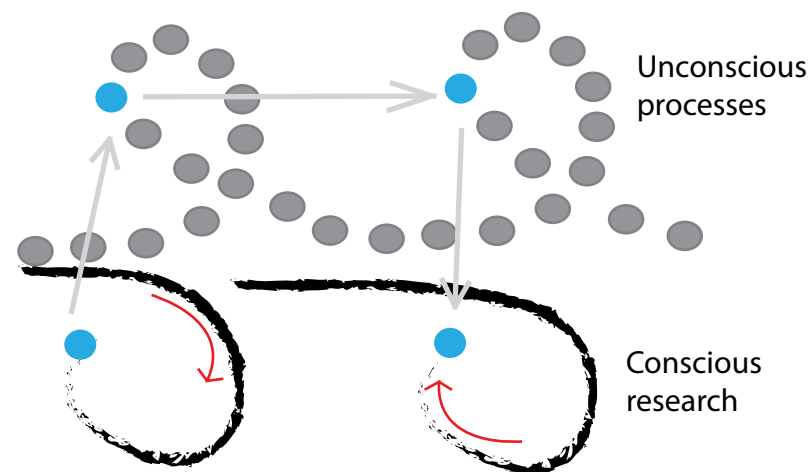


Figure 47: The explicit and implicit nature of my research.

PART THREE: THE PROCESS

3.1 Textile investigation

A. Introduction

As a designer I draw inspiration from many different and seemingly unrelated sources. These include contemporary art, literature and popular culture. In this exploration the initial inspiration or starting point was the source material itself, and the sportswear context. Heat transfers as well as newer techniques were experimented with over the course of many months.

To begin with, the exploration was very wide and extensive. As it continued, the study narrowed to more specific styles and combinations. Despite this, the focus on the source material itself was not enough. A process of collecting images, ideas, technical information as well as samples of trialled textiles occurred and these were collated in visual diaries, workbooks and storyboards.

This process of sampling and collation allowed me to work through initial ideas and possibilities to see those that had potential.

As Newbury (2001, p. 2) suggested, this method is not a linear report on the process, but something that captures the true nature of ideas for the researcher themselves. This was a place where my own ideas could literally sit along side outside influences.

In my case the outside images or data were pulled from a variety of sources, but much of it came from the information gathered in the contextual review. Newbury (2001, p. 3) indicates that this is what this process does well, bringing the subjective and the objective together so they are 'productive'. Put simply; visual diaries and storyboards were where new ideas were created, worked through and thought about.

An example of my visual diary from the early stages of the textile investigation can be seen in Figure 48. As my exploration developed, so did the storyboards. Later examples are shown in Figures 49 and 50.



Figure 48: A page from my early print and pattern workbook.



Figure 49 (Top) My early inspiration wall, showing an early focus on skin, cells and folded volumes.
Figure 50: (Bottom) A more focused collection of textiles.

B. Initial exploration

Before much in-depth design thinking and examination could begin, a phase of 'tentative exploration' was undertaken (Schon, 1983, p. 80). This stage involved getting a hands-on feel for the different heat transfer products and their possibilities.

A key feature of this stage involved experimenting with different heat, pressure and printing variables when working with the different transfers.

The basic bonding process of vinyl transfers and foils is shown in Figure 51. Figure 52 shows how screen-printed folk is applied.

The initial samples were simple and focused on achieving a satisfactory bond to different base textiles. Bonding on leather was an early motivation and some imitation of styles and ideas occurred to aid the creative process.

Examples from this stage are shown in Figures 53-62.



Figure 51: For vinyl transfers, foils and roll-cut flock, motifs can be produced using computer software, which get cut out using a plotter. The image is weeded and heat-set to the desired base. The same heat-set process is used for all over applications.

THE PROCESS



Figure 52: The process of screen printing flock uses the standard method of screen printing, but instead of printing with ink, a heat-set adhesive is used (and slightly diluted). Once it is printed on the base fabric it is cured with a heat-gun at approximately 300 degrees Celcius. The flock sheet is then applied over the adhesive and is then heat-set and removed.



Figure 53: (Left) An early sample of vinyl transfer on pigmented leather.

Figure 54: (Right) A further iteration using deer skin and flocking on the reverse.

THE PROCESS

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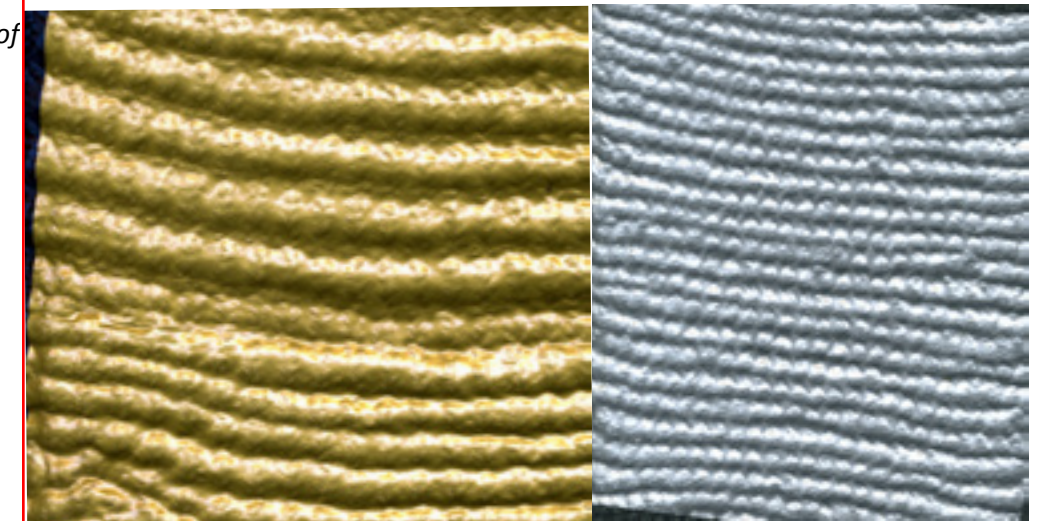


Figure 55: (Left) Stella McCartney's recent exploration of vinyl transfered over a grid texture.

Figure 56: (Middle) My first attempt at a similar idea.

Figure 57: (Right) Another attempt with a smaller knit structure.

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Figure 58: (Left) Vinyl clutch. Christopher Kane (2010).

Figure 59: (Right) My attempt to mimic a similar textile and print.

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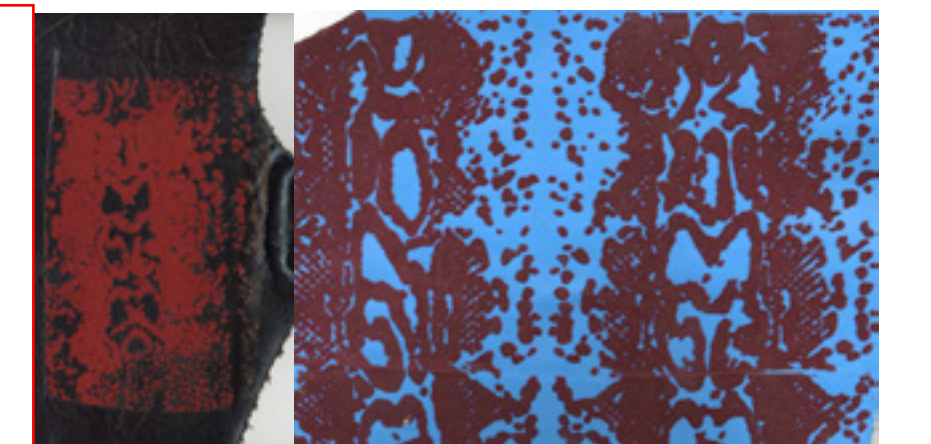


Figure 60: (Left) A flocked leather clutch from Gucci (2012).

Figure 61: (Middle) An early attempt at using flock on leather.

Figure 62: (Right) A more successful attempt at flock on leather.

C. Focused exploration

After successfully working with heat transfers in isolation, a focused exploration of the media together and with newer technology occurred. This was a lengthy process and involved working with the different factors and heat-set requirement of each type of media, when combined together.

There were numerous mistakes and non-usable textiles produced during this stage. Some were burnt, melted or unsuccessfully bonded. Figures 63-65 show some examples.

After a long period of experimentation a sizeable variety of composite textiles were produced. These undeveloped textiles demonstrate future directions and possibilities with regards to composite textiles.

Some examples are shown in Figures 66-78.



Figure 63: (Left) A burnt screen printed and roll-cut flock textile.

Figure 64: (Top right) A melted vinyl on wool sample.

Figure 65: (Bottom right) An unsuccessfully bonded flock on foil example.

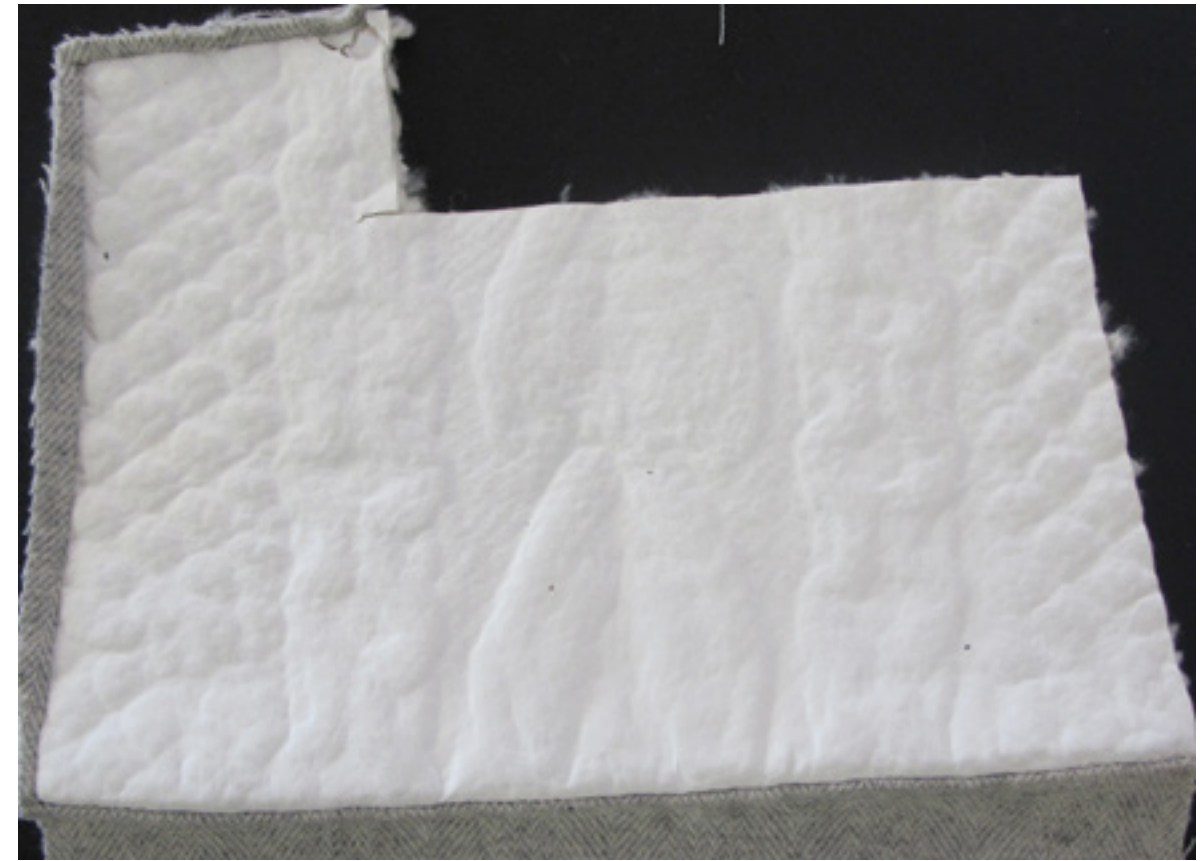


Figure 66: This sample uses a cable knit base, which is then bonded over with a vinyl transfer.

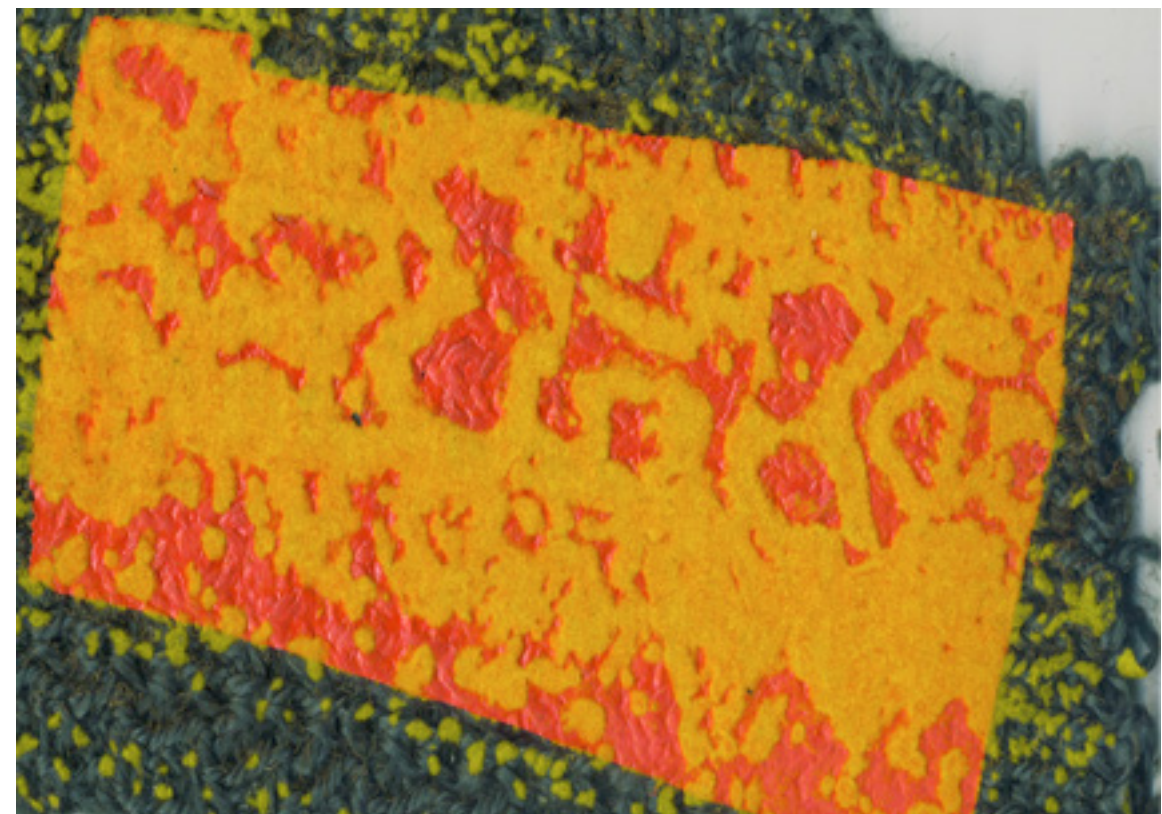


Figure 67: A further iteration of the bonding on knit process. This time with a flocked pattern texture over top.



Figure 68: Combining the knitted and leather direction became an early motivation. This sample shows knitted vegetable leather bonded over with a vinyl transfer.

Figure 69: A further iteration of the bonding on knit idea, this time laser cut with a counter pattern.

Figure 70: A digital print that has been printed with a flock print and a laser cut pattern.

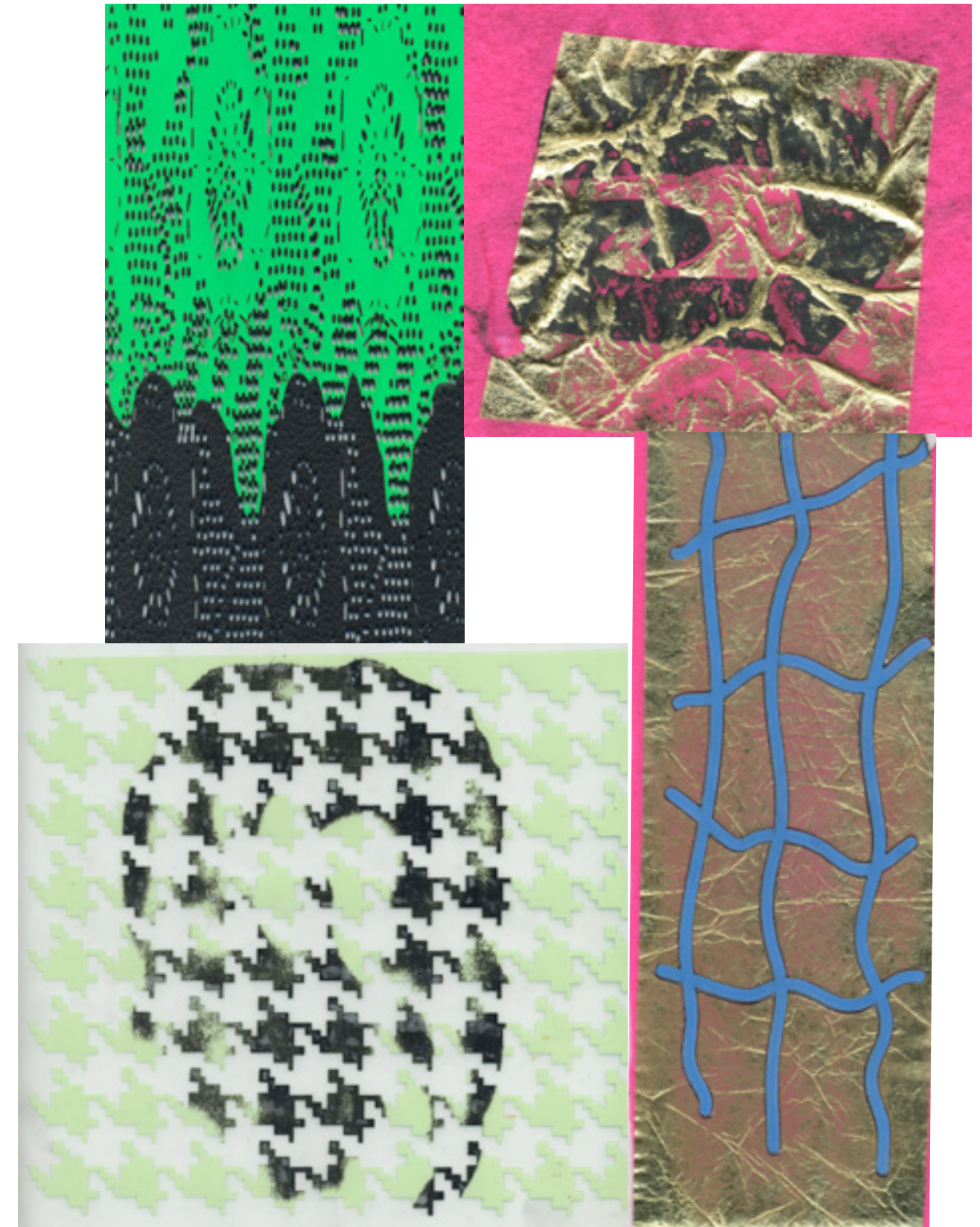


Figure 71 (Top left): Plotted vinyl transfers on laser cut leather.

Figure 72 (Top right): Vinyl transfer bonded beneath distressed foil transfer.

Figure 73 (Bottom left): A sample that combines vinyl transfers and screen printing on a transparent base.

Figure 74 (Bottom right): Distressed foil transfer with inset laser cut leather section.

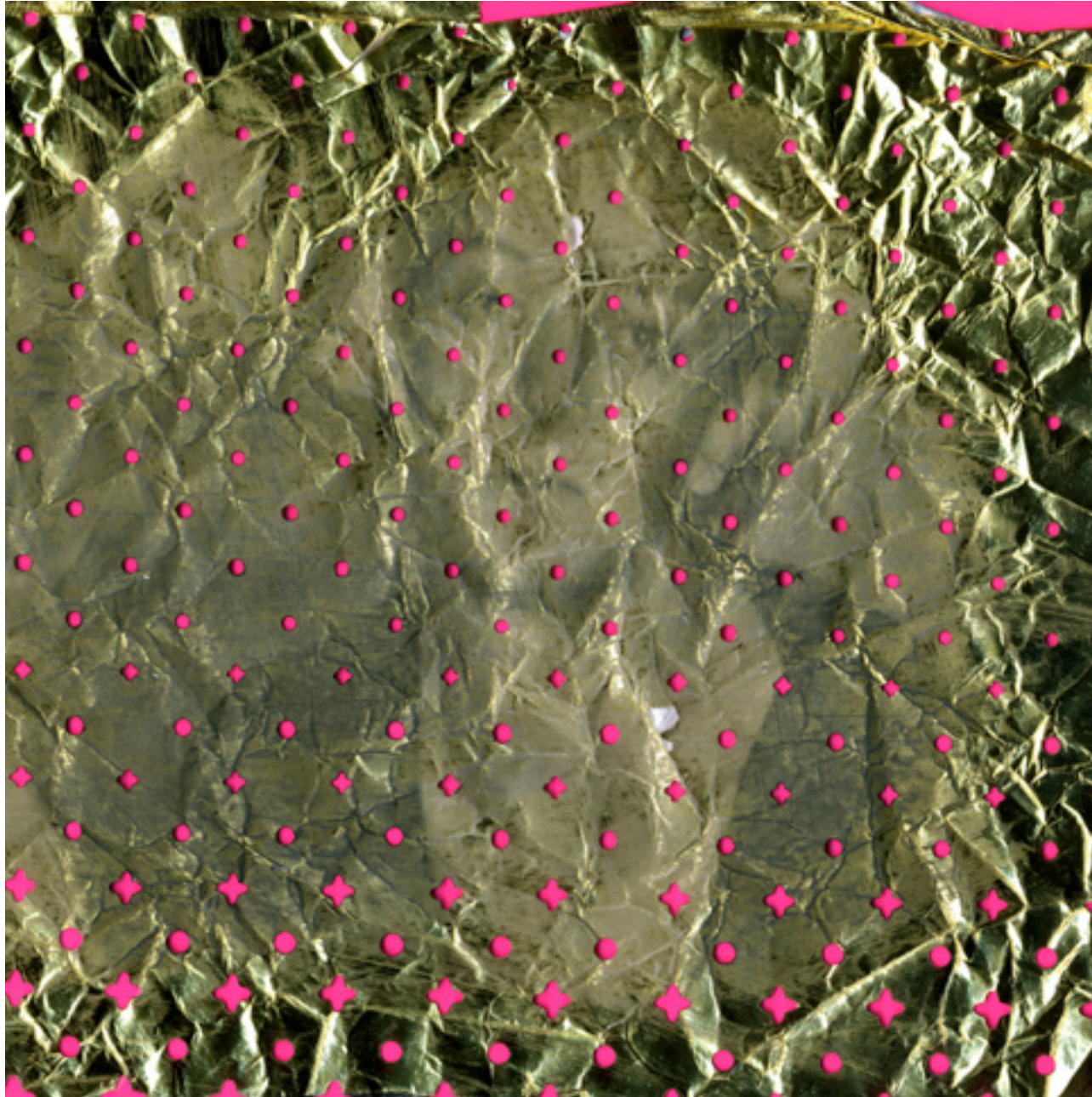


Figure 75: This textile incorporates laser cutting, digital printing and foils. The digitally printed image is bonded over with a foil transfer. The foil is then distressed with an industrial sander. It is then laser cut with a counter motif and heat-set again and crinkled. A fabric underlay has been used to contrast the foil.

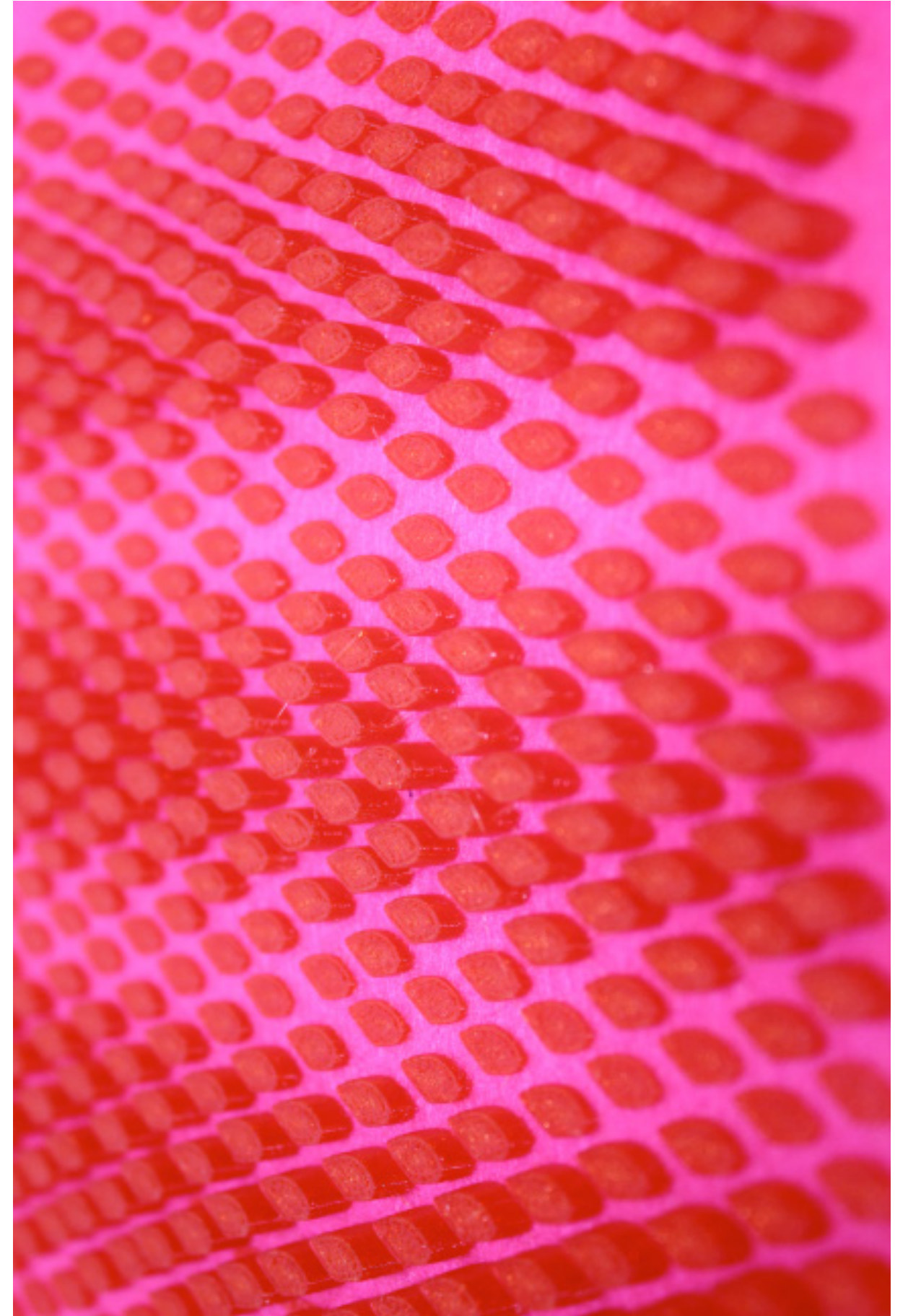


Figure 76: One of the last textiles I began to develop looked at using 3D printing on fabric. A further exploration of this idea can be found in the Appendix. This sample is PLA on felt.



Figure 77: An idea that begins to incorporate 3D printed elements with laser cutting and digital printing.

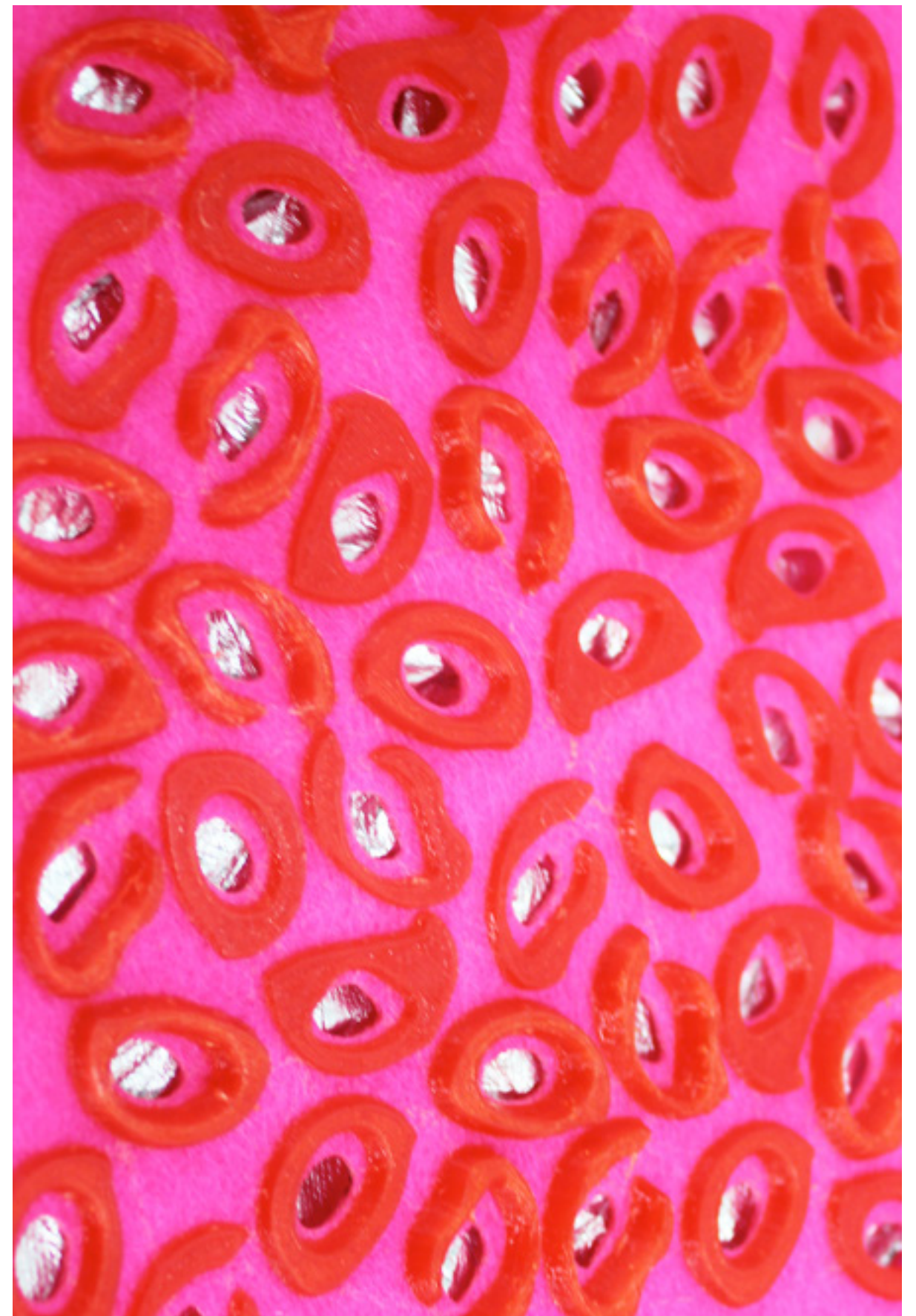


Figure 78: Felt that has been 3D printed with a cell motif, then laser cut and underlayed with a foil transfer.

D. Chosen fabrics

After exploring a wide range of combinations, techniques, products and methods, three key textiles were chosen to be developed further. From these textiles a design direction and motivation was determined.

While reflecting upon the contextual examples of composite textiles, and the lack of texture in digital printing and laser cutting, I began to think and experiment further with the idea of adding a strong textural quality to my own heat transfer composite fabrics.

I came to recognize that a quality explored in composite textiles – involving a textural focus – could be further applied to techniques like digital printing and laser cutting. Transfers could be used to achieve this textural quality, and in using this media with more advanced and fashion-oriented techniques this could bring new life to the out-dated medium.

I continued to investigate laser-cutting and digital printing through my own sampling as well as looking at contextual examples. The contemporary exemplars of both of these techniques tended to be very flat, and without a strong textural focus.

I began to appreciate how perfect, precise and hyper-real these digital designs are. Even though they often attempt to appear 'real', they come across as highly man-made, and lacking a natural or 'organic' quality. They also lack any strong three-dimensional texture.

The textiles I chose to develop further (shown in Figures 79-81) used transfers in combination with laser cutting and digital printing. Heat transfers, although older and out-dated in comparison to these newer techniques gave the textiles a strong, natural and organic quality.

The transfers gave the digitally printed and laser-cut pieces structure, form and a strong textural quality. The stiff and crinkling ability of the heat transfers – so often overlooked – achieved this. These fabric designs no longer appear so man-made and hyper-real. The textiles have a worn, lived in, and personal quality, a quality missing from the traditional use of heat-set media, and the traditional uses of digital printing and laser cutting.

The development of each of these textiles will now be briefly discussed.



Figure 79: A foil, felt and roll-cut flock textile to be developed further.

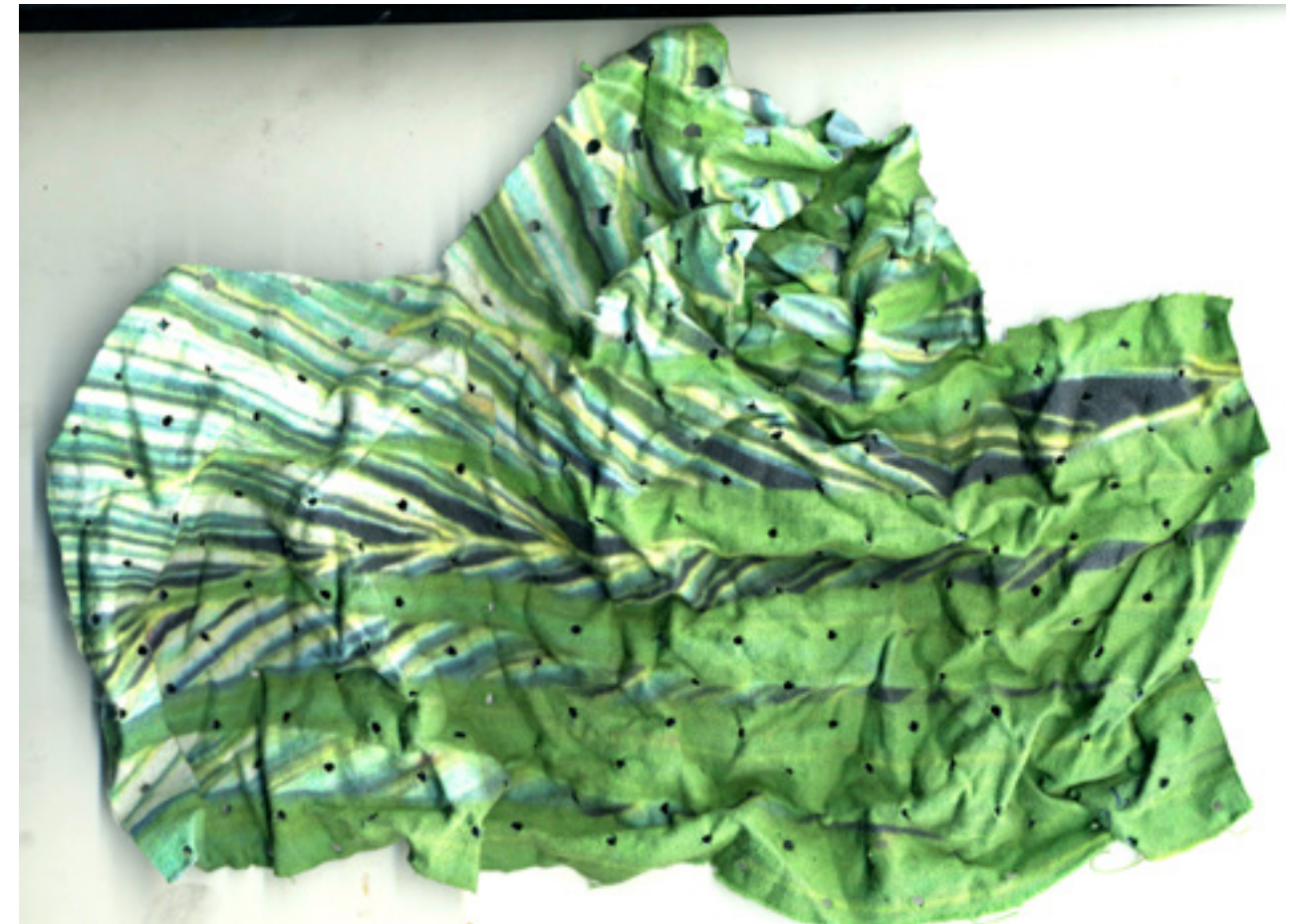


Figure 80: A digitally printed textile with a flocked reverse and laser cut counter pattern.



Figure 81: The third textile incorporates vinyl transfers and screen printed flock.



Figure 82: The foil transfer on the roll.

Figure 83: The foil and roll-cut flock is heat set to each side.

Figure 84: The laser cutter used to produce the detailed cuts.

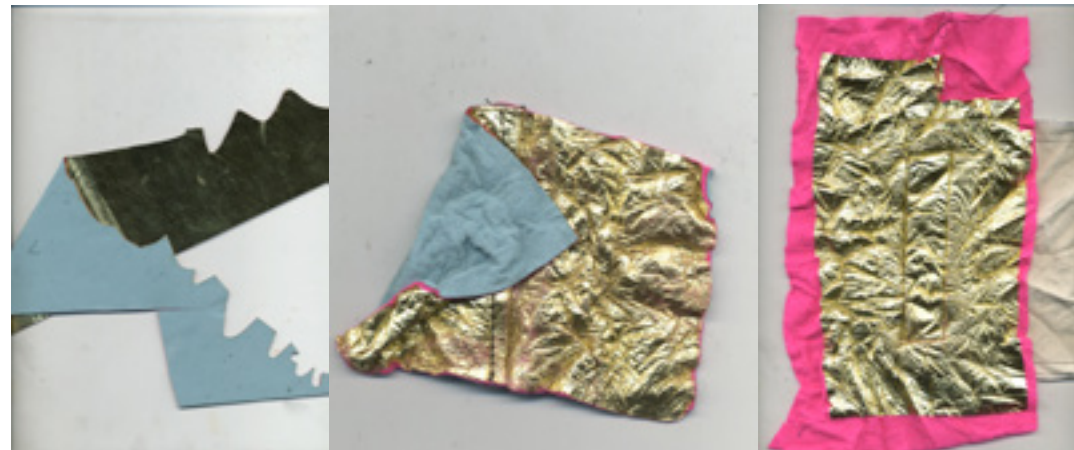


Figure 85: An early un-crinkled prototype of the textile.

Figure 86: A sample after crinkling.

Figure 87: A welt pocket made in the prototype textile

Figure 88: A close-up of the laser cut textile

Figure 89: The flocked reverse of the textile with burn marks.

This first textile was a foil and flock composite created by using felt as the base. Roll-cut flock and foil were bonded to each side separately and with care to insure the surface is not distorted. The fabric created is soft and fuzzy on the reverse and reflective on its face (or vice-versa). At this stage a motif was laser cut into the textile. It was then heat-set again, scrunched and cooled quickly (with the aid of a freezer to speed up the process). The fabric now has a stiff, crinkled and distorted nature.

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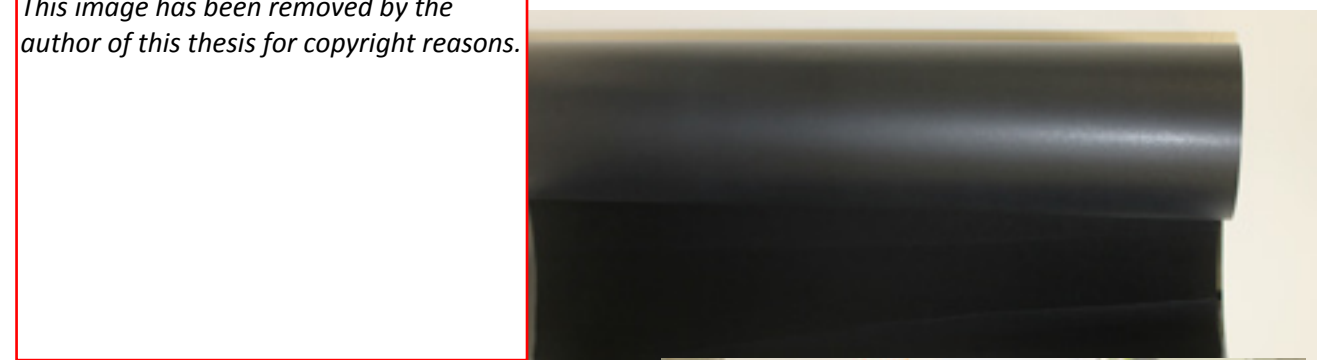


Figure 90: An example of the digital printing process.

Figure 91: The roll-cut flock before bonding.

Figure 92: Bonding the flock to the reverse of the printed fabric.

Figure 93: The laser cutter used to produce the cut patterns.



Figure 94: An early prototype of the textile, crinkled and before laser cutting.

Figure 95: The un-crinkled and laser cut iteration of the textile.

The second textile also used flock as a backing. Here, a digitally printed fabric was heat-set with roll-cut flock on the reverse. It was then laser-cut with a counter motif before scrunching, or left un-cut. The use of flocking on the reverse had a similar effect as in the foil example; where the addition of more heat and scrunching caused the fabric to hold the strong creases. The use of flock on the reverse also gave the fabric a soft handle, and a cushioned quality. This soft and cushioned quality can be seen in Figure 95.



Figure 96 (Left): The pre-inked vinyl/flock textile
Figure 97 (Right): After heat-setting again and crinkling.

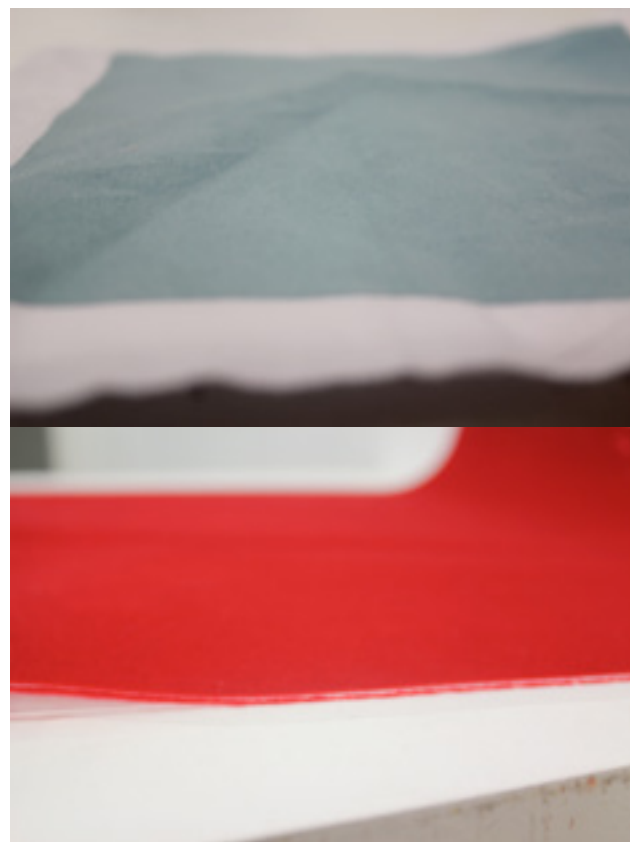


Figure 98: The roll-cut flock had a less textured pile than the screen printed variety.
Figure 99: The screen printed flock, with a higher pile.

The third textile did not incorporate newer technology like the previous examples. It was created by combing the crinkling ability of vinyl transfers, with the soft texture of screen-printed flock. Although simpler in nature, the textile was difficult to produce, due to the differing heat-set requirements. Screen-printed flock has a thicker, more textural pile and was selected instead of the roll cut variety of flock to produce this fabric.

After heat-setting the vinyl on a linen base fabric, flock adhesive was screen-printed on top. This was then cured with a heat-gun. Great care had to be taken in order to set the adhesive without melting the vinyl layer. A flock sheet was then heat-set to the flock adhesive, and removed when it had cooled. It was then put through another heat-set processes and scrunched by hand to give it a crinkled texture.

Due to the lack of newer technology used with this fabric, a decision was made to use 3D printing software to draft the 2D pattern for this textile.

After a lot of reflection and consultation with supervisors, industry experts and classmates I then decided to develop these textiles in a range of garments and accessories.

3.2 Design Collection

A. Introduction

In the process of creating this collection, a number of useful tools and techniques were utilised. Drawing, compiling mood boards, and creating miniature and full-sized prototypes were all used in the process of making the proposed fabrics into product. This was an extensive process that required a large amount of thought, and a great deal of tacit knowledge.

The first part of this process involved a design focus.

B. The design focus

While the textile experimentation was taking place, sketching was a way of turning the physical knowledge I had of the fabrics into a design direction.

Sketches of full garments, accessories and details were made. This method was useful to me because it helped work through initial ideas, and see variations. Rogers (2000, p.2) supports this, suggesting that concept sketching helps frame early ideas and aids the designer to get a better grasp of the problem.

Some early design ideas are shown in Figures 100-103.

Sketching was a method that allowed me to communicate an idea quickly and clearly. Griffiths (2000), indicates that words alone can only act as guides and that, in the early stages of design, the meaning or intention is in the drawing.



Figure 100 (Left): An early concept drawing.
Figure 101 (Middle): A later concept drawing.
Figure 102 (Top far right): An early bag concept.
Figure 103 (Bottom far right): Another bag concept.

THE PROCESS

Intense reflection on these early sketches, ideas, proposed textiles, and contextual literature led to experimentation with miniature, virtual and full-sized prototypes.

The creation of miniature and simplified prototypes happened from the beginning of the study, and a variety are shown in Figures 104-111.

The creation of virtual and miniature prototypes allowed me to trial design ideas that would otherwise be too expensive and time consuming if produced in full-scale. From reflection on these prototypes, a design focus was determined.

The use of 3D software became a very important part of my creative process, and changed with the work. In the beginning the 3D software was focused on drafting shapes and full concepts. As my research changed, the same software was used to compose two-dimensional prints. Towards the end of the study I became aware that same patterns could actually be printed in three dimensions.



Figure 104: A variety of miniature prototypes and details

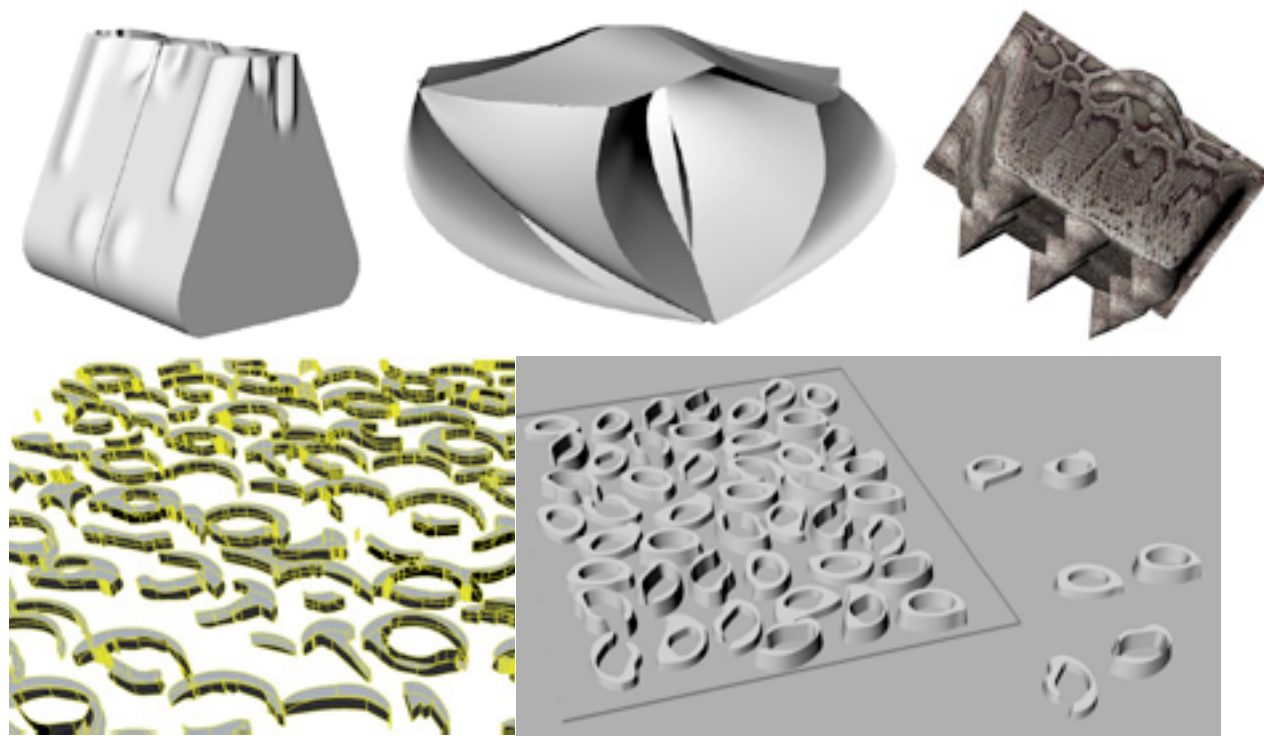


Figure 105: The use of 3D modeling software was helpful in concept creation, for drafting 2D patterns and 3D printing on fabric.

THE PROCESS



Figure 106: An early silver foil bag sample.

Figure 107: A gold foil bag sample.



Figure 108: An early jacket idea.

Figure 109: The jacket idea is developed further.

Figure 110: An attempt at draping the proposed textile.



Figure 111: An exploration of foils in sculptures exhibited at AUT early on in the study.

Due to the complex nature of the proposed textiles – in creation and aesthetic – I believed it wise to balance this by using the textiles in simple garments. As with my honours year work, the t-shirt became the focus. Not only did this carry the story on from my previous work, but it made reference to the origins of heat transfers, and a key movement the composite pattern direction is part of – sportswear into fashion.

The initial design proposal is pictured in Figure 112. Here the textiles are represented in highly textured and irregular t-shirt dresses. A range of accessories were also proposed to go with the t-shirts. These too were simple in nature and had a reference to sportswear. The hat concept was based on an outdoorsy bucket hat, and the bag was hand held (making the wearer feel the fabric) and resembled a strange shrunken football or something from nature.



Figure 112: The design proposal, features strange oversized t-shirt dresses, sporty hats and strange bags.



Figure 113: An early render of the hat concept.

Figure 114: The proposed bag shape.

Figure 115: The proposed bag with rendered print.

Figure 116: The sporty draw-string inner of the bag.

With a design direction in mind, I continued to sketch and create miniature prototypes. At this stage the use of sketching and prototypes was more focused, and helped me to refine my ideas. Some examples are shown in Figures 113-119.



Figure 117: An early rendering of the t-shirt concept.



Figure 118: Garment concepts and development.



Figure 119: Miniature prototypes of the proposed textiles.

Photographing miniature prototypes also provided a way of documenting and presenting the textiles while they were still developing. Some examples are shown in Figures 120-125.



Figure 120: The flocked vinyl transfers textile.



Figure 121: A proposed digitally printed, flocked fabric.

Figure 122: An early iteration of the 3D printed/laser cut fabric.



Figures 123 and 124: Some early textiles.



Figure 125: A more three-dimensional iteration of the 3D printed/laser cut textile.



Figure 126: Developing prototypes of a t-shirt concept.



Figure 127: Further concept development.

After reflecting on these early models; full-sized prototypes using inexpensive fabrications were then produced. Development of these garments and accessories then occurred, focusing on fit, balance and proportion. The evolution of these ideas is shown in Figures 126-135.

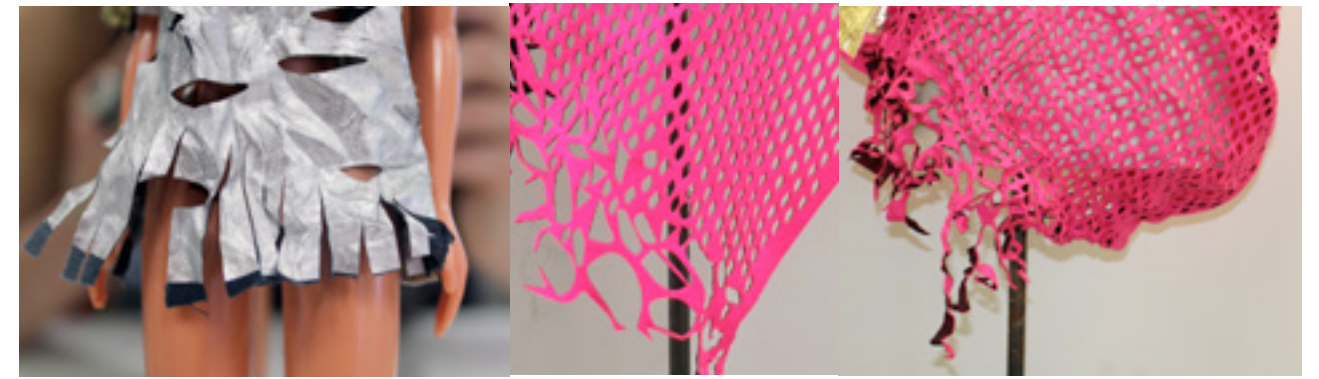


Figure 128: An early hem idea.



Figure 129: The development of a design idea.

THE PROCESS



Figure 130: A closer fit around the neck was considered, with the addition of zips.



Figure 131: Zip samples.



Figure 132: The development of the bucket hat concept

THE PROCESS

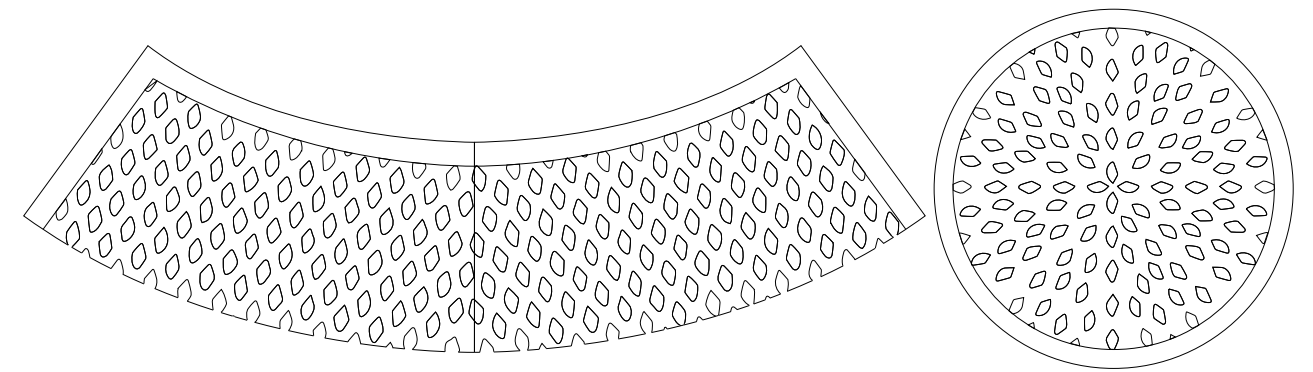


Figure 133: The perforated design is engineered to the hat pattern pieces



Figure 134: The first prototype of the hat idea.



Figure 135: A final hat design.

Greater thought then had to be given to the designs to accommodate the proposed textiles. There were a lot of variables to be considered due to the limited nature of the products and the methods used to create the textiles. The laser cutting bed was only 130cm by 60cm in size, so pattern pieces had to fit within this and be registered correctly to get an accurate cut.

The size of the roll cut flock and foil was also small, so joins and seams had to be calculated. The screen-printed flock sheets were limited in size (52cm by 37cm), as was the maximum silk-screen size readily available (A1).

As a result of these restrictions I found it more effective to engineer the textiles specifically to the garments. By doing this, greater control over pattern placement and the relationship to the body could be achieved.

For the digitally printed and laser cut textile to work, a lengthy process of digitising the pattern before and after printing was necessary. This was due to the shrinkage of the fabric as a result of the printing process. The second digitising process required the pattern design to be digitised as well to insure accurate registration with the laser cutting.

Pattern style, placement and colour were then explored in relation to the textiles and the garments.

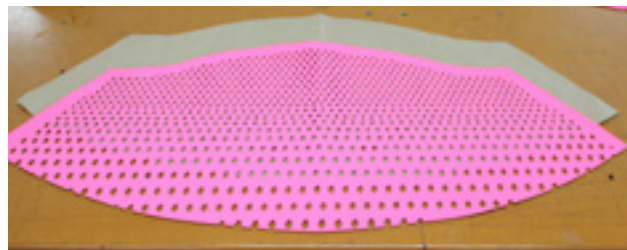


Figure 136: A pattern piece with an engineered design.

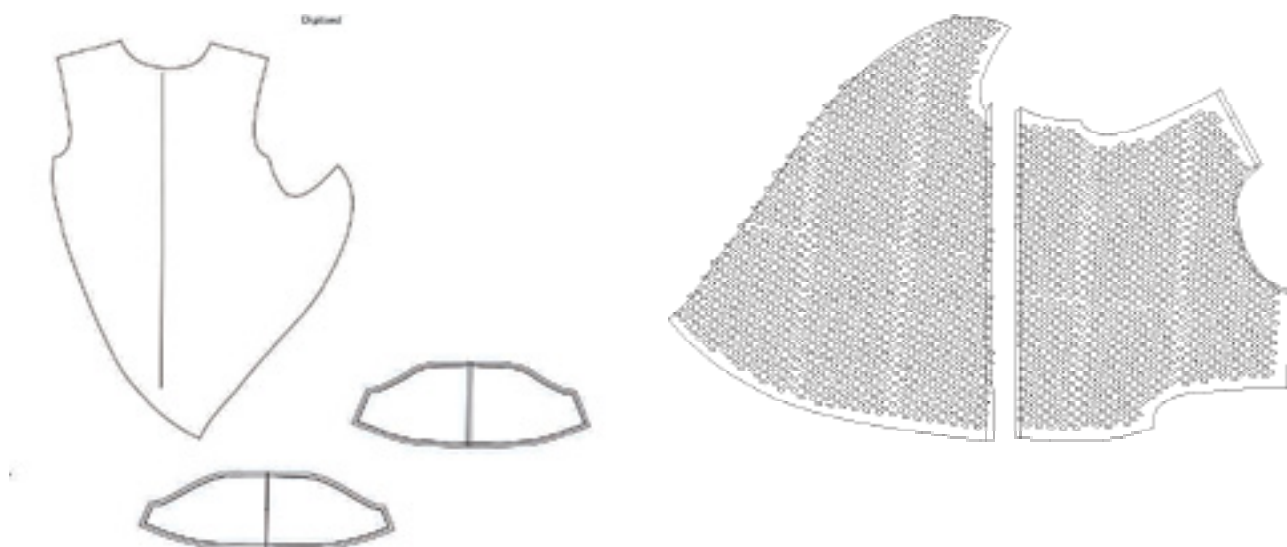


Figure 138: The result of the digitising process

Figure 139: The digitised pattern is then manipulated



Figure 137: The pattern digitising process.

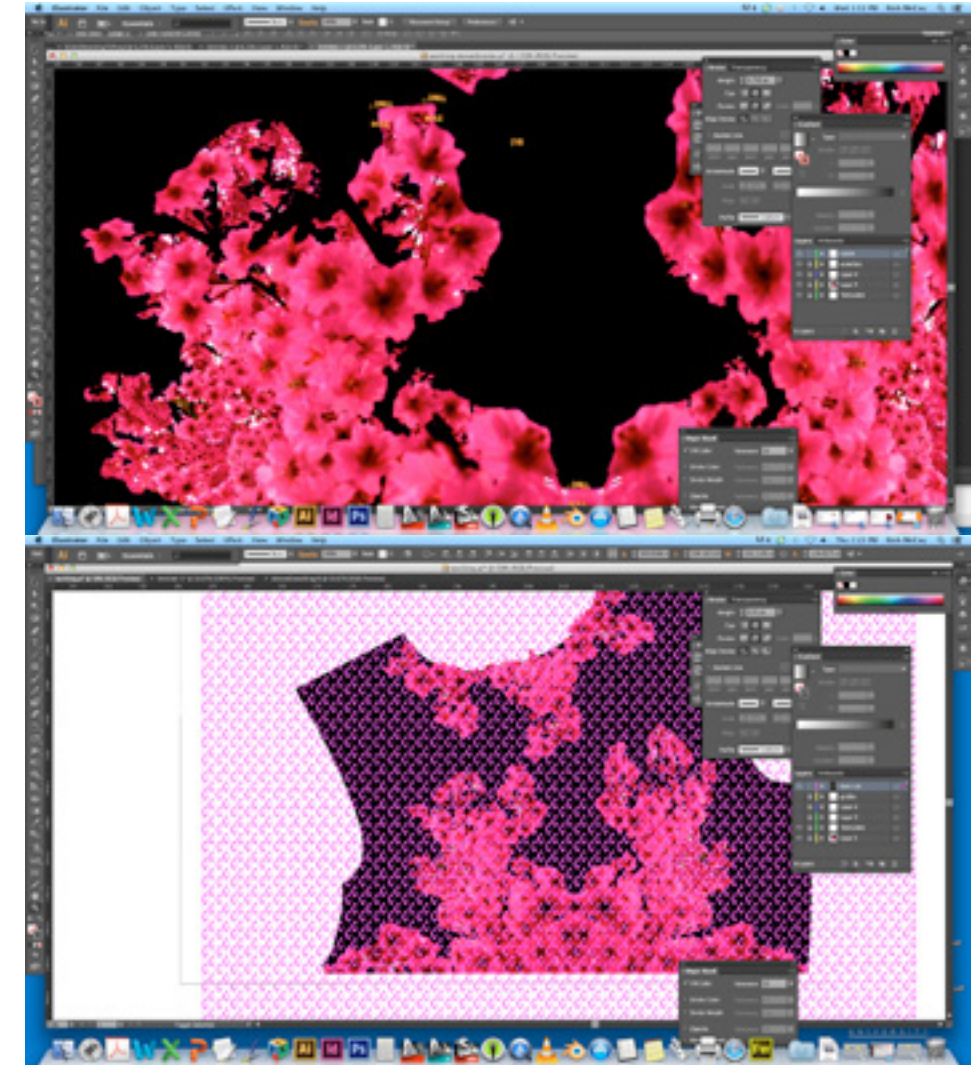
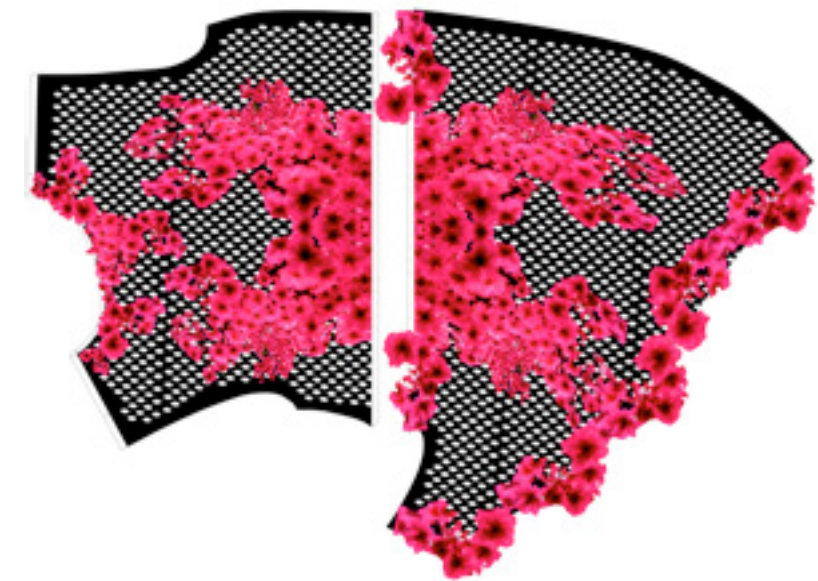


Figure 140: The digital print was aligned with the drill holes (guides) after being printed.

Figure 141: The design was then layed over with the laser cut motifs.

Figure 142: The final design.



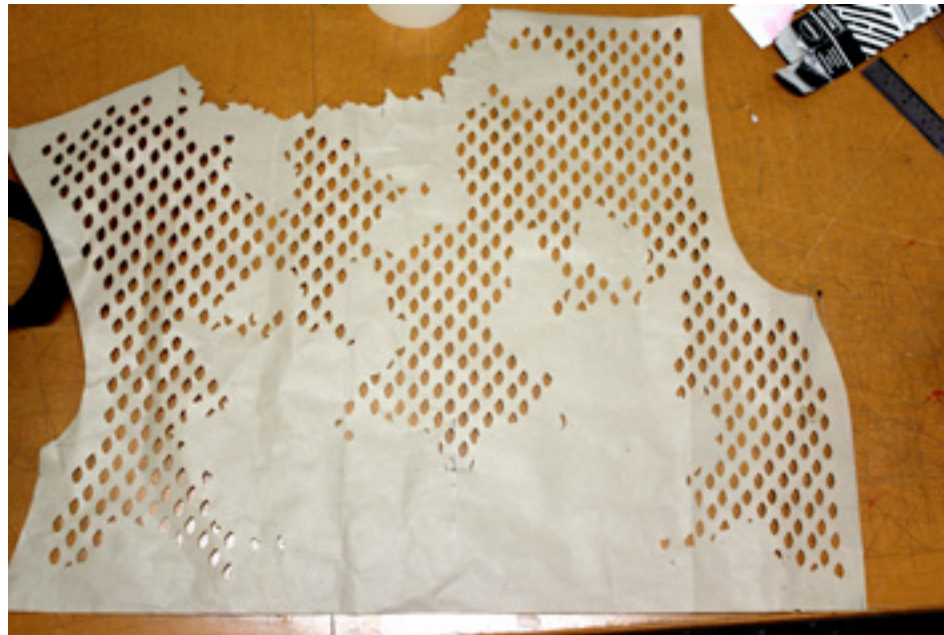


Figure 143: A paper sheet was used below the print during the laser cutting process, to insure accurate registration.



Figure 144: Examples of the end result, with alternative hem.

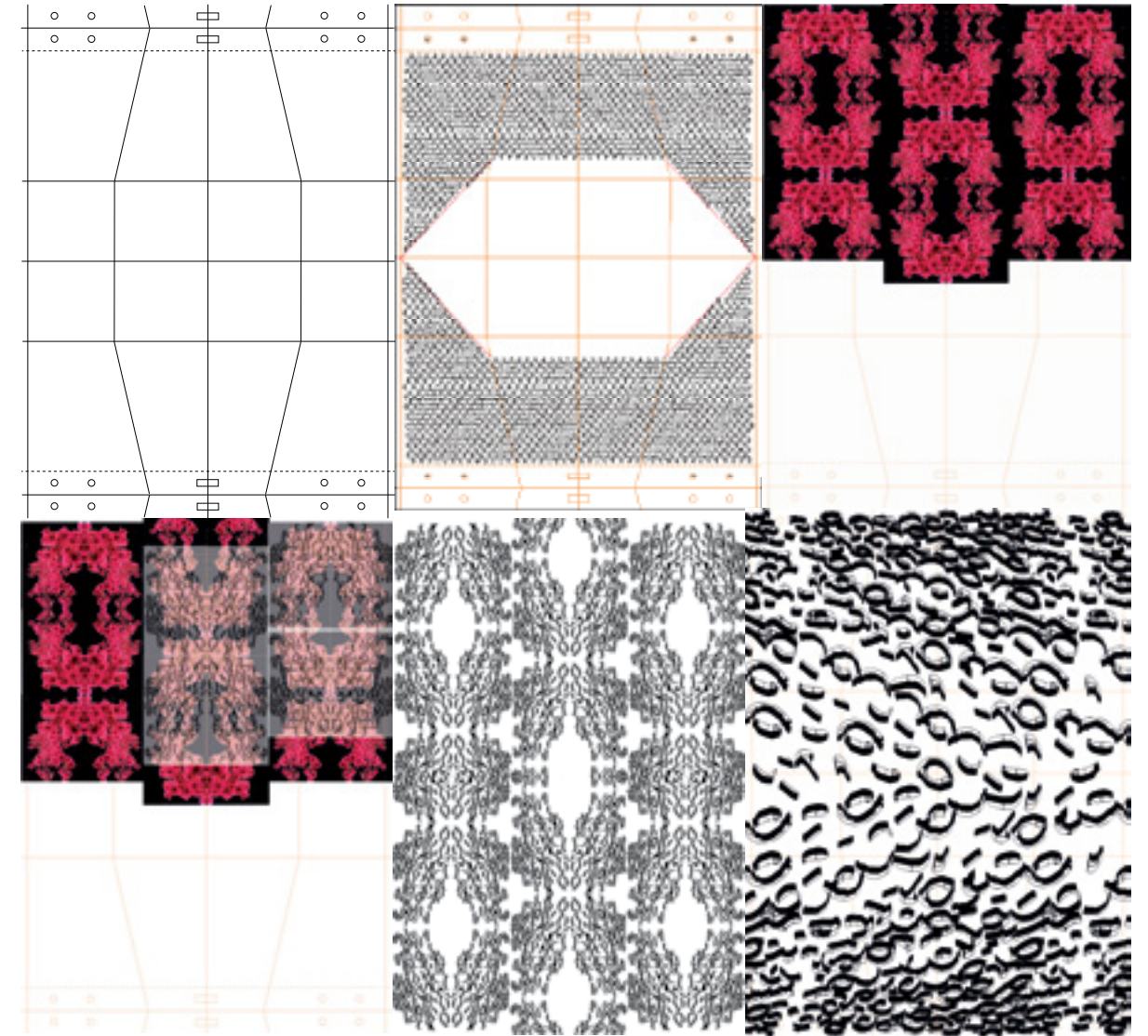


Figure 145: The bag prints were also specifically designed for the pattern pieces.



Figure 146: Two bag test prints.



Figures 147 and 148: Final bag examples.

C. Colour and print composition

Colour and print selection are very important parts of the creative process. Due to the nature of this study, colour and pattern were explored extensively during the textile experimentation phase as well as the design phase. Many different ideas and directions were undertaken. Some examples of the different print directions are shown in Figures 149-151.

A key consideration of this phase concerned achieving a harmony between the pattern types and styles.

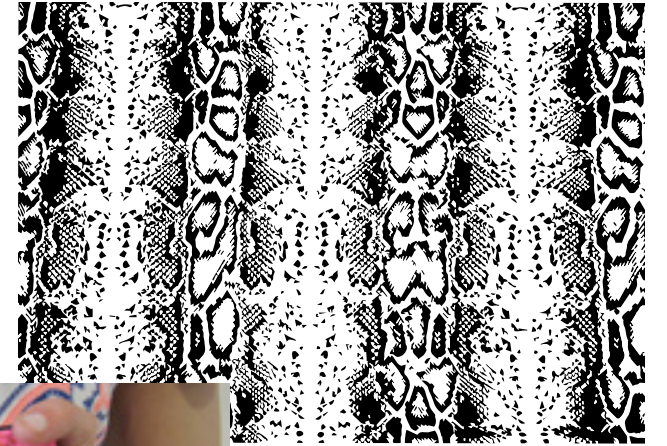


Figure 149 (Top): An early snakeskin print idea.

Figure 150 (Bottom): This print using the proposed textile was then used for several small purses, sold online for charity.



Figure 151: A variety of pattern ideas considered.

THE PROCESS

The main motivation behind the colour and pattern direction started to take shape when the textiles were chosen. The highly textured nature of the fabrics, and my desire to show an 'organic' or lived-in quality, meant that I was attracted to colours and patterns that recalled the body and nature. However, I did not want this to be too literal, and wanted to bring in my own loud and colourful aesthetic into the range.

I began to explore and create prints inspired by nature and microscopic life. This development is shown in Figures 152-157.

This avenue also led to the 3D printed felt textile that shared the same elements. This is shown in Figures 158-160.

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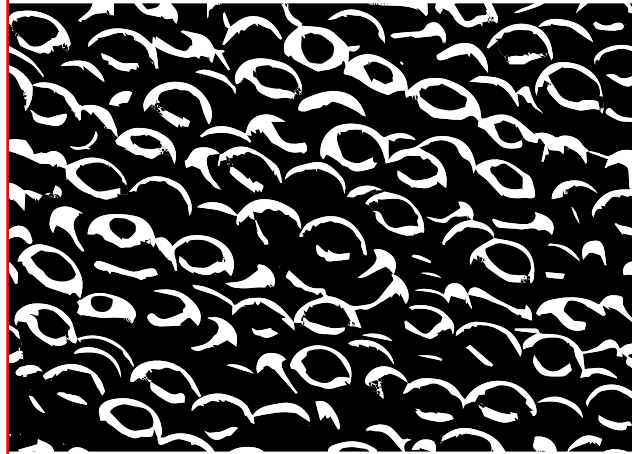


Figure 152: The original blood cell image, used as inspiration for the flock print.

Figure 153: This image was then simplified and 'live-traced' so it could work with 3D print software.

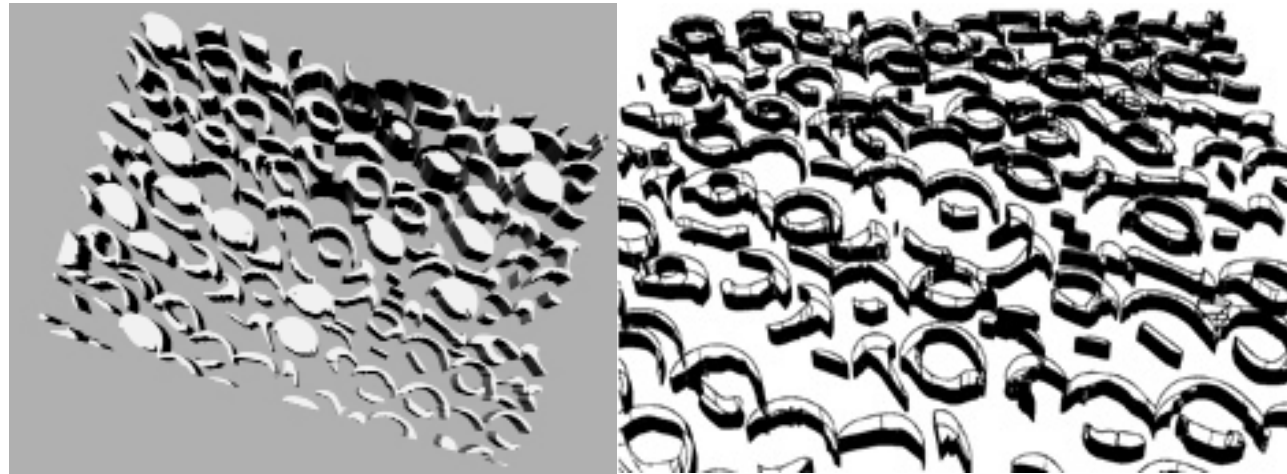


Figure 154: The blood cell print after it has been extruded into three dimensions by the 3D modeling software.

Figure 155: The image was then returned to two dimensions and manipulated, then exposed on a silk screen.



Figure 156: A test print of the final design.

Figure 157: The proposed textile after scrunching.

THE PROCESS



Figure 158: The use of the same print was attempted for a collar, printed in 3D plastic on felt.

Figure 159: The 3D printed textile was then combined with laser cut elements.

Figure 160: A possible placement of the 3D printed felt textile.

THE PROCESS

The motivation behind using such an obvious floral print was to balance the highly abstracted and irregular nature of the fabrics and garment with something recognizable and commercial. Similar floral digital prints are seen regularly in contemporary fashion, yet without the textured and irregular quality of this textile.

I used shades of red and pink in keeping with the floral motif, and the visceral aspect of cells and microscopic life.

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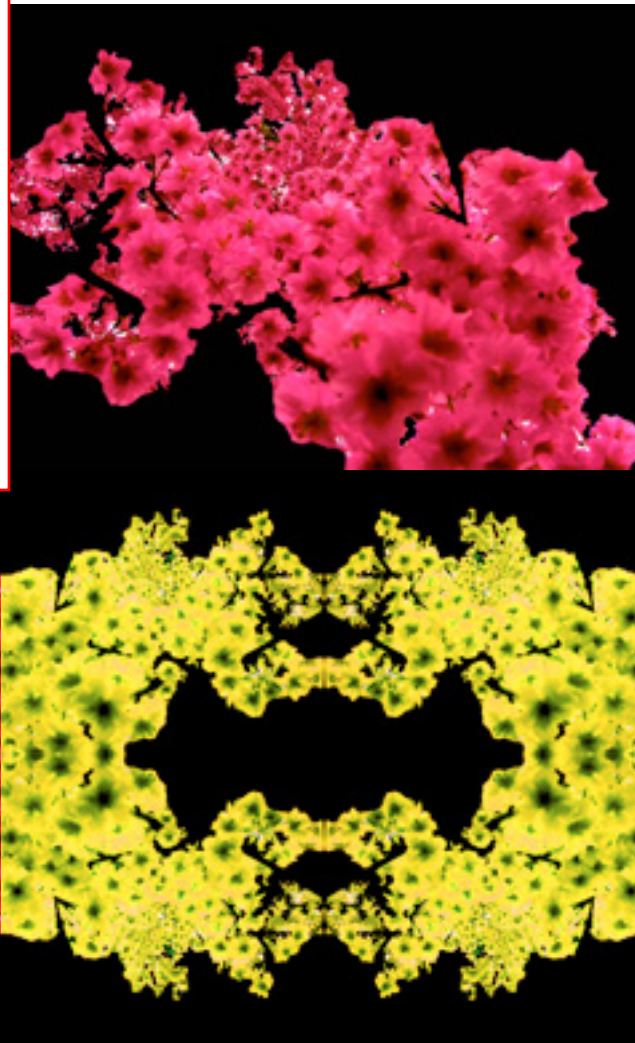


Figure 161 (Top left): Original image.

Figure 162 (Top right): Print development.

Figure 163 (Bottom left): Pink colour way.

Figure 164 (Bottom right): Yellow colour way.



Figure 165: The blossom print before scrunching.

Figure 166: The blossom print after scrunching.

THE PROCESS



At the same time I was working on this, I was also looking at the style and colour combinations for the foil textile. Varieties of different laser cut motifs were explored in the beginning, and can be seen in Figure 167.



Figure 167: Some early laser cutting ideas.

With the sportswear context in mind, I began to explore sportswear mesh as a possible laser cut motif. This design could then be used with the floral digital print to tie the stories together. Some initial ideas are shown in Figure 168.

I was attracted to the mesh pattern because the diamond shapes recalled the shapes in the flocked vinyl fabric, and the shapes in the digital print. This shape also recalled a leaf motif, fitting in with the natural aspect.

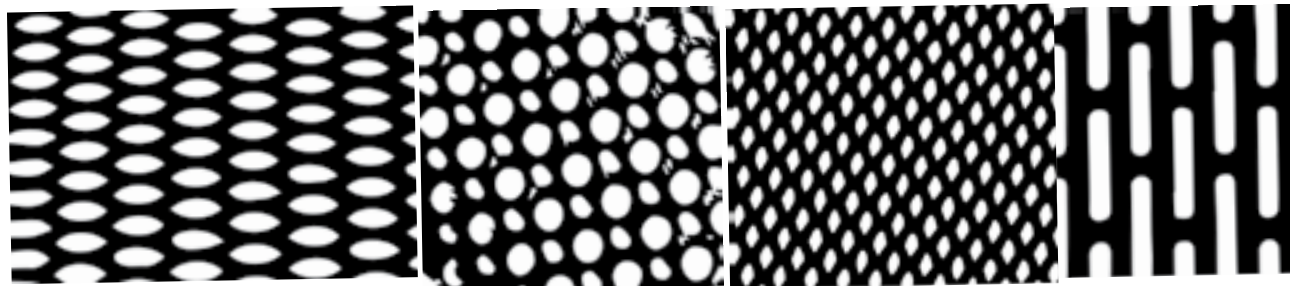


Figure 168: A variety of perforated styles considered.

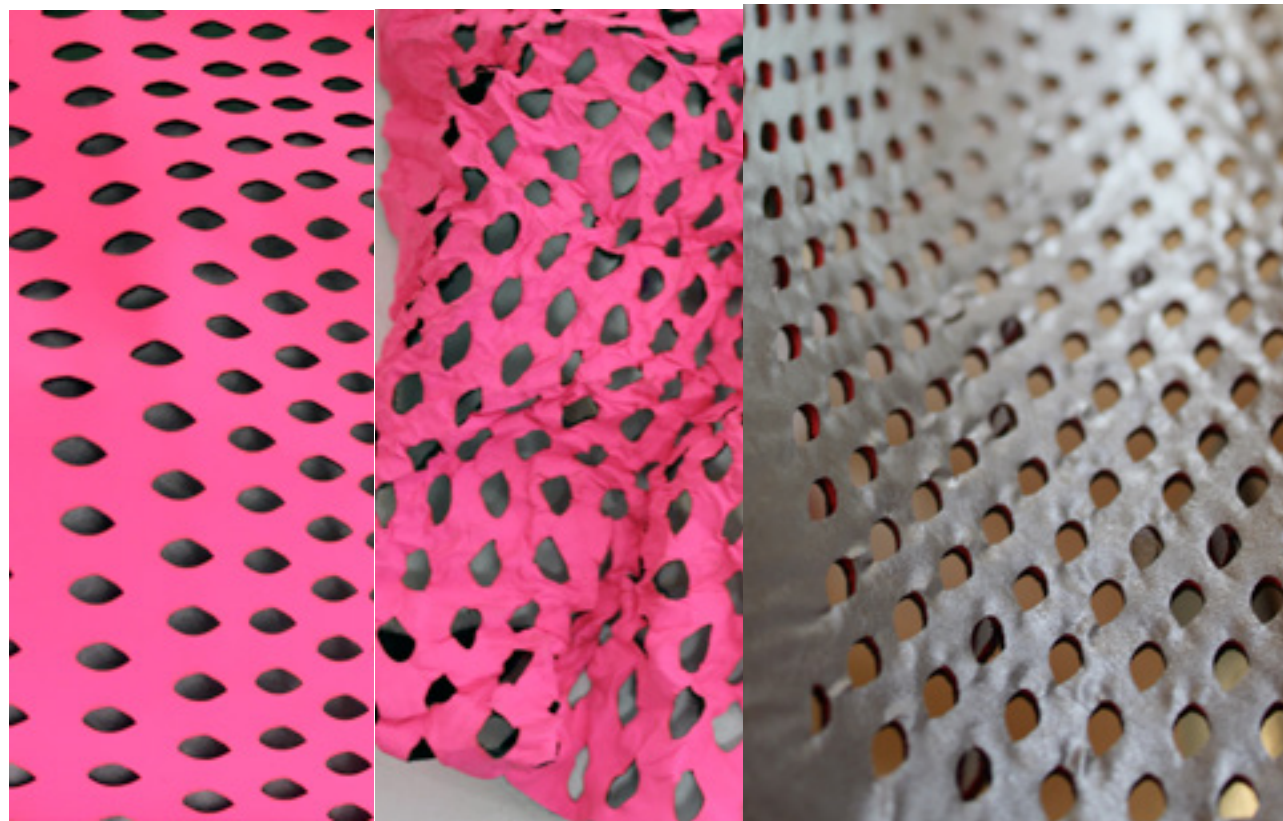


Figure 169: The laser cut textiles.



Figure 170: The patterns in relation to one another.

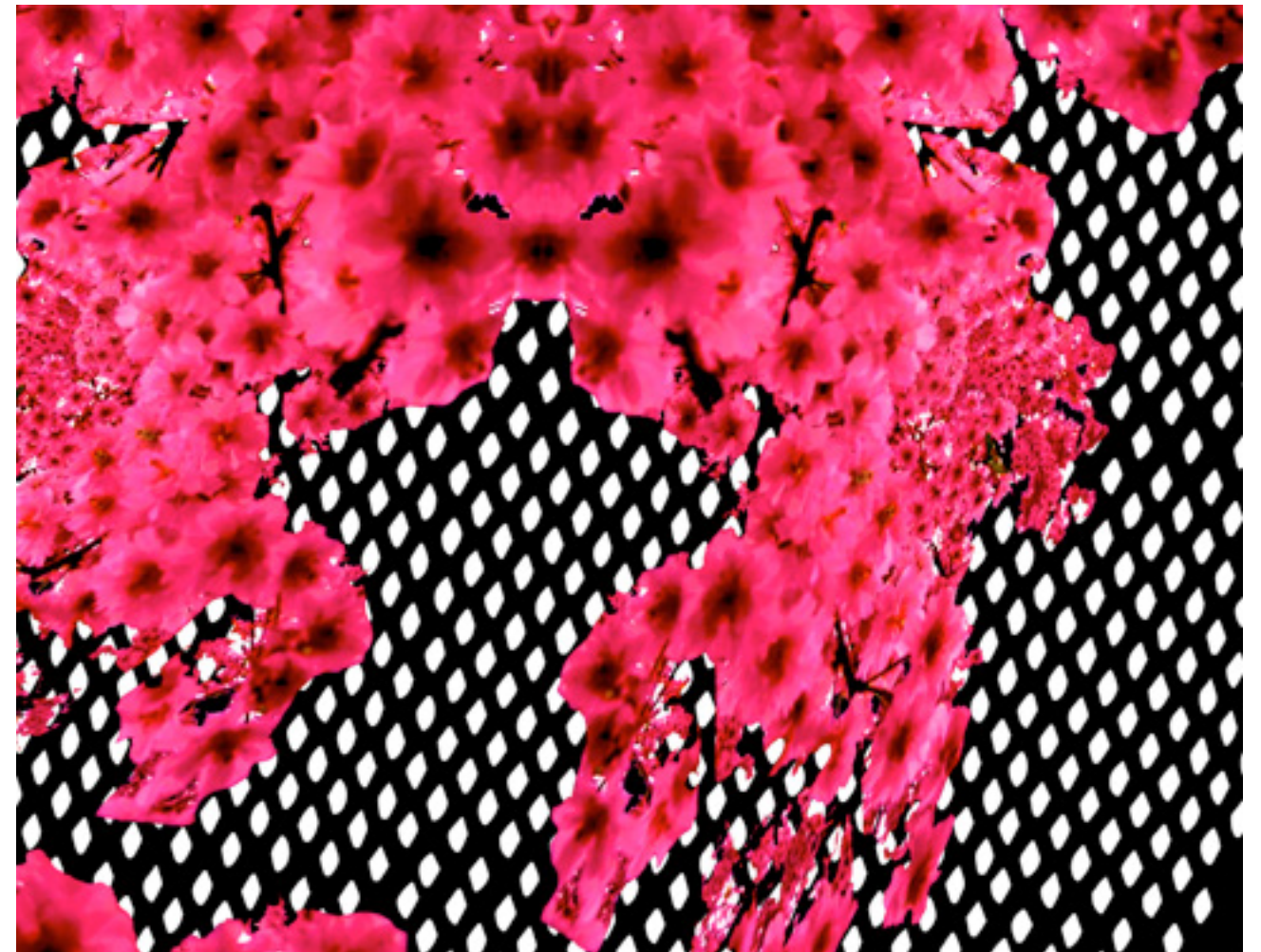


Figure 171: A close-up of the digital print with the perforated pattern.

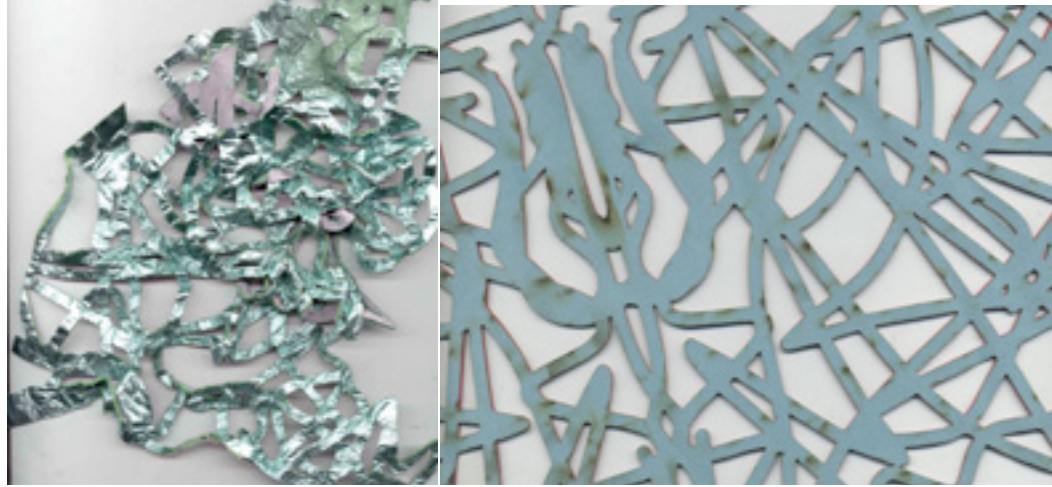


Figure 172: The silver colour way of the textile.

Figure 173: The reverse of the textile with burn marks.

Using a pink felt as the middle layer of the foil textile fitted with the pink story already developing. This was also the case with the black roll cut flock (on the reverse) that worked with the dark background of the digital print. Having a black flock backing also meant that the (unavoidable) scorch marks from the laser cutting would go unnoticed.

The choice of the silver foil instead of the gold foil took some time. Initially I liked the gold nugget quality of the gold foil, and made several gold bag/sculptures to demonstrate this direction. These were shown earlier in this work. But as time went on, I was more drawn to the silver foil and felt it was more harmonious with the red/pink and black colour palette.



Figure 174: The pink felt interior and black inside layer can be seen in this photo.

D. Work in progress

Further work will be undertaken for the exhibition. This will entail the completion of final garments, and accessories. Documentation of this work will then be included in the Appendix of the final version of this written work.



Figure 175: Two proposed garments that will be finished before examination.



Figure 176: The pink vinyl laser cut t-shirt, can be uncrinkled as shown or crinkled.



Figure 177: The crinkled silver t-shirt (hem to be added)



Figure 178: Stylistic considerations will also be made.

CONCLUSION

This study has focused on creating a new generation of patterned textiles. The examples I have produced here are just the beginning of what can be accomplished. By combining out-dated techniques like heat transfers, with new technology we can create a new generation of patterned fabrics.

The textiles I have created here are complex, irregular and compelling. By combining the overlooked characteristics of transfers – stiffness and crinkle – with the man-made and hyper-real qualities of digital printing and laser cutting I have created new textiles that are highly tactile, visually arresting and exclusive.

These textiles are part of a new movement towards hybridised patterned fabrics in contemporary fashion. This is in response to the quick adoption of new technology by the mass market; making once specialised techniques like laser cutting and digital printing commonplace.

This hybridised movement has analogies with the commercial print and publishing industries. Due to the demand for more sophisticated printed products; print lines and machinery are now able to produce complex multimedia documents.

I believe in the near future we may see fabric ‘printers’ that are also multi-method; they could be able to digitally print, flock, foil, laser cut and create 3D printed fabrics in one operation. This technology already exists in isolation it merely needs integration. If further amalgamation were to take place I believe that the very nature of the term ‘print’ may change and evolve with technology. Aesthetics will also evolve.

As I have shown in this study, the technology for creating these textiles already exists. But in order to manufacture these fabrics in larger quantities and for hybrid textiles to truly develop, more automated hybrid ‘printing’ lines and machines need to be created.

The underlying rationale behind this study – which looked at combining the old with the new – needs to be applied to other print and pattern methods. The possibilities of such exciting combinations are endless.

I believe future explorations at graduate and undergraduate level could look at combining traditional techniques like puff-paints, embroidery, engraving and tattooing with procedures used in this study. I can imagine a strange and wonderful world where fabrics with 3D printed patterns undulate with puff-painted sections, and embroidered features. These fabrics can be created today, however the research and development of such technology is at the early stages.

The main challenge with hybridised textiles such as these is not in their conception, but in composing them in garments on a large scale. In this study it was not enough for me to just produce the fabrics. I learnt more about the textiles themselves and the processes behind them by trying to replicate them in garments.

The most difficult aspect of this has been the un-standardised nature of the media widths, and the limitations of printer, laser-cutting, and heat-setting beds. The more elements you add into the textile, the greater chance that variables affecting it can change. This was the case many times in this study. In some cases this could be overcome with additional processes. For example, to take into account the shrinkage from digital printing; re-digitizing the pattern, and the ‘print’ itself provided a solution. In other cases a change in factors could completely alter a garment design. This also happened when large laser-cutting beds became unavailable, meaning that the pattern pieces that could be cut were smaller, and required a re-design in the garment.

Another aspect that is often overlooked in research of this kind concerns the place within the creative process that technology is introduced. As this study progressed I became aware that when I was introducing technology like laser cutting and digital printing, it was always towards the end of the creation cycle. Introducing technology earlier on in the creative process needs greater exploration. For example, laser cutting and 3D printing could be utilised to create extremely complex and detailed fabric stamps. As shown in this study, 3D printing software can actually be utilised for producing 2D prints, which then can be produced using more traditional methods like screen printing. The possibilities are endless.

From an educational perspective, I believe that with the addition of all these new techniques and technologies, greater emphasis needs to be placed on the technical expertise of the textile designer. I believe a lack of in-depth understanding of the technology and programs used to create these kinds of textiles is limiting the abilities of textile designers to be experimental. AUT and other fashion and textile institutions could teach 3D modelling to their undergraduate students, to meet the changing nature of textile and garment design and creation.

The role that technicians play in this design process is also incredibly important. I believe that for the large-scale development of hybrid textiles (particularly the 3D printed variety), multidisciplinary teams may be required. This would be especially true for the development of hybrid fabric ‘printers’.

The future of patterned textiles?

I believe that the textiles developed here represent a new generation of patterned fabrics, yet whether this is the future of patterned textiles remains unclear. This would depend on the development of the infrastructure necessary to produce these fabrics at a commercial level. I have no doubt that this can be achieved, but I am unsure whether there will be the demand, desire or necessity for it.

Much of the development of this textile direction may also depend on how 3D printing develops as an alternative to traditional textiles. If 3D printed garments are embraced on a large scale, traditional techniques and fabrics may fall by the wayside. Perhaps a hybrid of the two (like the 3D printing on fabric shown in this study), could be the step before full 3D printed garments become mainstream? Perhaps a step like this is first necessary in such a revolutionary movement?

At the end of studies of this nature, a sense of closure, conclusiveness and lucidity is expected. However, here I am at the end of this project more confounded, excited and surprised by the future of patterned textiles than I was in the beginning. This study has pushed my technical and design abilities further than I thought possible. I believe that these textiles are examples of a new generation of patterned fabrics, and hope that future designers at this university and elsewhere will carry on this story. The textiles produced from this research are innovative and pioneering within the area of printed fabrics. The work illustrates the fusion of new and old technology creating textiles for the future.

Richard McCoy

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APPENDIX I:

3D printing on fabric

This research would not have been possible without the help, advise, guidance and work of Glenn Maxwell, whose role as a technician in AUT’s 3D Lab was instrumental to this line of inquiry.

A. Introduction

Near the end of my master’s project on composite textiles, I started to develop a way to 3D print on top of fabric. This excited me immensely, but due to time restraints I was only able to look at this area briefly. There is ample room for further studies within this area of textile design.

The contextual grounding for this area is unclear, as there is currently very little documentation and reporting of the use of this technique by designers or researchers. There are cases in contemporary fashion where it appears that 3D printing on fabric has been used; yet no other information exists. Minimal experiments with this avenue have been carried out, but almost no technical information on the process or documentation of the problems and issues could be found.

Some examples were shown earlier in my thesis, and for clarity these will be shown again here, as well as some further images of my experimentation. I looked towards the literature of the standard process of 3D printing as a guide to my own exploration and adapted aspects of it to work with fabric. I have included this section as a guide for this process, and to impart the things I have learnt and the issues that need to be addressed within this printing area.

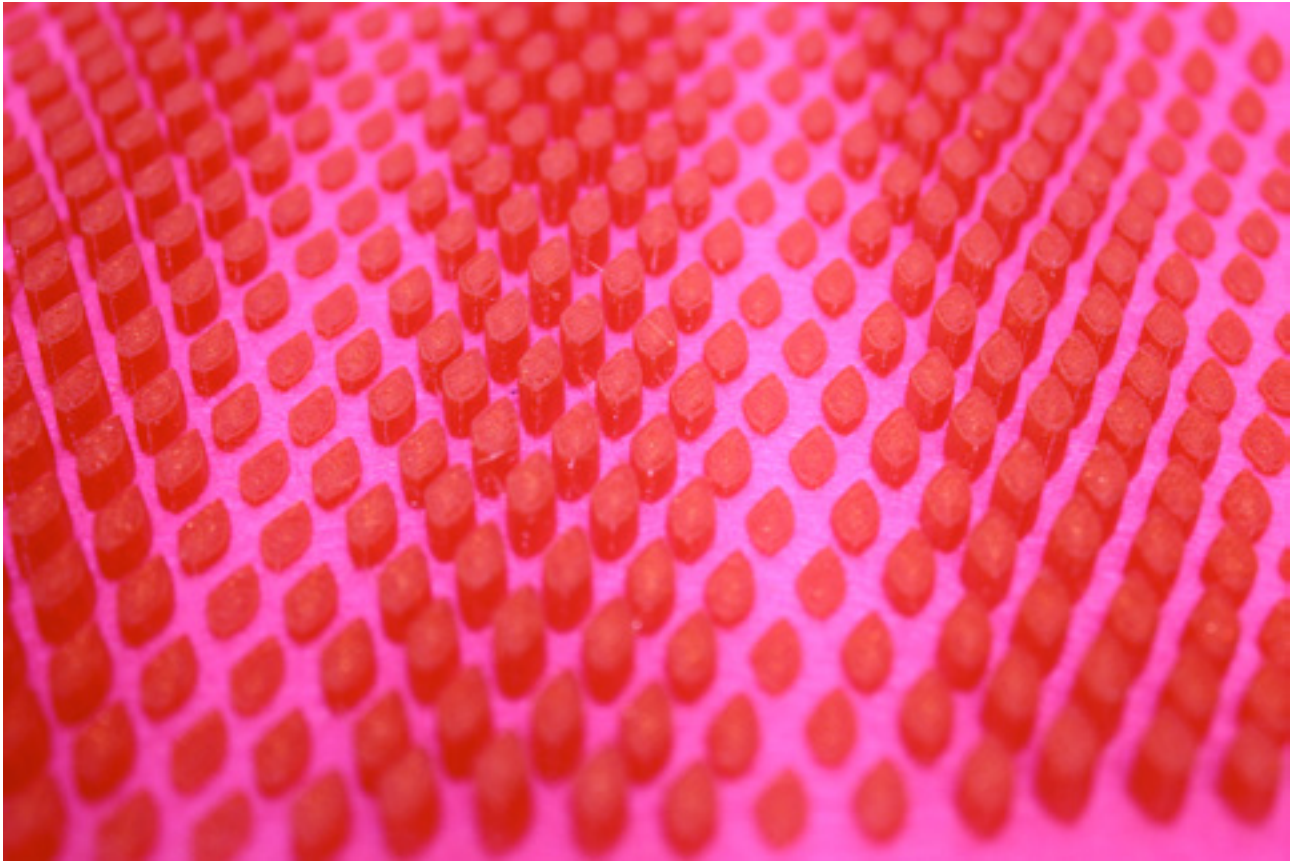


Figure 1: 3D printing on top of felt. Prototype textile.

B. Contextual background

Gathering contextual information in this area has proved very difficult. To my knowledge there has been a limited number of experiments with 3D printing on fabric. Those that I have found are restricted to workshops, personal projects and outside the bounds of academia. Even gathering accurate information with regards to the individuals or researchers behind these experiments has proved very difficult.

Figure 2 shows a clear plastic (PLA) that has been 3D printed on to the surface of a fabric with a loose weave. No other information pertaining to the sample could be found. The researcher behind this work - ClothBot Designs - has a guide on how to 3D print on paper and has created a model paper/plastic airplane that resulted from this research. In the section below this guide, the designer comments that he plans to create a guide to printing on cloth as well. So far no guide has been forthcoming.

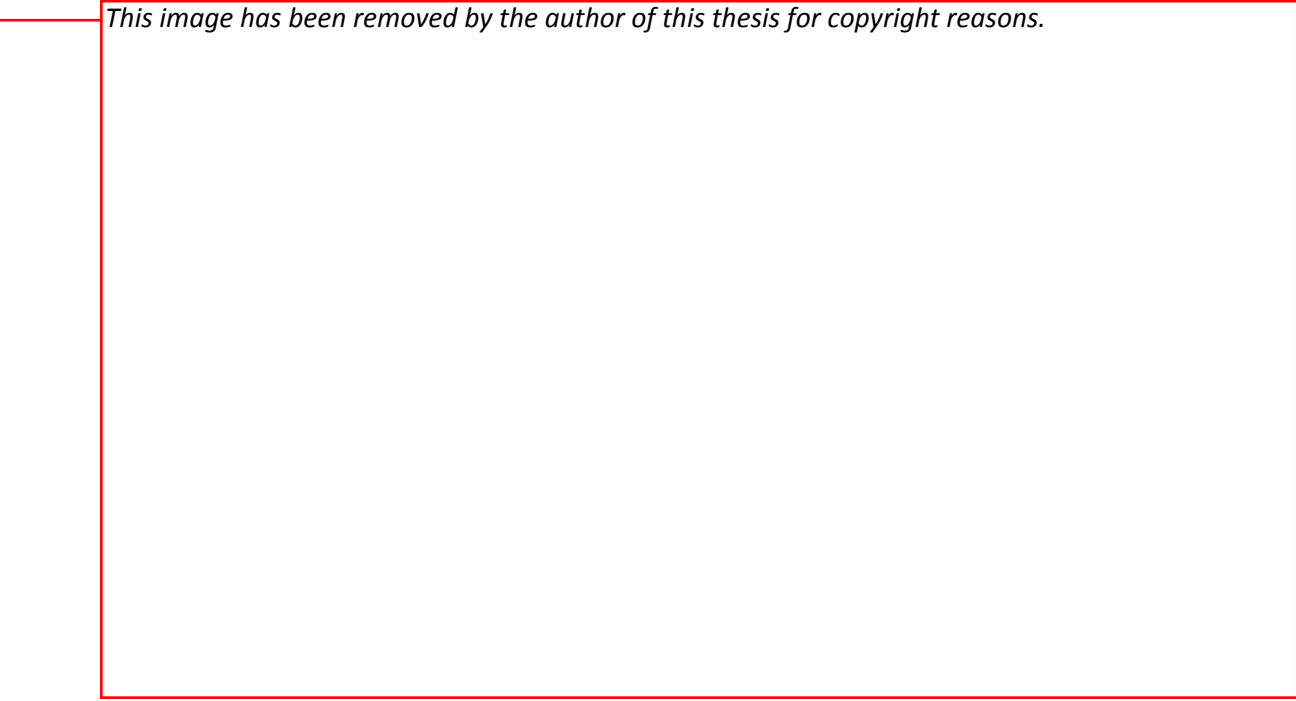
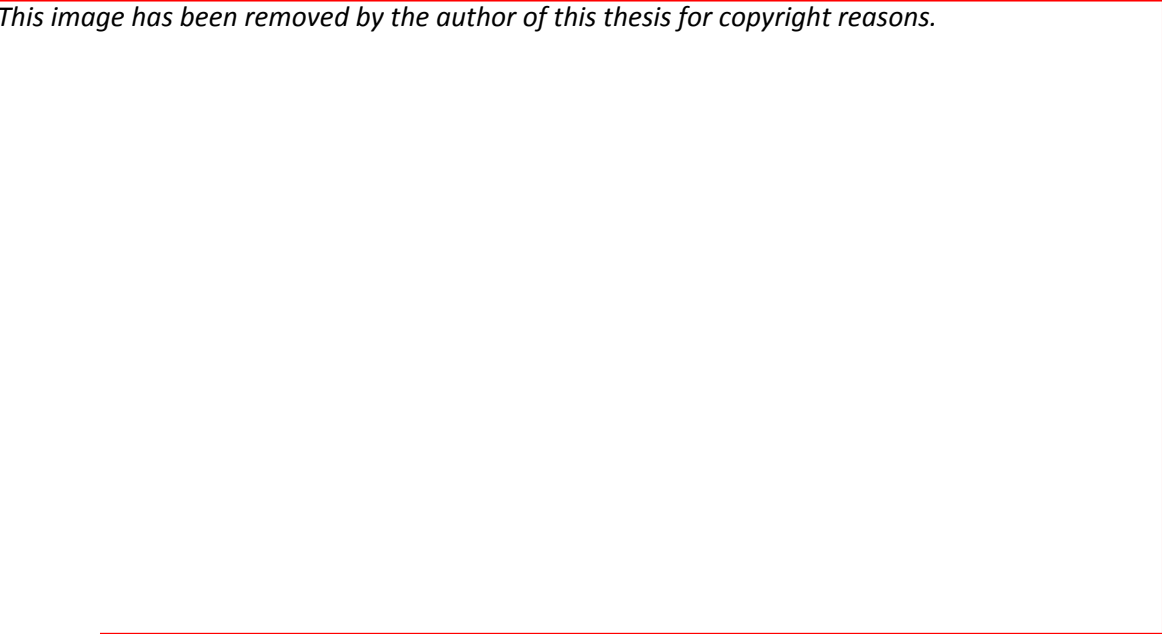


Figure 2: An example of clear PLA printed on top of fabric.

Figure 3: The triangles in this video still are 3D printed on top of a lightweight fabric.

Figure 3 is an example from the Dutch Electronic Art Festival (DEAF) workshop held in 2012. The workshop focused on looking at integrating 3D materials with fabric. This example uses a less transparent filament that has been printed onto the surface of a lightweight sheer fabric. No information with regards to the researcher or designer of the piece could be found.

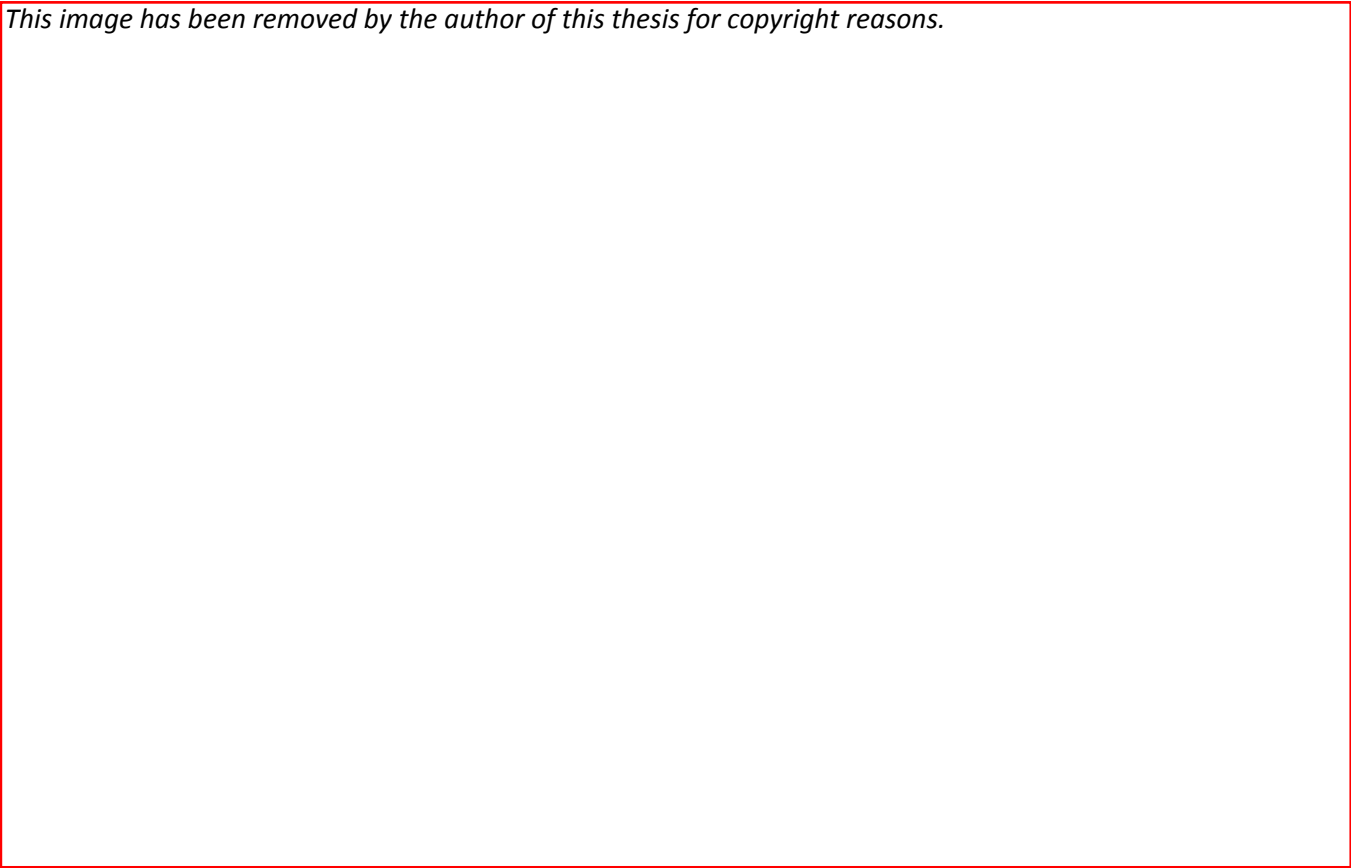


Figure 4: This example shows fabric placed in the middle of a 3D printed textile.

The example shown in Figure 4 was created in February 2013 and involves starting a 3D printing job, then pausing and inserting fabric into the media before resuming the print job. This creates a fabric that is encased in the 3D printed material.

These three examples are all that could be found on the 3D printing on fabric process.

Numerous fashion designers have explored 3D printed clothing in the past, but the vast majority of it is 3D printing alone.

The most well known explorer of the medium is Dutch fashion designer Iris van Herpen, who has shown in Paris as part of the Couture presentations. The majority of her work appears to be 3D printing in isolation, but some of it may be onto fabric; there is little clarification. An example is shown in Figure 5.

American label Threearfour may have used 3D printing onto their fabrics in their Spring/Summer Collection for 2014. Figure 6 is an example of this, but whether it is on top of the fabric or in isolation is also unclear.

There was some speculation that British label Peter Pilotto used 3D printing onto the pockets of their Winter 2013 jackets (Georgiou, 2013). This speculation was inaccurate and closer inspection showed that it was heavy embroidery. This example is shown in Figure 7.

The label did use 3D printing software for drafting their 2D patterns and garment shapes in this collection, and this is where the confusion may have arisen.

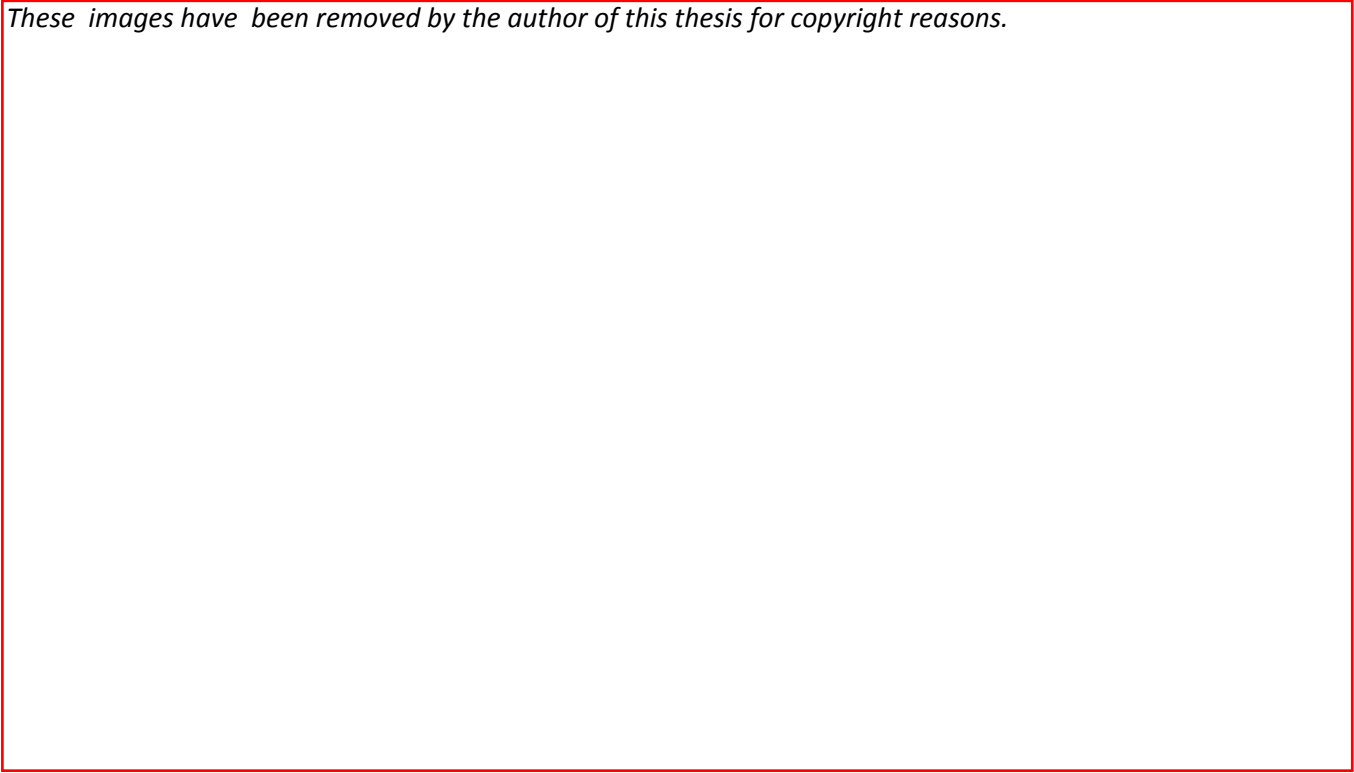


Figure 5: Iris van Herpen may have used 3D printing on top of her textiles, but there is no documentation of this.



Figure 6: Threearfour's possible use of 3D printing on fabric.

Figure 7 : Early speculation that Peter Pilotto used 3D printed elements on his jackets was incorrect. The 3D effect was achieved with embroidery.



C. Experimentation

The experimentation I undertook with 3D printing onto fabric was limited to AUT's Makerbot 3D printers, and only utilized PLA filament. This next section and images detail my exploration.

My first experiment with 3D printing on fabric was on top of a cotton pique (a fabric I was digitally printing on). The experiment was successful, in the sense that the machine was able to print onto the fabric, yet the bond to the fabric was not very strong, and the plastic could easily be removed.

The production of this sample involved first making a 3D pattern on Rhino (3D modelling software), and then exporting it to MakerWare (3D printing software). This process is exactly the same as the method for printing 3D objects.

The fabric was then taped down to the build plate, and then levelled to insure the nozzle knew the new build height. All rafts and scaffolding were removed so it would print straight onto the fabric or what the machine thought of as the build plate.

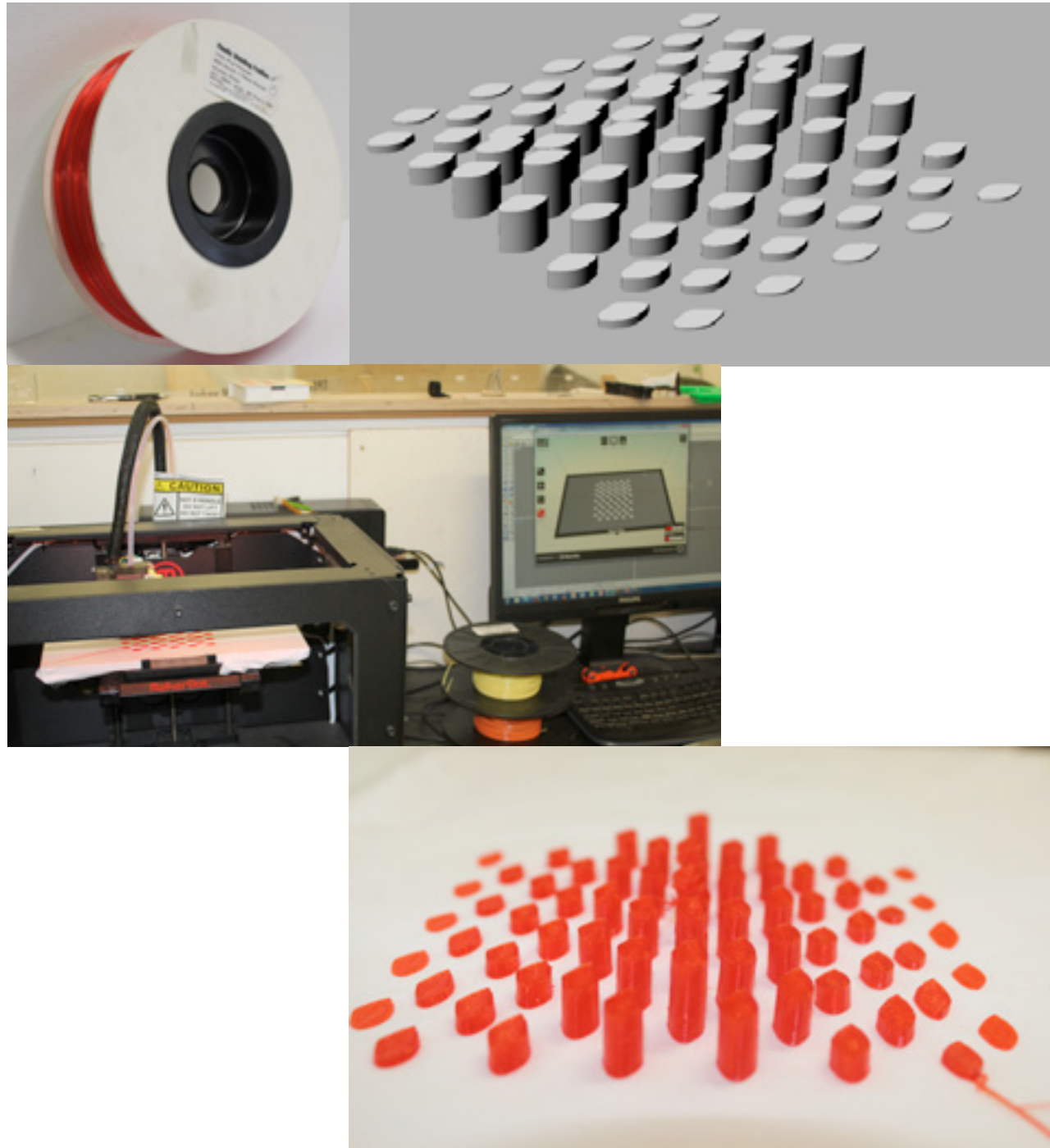


Figure 8 (Top left): The 175mm PLA transparent filament used in these experiments on the roll.

Figure 9 (Top right): The drafted pattern.

Figure 10 (Middle): The printing process.

Figure 11 (Bottom): The end result.

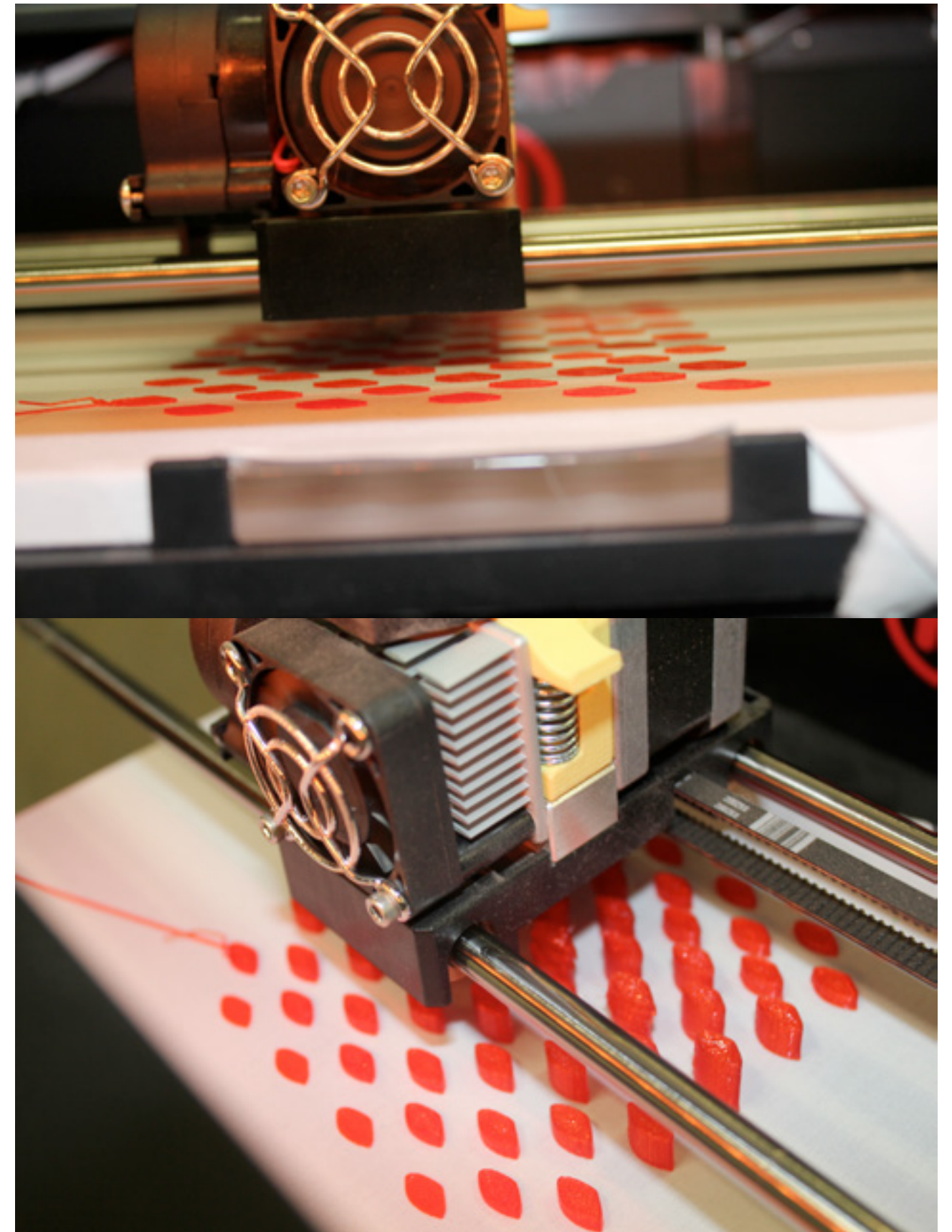


Figure 12: The early stages of the printing process.

Figure 13: The job almost complete.

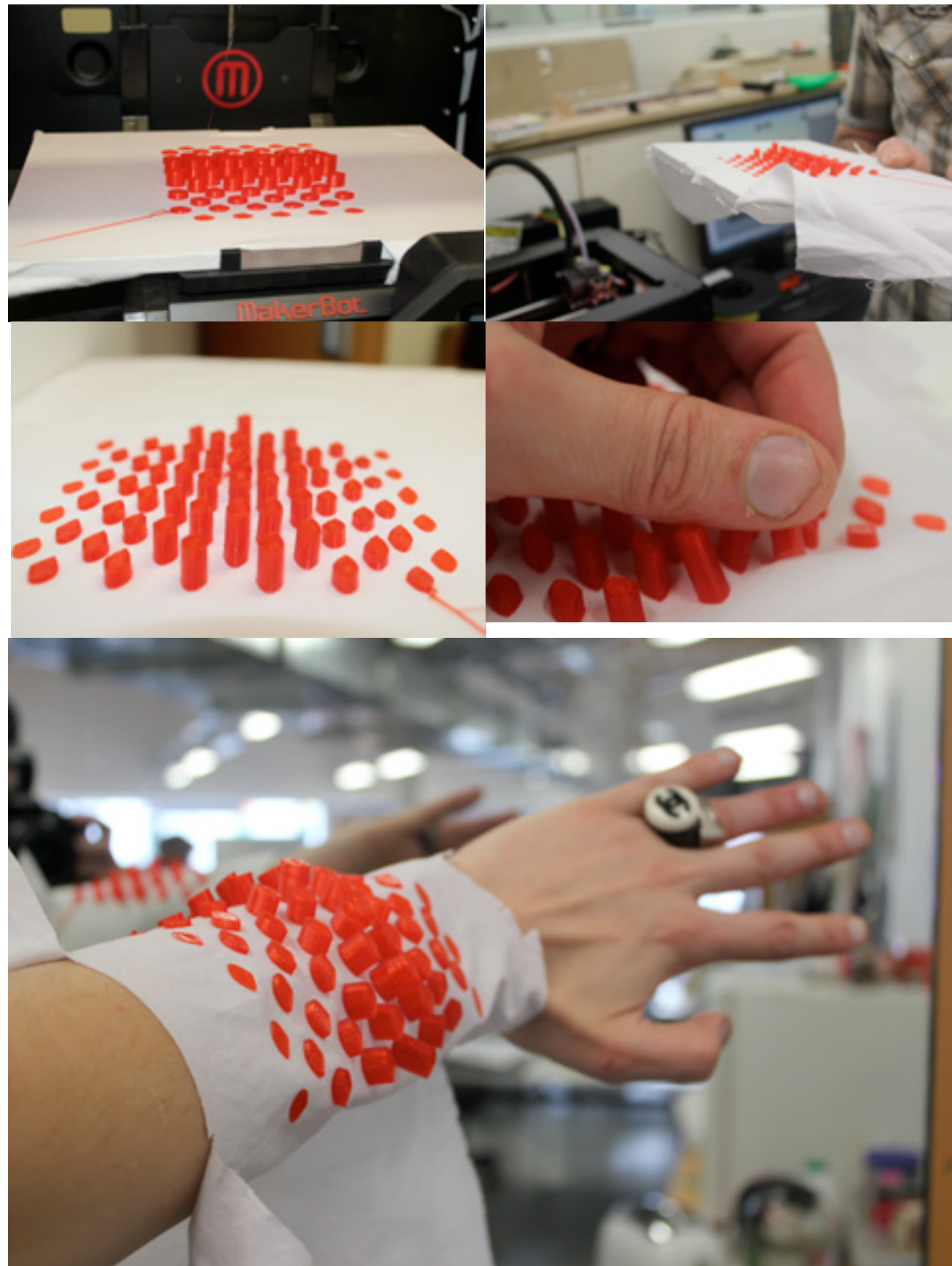


Figure 14 (Top left): The finished result still on the build plate.
 Figure 15 (Top right): Removing the print job from the build plate.
 Figure 16 (Middle left): The end result.
 Figure 17 (Middle right): Testing the adhesion.
 Figure 18 (Bottom): An example of how the textile can move.

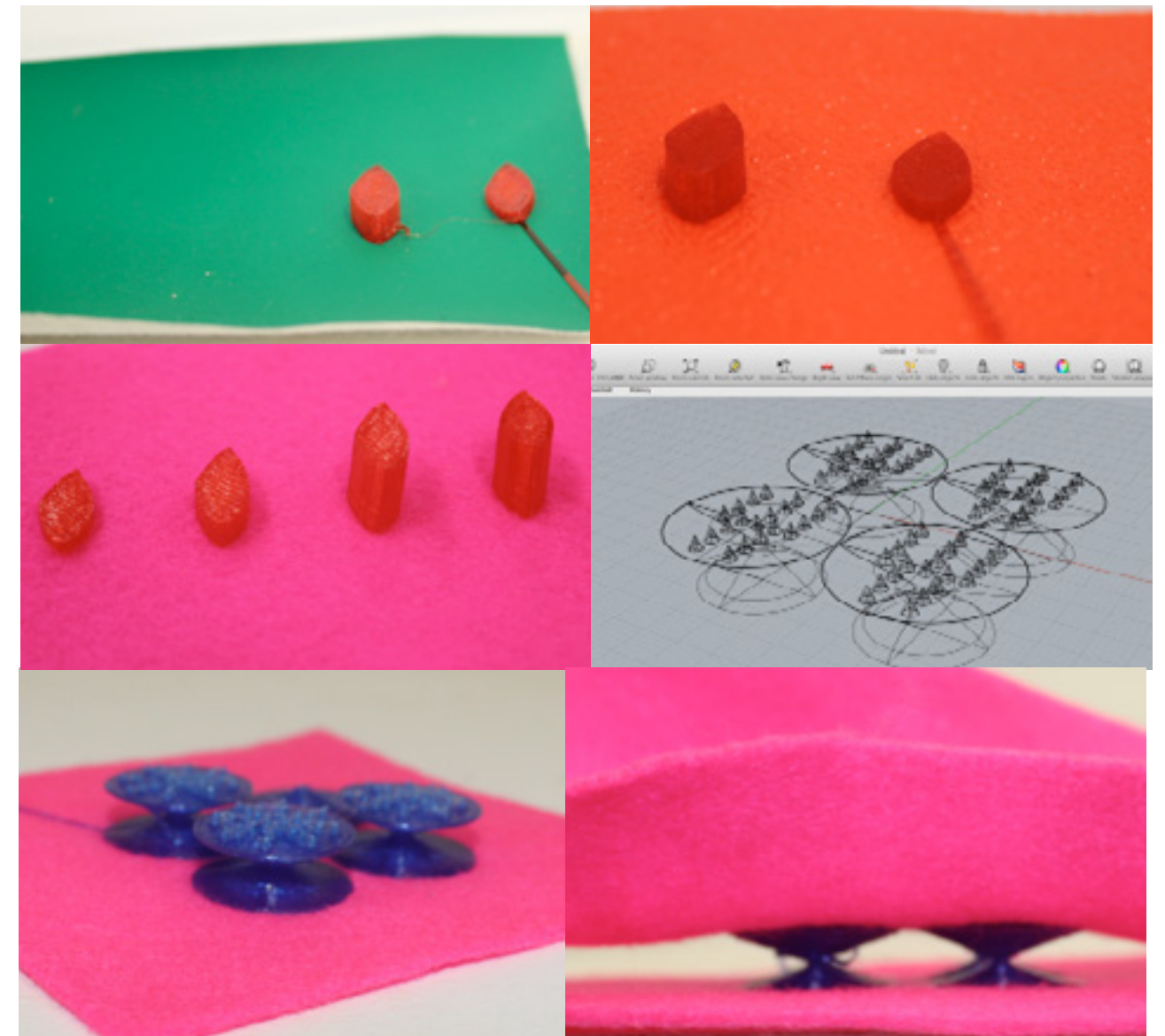


Figure 19 (Top left): PLA printed on vinyl transfer (unsuccessful bond).
 Figure 20 (Top right): PLA printed on vinyl (unsuccessful bond).
 Figure 21 (Middle left): PLA printed on synthetic felt.
 Figure 22 (Middle right) A 'button' design idea.
 Figure 23 (Bottom left): Textured 'buttons' printed on synthetic felt.
 Figure 24 (Bottom right): Using the 'buttons' as a divider between fabric.

From this semi-successful result I experimented on a variety of other fabrics and found that the filament had the best adhesion to synthetic felt (for these particular settings, temperatures, and plastic).

On a synthetic felt I found that for 'print' sections that were approximately 1cm squared in surface area, the adhesion was satisfactory.

A number of other designs were experimented with, including a sample that also included laser cutting into the design.

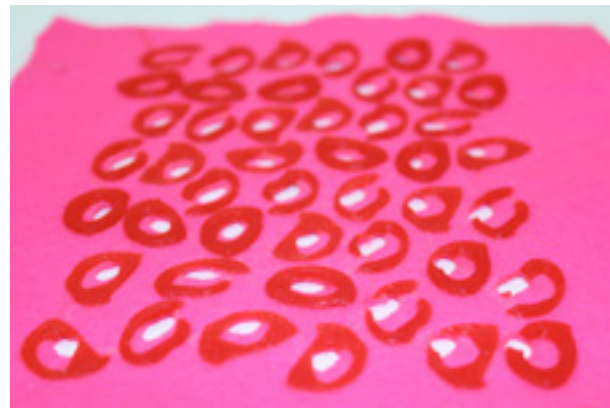
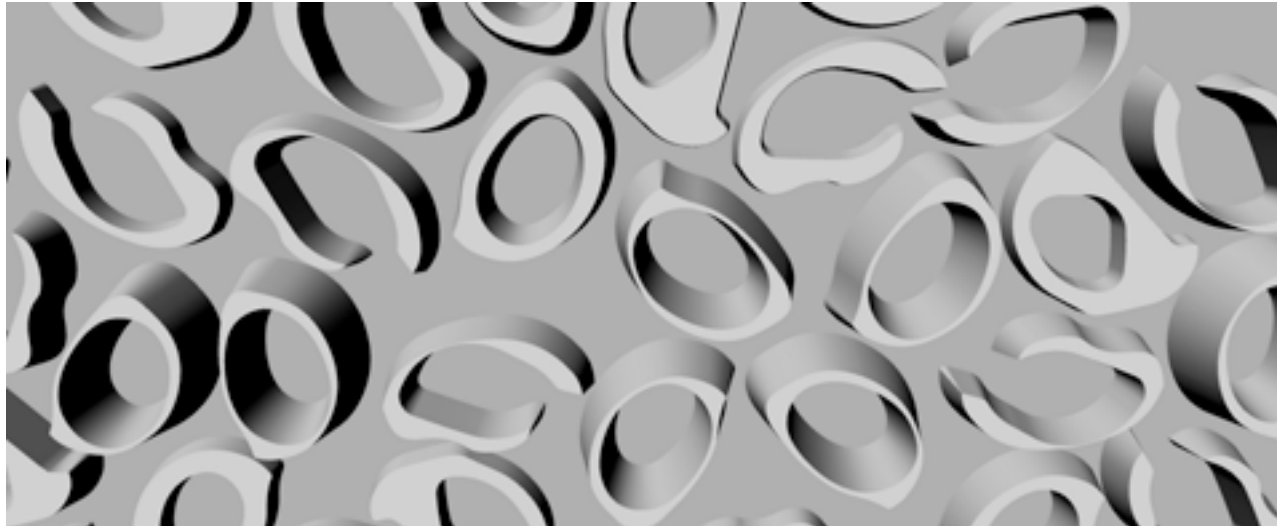


Figure 25 (Top): 'The blood cell' design idea.

Figure 26 (Bottom left): The template created to laser cut the holes.

Figure 27 (Bottom right): An early version of this composite textile.

D. Thoughts and conclusions.

The writing that follows are my thoughts on this process and the things I have learnt. I believe these ideas could be very useful in developing this print avenue, as there is very little technical information on this area.

At this stage it is difficult to get accurate registration with domestic 3D printing machines (like those used at AUT). It would be easy enough to fix this by modifying the build plate, and setting up a template with the Makerbot software. This would be the first step in starting to use 3D printed fabrics in combination with other media. At this stage, to get around this issue, and combine 3D printing with laser cutting, I printed the 3D elements first, and made this register with the laser cutting bed (a very standard procedure with laser cutting).

Further research needs to be undertaken to see how other fabrics besides felt can be printed on. This research would look at experimenting with different textiles, and different coatings and finishes. Introducing 3D printed patterns on knitted fabrics could also be look at (stretch would be an issue, as mentioned later in this section).

Future research needs to address the best temperature that the print is extruded at. So far because of the nature of the domestic machines I have worked with, we have been limited with regards to the temperature we can extrude at. Following the advise of the supplier of the PLA (type of plastic used), extruding it at higher levels than 230 degrees is fine for the plastic itself, but the printing machine's heads and surrounding infrastructure cannot take temperatures that high. To get around this issue, the PLA supplier (Diamond Age, Auckland) suggested getting a metal extruder head, so higher temperatures could be reached.



Figure 28: A more developed composite with higher extruded print, and better registration of the laser cut sections.



Figure 29: The composite textile.

And then of course, different type of 3D printing plastics need to be experimented with. There are many different varieties that have different qualities and extrusion temperatures, but this can be problematic because certain plastics can only be used with certain varieties of 3D printers. Perhaps a 3D printing material could be developed that prints exclusively on fabric? Looking into the type of plastic used in vinyl transfers (also extruded, and set with heat), could yield positive results. Currently my experimentation has been limited to PLA, and further research needs to be undertaken to see the effectiveness of other substrates.

Another issue that needs to be taken into consideration when printing on fabric (particularly if accurate registration is required), concerns the stretching of the base fabric when it is laid on the build plate. Because of the necessity of having a flat and even build surface, the base fabric needs to be stretched on, and in my experiments secured with double-sided tape to the build plate.

In my experiments with the felt, I found that it stretched, and then returned unevenly, causing the print placement to be slightly out of alignment. This was only in millimetres, but this could be an issue if very accurate registration is required. This issue would also become much more of a problem with larger sized fabric pieces and build plates. This could be a serious issue with stretch fabrics. Building into the pattern design an element of tolerance to allow for this stretch could overcome this issue.

Further experimentation with the bed height needs to be taken into account also. When the designer has positioned the fabric on the bed, you must then tell the printer where on that surface to print, in my case we were setting the extruder nozzle so that a sheet of paper could be firmly pulled between it and the fabric. How 'deep' or high on top of the fabric to print on will be another factor to consider.

With some 3D printers the printing bed can be heated between 40-50 degrees Celsius. Experimenting with heated beds in conjunction with fabric needs to be looked into. It could be that the heat of the fabric makes the filament set more effectively.

Another area that needs to be addressed for 3D printing on fabric concerns the type of extruder nozzle used. There are a variety of different types, the main difference in nozzles has to do with how long the nozzle keeps the filament in a liquid form for. Having a nozzle that liquefies the plastic quickly, before it hardens again is said to be best. However this method may not be the case for printing on fabric and would need to be investigated.

Another issue that needs to be resolved with 3D printing on fabric concerns the 'anchor'. An 'anchor' is the thread of filament that runs from the nozzle onto the bed or fabric before it begins to print. It appears like a wax thread across the fabric. The reason for the 'anchor' is to get rid of the degraded plastic that has melted between the start of printing, and reaching the first place to print. More research needs to be undertaken to see if this 'anchor' can be removed, so as to not leave a mark on the fabric.

A further idea that has come to mind regarding 3D printing on fabric concerns the idea of perhaps first printing a base layer in a different material, before then printing on top of it. The base layer could be more adhesive and act like a primer for the fabric.

Upon further reflection, varying the temperatures between layers could be worth exploring. Perhaps the lower levels in contact with the fabric could be extruded at higher temperatures to ensure a better bond. The higher levels could then be extruded at lower heat levels if it was required for strength and stability. Having an in-depth understanding of what variances in temperature does to the filament will be important.

The addition of cooler fans directed over the build plate/fabric is another area that needs to be investigated. This idea could result in changing the speed at which the plastic returns to a solid form, and could result in a better bond to fabric.

Further studies need to address a number of practicalities including wash-ability, ware, and biodegradation of these kinds of textiles.

While investigating how these 3D printed textiles could be laser cut, I found that in order to let the laser head pass over the three-dimensional surface; a 5mm height limit was placed on the 3D print. If it was any higher than this, it would interfere with the laser head. Raising the laser head would be an option, but this causes the laser to lose focus and cut smaller and inaccurately. When using a laser cutter, it is necessary that the user focus that head in relation to the cut surface. This can be problematic with a 3D print, because the 3D elements can get in the way of focusing the head on the true surface it needs to cut. To get around this, first focusing the head on a scrap of material that the 3D print has been set on, will insure it is focused at the correct height, before putting the real textile on the bed.

While creating my first 3D printed elements on fabric, I was advised of the possibility of including copper wires within the print. Copper wires, and other products could be used in many different ways, and work within the e-textiles line of inquiry. It was suggested that printing the first few layers in the plastic should take place, then a 'cold pause' would happen where the copper wires would be laid onto the plastic. The printing process would then be un-paused, and the remaining layers would print over and around the copper wires.

However, the technician reiterated the difficulty with doing a 'cold pause'. He suggested breaking the process into two jobs or files, while leaving the print on the build plate (to insure exact registration). There are often many problems with pausing a print 3D print job while it is underway, further research needs to be undertaken in this area.

APPENDIX II:

Final work.

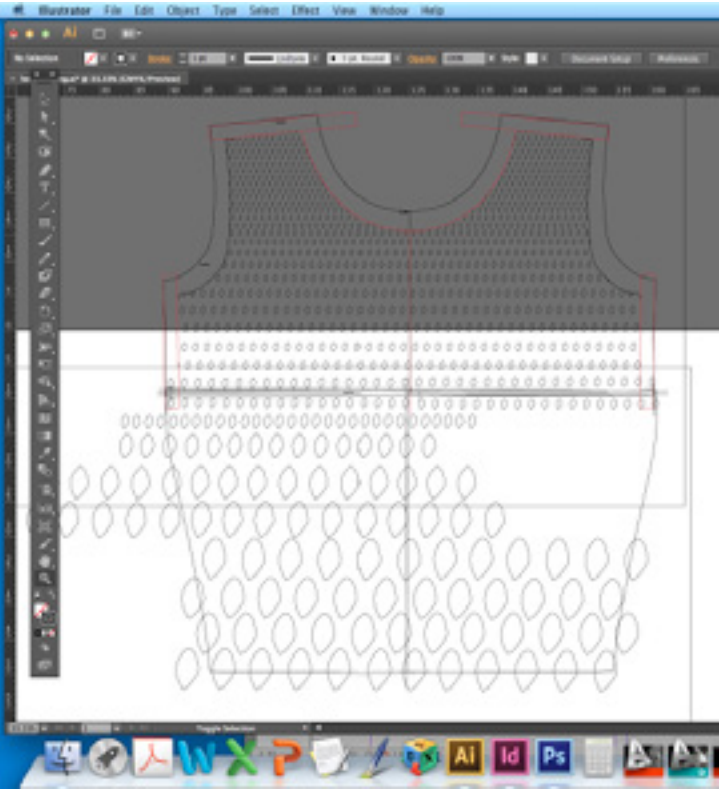


Figure 30: Planning of the hem of the foil dress.

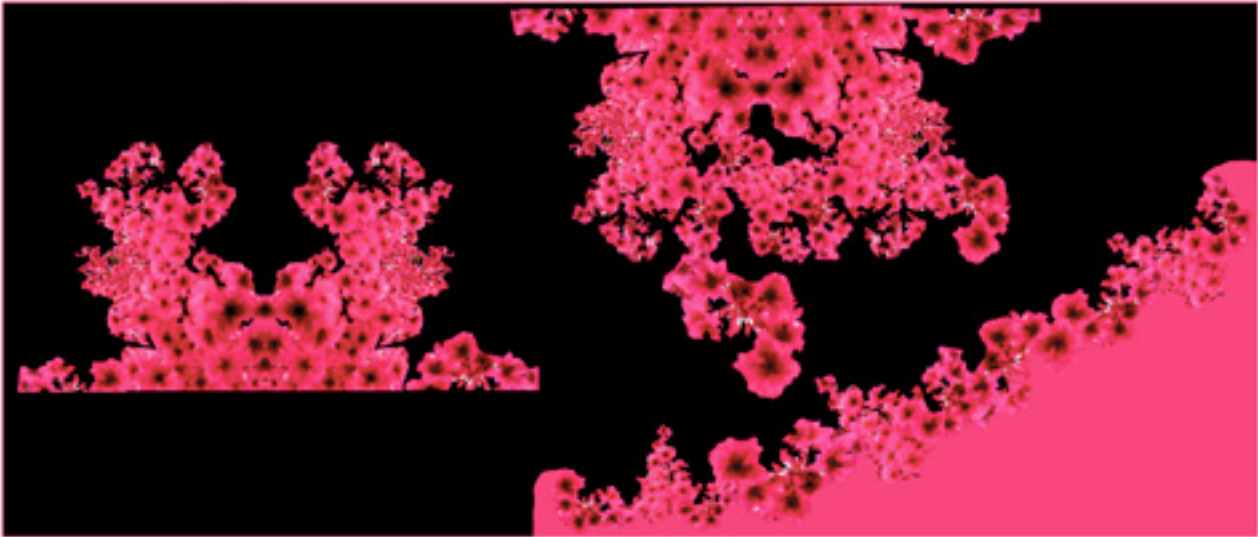


Figure 31: The digital print of the laser cut dress, before cutting.

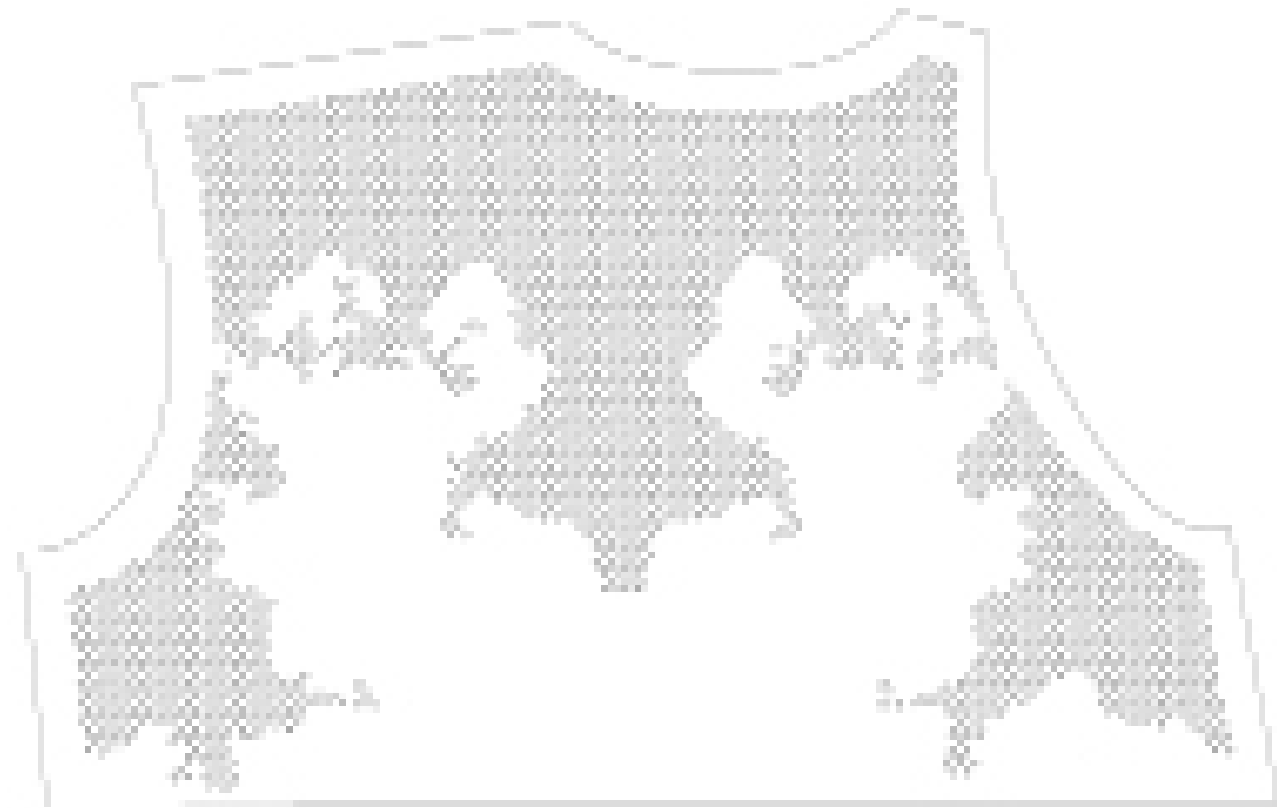
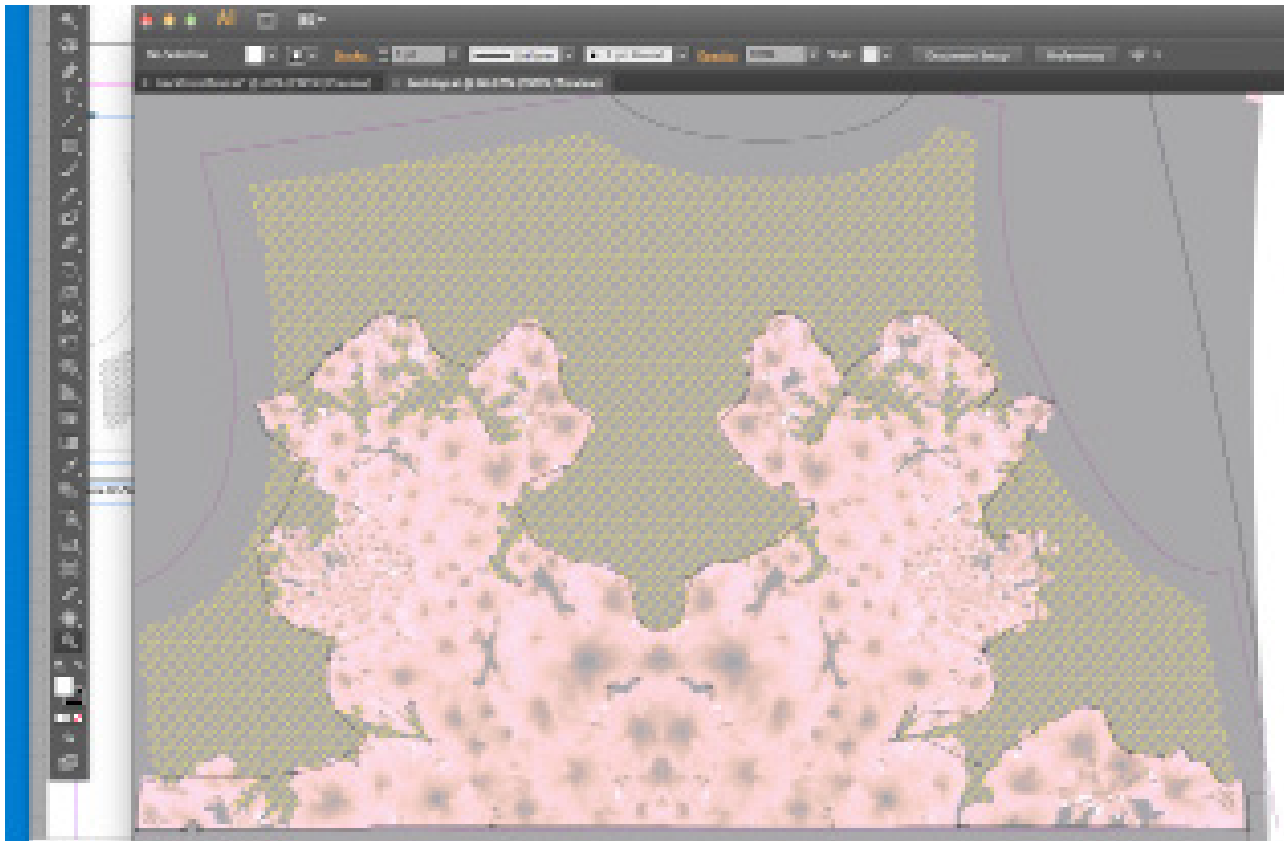


Figure 32: Planning for the laser cutting of the digital print.
Figure 33: The laser cut pattern.

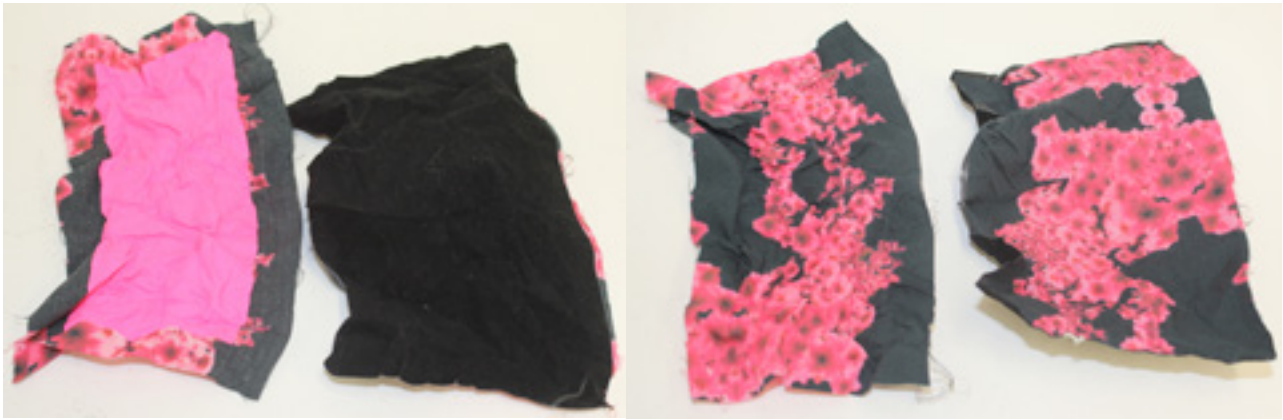


Figure 34: Vinyl was bonded to the reverse of the digital print, instead of flocking as initially planned. This gave a greater texture and was more vibrant beneath it.

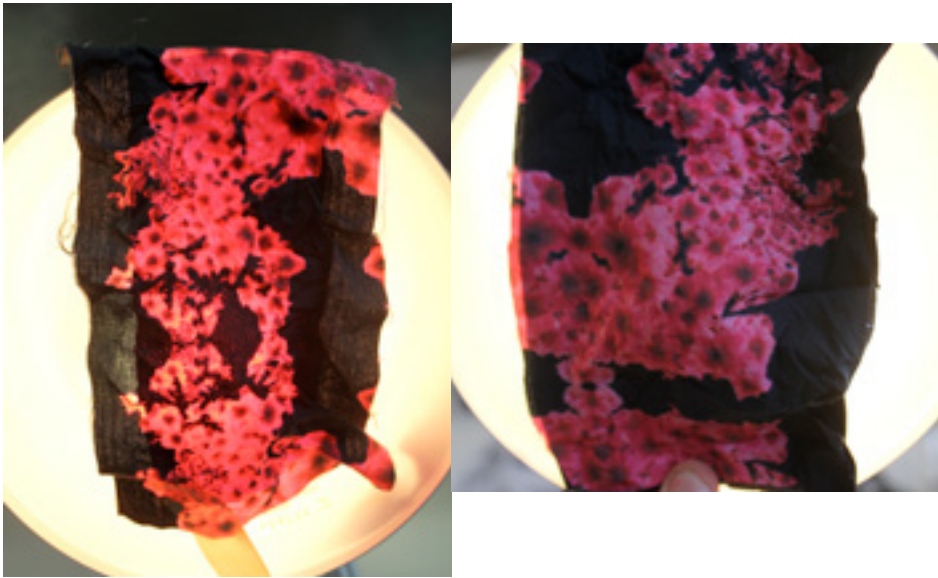


Figure 35: The image on the left is with the pink vinyl, on the right is the flock.



Figure 36: The digital print, and its reverse.



Figure 37: Black 3D printed, laser cut, felt necklace.

Figure 38: Pink 3D printed, laser cut, felt necklace.



Figure 39: Composite hats.

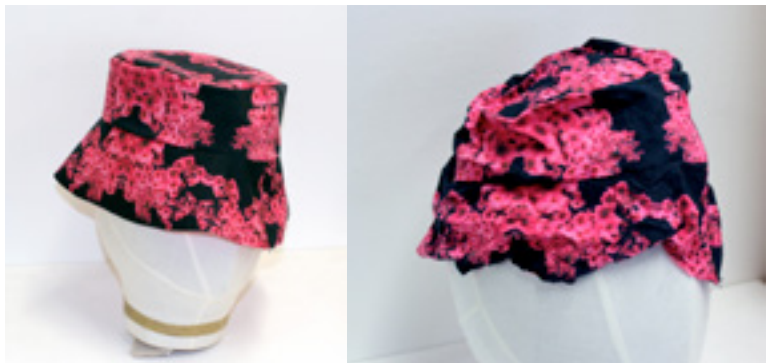


Figure 40: Composite hats.



Figure 41: Flocked and vinyl garment.

Figure 42 : Foil and laser cut garment, with flock and vinyl hat.



Figure 43: Digital print look with gold bag.

Figure 44: Digital print look with silver bag.

Figure 45: Digital print look with pink bag.



Figure 46: A proposed look featuring the crinkled laser cut vinyl.

Figure 47: Another look featuring the digital print dress.



Figure 48: Vinyl and flock garment from below.



Figure 49 (Top): Flock and vinyl garment.
Figure 50 (Bottom): Side views of two garments.



Figure 51 : The six looks together.

A) The collection

My main motivation behind this collection was of course to exhibit the textiles.

Sportswear was the inspiration behind the garment styles and silhouettes (reflecting the context of heat transfers). Each garment and accessory recalled sportswear in some way. The garments were based around the idea of a skewed t-shirt or sports singlet, the hats were an outdoorsy bucket hat, and the bags were like shrunken rugby balls. The large elastic bands on the knit pieces made reference to sportswear as well. The pattern inspiration looked at both the sportswear aspects (the mesh motif), mixed with the aspects from nature (the crinkle, and the cell and flower prints).

The collection is top heavy, as a result of the decision to focus just on the t-shirt idea. The hats add to this top heavy result. The experimental textiles could work well with leather style skirts, as well as leather style jackets. Had the collection been larger, these two products would be explored.

This work grew out of my honours year research, so I wanted of last this work to carry through, and for a natural progression to be seen. For this reason the grey knit from the honours collection was used again for the companion garments in this range. In my honours collection the grey knit was actually a large percentage of the garments, was fluidly draped and had an equal role to the experimental textile created. Here I wanted the knit to be nominal, basic, and very much overshadowed by the new and exciting textiles. This was the reason that these companion garments were basic and insipid - to highlight the vibrancy, texture and immediacy of the new textiles. The grey knit is there to remind the viewer of the humble origins of heat transfers - a predominantly a t-shirt and sportswear medium.

B) The relationship of the garments to the body

As a result of the difficulties in producing these textiles on a large scale, the patterns and textiles were engineered specifically to the garments. So the development and design of both happened in tandem. This was difficult for me, as my past experience with designing textiles largely happened before specific garment designs were determined. With this, the physical textiles and the patterns (which in this case were strongly interrelated), needed to take into account the wearer's body, because they would be engineered specifically to the garment.

The use of early prototypes as close as possible to the final garments in terms of drape and how they molded to the body was necessary. In most cases the last prototypes produced before the final garments were in fact made in the final base fabrics, to see how they would really perform on the body. In the case of the sleeveless laser cut looks, the same felt was used, but bonded on the reverse with a standard fusing, so the felt would perform in a very similar way to the final garments (and would not shrink, merely crinkle when treated with heat).

When it came to the patterns themselves and how they related to the body, testing these ideas with trial and error was used. Yet a lot of the sizes of the motifs such as the perforated pattern, was first determined by the design direction, which desired to recall a sports element. Yet, making the perforated patterns small like a sports mesh was going to be problematic with the felt bases (which would almost close up again, and the negative material would remain, especially when heat set again and crinkled). Having a large pattern would then make the design too unrecognizable as a sports mesh. For this reason a mid-sized laser cut pattern was used in three of the looks. When this sized pattern was trialed on the body in an early garment, the crinkle and molding to the body was noticeable yet not too extreme. I found this desirable, and balanced the somewhat modest amount of skin visible through the cuts when worn. I believed that having the laser cut pattern (which was also the structure itself) too molded to the body would change the silhouette too much. In the large sleeved silver garment the idea that the textile could also be used in the opposite way (to come away from the body) was explored.

In the case of the laser cut patterns on the digitally printed dress, the first proper prototype had the same sized cuts as three other of the garments. I then realised that because the textile base in this garment was cotton, it could take a smaller more sporty mesh pattern than the other garments. This was why the digitally printed dress had the smaller mesh pattern, because as a textile it could accommodate it, unlike the others.

The relationship of the digitally printed flower pattern to the body, on this dress, was also affected by technical aspects. Due to the size of the laser cutting beds, and my desire to cut the pattern pieces over a number of weeks (as a result of limited use of the laser cutter), a central seam just under the bust was used. A less obvious or integrated seam could have been used, but due to the extreme amount of time it took to draft and align the patterns as it was, a simple solution was thought best.

The floral design itself emanates from this seam and creeps up and down the body covering the breasts and pubic region. Originally the floral pattern was going to be featured around the neckline as well as the hem, yet I believed it overkill, and would not work as well with the zip closure. For this reason the neck flowers were removed, and were instead just left to the hem, where they were laser cut as a hem feature that was congruent with the sleeveless laser cut looks.

I originally planned on producing another digitally printed laser cut dress, that would feature a floral neck but no hem detail and in an alternative colour way. But time constraints meant that this was not possible. This example was going to be engineered to naturally carry the flower pattern into and down the sleeve.

C) Commercially producing hybrid textiles.

Turning the early samples and those developed further in this study into commercially viable textiles is an avenue that needs attention. This path would require greater research into the production, dimensions and availability of the materials used to create the textiles. Having the source materials produced to the same dimensions would perhaps be the first step for large-scale production of many of these fabrics. This would decrease the production time (and therefore cost) of the fabrics, as it would result in fewer time consuming joins and less wastage of excess material.

The size of equipment such as 3D printers, heat presses, laser cutters and digital printers used for producing textiles like these would also have to be taken into consideration, and may determine the material dimensions. Further research into the different variety of machinery would also have to be looked at. For example a roller press would be more effective and accurate than a scissor press, for producing many of these fabrics.



Figure 52: Look 1, digitally printed laser cut dress.



Figure 53: Look 2, Crinkled, laser cut foil top.



Figure 54: Look 3, crinkled laser cut vinyl top.



Figure 55: Look 4, flocked and vinyl top.



Figure 56: Look 5, Pink laser cut top.



Figure 57: Look 6, Foiled, laser cut dress.

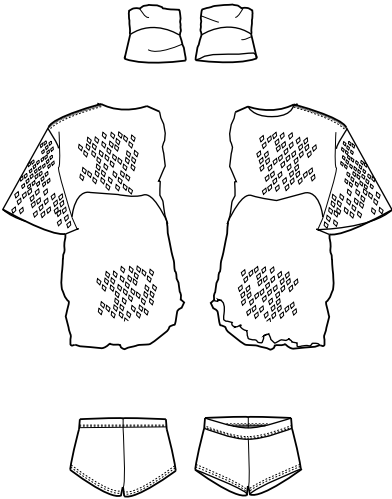
APPENDIX III: Costings & development.

The costings that follow are all approximations, and are for materials alone. Prices are in New Zealand dollars, as at November 2013. The times taken to do each task are also approximations and for how long it would take to undertake again (not the actual time it took me to develop the designs or processes).



Figure 58: Look 1.

Figure 59: Look 1 flat drawings.



Vinyl/Flock Bucket Hat			
Vinyl	0.3m @ \$20	=	\$6.00
Flock	1 sheet @ \$10	=	\$10.00
Felt	0.3m @ \$6	=	\$1.80
Laser cutting	0.25@ \$20hr	=	5.00
Total Materials			\$22.80

Bonding vinyl and screen printing flock:	1hr
Laser cutting pieces:	15mins
Construction:	15mins.
Total time	1.5hrs

Laser cut/vinyl/digi print dress			
Vinyl	4 m @ \$20	=	\$80
Digi Print fabric.	3m @ \$30	=	\$90
Zip	1 @ \$5	=	\$5
Laser cutting	2hrs @ \$20hr	=	\$40
Total Materials			\$215.00

Bonding vinyl on reverse	1hr
Construction	0.5 hr
Total time	1.5hrs

Grey Knit Hot Pants			
Grey Knit	0.4m@\$10	=	\$4.00
Elastic	1m@\$3	=	\$3.00
Total Materials			\$7.00

Construction	0.5hr
Total time	0.5hr

Vinyl/Flock Bucket Hat			
Vinyl	0.3m @ \$20	=	\$6.00
Flock	1 sheet @ \$10	=	\$10.00
Felt	0.3m @ \$6	=	\$1.80
Laser cutting	0.25@ \$20hr	=	5.00
Total Materials			\$22.80

Bonding vinyl and screen printing flock:	1hr
Laser cutting pieces:	15mins
Construction:	15mins.
Total time	1.5hrs

3D Printed/Felt Necklace			
Felt	0.25m @ \$6	=	\$1.50
Clear red PLA	Based on weight	=	\$3.00
Laser cutting	0.25hr @ \$20hr	=	\$5.00
Total Materials			\$9.50

Construction	0.5 hrs
Total	0.5hrs

Laser cut foil and felt singlet			
Felt	1m @ \$6	=	\$6.00
Foil transfer	1.5m @ \$20	=	\$30.00
Laser cutting	1 @ \$20hr	=	\$20.00
Total Materials			\$56.00

Bonding foil	1hr
Construction	0.5hrs
Total	1.5 hrs

Grey Knit Skirt			
Grey Knit	1m @\$10	=	\$10.00
Elastic	1m@\$3	=	\$3.00
Total Materials			\$13 .00

Construction	0.5hr
Total time	0.5hr



Figure 60: Look 2.

Figure 61: Look 2 flat drawings.

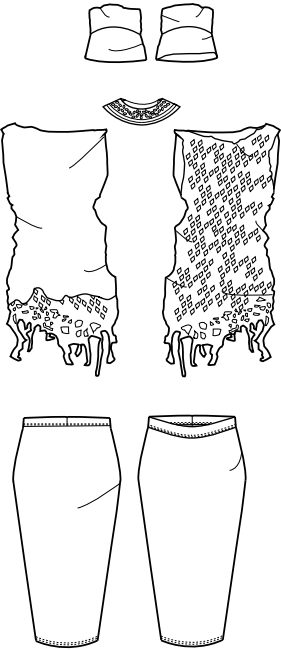




Figure 62: Look 3.

Figure 63: Look 3 flat drawings.

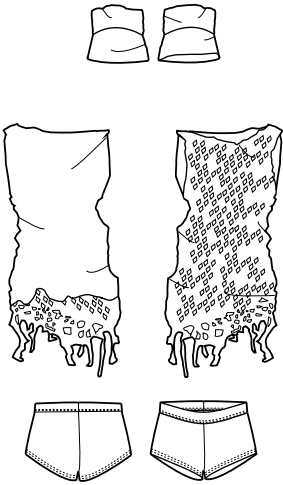
			
Laser cut vinyl and felt hat			
Vinyl	0.3m @ \$20	= \$6.00	
Felt	0.3m @ \$6	= \$1.80	
Laser cutting	0.5@ \$20hr	= 10	
Total Materials		\$17.80	
Bonding vinyl:			
Construction:			
Total time			
15mins			
15mins.			
0.5hrs			
Laser cut transfer and felt singlet			
Felt	1m @ \$6	= \$6.00	
Vinyl transfer	1.5m @ \$20	= \$30.00	
Laser cutting	1 @ \$20hr	= \$20.00	
Total Materials		\$56.00	
Bonding vinyl			
Construction			
Total			
1hr			
0.5hrs			
1.5 hrs			
Grey Knit Hot Pants			
Grey Knit	0.4m@\$10	= \$4.00	
Elastic	1m@\$3	= \$3.00	
Total Materials		\$7.00	
Construction			
Total time			
0.5hr			
0.5hr			



Figure 66: Look 5.

Figure 67: Look 5 flat drawings.

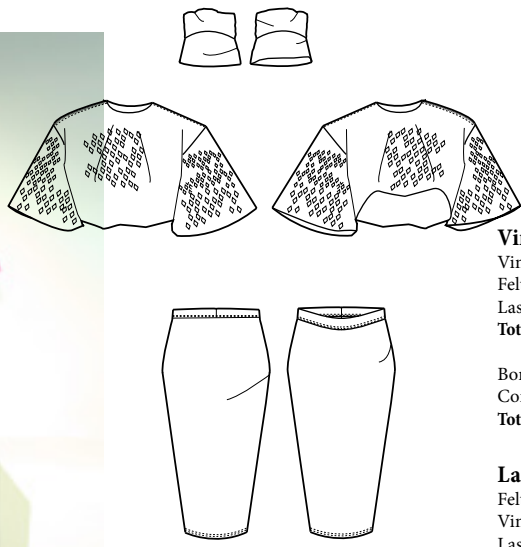
			
Vinyl transfer felt hat			
Vinyl	0.3m @ \$20	= \$6.00	
Felt	0.3m @ \$6	= \$1.80	
Laser cutting	0.25@ \$20hr	= 5.00	
Total Materials		\$12.80	
Bonding vinyl:			
Construction:			
Total time			
15mins			
15mins.			
0.5hrs			
Laser cut transfer and felt t-shirt			
Felt	1.5m @ \$6	= \$9.00	
Vinyl transfer	3m @ \$20	= \$60.00	
Laser cutting	2 @ \$20hr	= \$40.00	
Total Materials		\$109.00	
Bonding vinyl			
Construction			
Total			
1hr			
0.5hrs			
1.5 hrs			
Grey Knit Skirt			
Grey Knit	1m @ \$10	= \$10.00	
Elastic	1m@\$3	= \$3.00	
Total Materials		\$13 .00	
Construction			
Total time			
0.5hr			
0.5hr			



Figure 64: Look 4.

Figure 65: Look 4 flat drawings.

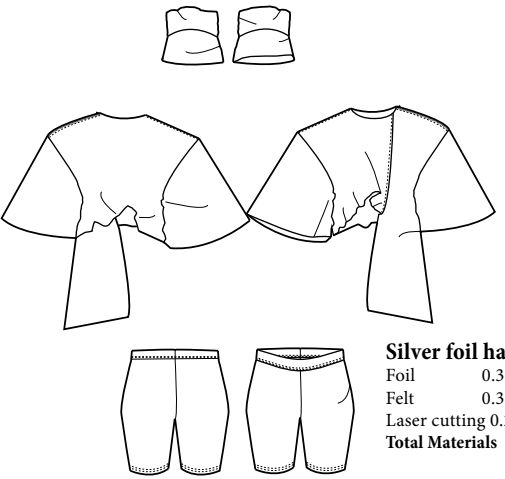
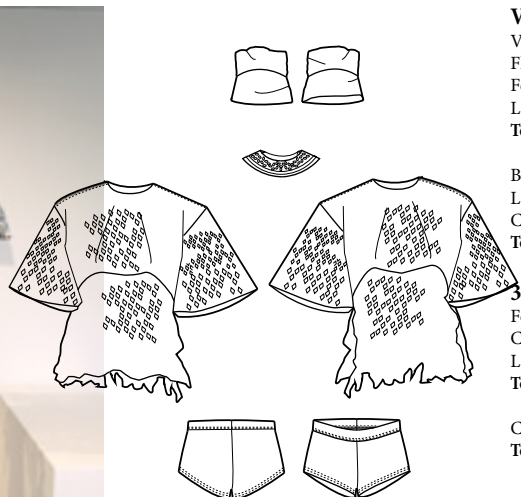
			
Silver foil hat			
Foil	0.3m @ \$20	= \$6.00	
Felt	0.3m @ \$6	= \$1.80	
Laser cutting	0.25@ \$20hr	= 5	
Total Materials		\$12.80	
Bonding foil:			
Construction:			
Total time			
15mins			
15mins.			
0.5hrs			
Vinyl transfer flock and felt top			
Felt	1.5m @ \$6	= \$9.00	
Vinyl transfer	2.5m @ \$20	= \$50.00	
Flock sheet	6sheets @\$10 each	= \$60.00	
Laser cutting	0.5 @ \$20hr	= \$10.00	
Total Materials		\$129.00	
Bonding vinyl			
Bonding flock			
Construction			
Total			
1hr			
2hrs			
1hrs			
4 hrs			
Grey Knit bike shorts			
Grey Knit	0.5m@\$10	= \$5.00	
Elastic	1m@\$3	= \$3.00	
Total Materials		\$8.00	
Construction			
Total time			
0.5hr			
0.5hr			



Figure 68: Look 6.

Figure 69: Look 6 flat drawings.

			
Vinyl/Flock Bucket Hat			
Vinyl	0.3m @ \$20	= \$6.00	
Flock	1 sheet @ \$10	= \$10.00	
Felt	0.3m @ \$6	= \$1.80	
Laser cutting	0.25@ \$20hr	= 5.00	
Total Materials		\$22.80	
Bonding vinyl and screen printing flock:			
Laser cutting pieces:			
Construction:			
Total time			
1hr			
15mins			
15mins.			
1.5hrs			
3D Printed/Felt Necklace			
Felt	0.25m @ \$6	= \$1.50	
Clear red PLA	Based on weight	= \$3.00	
Laser cutting	0.25hr @ \$20hr	= \$5.00	
Total Materials		\$9.50	
Construction			
Total			
0.5 hrs			
0.5hrs			
Laser cut foil/felt and flocked t-shirt			
Felt	2.5m @ \$6	= \$15.00	
Foil transfer	4m @ \$20	= \$80.00	
Flock transfer	4m @ \$20	= \$80.00	
Laser cutting	2 @ \$20hr	= \$40.00	
Total Materials		\$215.00	
Bonding foil/flock			
Construction			
Total			
2 hrs			
1 hrs			
3 hrs			
Grey Knit Hot Pants			
Grey Knit	0.4m@\$10	= \$4.00	
Elastic	1m@\$3	= \$3.00	
Total Materials		\$7.00	
Construction			
Total time			
0.5hr			
0.5hr			

Look 1 Garment development



Figure 70: The initial inspiration.

Figure 71: Concept development.

Figure 72: Miniature prototype.



Figure 73: Early full sized prototype.

Figure 74: Early full sized prototype with more volume.

Figure 75: Variation of prototype.



Figure 76: Top half of prototype with uncrinkled hem.

Figure 77: Top half of prototype with crinkled hem.

Figure 78: Full front with larger laser cuts.

Figure 79: Sleeve extension idea.



Figure 80: Last prototype front.

Figure 81: Last prototype back.

Figure 82: Final garment with smaller laser cuts.

For Look 1 the development started with the proposed textile. Sketching and creating miniature prototypes were developed in the beginning before moving on to full sized prototypes. I knew the design and general concept was a skewed t-shirt dress, and experimented with different amounts of excess and the use of two sleeves and then one sleeve.

For this garment a central seam had to be used to fit the design on the laser cutting bed, but also larger sized patterned piece could result in greater registration difficulties, so smaller pattern pieces were desired. Full sized prototypes of the garments were made in the beginning out of a striped nylon/cotton blend that would hold the crinkle in a similar fashion to the final fabric.

These early prototypes looked at how the much excess would be enough for the garment to be able to crinkle in towards the body, while still holding the desired silhouette. A first prototype of the print/garment was created without a vinyl transfer back (to reduce cost). This prototype was made in stages. I started with the top half, and looked at how it would appear with a crinkled hem, or without the crinkle. The creation of the first prototype (as well as the final) was in stages over the course of several weeks and allowed me to work through the problems I faced in the production of the textile, where the lessons I learnt from the first pattern pieces could be passed on to the later pieces. Originally I planned to have the floral motif around the neck, but decided against it in the final because of the closer fit (and addition of a zip), which would make it appear sportier.

Look 2 Garment development



Figure 83: Initial concept.

Figure 84: Concept development.

Figure 85: Further development.

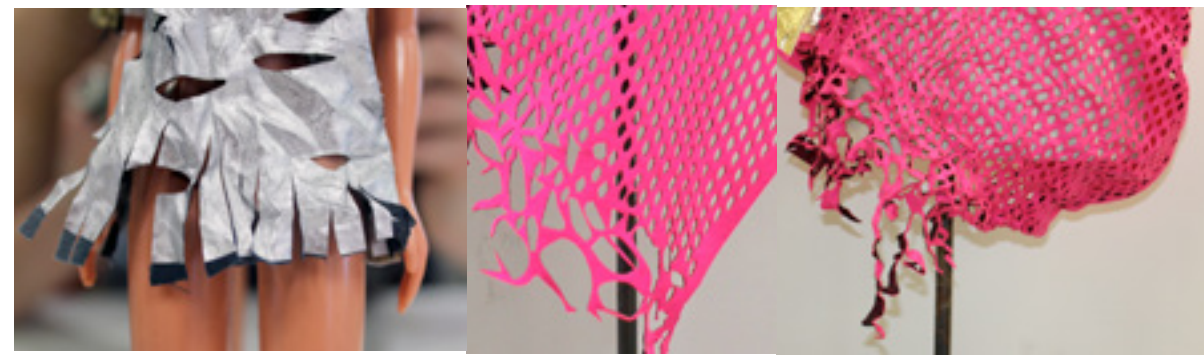


Figure 86: Miniature prototype.

Figure 87: Uncrinkled hem detail.

Figure 88: Crinkled hem detail.



Figure 89: Full sized prototype with sleeves (Front).

Figure 90: Full sized prototype with sleeves (Back).



Figure 91: More refined sample, with central seam.

Figure 92: Final prototype.

Figure 93: Final garment.

The development of Look 2 started with the initial textile. From that I used sketching and miniature prototypes to conceptualise my ideas. Crinkled and non-crinkled versions of the distorted hem idea were sampled in full size as I decided on the amount and placement of the laser cut motifs. From these, size and proportion of the laser cut motifs were decided. Full sized prototypes were created, in the beginning sleeves were used, but were decided against in the final garment, so there would be a stronger relationship with the one-sleeved Look 1, and made the garment more like a skewed sports singlet.

Originally a seam was placed through the middle of the garment (due to restrictions of the laser cutting bed). I found this unsatisfactory, in this garment (due to the difficulty of the join) and decided to slim down the design so it could be laser cut as a full piece. Having a solid, non-bonded or laser cut back was decided because it reduced the cost, and time taken on the garment.

APPENDIX IV:

Textile breakdown.

Sample



Figure 94: Vinyl on cable knit wool.

Method

This sample was created by bonding a vinyl transfer over a chunky hand knitted cable knit. Standard heat and pressure was used when bonding this example. The wool in this case is thick, and after further experimentation greater depth and dimension is achieved with thicker wools.

Development

This idea is explored further in other samples. More research needs to be undertaken to create greater depth and dimension with the raised result, as well as looking at other textured textiles or objects that could work with this idea. There are many possible applications with such a textile, both in fashion and in furnishings. This would make great seat coverings, embossed and padded areas on jackets and interesting sculptures.



Figure 95: Flock on vinyl, bonded to knitted wool.

This sample was created by first using an industrial hand-flat knitting machine to create a textured base on which to bond. It was then bonded with vinyl transfer at the normal heat and pressure levels. Examples of this stage can be found later on in this work. Flock adhesive was then screen printed over top of this sample. (In this case a snakeskin print was created and exposed on a silk screen. A more open meshed screen than the standard fabric-printing screen was used to accommodate the thick and fast setting flock adhesive. The flock adhesive was also slightly diluted for a runnier consistency). The printed adhesive result on top of the vinyl was then cured until it was dry using a heat-gun at approx. 300 degrees C. (Care must be taken to set the adhesive, but not melt the vinyl below it. Direct heat for very short periods was best, achieved by quickly passing the gun over the work repeatedly). A flock sheet was then applied over top of the cured adhesive and heat set at 160 degrees C. for 20 seconds. This was done two times, both times with a cover sheet to protect the textile. Once the sample had cooled (waiting 10 minutes can be a good idea), the flock sheet was removed to show the textile.

The sample is slightly melted. Yet it still has some appeal. Further experiments with this idea need to be undertaken, looking at ways to add the flocked texture, but without squashing the raised pattern. This could be fixed by using an industrial spray-on flock variety. On an aesthetic level, designing a textile that integrates these elements could be very interesting. Further effects like smocking; embroidery or puff paints could be used instead or alongside flock.

Sample



Figure 96: Double gold foil on knit.

Method

In this case, this gold on gold textile was created by bonding one variety of gold foil transfer over a textured knit base. Another different gold foil was then bonded over the first, and sanded by hand with sandpaper.

Development

Further experimentation with this idea needs to be undertaken; this could include the possibility of using a knit motif or pattern beneath the sanded back gold foil, in combination with the knit texture. Using different methods to sand back the foil could also be looked into, as well as designing textiles that layer up a variety of colours or patterns of transfer on the knit textured base.



Figure 97: Vinyl transfer on knit.

This sample is an iteration of the other knit textile examples. Here a gold foil transfer is bonded on a rippled knitted base. Changes in the knit structure were used and can be seen in the transfer.

Further experiments with knit structures and patterns could be looked into. Using seamless knitting machines and computerised patterns could be worth exploring to create more complex designs.

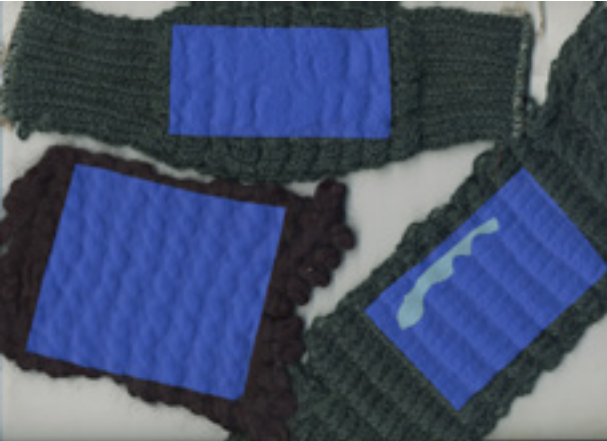


Figure 98: Vinyl transfer on knit.

These samples show a variety of different knit structures created on a hand flat knitting machine that were then bonded with vinyl transfer. Roll-cut flock is shown on top of the sample on the right.

Further experiments with different types and thicknesses of yarn need to be undertaken.

Sample

Method

Development



Figure 99: Vinyl bonded to knit, then laser cut.

In this sample two shades of vinyl transfer were bonded on a textured knitted base. After bonding, a dot motif was laser cut as a counter pattern on the textile. Parts of the negative of this pattern can be seen still in place, as the wool backing made it difficult for them to fall out.

This idea needs proper exploration. Designing a textile that incorporates the cut-out elements with the textured surface would be a start. Exploring different textures and different cut motifs would be interesting.



Figure 100: Flock on kint.

This sample was created by first making a simple knit pattern on a hand flat knitting machine. Flock adhesive was screen printed on the surface of the knit, and set with a flock sheet, as explained in earlier. The surface of the knit has been slightly charred by mistake in the curing process. The contrasting textural element of the knit and the flock is interesting.

Further exploration of this idea could to be looked into, first with the attempt at leaving the wool surface burn free from the heat process. I can imagine fantastic cable knit sweaters with strange flocked sections.



Figure 101: Vinyl on twisted knit

In this sample a pre-knitted mid-weight fabric with bow or twist structures was bonded over with a vinyl transfer. In this sample I found it more effective to remove the top plastic layer of the transfer while it was still hot, so the raised shape was not restricted by the plastic layer while cooling, and it could hold it's shape easier and cool as a raised form.

This idea of removing the hard plastic layer of the transfer while still hot needs to be explored with other samples and looked at for the production of these types of fabrics, where the imprinted form is a feature. Perhaps removing the plastic guard layer of the transfer before heat setting could be looked at, and instead using the material as a cover cloth when bonding.

Sample

Method

Development

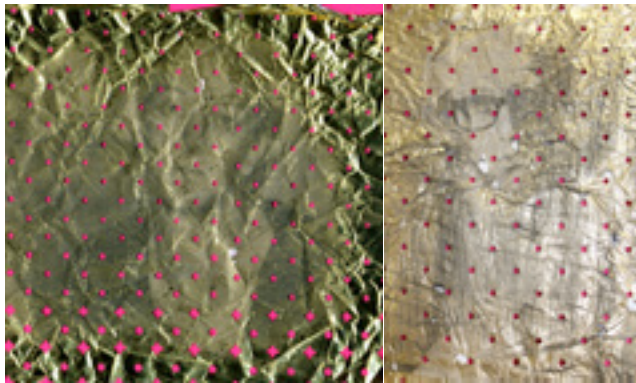


Figure 102: Digital prints with sanded foil and laser cutting.

These two samples were created by taking personal images of myself and digitally printing them onto cotton. The resulting black and white fabric was then bonded with a foil transfer, before being sanded with an industrial sand belt. The dot pattern was then laser cut into the textile and a pink base added for contrast.

This idea has a lot of potential. I could see this idea being used on the back of leather style jackets to great effect, whether with an image below or numbers or words. These textiles by themselves could work beautifully as artworks. This suggests the possibilities of heat transfers in the world of fine arts. Exploration of this media with other fine art materials such as paint, charcoal and resins could be of interest.

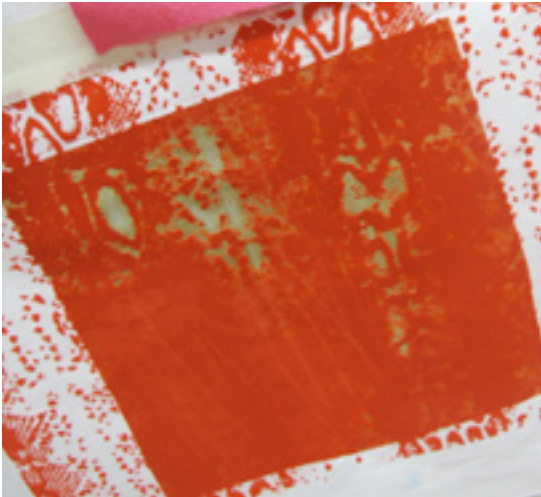


Figure 103: Flock over foil.

Here the foil idea is explored with an image or motif on top of it, as apposed to below it. A foil transfer has been heat set on top of a cotton fabric, and then flock adhesive has been screen printed and cured on the foil and heat-set with a flock sheet. The result has not worked effectively as the flock as set irregularly.

Further exploration needs to be undertaken to see if a correct pattern can be set to the surface of the foil. The contrast between the sleekness of the foil and the fuzziness of the flock is a great effect. Experimenting with sanding back the foil first before using the flock could be an interesting effect as well.



Figure 104: Sanded foil with laser cut inset leather.

In this sample a foil transfer has been in-bonded to a felt base. It has then been lightly sanded by hand, and then laser cut with the net motif. The same net motif was laser cut in pigmented leather, and the negative cut has been placed where the foil cut has been removed. Fusing was used on the reverse to keep the motif in place.



Figure 105: Sanded foil/vinyl transfer prototype.

This sample features a black vinyl transfer motif that has been bonded to a felt base. A foil transfer has been bonded over the motif before being heat set again and scrunched. It was then sanded by hand to reveal the motif below.

Exploring different motifs below the foil could be interesting, with addition of different colours and patterns. Like an earlier sample, this could have interesting use within the field of fine arts.

Sample

Method

Development



Figure 106: Vinyl and foil textile.

Similar to the previous sample, first This all over method could be a bonding a vinyl transfer on felt cre- great way of creating colourful tex- ated this variety. It was then bond- tiles with accents of gold and silver. ed over with the foil, scrunched then sanded.

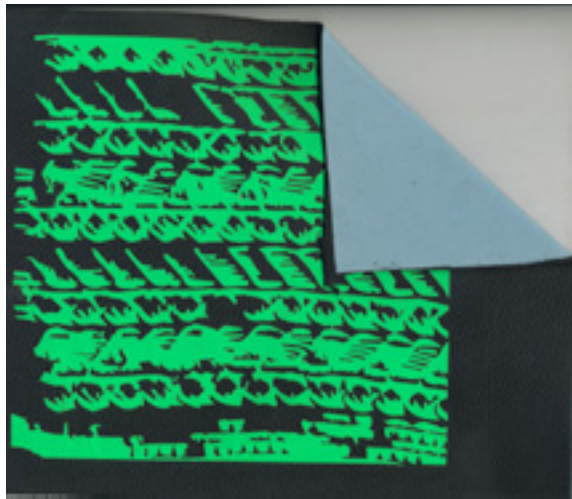


Figure 107: Leather, flock and vinyl textile.

This sample was an early attempt at Perfecting the use of heat set prod- using vinyl and flocking transfers ucts on top of leather needs to be on leather. This sample uses deer undertaken. So far getting a suc- leather and was first heat-set with cessful bond was problematic, and a light blue roll cut flock on the re- changed depending on the finish of verse. Care was taken not to ‘cook’ the leather, its type and treatment. I the leather and damage its finish. found I had a better results when I A cable knit design was plotted in ‘hot peeled’ the top protective layer the vinyl transfer, weeded then ap- of the transfer, instead of waiting plied normally to the surface of the until it cooled before removing. leather. Again attention to preserv- This was very much dependent on ing the quality of the leather finish had to be considered. The flocked reverse of the leather gave the tex- the nature of the leather. tile a strange synthetic drape simi- lar to neoprene. The green vinyl bond was not completely successful and peeled away in places.



Figure 108: Mixed media sample.

This sample features simple laser Further exploration of this cutting, roll cut flock and two dif- idea needs undertaking to ferent colours of vinyl transfers, create more integrated pat- all on top of two different types terns using the different of pigmented leather. This sample media. was created to see if a variety of heat transfers could be applied to pigmented leather. Although lack- ing in any design direction, it was a successful test.

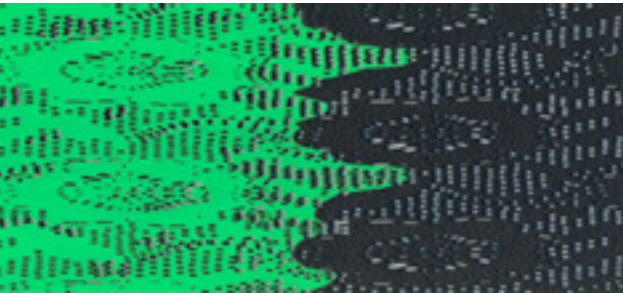


Figure 109: Laser cut vinyl and leather.

The pattern of this textile was first This method could be very created to approximate an existing effective at integrating the lace design. This lace pattern was vinyl transfers with laser created with a vinyl plotter and cutting. If overlapped and then weeded before heat-setting integrated well, these two it onto the deer leather base. The techniques could be very same pattern was then converted harmonious. to a ‘dxf’ format so it could then be cut with a laser cutter. Problems with getting a satisfactory bond of the vinyl on the leather were en- countered, as well as problems get- ting the registration of the pattern very accurate.

Sample

Method

Development

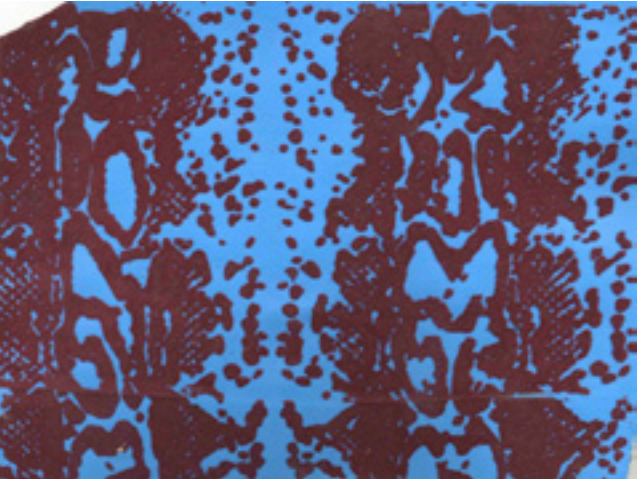


Figure 110: Flocking on pigmented leather.

This successful sample is a combi- Achieving a similar suc- nation of screen-printed flock on cessful result on different top of pigmented leather. Its crea- types of leathers, and fin- tion is the same as earlier samples ishes needs to be looked using screen-printed flock. Greater into. Flocked patterns on care had to be taken to avoid dam- leather have been seen re- age to the finish of the leather, both cently in contemporary during the adhesive curing process fashion, but literature as and the flock sheet bonding. to the methods used to achieve it are rare. Differ- ent methods of flock ap- plication need to be looked into, which may provide better or different results.

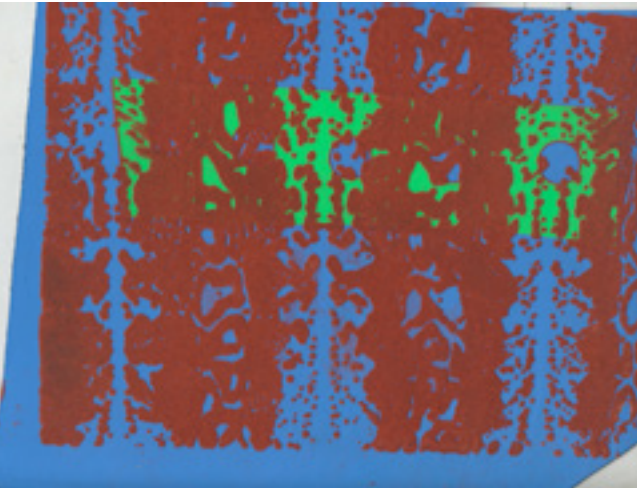


Figure 111: Flocking and vinyl transfer on pigmented leather.

Similar to the textile before it, the This method of layering up same method was applied. Before of media could be a very the application of the flock adhe- good way of integrating sive, a vinyl transfer was heat-set to techniques and adding in- the pigmented leather. teresting surface texture to leather.



Figure 112: Air brushed leather and vinyl transfer sample.

This sample was created by first Greater exploration of us- ing air brushing leather before bond- ing it with vinyl transfers. The low quality leather was painted by an industrial air-brusher using leather dye (commercially available and normally used to dye shoes). First the leather was sprayed with a light adhesive and then an open lace fab- ric was placed on top of the leather. The adhesive stopped the lace from moving when the air from the air brusher hovered over the surface. After the dye was evenly applied, the lace was removed and let to set. Vinyl transfers were bonded over the pattern and were unaffected by the dye treatment.

Sample

Method

Development



Figure 113: Knitted leather with vinyl transfer.

This sample was as a result of my desire to combine the knit experiments with the leather experiments. Vegetable leather strips were tied together and knitted by hand into the sample shown. A vinyl transfer was then heat set to the sample.

Further experiments using different types of leather and different types of knit structures could be undertaken. Then using another surface treatment on top of the vinyl could be interesting.



Figure 114: Deer leather with overheated vinyl transfer.

This sample came as a result of overheating a vinyl transfer too much. The vinyl was heat set to a base (in this case deer leather), and then a heat gun was used over the surface of the vinyl, melting it and causing it to get a shiny appearance. While it was still hot, marks were made in the vinyl.

Further exploration of the overheating idea needs to be looked at. Making the surface shiny in certain areas could be attempted, perhaps with the aim of making patterns of shiny and non-shiny areas. Creating patterns out of marks in the vinyl could also be explored.

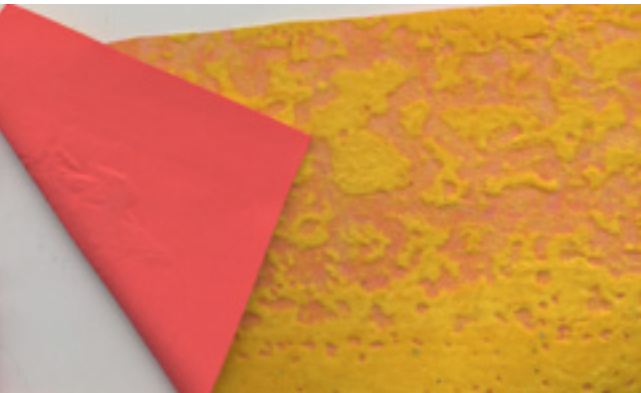


Figure 115: Vinyl and recycled flock backing.

This sample uses the normally discarded top layer from a screen-printed flock sheet. Usually thrown away, this discarded material has been bonded on its non flock side with a vinyl transfer. The textile created is very irregular and stiff.

Finding an application for a recycled textile like this and it's iterations needs to be looked at.

Sample

Method

Development



Figure 116: Various screen printed on vinyl transfer samples.

These samples were experiments combining screen-printing with combining vinyl transfers and heat transfers in with screen-printed images on top, general needs greater exploration outside of its t-shirt context. Other than a small bit of bleeding with the images, the results were successful.



Figure 117: Screen printing on vinyl transfer prototype.

This sample was created by first plotting a houndstooth pattern into the transfer vinyl. Before it was weeded, it was screen printed on the reverse of the fabric, which can become double faced with the use of a pattern in between (as shown here), but also with the affect that transfers can have on lightweight fabric in terms of drape.

The use of sheer fabric with heat transfers requires further exploration, in terms of the reverse of the fabric, which can become double faced with the use of a pattern in between (as shown here), but also with the affect that transfers can have on lightweight fabric in terms of drape.

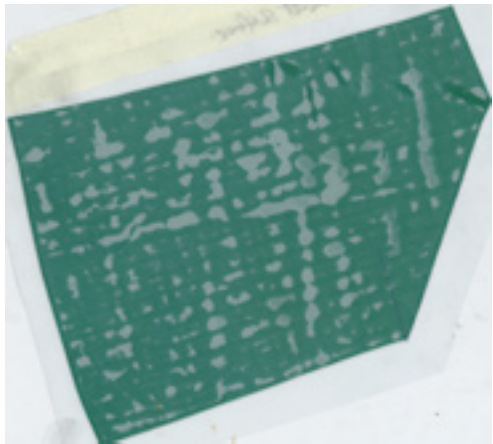


Figure 118: Transfer on discarded plastic base.

Using the discarded top plastic layer of a transfer was used in the creation of this sample. An old unused plastic lay was bonded to with a vinyl transfer. Air bubbles were trapped between the layers resulting in the pattern shown in this sample. The textile is stiff and rigid.

Using heat transfers on materials other than fabric needs a fuller exploration.

Sample

Method

Development



Figure 119: Transfer on discarded plastic.

In this sample, a similar idea was explored as in the last sample, where a plotted transfer pattern was bonded to a discarded plastic transfer top layer. The sample was then cut up and staggered when attached to a fabric base.

Due to the rigid nature of textiles like these, further exploration of such textiles with more 3D forms or in the context of sculpture could be undertaken.

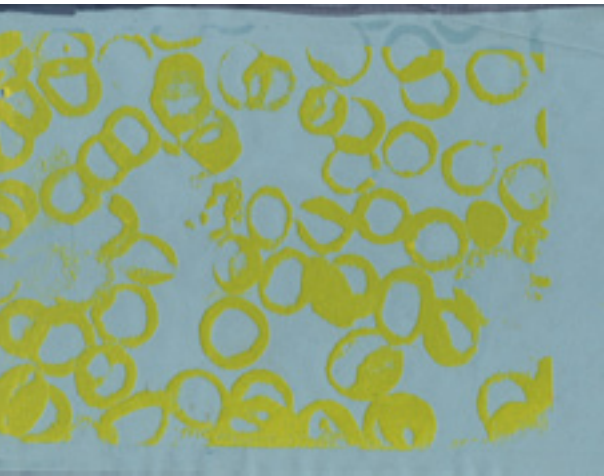


Figure 120: Screen printed flock on roll cut flock.

This fuzzy sample was created by bonding roll cut flock on a lightweight synthetic fabric. Flock adhesive was screen printed on, cured and then a flock sheet was applied.

Combining different methods of flock application could be explored further. This sample could then be heat set again and scrunched to give it a crinkled texture.



Figure 121: Screen printed flock on felt.

In this sample a variety of different coloured flock sheets were used on the same print. Felt was used as a base, but got a little burnt from the curing process.

Perfecting this process without the burnt quality needs to be looked at. Using flock on other textured services could also be explored.

Sample

Method

Development



Figure 122: Screen printed flock with vinyl transfer over top.

In this sample the screen printed flock has been applied first and then twining the two elements bonded over with a vinyl transfer. in a print would be very interesting, as well as looking at creating a very high piled flock, and using it under the vinyl transfer, to give the vinyl surface a raised quality. This could be an easier method of achieving the raised quality shown earlier with the knit samples.

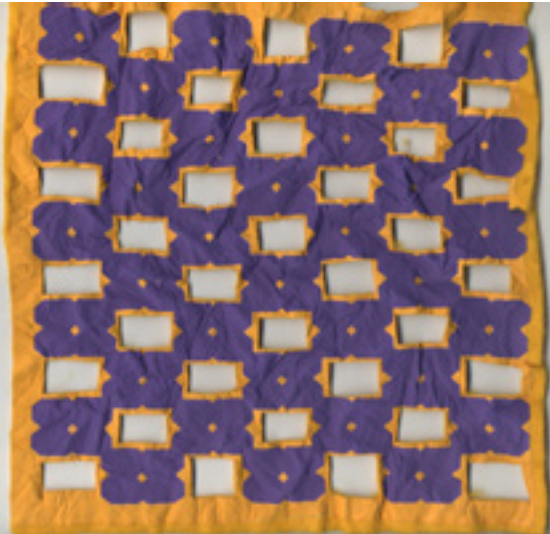


Figure 123: Vinyl transfer and laser cut textile.

This laser cut vinyl sample was created by first bonding a base layer of vinyl transfer to a synthetic felt. A plotted vinyl transfer design was made and weeded before being bonded to the existing vinyl felt textile. Another simpler file was created and aligned with the pattern so it could be laser cut. It was then put through another heat process and scrunched to create the creased textile.



Figure 124: Mixed media textile prototype.

This textile incorporated vinyl transfers, foils, roll cut flock and screen printed flock. It was then laser cut with a scribble motif. A cotton base fabric was used and printed flock is also imbedded. The screen printed flock can be easily fixed with further attempts. Future attempts at a textile that incorporates these different media together need to focus on composing all of the elements together so they are harmonious and integrated.

Sample

Method

Development

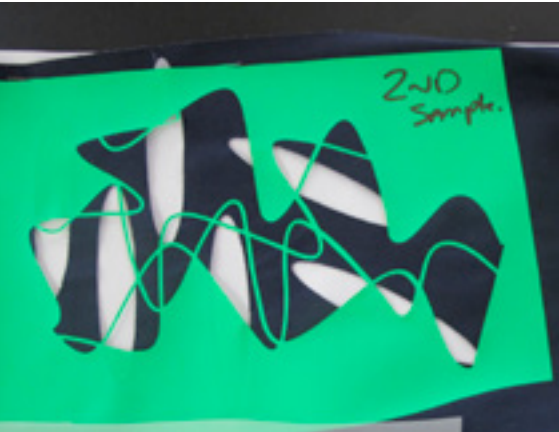


Figure 125: Vinyl and laser cut textile prototype.



Figure 126: Vinyl transfer model.



Figure 127: Flock, digital print, laser cut composite.

This textile was created with the idea of wildly offsetting a laser cut pattern with a vinyl-plotted pattern. First a design was created and plotted in the vinyl transfer, it was weeded and prepared for the base textile. Another simple counter pattern was created and laser cut in a t-shirt knit base. The vinyl pattern was then heat set to the knit base. A clear plastic layer was placed under the knit to insure that the vinyl pattern would not go through and stick to the heat press base where there are holes

This sample and small prototype is an example of the rigidity that is given to a simple t-shirt knit when it is bonded with an all over vinyl transfer.

Using this kind of heat set media to give fabric structure could be explored further, in terms of sculpture or turning flimsily fabrics into heavier weights or double faced fabrics.

In this sample a digitally printed leaf image has been heat set with a screen printed flock pattern and then laser cut with a differing dot motif.

Future explorations of this idea could focus on creating harmony and integration of the different elements. It would be fantastic to see digital prints with details of the print picked out with laser cutting, flock or puff paints. In doing so, getting accurate registration of the print will be necessary, as has been shown in this study.

Sample

Method

Development



Figure 128: Deer leather and vinyl transfer prototype.



Figure 129: Laser cut vinyl transfer through leather.



Figure 130: Squashed vinyl transfer through leather.

Similar to an earlier sample, this example was created by laser cutting two different textiles (a vinyl transfer example, and leather) with the same motif. The laser cut results were then exchanged. They could then be connected by heat setting the reverse with a fusing, or even partially connected and having a 3D element.

Similar to the previous sample, this example attempts to take it further, by making the elements incongruent and three-dimensional. Here vinyl transfers have been bonded to a linen base, then laser cut into ribbons. Cuts have then been made in leather and the pieces have been threaded through and bonded on the reverse to hold them in place.

As an extension of the previous sample the textile was created in a similar way, but was then squashed in a roller press. The idea behind it was looking at creating 3D forms and then returning them back into 2D patterns.

Sample

Method

Development

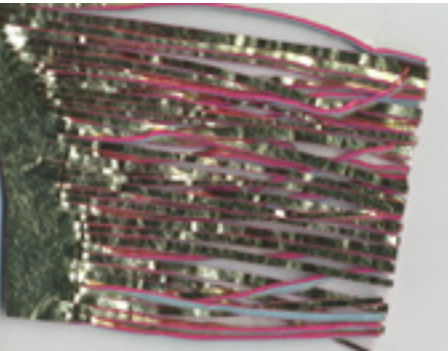


Figure 131: Flock and foil prototype.

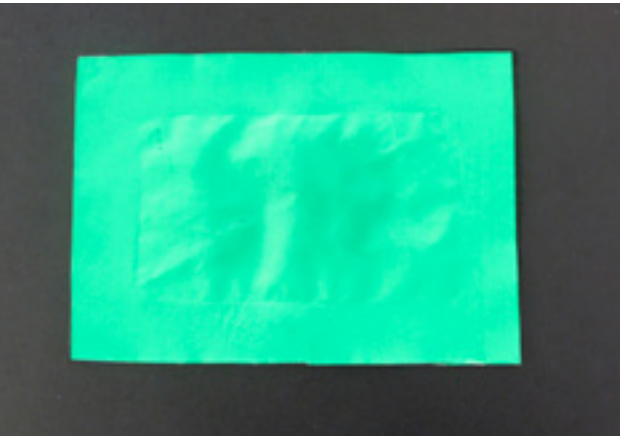


Figure 132: Air gap textile.



Figure 133 : 3D printing on fabric errors.

This fringed example was created by first bonding a foil transfer to a pink felt base, it was then bonded on the reverse with a light blue roll cut flock. It was then cut into the fringe shown.

Having a double bonded textile like this is interesting and highly usable as fringing because when it is bonded, and then cut – even with scissors – the edges are finished like leather and don’t need to be sewn.

In this example a smaller rectangle of fabric was placed between the vinyl transfer and it’s base. The transfer bonded to the base and this smaller rectangle of fabric, leaving a rectangular air pocket. Air was fairly trapped by this process and needed to be slowly released.

Further trials with this idea could be undertaken. It would be interesting to see if you could create patterns with the air pocket idea.

These two examples are of unsuccessful attempts at 3D printing on felt. Both had problems with stalled prints, due to the filament becoming stuck on the roll. The top example was then put through another heat-set operation and crinkled.

Even in their unfinished and problematic states, these textiles are very interesting. The top example with it’s distorted and crinkled appearance points to the idea that further processes could then be applied to such 3D textiles after the 3D print process, not just before.

References

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TABLE OF IMAGES

- Figure 1. McCoy, R. 3D printing on fabric. Digital photograph, 2013
- Figure 2. ClothBot Designs (2012) 3D printing on fabric paper. Digital photograph. Retrived on September 26, 2013, from <http://www.flickr.com/photos/plusea/8066364278/>
- Figure 3. Piem Wirtz (2012) Crafting the Future Workshop - DEAF 2012 (Video file). Retrieved on September 26, 2013, from <http://vimeo.com/43023078>
- Figure 4. Itsacyn (2013) 3D printing a composite of PLA and fabric. (Digital photograph). Retrieved on September 26, 2013, from <http://fablab.waag.org/project/3d-print-composite>
- Figure 5. van Herpen, I. (2011). 3D printed garment. Retrieved on September 26, 2013, from <http://blog.ponoko.com/2011/02/01/3d-printed-fashion-hits-couture-week-in-paris/>
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- Figure 7. Peter Pilotto (2013) Embroidered Jacket. Fall/Winter 2013 Collection. Retrieved on September 16, 2013, from <http://www.net-a-porter.com/product/382082>
- Figure 8. McCoy, R. PLA plastic. Digital photograph, 2013
- Figure 9. McCoy, R. 3D print design. CAD drawing, 2013
- Figure 10. McCoy, R. 3D printer and software. Digital photograph, 2013
- Figure 11. McCoy, R. Fabric prototype. Digital photograph, 2013
- Figure 12. McCoy, R. 3D printing process. Digital photograph, 2013
- Figure 13. McCoy, R. 3D printing process. Digital photograph, 2013
- Figure 14. McCoy, R. 3D printing process. Digital photograph, 2013
- Figure 15. McCoy, R. 3D printing process. Digital photograph, 2013
- Figure 16. McCoy, R. 3D printing on fabric. Digital photograph, 2013
- Figure 17. McCoy, R. 3D printing on fabric. Digital photograph, 2013
- Figure 18. McCoy, R. 3D printing on fabric. Digital photograph, 2013
- Figure 19. McCoy, R. 3D printing on fabric. Digital photograph, 2013
- Figure 20. McCoy, R. 3D printing on fabric. Digital photograph, 2013
- Figure 21. McCoy, R. 3D printing on fabric. Digital photograph, 2013
- Figure 22. McCoy, R. 3D print idea. CAD drawing, 2013
- Figure 23. McCoy, R. 3D printing on fabric. Digital photograph, 2013

- Figure 24. McCoy, R. 3D printing on fabric. Digital photograph, 2013
- Figure 25. McCoy, R. 3D printing design. CAD drawing, 2013
- Figure 26. McCoy, R. Laser cutting guide. CAD drawing, 2013
- Figure 27. McCoy, R. First laser cut/3D printed sample. Digital photograph, 2013.
- Figure 28. McCoy, R. Later laser cut/3D printed sample. Digital photograph, 2013.
- Figure 29. McCoy, R. Prototype textile. Digital photographs, 2013.
- Figure 30. McCoy, R. Foil dress planning. CAD image, 2013.
- Figure 31. McCoy, R. Digital print dress. CAD image, 2013.
- Figure 32. McCoy, R. Digital print, laser cutting planning. CAD image, 2013.
- Figure 33. McCoy, R. Laser cut pattern. CAD image, 2013.
- Figure 34. McCoy, R. Flock and vinyl digital print samples. Digital photographs, 2013
- Figure 35. McCoy, R. Fabric samples. Digital photographs, 2013.
- Figure 36. McCoy, R. Flower print and the reverse. Digital photographs, 2013.
- Figure 37. McCoy, R. Black 3D printed, laser cut, felt necklace. Digital photograph, 2013.
- Figure 38. McCoy, R. Pink 3D printed, laser cut, felt necklace. Digital photograph, 2013.
- Figure 39. McCoy, R. Composite hats. Digital photographs, 2013.
- Figure 40. McCoy, R. Composite hats. Digital photographs, 2013.
- Figure 41. McCoy, R. Flocked and vinly garment. Digital photograph, 2013.
- Figure 42. McCoy, R. Foil and laser cut look. Digital photograph, 2013.
- Figure 43. McCoy, R. Digital print with gold bag. Digital photograph, 2013.
- Figure 44. McCoy, R. Digital print with silver bag. Digital photgraph, 2013.
- Figure 45. McCoy, R. Digital print with pink bag. Digital photgraph, 2013.
- Figure 46. McCoy, R. Crinkled laser cut look. Digital photograph, 2013.
- Figure 47. McCoy, R. Digital print look. Digital photograph, 2013.
- Figure 48. McCoy, R. Vinyl and flock top. Digital photograph, 2013.
- Figure 49. McCoy, R. Vinyl and flock top. Digital photographs, 2013.
- Figure 50. McCoy, R. Side views. Digital photographs, 2013.
- Figure 51. McCoy, R. The full collection. Digital photographs, 2013.

Figure 52. McCoy, R. Look 1. Digital photograph, 2013.

Figure 53. McCoy, R. Look 2. Digital photograph, 2013.

Figure 54. McCoy, R. Look 3. Digital photograph, 2013.

Figure 55. McCoy, R. Look 4. Digital photograph, 2013.

Figure 56. McCoy, R. Look 5. Digital photograph, 2013.

Figure 57. McCoy, R. Look 6. Digital photograph, 2013.

Figure 58. McCoy, R. Look 1. Digital photograph, 2013.

Figure 59. McCoy, R. Look 1 Flat drawings. CAD drawing, 2013.

Figure 60. McCoy, R. Look 2. Digital photograph, 2013.

Figure 61. McCoy, R. Look 2 Flat drawings. CAD drawing, 2013.

Figure 62. McCoy, R. Look 3. Digital photograph, 2013.

Figure 63. McCoy, R. Look 3 Flat drawings. CAD drawing, 2013.

Figure 64. McCoy, R. Look 4. Digital photograph, 2013.

Figure 65. McCoy, R. Look 4 Flat drawings. CAD drawing, 2013.

Figure 66. McCoy, R. Look 5. Digital photograph, 2013.

Figure 67. McCoy, R. Look 5 Flat drawings. CAD drawing, 2013.

Figure 68. McCoy, R. Look 6. Digital photograph, 2013.

Figure 69. McCoy, R. Look 6 Flat drawings. CAD drawing, 2013.

Figure 70. McCoy, R. Concept drawing. CAD drawing, 2013.

Figure 71. McCoy, R. Concept drawings. CAD drawings, 2013.

Figure 72. McCoy, R. Miniature prototype. Digital photograph, 2013.

Figure 73. McCoy, R. Prototype. Digital photograph, 2013.

Figure 74. McCoy, R. Prototype. Digital photograph, 2013.

Figure 75. McCoy, R. Prototype. Digital photograph, 2013.

Figure 76. McCoy, R. Prototype. Digital photograph, 2013.

Figure 77. McCoy, R. Prototype. Digital photograph, 2013.

Figure 78. McCoy, R. Prototype. Digital photograph, 2013.

Figure 79. McCoy, R. Prototype. Digital photograph, 2013.

Figure 80. McCoy, R. Final Look 1 prototype (front). Digital photograph, 2013.

Figure 81. McCoy, R. Final Look 1 prototype (back). Digital photograph, 2013.

Figure 82. McCoy, R. Look 1. Digital photograph, 2013.

Figure 83. McCoy, R. Concept drawing. CAD drawing, 2013.

Figure 84. McCoy, R. Concept drawing. CAD drawing, 2013.

Figure 85. McCoy, R. Concept drawing. CAD drawing, 2013.

Figure 86. McCoy, R. Miniature prototype. Digital photograph, 2013.

Figure 87. McCoy, R. Prototype. Digital photograph, 2013.

Figure 88. McCoy, R. Prototype. Digital photograph, 2013.

Figure 89. McCoy, R. Prototype (front). Digital photograph, 2013.

Figure 90. McCoy, R. Prototype (back). Digital photograph, 2013.

Figure 91. McCoy, R. Prototype. Digital photograph, 2013.

Figure 92. McCoy, R. Prototype. Digital photograph, 2013.

Figure 93. McCoy, R. Final Look 2. Digital photograph, 2013.

Figure 94. McCoy, R. Vinyl on cable knit wool. Digital photograph, 2013.

Figure 95. McCoy, R. Flock on vinyl, bonded to knitted wool. Digital photograph, 2013.

Figure 96. McCoy, R. Double gold foil on knit. Digital photograph, 2013.

Figure 97. McCoy, R. Vinyl transfer on knit. Digital photograph, 2013.

Figure 98. McCoy, R. Vinyl transfer on knit. Digital photograph, 2013.

Figure 99. McCoy, R. Vinyl bonded to knit, then laser cut. Digital photograph, 2013.

Figure 100. McCoy, R. Flock on kint. Digital photograph, 2013.

Figure 101. McCoy, R. Vinyl on twisted knit. Digital photograph, 2013.

Figure 102. McCoy, R. Digital prints with sanded foil and laser cutting. Digital photographs, 2013

Figure 103. McCoy, R. Flock over foil. Digital photograph, 2013

Figure 104. McCoy, R. Sanded foil with laser cut inset leather. Digital photograph, 2013

Figure 105. McCoy, R. Sanded foil/vinyl transfer prototype. Digital photograph, 2013

Figure 106. McCoy, R. Vinyl and foil textile. Digital photograph, 2013

Figure 107. McCoy, R. Leather, flock and vinyl textile. Digital photograph, 2013

Figure 108. McCoy, R. Mixed media sample. Digital photograph, 2013

Figure 109. McCoy, R. Laser cut vinyl and leather. Digital photograph, 2013

Figure 110. McCoy, R. Flocking on pigmented leather. Digital photograph, 2013

Figure 111. McCoy, R. Flocking and vinyl transfer on pigmented leather. Digital photograph, 2013

Figure 112. McCoy, R. Air brushed leather and vinyl transfer sample. Digital photograph, 2013

Figure 113. McCoy, R. Knitted leather with vinyl transfer. Digital photograph, 2013

Figure 114. McCoy, R. Deer leather with overheated vinyl transfer. Digital photograph, 2013

Figure 115. McCoy, R. Vinyl and recycled flock backing. Digital photograph, 2013

Figure 116. McCoy, R. Various screen printed on vinyl transfer samples. Digital photograph, 2013

Figure 117. McCoy, R. Screen printing on vinyl transfer prototype. Digital photograph, 2013

Figure 118. McCoy, R. Transfer on discarded plastic base. Digital photograph, 2013

Figure 119. McCoy, R. Transfer on discarded plastic. Digital photograph, 2013

Figure 120. McCoy, R. Screen printed flock on roll cut flock. Digital photograph, 2013

Figure 121. McCoy, R. Screen printed flock on felt. Digital photograph, 2013

Figure 122. McCoy, R. Screen printed flock with vinyl transfer over top. Digital photograph, 2013

Figure 123. McCoy, R. Vinyl transfer and laser cut textile. Digital photograph, 2013

Figure 124. McCoy, R. Mixed media textile prototype. Digital photograph, 2013

Figure 125. McCoy, R. Vinyl and laser cut textile prototype. Digital photograph, 2013

Figure 126. McCoy, R. Vinyl transfer model. Digital photograph, 2013

Figure 127. McCoy, R. Flock, digital print, laser cut composite. Digital photograph, 2013

Figure 128. McCoy, R. Deer leather and vinyl transfer prototype. Digital photograph, 2013

Figure 129. McCoy, R. Laser cut vinyl transfer through leather. Digital photograph, 2013

Figure 130. McCoy, R. Squashed vinyl transfer through leather. Digital photograph, 2013

Figure 131. McCoy, R. Flock and foil prototype. Digital photograph, 2013

Figure 132. McCoy, R. Air gap textile. Digital photograph, 2013

Figure 133. McCoy, R. 3D printing on fabric errors. Digital photograph, 2013