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## CUTTING THROUGH THE SURFACE: THE USE OF LASER CUTTING TECHNOLOGY WITH TRADITIONAL TEXTILE PROCESS

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Laser cutting technology is now widely associated with textiles, but prior to the work of designers such as Janet Stoyale in the early 1990s, it was regarded as a non textile specific technology. Over the past ten years many contemporary designers, from a range of differing design disciplines, have used laser cutting technology in conjunction with textile materials, but little research has been conducted into the use of this technology in conjunction with textile processes.

The widely seen ‘cut through’ design aesthetic, as exemplified by the work of Tord Boontje<sup>1</sup> is most strongly identified with laser cut textiles and many designers have exploited this aesthetic. Tord Boontje within his laser cut textiles explores the ideas of cutting away; layering and creating three dimensional surfaces through cutting and opening out. Other designers such as Lauren Moriarty<sup>2</sup> explore the ideas of layering and removal, whilst responding to specific materials behavioural characteristics; using heat responsive materials such as neoprene, with the laser cutting process in order to create surfaces that have buckled and contorted. There is however a myriad of other ways in which laser cutting technology can be used within the field of textiles.

This paper discloses some of the research that I have conducted over the past two years into the design possibilities suggested by the use of laser cutting technology in conjunction with various textile processes. Revealing how laser cutting can be used as an alternative to the much more environmentally damaging textile process of Devore, more commonly referred to as ‘burn away’. The following three research areas are discussed within this paper

- The use of laser cutting technology to replace existing textile process.
- The use of laser cutting technology in conjunction with existing textile process
- The design and development of specific textile structure for laser cutting.



*Figure 1, left. Universal Laser System Image by author.*

*Figure 2, right. Close up of cutting bed Image by author.*

<sup>1</sup> Tord Boontje designed the ‘fallen flowers’ laser cut microfiber screen for Moroso in 2005.

<http://tordboontje.com/projects/textiles/fallen-flowers/>

<sup>2</sup> Lauren Moriarty, a UK based designer, uses laser cutting technology for many of the products that she creates, including ‘noodle block cubes’ and ‘laser cut lace panels’. <http://www.laurenmoriarty.co.uk/>

A Universal Laser System 1LS12 .75 (Fig .1 and Fig. 2) was used throughout the research. A diverse range of textile samples were first collected and then laser cut using both vector (Fig.3)<sup>3</sup> and raster (Fig.4)<sup>4</sup> settings, in order to provide a comprehensive database of accurate speed and power settings for all textiles used in subsequent research. All behavioural and performance characteristics of the textiles were assessed and recorded before and after the laser cutting process, in order to provide a good overview as to the effect of the process on the textile.



*Figure 3, left. A black and white design for a Raster setting  
Figure 4, right. A blue linear design for a Vector cut.  
Images and designs by author. Copyright 2010 Jessica Payne*

The ‘cut through’ aesthetic, discussed earlier, can be seen in figure 5 and figure 6. A vector file of a single blue line was created and the same design used for both textile samples, to demonstrate the differing affects that can be achieved. The industrial felt (Fig.5) was cut at a very slow speed and high power, whilst the silk sample (Fig.6) was cut at low power and high speed. The two materials responded very differently. The industrial felt creating a lot of smoke, flame and odour and the edges of the cut were much burnt; whilst the silk cut cleanly, with little smoke emission and minimal burning to the cut edges.

A vector setting has also been used in the samples shown in figure 7 and figure 8; in this instance though the power setting was greatly reduced so that the laser cut **into and not through** the surface of the felt.

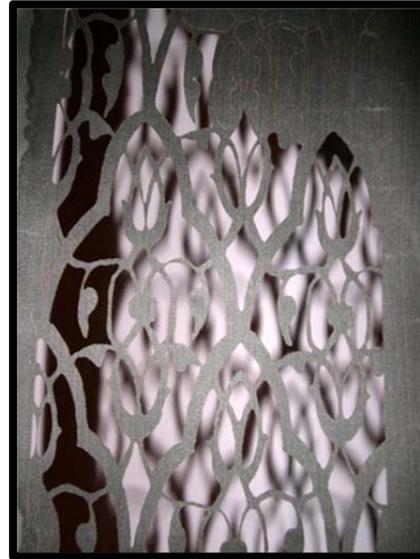
Interesting effects can also be achieved ‘post cutting’, through the use of various finishing processes. The sample (Fig.8) was washed after being laser cut and the scars that had been created in the surface of the textile opened up. This is particularly effective with wool felt textiles.

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<sup>3</sup> The vector cut setting is represented by a single blue line and is used to cut through a material

<sup>4</sup> The raster setting is represented by a black and white (positive and negative space) design. The laser moves backwards and forwards cutting down into, but not through the surface.

Laser cutting technology is not merely a static manufacturing process. It allows for designer intervention at any point during the cutting process. In the textile, shown in figure 7, the laser cutter was halted during cutting and the material was moved on the laser bed before cutting was recommenced, thus creating a broken and overlaid pattern. The designer is able to see the cut mark on the computer screen just prior to its execution. This enables the designer to interact during the cutting process, to intervene and stop the laser in order to rethink part of the design if required. It is a small window of opportunity which allows for a more spontaneous interaction between the designer and the technology.



*Figure 5, left. Vector cut through industrial felt*

*Figure 6, right. Vector cut through silk*

*Images and designs by author. Copyright 2010 Jessica Payne*



*Figure 7, left. Vector cut into the surface of industrial felt.*

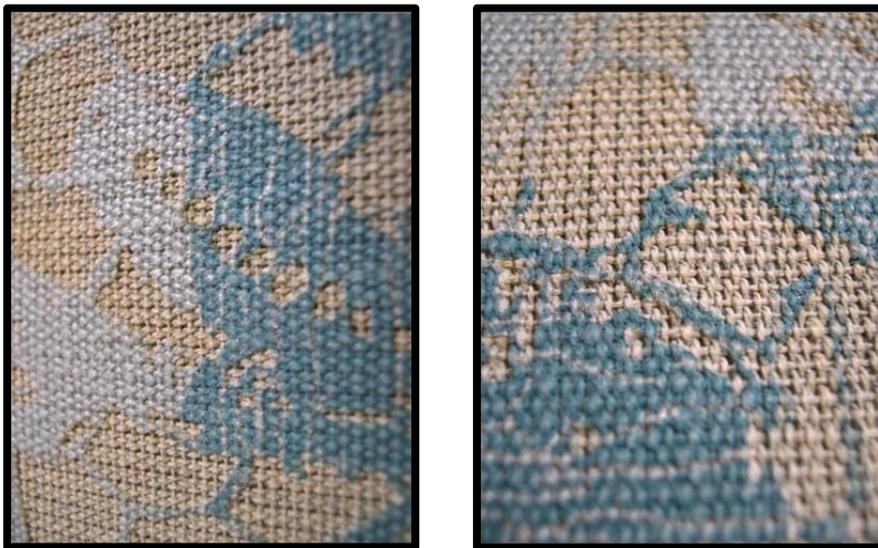
*Figure 8, right. A close up showing how the cut in the surface of the felt open up once it is washed Felt. Images and designs by author. Copyright 2010 Jessica Payne*

The woven cotton plush structure, shown in figure 9 was rastered to create a similar affect to that achieved through the use of chemicals in the Devore process. It was developed to offer a less environmentally damaging alternative to Devore. The laser as it moves backwards and forwards burns away the surface fibre. The power and speed settings have to be adjusted depending on the depth of the pile of the velvet. Very different effects can be achieved through the use of plush fabrics of different compositions and structures. Knitted plush fabrics tend to disintegrate, whilst woven 'velvets' composed of natural fibres work well. The most dramatic effects are achieved with thick pile fabrics.



*Figure 9: Raster cut into surface of velvet. Images by author, Copyright 2010 Jessica Payne*

The laser can also be used to cut through a surface coating or print. In figure 10 the raster technique was used to cut through the screen printed surface layer. The success of this process depends on variable factors: the type of screen printing inks used; the amount of pulls employed when printing and the absorbency of the base textile. The sample here is a hemp and linen mix base textile, printed with procion screen printing inks.



*Figure 10. Raster cut through the printed surface of a textile. Images by author, Copyright 2010 Jessica Payne*

The laser cut process works very well with woven textiles that are composed of yarns of differing types. The woven cotton sample (Fig.11) contains a hidden additional metal weft yarn, which was revealed once the cotton fibre was burnt away.



**Figure 11.** Raster cut through a woven cotton textile with a weft inserted fine metal weft thread.  
*Images by author. Copyright 2010 Jessica Payne*

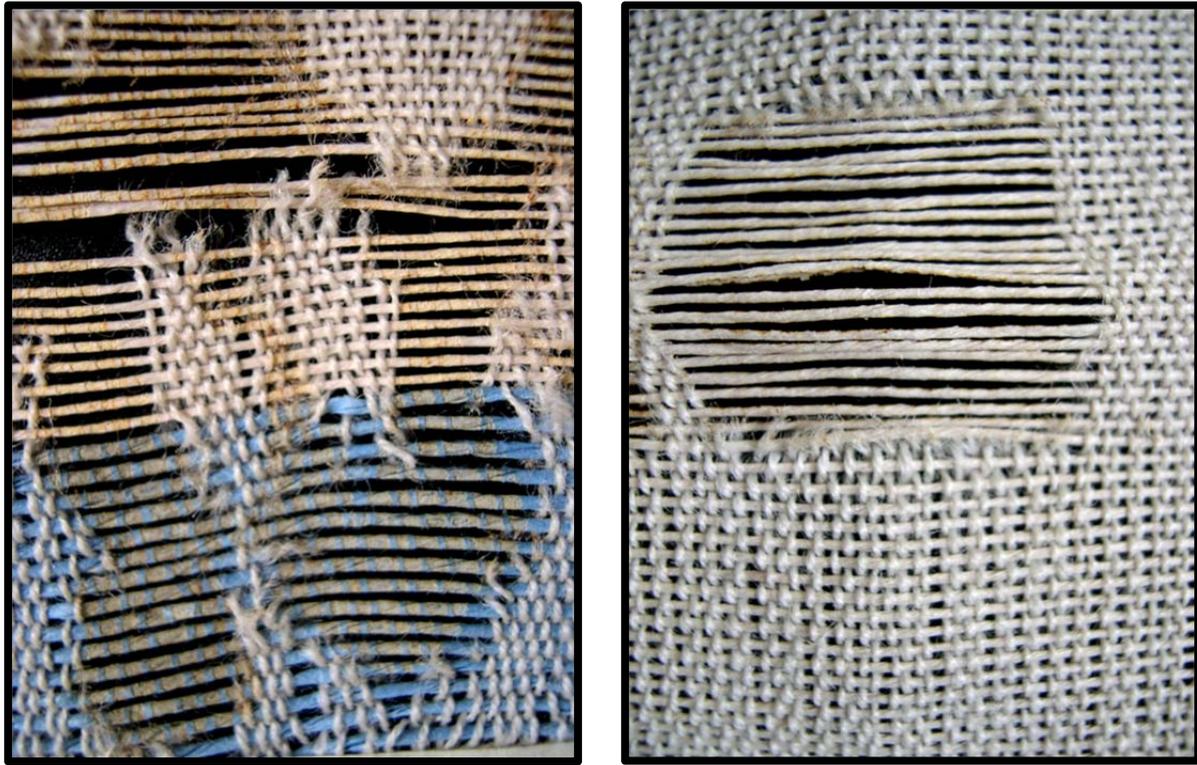
The interaction between the designer, the technology and the material structure is of key importance. A colleague was asked to set up a loom and weave a series of samples using different combinations of yarn in the warp and weft. Yarns of different thicknesses and material compositions were specifically selected, the intention being to construct a textile in which either the warp or the weft could be removed during the laser cutting process (Fig.12). ‘Material design for purpose’ is a very effective way of combining two manufacturing techniques to create innovative textile design solutions. The woven material (Fig.12) was constructed with a fine wool warp and a thicker paper weft yarn. The textile was laser cut and the dust residue from the wool warp was rubbed away. As can be clearly seen (Fig.13 & Fig. 14) this approach works much more effectively with simple rather than complex cut away design. It is always a balance between the designer, the technological capabilities, intended end use application and material behaviour and properties.



**Figure 12.** Raster cut through a woven cotton textile. Image and design by author.  
*Copyright 2010 Jessica Payne and Flora Waycott*

The information disclosed in this paper is part of an extension body of research, which I have carried out over the past two years into the design possibilities suggested by the use of laser cutting technology with textile processes.

I would be delighted to hear from other academics or designers currently working within this field.



*Figure 13, left. Raster cut through engineered paper and wool woven fabric, showing how the material disintegrates when a free flow organic design is used.*

*Figure 14, right. Raster cut through engineered paper and wool woven textile, showing how the material is more stable when laser cut using a geometric design.*

*Images by author. Copyright 2010 Jessica Payne/Flora Waycott*