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### **An Exploration of the Sustainable and Aesthetic Possibilities of 3D Printing onto Textile as an Alternative to Traditional Surface Decoration, Utilising Cellulosic Materials.**

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Textile embellishments are a small percentage of a finished product yet contribute a significant ecological impact. They can draw on the mining industry (metals for zips, poppers and electroplated studs for jeans) and the oil industry (plastic buttons, sequins and beads), with their associated impacts on global warming, land degradation, human health, air emissions and toxic contamination of water. In addition to this, at the end of a garments life cycle, in large scale textile recycling plants, items must be free of all trims to facilitate reprocessing. They can be difficult and labour intensive to detach or remain on the garment meaning that otherwise recyclable yarns or fabrics are passed by and sent to landfill.

According to Fletcher and Grose (2011), sustainably led innovation involves using renewable source materials and rapidly renewable fibres; materials with reduced processes such as water, energy and chemicals, fibres produced under improved working conditions for growers and processors and materials produced with reduced waste such as biodegradable and recyclable fibres from both consumer and industry waste streams.

From this standpoint, this research looks at alternative approaches to both the way that we embellish textiles and the materials used, concentrating on the renewable source materials of PLA (a biodegradable polymer derived from vegetable starch) and Lyocell (provided by Lenzing). This is a low-impact, regenerated cellulose fibre made from wood pulp. The raw cellulose is dissolved directly in an amine oxide solvent, substantially reducing pollution levels in water. It requires no bleaching prior to dyeing and is coloured with low chemical, water and energy techniques. 3d printing also offers an approach with little waste, which is less labour intensive than hand sewing. The full potential of this technique, in a textile context, is yet to be fully exploited.

Although 3D printing is occasionally used in a fashion context at this time, it is usually for 'novelty' rather than to approach any issues around sustainability in the textile industry. In addition to this, Lyocell and Tencel are utilised by several companies, including Marks and Spencers, H&M and Esprit, but they have not made enough of an impact to displace the use of more unsustainable fabrics such as cotton. This project intends to look at new ways to use cellulosic textiles and, potentially mixed with PLA, 3D printable materials to be used as embellishment *on* the textile. The embellishment and the material on the whole product would therefore be generally more sustainable for a number of reasons, as highlighted. Through this practice led investigation, there will also be emphasis on the technique's aesthetic appeal and the usability of the processes, so that it may be a real alternative to current provision and practices. This will be tested through observational methods looking at designer and consumer responses to prototypes and the new methods of embellishment in this study.