TEXTILE + DESIGN LAB

Case study number: 02/2011

Project Title: Knitted Fibonacci scarves

TDL Partner: Diana Eng

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Project Period: February 2011

Partner Profile: Diana Eng is an American fashion designer who graduated from the Rhode Island School of Design in 2005. Diana gained prominence as a contestant in the second season of the reality TV show, "Project Runway". She has since become a highly regarded professional fashion and textile designer, recognised for her innovative, cutting edge designs. She is author of "Fashion Geek", a publication that teaches simple methods to create clothing and accessories incorporating LED lights, electro-luminescent (EL) wire and personal audio equipment. Diana's studio is based in New York and she specialises in various forms of electronic, scientific and mathematical designs through fabric, sometimes in collaboration with electronics engineers and scientists.

Project background: Diana visited New Zealand as a guest of Colab and the TDL in February 2011. She collaborated with the TDL during her visit to develop a machine knitted version of her Fibonacci scarf design.

Project Description: The finished product is a "Fibonacci" scarf knitted on the Shima Seiki WholeGarment® machine. The project involved transferring Diana's design from her domestic knitting machine template to the Shima Seiki electronic knitting machine format. Being able to produce her scarves on electronic machines, would give her the benefit of being able to knit the scarves 'on demand,' as needed, using fine merino wool yarn, to a standard appropriate to Diana's brand and reputation.

The Fibonacci sequence is a certain order of numbers where each number after 1 is the sum of the previous two: (0, 1,) 1, 2, 3, 5, 8, 13, 21, 34 and so on. This sequence occurs in nature and can be seen in the spiral of a snail's shell, the curl of an artichoke and pine cone, and the unfurling of a fern. Diana developed this sequence as the basis of her knitted scarf pattern.

Project Methodology: Diana brought her fully calculated design with descriptions and drawings on graph paper to the TDL, thereby making the process for translation onto the Shima Seiki computer software easier.

The Fibonacci design required different computer encoding techniques to accurately produce the two different sides of the scarf. The CAD template library did not have the required pattern elements and TDL technician, Gordon Fraser, programmed the scarf into the software using Diana's graphic patterns. Gordon was able to do this immediately, and knew what machine limitations to work around so the design could be programmed and automated without too much difficulty. With Gordon's technical skill and experience and Diana's clear description and blue-print, this project was very effective in that it took less than a day to create the programme on the CAD system and knit the order.

Technical Methodology: Specific stitch sizes were added into the programme to reproduce the Fibonacci sequence and a technique to replicate each design block while altering the structures of holes in the scarf in relation to the width was applied. Fibonacci numbers increase exponentially and correspondingly challenged the capabilities of the Shima Seiki machine, resulting in an inevitable limit of scarf width.

There were some technical issues with this knitting technique. Whilst one side of the scarf is being produced using multiple short row knitting, the other side of the scarf is being held under increasing tension created by the take down and sinkers. Special techniques were required to prevent the longer rows from bursting during the knitting process.

Outcome: The short time frame in which it took to develop the programme and produce multiple units of the scarves resulted in a successful outcome of the Fibonacci project. Diana is now retailing the Fibonacci scarves via her online shop: http://www.dianaeng.com/smart-scarves

Feedback: The opportunity for Diana to work in partnership with the TDL enabled her to gain a fuller understanding of the electronic knitting process and she also benefited from seeing the entire process from design to the machine knitting of her own design. Being able to discuss each stage of the process and the necessary adaptations and changes with Gordon was also beneficial. She was delighted with her TDL experience.

Insights: As a fashion designer, Diana saw immense benefit in working with the TDL, due to its ability to offer an efficient service for the development of high specification garments in small runs. A great deal of flexibility resulted from the personal contact between designer and technician, which also allowed for experimentation and on-the-spot changes to the design during the product development and sampling process. From the TDL's perspective, this project is a good example of how the design of a product can push the boundaries of the Shima Seiki WholeGarment® machine.

Conclusion: This project, while presenting some technical challenges, was an excellent example of designer/technician collaboration, which produced an efficient and successful end result. The design, based on mathematical sequences, was innovative and pushed the capability of the WholeGarment® machine. Through the use of the lab's electronic knitting technology, the knitting time for each scarf was reduced from around 6 hours per unit using a hand flat knitting machine to just under an hour. Diana intends to continue working with the TDL on other projects. The TDL has also benefited from this project by being able to demonstrate its technical expertise and on-demand production capability for fashion knitwear, a service that is often difficult to locate.