

Case study number: 11/2011

Project Title: 3 Dimensional Knitted Fabric

TDL Partners: HyunJin Yun and Kate Ramsay

Contacts: [hyunjin.yun@gmail.com](mailto:hyunjin.yun@gmail.com) and [kate.anne.ramsay@gmail.com](mailto:kate.anne.ramsay@gmail.com)

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**Partner Profile:** HyunJin Yun, Bachelor of Design (Textiles) and Kate Ramsay Bachelor of Design (Product Design) collaborated on a range of knitted fabrics that incorporate micro light sources into their structures. The combination of electronic lighting components and knitted textiles creates fascinating effects. Kate Ramsay is a New Zealander and already has an honours degree in architecture. She is currently developing her design ideas for commercial applications. HyunJin, a textile designer, is Korean by birth and relocated to New Zealand in 2002. She previously worked in the Chinese/Korean silk trade and now specialises in digital textile prints, silk fabrics and knitted textiles. Together, Kate and HyunJin brought an eclectic range of skills and expertise to this project. Over a seven month period, they designed a range of knitted patterns, had the knitted fabrics produced at the Textile and Design Lab, developed the light sculptures and exhibited their range of illuminated products at the 2011 Art in the Dark' festival in Auckland.

**Project background:** HyunJin and Kate were introduced by textile lecturer Sharon Evans-Mikellis at AUT. Kate was designing a product utilising micro-lights, and was interested in incorporating fabric. HyunJin was working on machine knitted fabric patterns and was interested in the three dimensional knit design the Shima Seiki makes possible. Kate invited HyunJin to join her in developing the illuminated fabric lights, and together they planned how best to make the structures through the AUT design and textile facilities and TDL

Kate and HyunJin then attended the AUT "Get Knitted" symposium in early 2011. One of the guest speakers at the conference was Dr Jenny Underwood from RMIT in Melbourne. Jenny talked about creating three dimensional knitted fabrics on Shima Seiki machines. HyunJin and Kate then approached TDL for assistance in developing three dimensional knit fabrics using the TDL Shima Seiki machine for their sculptural light range.

**Project Description:** To use the Shima Seiki 'Whole Garment' technology and equipment to create three dimensional sculptural shapes of fabrics to be used in creating hanging illuminated sculptures. Considerations include pattern and texture design aesthetics, how the knit design looks in interplay with light, and physical fabric interaction with LED and electroluminescent light hardware (wires, filament and illuminating source). The fabric pattern had also to be producible in large scales (40 centimetres by 3 meters width, and up to 6 meters tall), and 'hang' or operate suspended as sculpted.

**Project Methodology:** HyunJin and Kate took their three dimensional fabric plans to Gordon Fraser at TDL to find out what the technology was capable of producing. Then, over the next twenty weeks, HyunJin and Kate tested, developed and made changes to their knit design plans as Gordon developed, programmed and produced knit fabric to their changing specifications. The plans started as drawings, origami and laser cut paper three dimensional models, small scale 'cut and sew' models, and prototype knit fabric patterns produced on manually operated flatbed knitting machines. The pieces Gordon produced ranged from small experimental knit patterns, to 6 meter long expanses of three dimensionally structured knitted acrylic textile.

Gordon developed and manually entered the knit programming from scratch, as there were no short cuts involving incorporating

existing Shima Seiki pattern programming into the design. Each row had a different width due to the spiral shape of the expanding knit structure. So Gordon programmed one block of rows, and then repeated this, altering it by manually by adding stitches as the design expanded outwards.

After many tests and alterations to the knit design, it became clear which shapes would suit the light range project. After developing some 50 prototype knit structures, HyunJin and Kate moved to testing various colours and types of yarns. Gordon also produced many tests on the Shima Seiki - mostly using 14 gauge fine yarn - in polyester, cotton, merino, wool, acrylic and other blended yarns, sometimes in different colours.

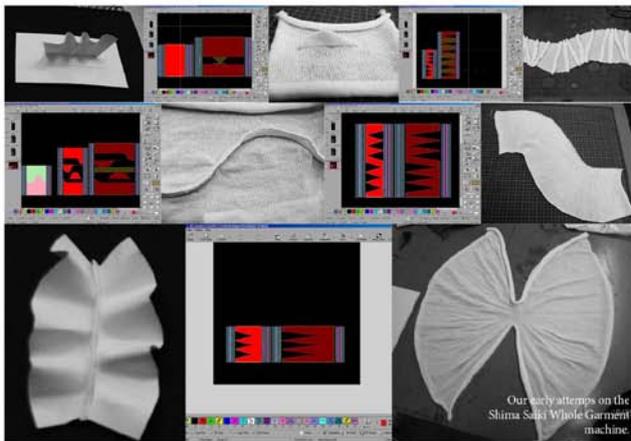
After all the tests HyunJin and Kate designed two shapes of final knit fabric, one five meters and one seven meters tall. They consisted of tubes or 'hoops' of knit fabric about 5cm across when flat, running across the fabric every 4 centimetres and thus overlapping. The tubes helped structure the fabric and provided substance and depth, as well as housing the electroluminescent wire. High tensile wire was also threaded through certain tubes as hanging support.

**Feedback:** From HyunJin: "We (Kate and HyunJin) were completely satisfied with TDL assistance and production throughout the project, especially the advice, experience and work of Gordon and Peter. We negotiated with Gordon's existing work demands and Gordon was able to produce as many tests, samples and final product pieces as we needed. We gained directly from Gordon's experience and teaching as he completed the knitting process - I now have a better understanding of the Shima Seiki capabilities and limitations - and Gordon's advice allowed us to better each stage of the development through to our finished product. Kate and I were very happy with the quality of the Shima Seiki knits, as they filled our practical strength requirements of large scale suspension, as well as amazing us with the quick production of three dimensional containers, or 'tubes', coming off from the main fabrics knit field - perfect for wiring the lights within."

**Insights:** The TDL has worked with a number of students and many companies helping design and produce knitted apparel. However the potential of using knit technology for other product applications, beyond apparel, is enormous and the TDL was very pleased with the opportunity, the process and the result of this project, which pushed beyond the technical limitations of standard Wholegarment programmes. The outcome of this project was exhibited in an environmental art exhibition in a park, which was a highly original location for presenting knitted product TDL director, Dr Frances Joseph commented 'Such projects require considerable research and development time and this sort of extensive prototyping process can be expensive for commercial development. However for our students, this is also an important learning process. The knowledge they gain can be taken out into industry and inform future design and product development.' The students worked closely with TDL technician Gordon Fraser and gained a deeper understanding of the technology and its capabilities and of the methodology of knitted product development.

**Conclusion:** This innovative project developed as a collaboration between a textile design student and a product design student at AUT, leading to the production and display of a highly original lighting system that used knitted textile with micro lights. The project required considerable research and development and pushed the normal garment design process to develop new knitted products.

Images:



As mentioned previously, Hyunjin and I worked closely, often working together on knit samples. From this project however I learnt that when working from different disciplines, working separately at times can be invaluable. This is something we did not perhaps embrace with as much enthusiasm or purpose as we should have. It was successful analysing and talking together about the pieces we had created, but often hindering to work on a sample together. Hyunjin with her knowledge of textiles and knit would often tell me that an idea I had would be unsuccessful, and when she would begin looking at textures, patterns and colour ways (this was a requirement of her design paper as well as obviously her particular area of interest) I would be impatient to concentrate on the form and how we may structure the piece. I went ahead with many of my ideas, often without success but managing to discover more about my own area of interest: how forms designed in 3D modelling programs (such as Rhino) may be taken into Knit programs. Likewise, Hyunjin went ahead with textures and colourways, creating beautiful samples that required such patience, specific knowledge and skill that as a product designer I would not have achieved.

I think we both at times felt frustrated with how our partner worked. At these points on reflection we would have benefited from separated for a week or so with twin briefs. In this way we could have celebrated our different approaches by tackling the same problem individually, then come back together to analyse and reflect upon our outcomes and decide upon the direction to be taken.

One key difficulty for Hyunjin and I in this project was that we were working to different briefs. While I was creating a lighting range, Hyunjin was naturally focussed on satisfying the requirements of her design paper, which had positive and negative effects. On the one hand it assisted us in setting the pace - Hyunjin had to have a certain number of shapes and developments per week. On the other hand she was required to design patterns and colourways at times when the project might have benefited from further work on shape and form. Another key issue was that the project had different weighting for the two of us. For me it is an entire honours year whereas for Hyunjin it was third year design papers, with unrelated papers on the side. It was unclear from the beginning how this would work in terms of grades and division of work load. In hindsight, Hyunjin and I would have discussed these issues earlier in the project.