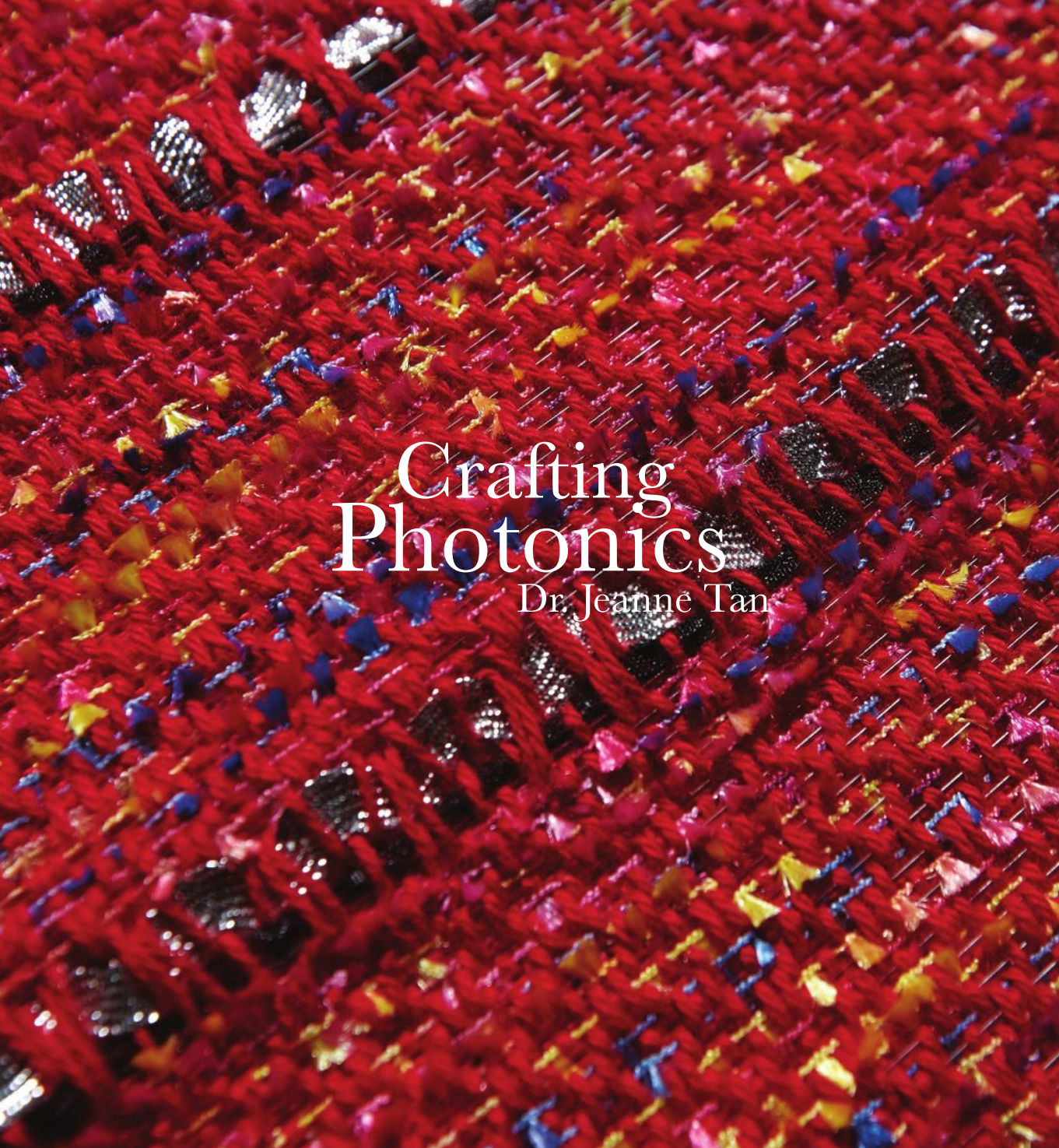


Crafting Photonics

Dr. Jeanne Tan

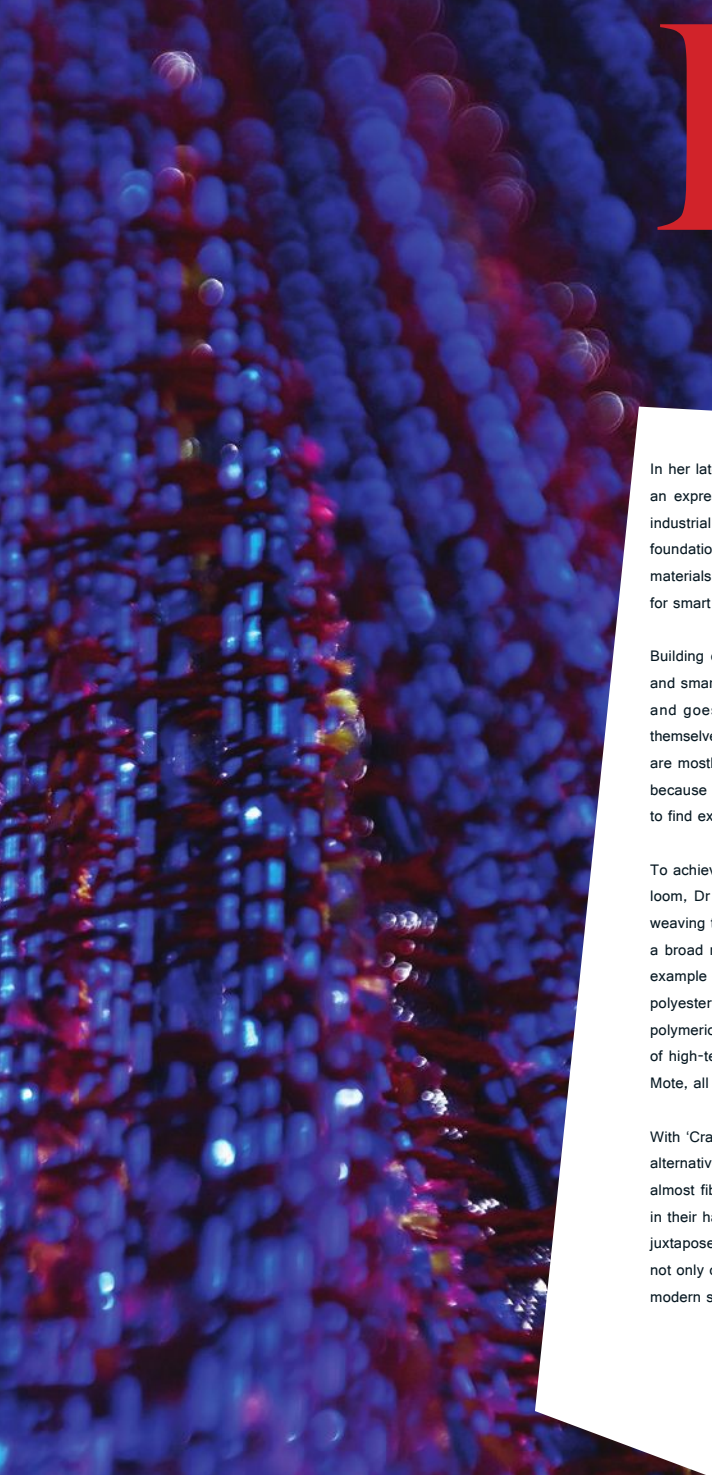
ForeWord

Dr Jeanne Tan's work proposes new ways of understanding and connecting people, usability, sustainability and aesthetics to the world of smart textiles and wearables.

With a constant demand for new innovative explorations and solutions, human aspects are often given less attention in the eagerness to improve products through purely technological solutions. But new technology rarely holds the answers alone. There is a gap between technology and the users thus it is in the human nature to seek meaning and make sense of the objects that we interact with; if we fail to connect and engage we find objects and solutions less attractive and hard to use. In the close relationship between textiles and the human body, smart textiles and wearables represents an interesting area of study and renders this gap very visible. The exhibition "Crafting Photonics" explores the field between technology, materials, craft traditions and aesthetics and shows new paths for how to bridge this gap.

This impressive work consists of a collection of photonic textiles that are able to trigger both the senses and the mind. Through the combination of craft, aesthetic value and technologically advanced materials, Dr Jeanne Tan's innovative textiles become unique; it's a work of exploration and research through design and craft that not only makes it much more likely to believe in the future usability of smart textiles, it goes beyond that; it points at added value both in terms of experience and sustainability. Through "Crafting Photonics", Dr Jeanne Tan covers new ground in the intersection of research through design, craft and technology that adds to her previous work and contributes highly to this field of research.

Irene Alma Lønne, MAA PhD
Forskningschef / Head of Research
Design School Kolding, Denmark



Exhibition Review

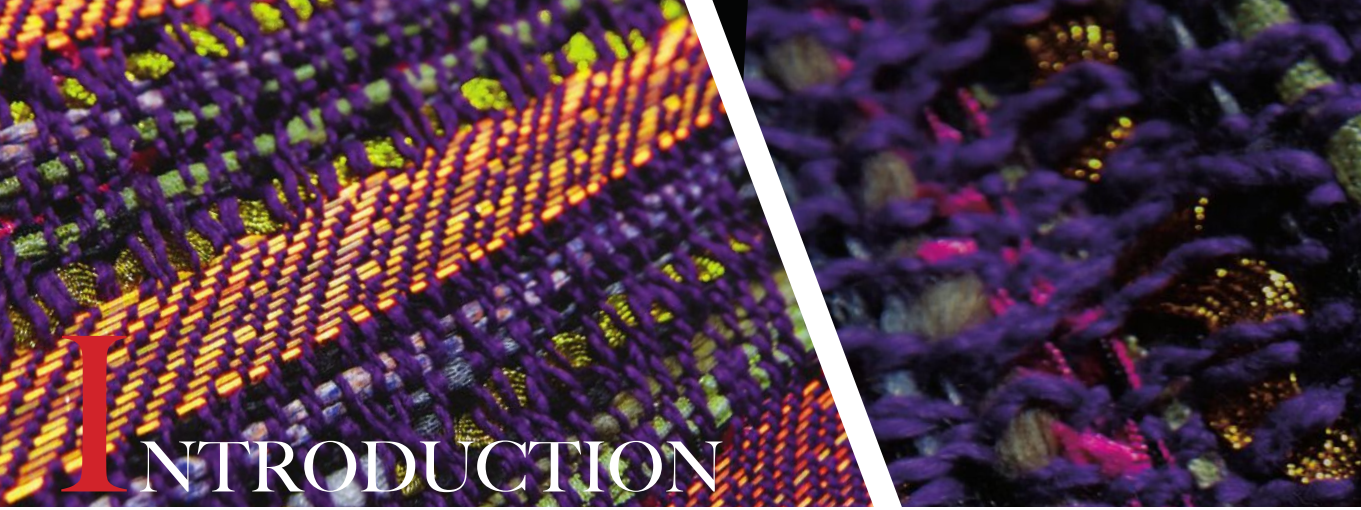
In her latest work 'Crafting Photonics', Dr Jeanne Tan challenges the relationship between functional an expressional qualities in textiles for wearable technology by exploring the relationship between industrial processes and artisanal techniques. By looking into basic structural properties on a very foundational level in the intersection between new technology and traditional textile structures and materials. Dr Tan demonstrates new important aesthetic possibilities in textiles that open up new ways for smart textile applications.

Building on her previous work where she has been exploring aspects of touch, movement sensors and smart phone remote controls through textile material and structures, this work takes a step back and goes even more in depth into the fundamental structural properties in textile structures themselves: both expressional and functional. While existing photonic textiles research and development are mostly limited to explorations of plain weaving structures and flat patterned surface design, also because of the brittle nature of polymeric optical fibres, Dr Tan on the contrary manages in this work to find expressive new ways of developing soft textile structures with 3D effect.

To achieve this, a diverse range of high-quality work, mostly built on experiments with a basic dobby loom, Dr Tan is able to redefine the expressions of hi-tech materials in combination with low tech weaving technique in interesting new ways. With the use of this kind of loom especially, together with a broad range of rustic fibre variables that standard machine looms does not allow for, such as for example coarse wool yarns, slub yarns, high twist yarns with Lurex, organza and tape ribbons, fine polyester yarns with tassels, chenille and other metallic yarns, combined with a rather coarse type of polymeric optical fibre, Dr. Tan clearly proves a cogent way of opening up the mainstream definition of high-tech textile structures. And for this purpose, the works Nexus, Sylvan, Plica, Cusp, Iota and Mote, all woven on the loom are especially significant.

With 'Crafting Photonics' Dr Tan demonstrates and successfully argues for the aesthetic potential in alternative artisanal approaches to crafting with new textile material in combination with old-style, almost fibre-art related materials, which also gives the illuminated material and very potent contrast in their haptic quality. As a result the informative and temporal expressions of computational material juxtaposed with the highly tactile textural expression of the yarns and particular weave structure does not only challenge our preconception of smart textile but both also introduce new social meaning into modern smart textiles.

Professor Clemens Thornquist
Professor in Fashion Design
The Swedish School of Textiles
University of Borås, Sweden



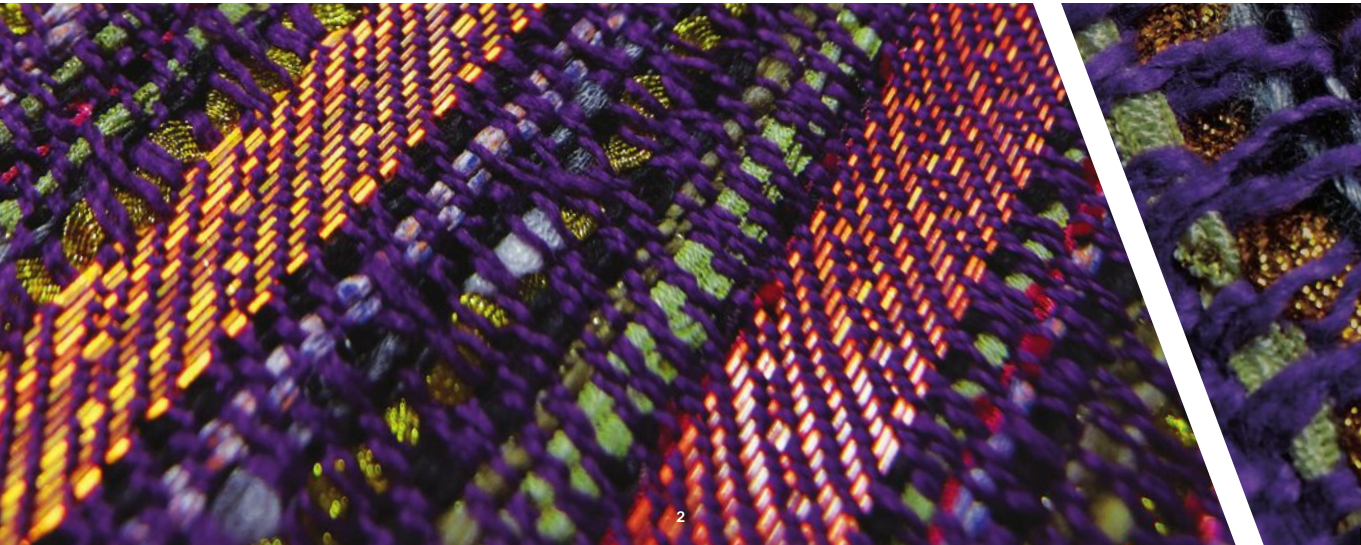
INTRODUCTION

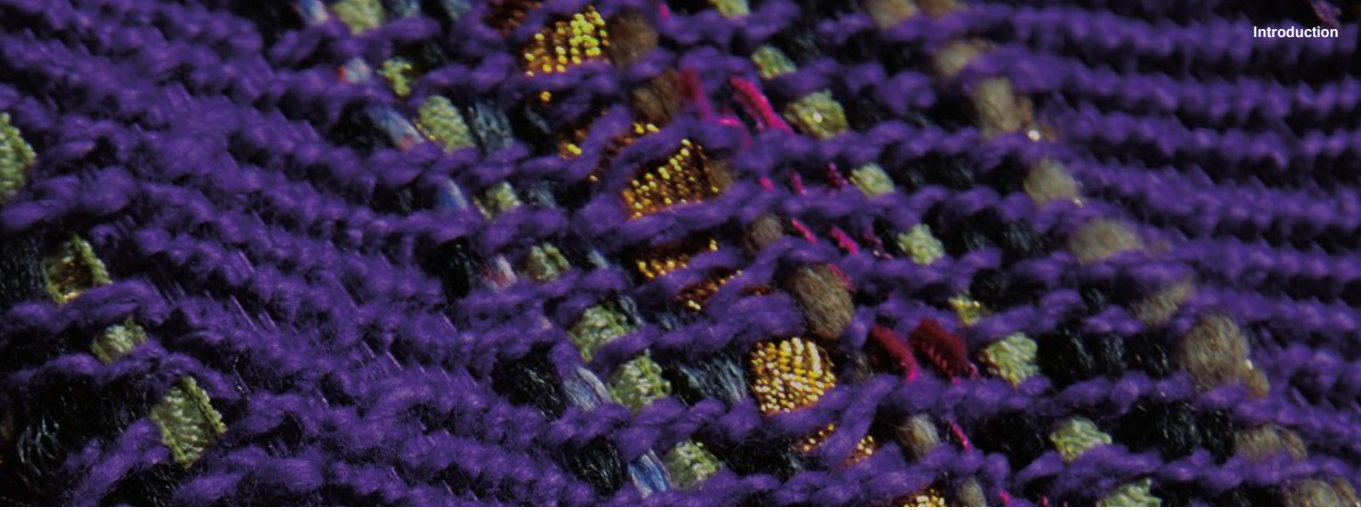
'Crafting Photonics' is a mini collection of textiles comprising of eight textiles entitled: Nexus, Sylvan, Plica, Cusp, Iota, Mote, Chimera and Annex. All textiles were woven via the Dobby loom except the latter two which were woven via Jacquard. This interdisciplinary research is explored via the perspectives of the designer and the researcher.

Existing photonic textiles research and development are limited to an exploration of textiles woven in plain and Jacquard weaves which mainly explores flat, patterned and soft dimensional structures due to the fragile and brittle nature of polymeric optical fibers (POFs). The resultant textiles often offer a sleek and defined appeal.

This body of work is distinct from existing research as it utilizes a synergy of hi-tech and lo-tech approaches to create interactive photonic textiles which possess artisanal and tactile qualities. It challenges the preconception of textiles for wearable technology application as only possessing futuristic inspirations. It is an alternative craft appeal which is yet to be explored in photonic textiles research.

Nexus, Sylvan, Plica, Cusp, Iota and Mote were woven on the Dobby loom. Within the context of this research, the Dobby loom offers creative flexibility as each integrated weft yarn can be of different thicknesses. Machine looms require yarns of similar quality thus creating a more uniformed design; the Dobby loom is capable of crafting bolder structures and obvious textures. The rustic quality of the textiles was achieved using coarse wool yarn on the warp and a mixture of fancy yarns and polymeric optical fibers (POFs) on the weft. The fancy yarns used includes: slub yarns, high twist yarns with Lurex, organza ribbons, metallic Ric Rac, bunchy yarns, grosgrain ribbons, fine



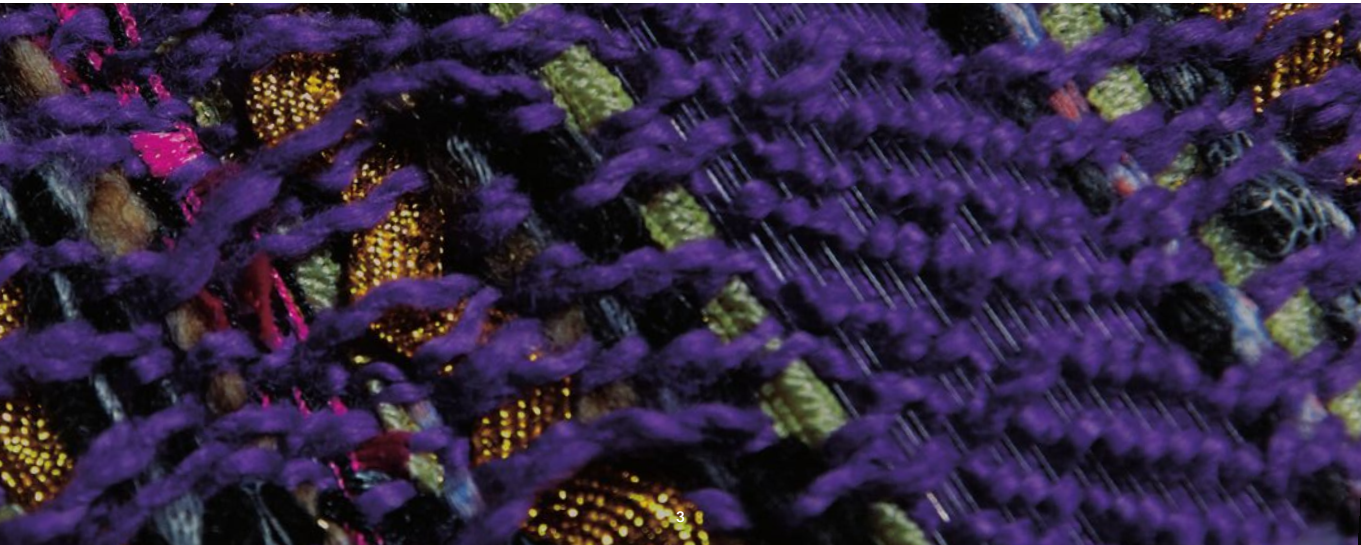


polyester yarns with tassels, tape ribbons, chenille yarns and metallic yarns. Another unique quality of this body of textiles is the use of coarser POFs. The researcher's previous works had been limited to finer POFs.

As the weft yarns are hand fed through the loom, it allows the use of coarse POFs which had not been utilized in the researcher's previous photonic textile developments. Weft yarns are mechanically trimmed on machine looms, thus it is very challenging to trim POFs which are course and brittle. The utilization of coarser POFs allows an exploration of alternative dissemination of colors which are unique from finer POFs.

The naive weave structures explored in Nexus, Sylvan, Plica, Cusp, Iota and Mote are integral to the rustic authenticity of the creative aim. The weave structures of each textile will be further discussed later in this catalogue.

Chimera and Annex are textiles which were woven on the mechanized Jacquard loom. These textiles explore the formation of soft structures by utilizing a combination of the jacquard weave structure and elastic yarns. This technique produces fine and uniformed fabrics which utilizes thinner POFs. Their sophisticated finish is a direct contrast to the rustic quality of the previous six textiles. Chimera and Annex are creative research extended from the previous body of work showcased in the exhibition, 'Dimensional Illumination' (2014). They explore the creation of soft dimensional structures via Jacquard. While the previous works focused on clean curve lines, Chimera and Annex explore more complex intertwining formations.



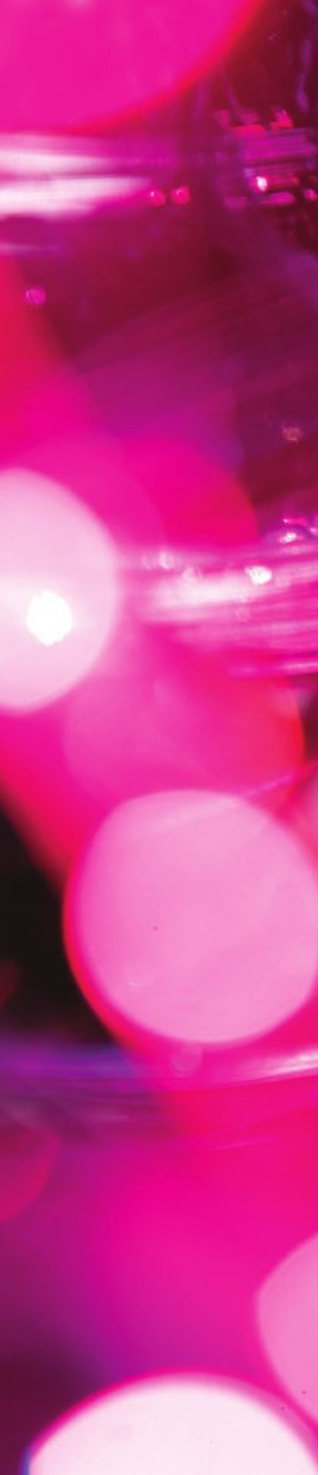
Loom

This body of work was created on 2 looms: the Dobby loom and a computerized loom with a Jacquard head. The textiles woven on the Dobby looms explore textures via the use of fancy yarns and weave structures while the loom with the Jacquard head explore textile dimensions with intricate patterned weave structures and elastic yarns.

The Dobby loom is a simple floor loom which has a device called a dobby which controls the bars to select the shafts which will be moved. This enables the formation of a variety of weave structures. The weft insertion allows insertion of different yarns thus enabling greater creative freedom with the exploration of yarns in various structures,

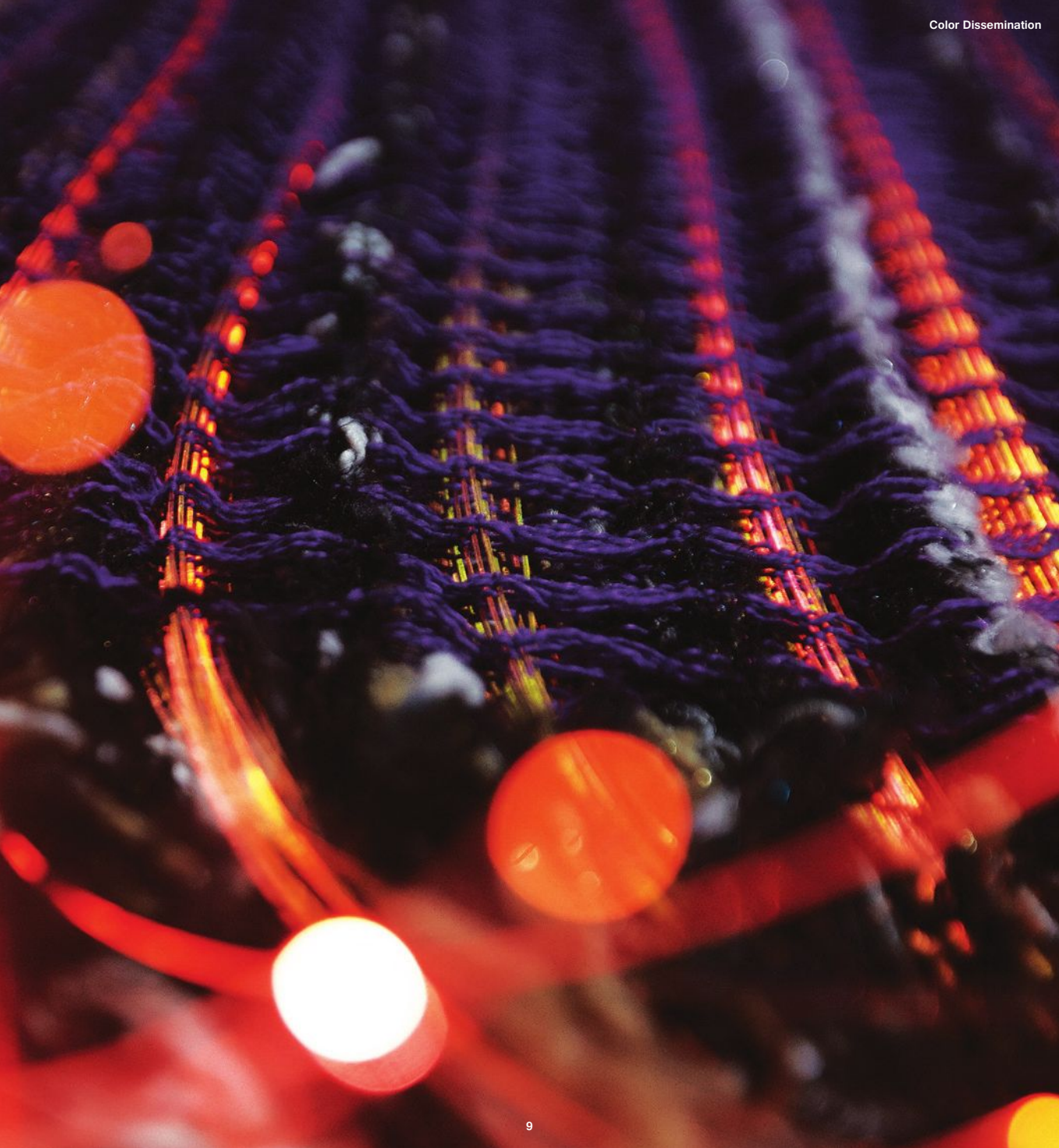
textures and widths. Coarse and stiff POFs which are challenging to integrate via machine weaving can be easily fed through via the weft on the dobby loom and manually cut off without jeopardizing the loom's mechanisms.

In contrast to the Dobby loom, the computerized loom with Jacquard head is a high speed automated loom. The intended designs are programmed into the system to create intricate patterns. This loom utilizes yarns which are of uniform quality thus creating a more refined textile. As the weaving process is mechanized, it was more viable to utilize fine POFs which can be easily cut by the machine.



Color Dissemination

The size differences between coarse and fine POFs affect the contact points between the POFs and the light sources. Coarser POFs provide a larger surface area to be treated by the laser which in turn affects the illumination effects of the textiles. While retaining the same light sources, the color dissemination of coarser POFs tend to be more even and consistent as compared to the mixed colors emitted by the finer POFs. The visual effects created by the color dissemination are exclusive to the POFs physical characteristics.



Intuitive Platforms

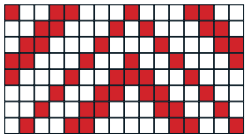
An intuitive platform is critical to the seamless integration of technology into everyday products. The adaptive nature of interactive photonic textiles creates a democratic approach to passive products, enabling users to adapt the products according to their needs and preferences. Previous research which was showcased in earlier exhibitions, Neophotonics (2013) and Dimensional Illumination (2014) had experimented KINETIC, touch, movement sensors and smart phone remote controls. Smart phones are an integral part of contemporary lifestyles. This body of work had continued to refine the application functions and interface for interactive textiles. In order to simplify the process to enhance immediate engagement between users, products and environments.

Explore Weave and Structure

Weaving interactive photonic textiles using such fundamental weaving techniques on a basic dobby loom introduces an alternative old-world perspective at looking at smart textiles. It explores the traditional heritage in the craft of cloth making thus allowing the technology to enhance the textiles rather than be the sole intention of the fabric. The discreet inclusion of technology which is subtle with intuitive interfaces may resonate more with contemporary users thus creating a sustainable product.

Sylvan

Created with a modified twill weave structured called the wavy twill. It is achieved by reversing the direction of the twill at planned intervals along the weft. The wavy twill produces the visual effect of continuous pointed waves. The grid figure represents the weave structure with the red squares representing the warp and the white squares representing the weft.

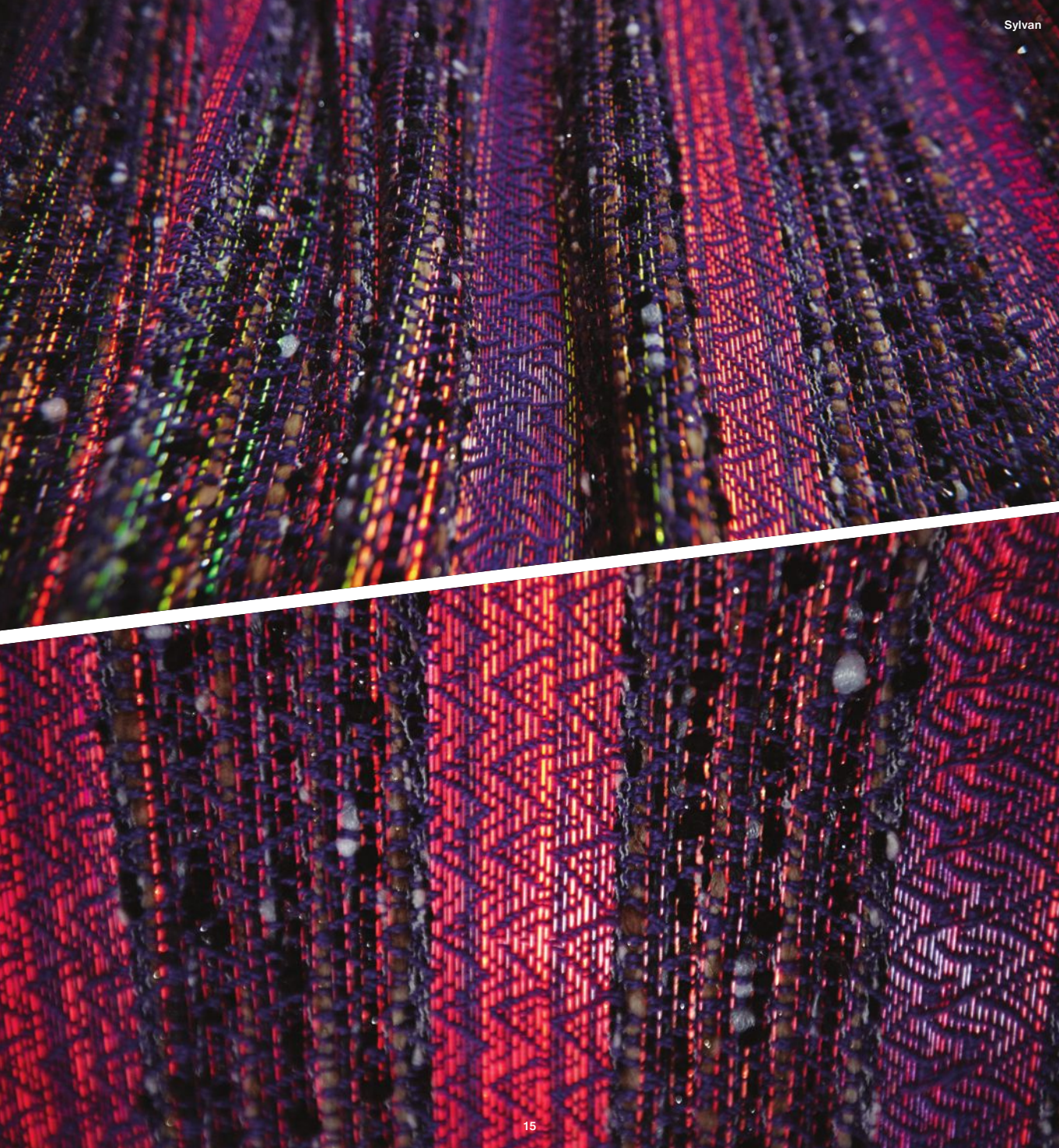


Material: Polymeric optical fibre, cotton yarns and polyester yarns.

Technique: Jacquard weave, laser engraving, LED color mixing.

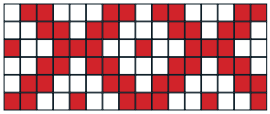
Technology: Smartphone remote control for color changes via Bluetooth technology.

Dimension: 167 cm by 100 cm.

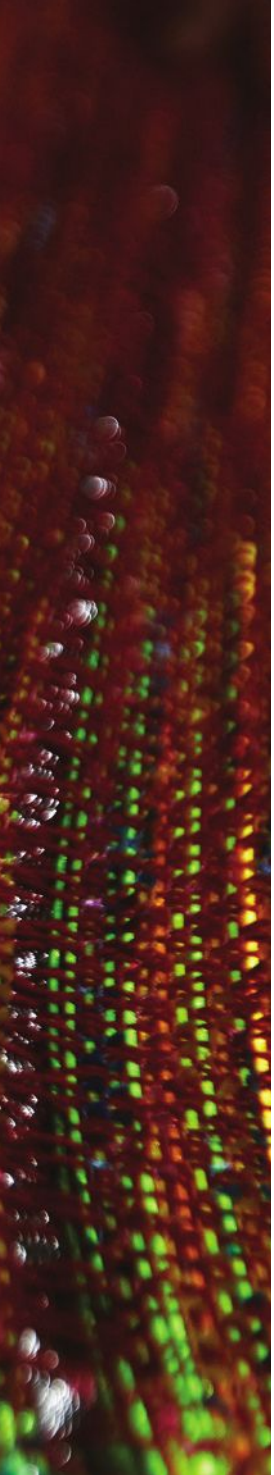


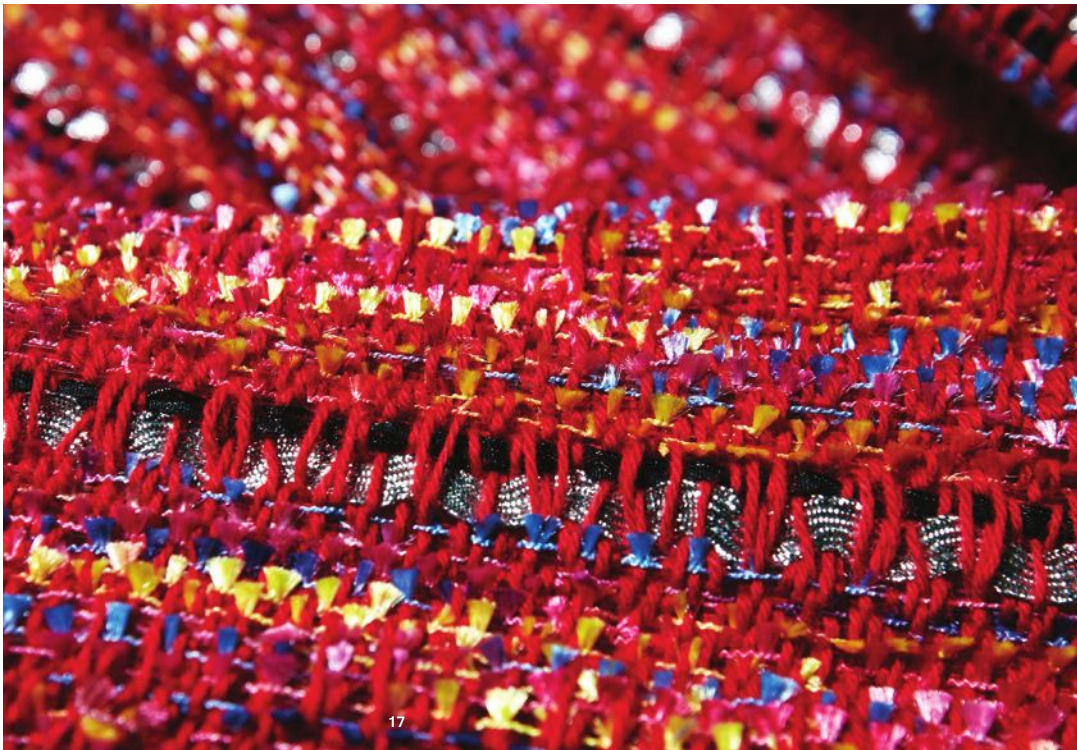
Plica

The diamond twill weave structure of this textile was obtained by breaking the twill line of a traditional twill structure. The traditional twill is divided into sections with every alternative section being placed in reverse. The grid figure represents the weave structure with the red squares representing the warp and the white squares representing the weft.



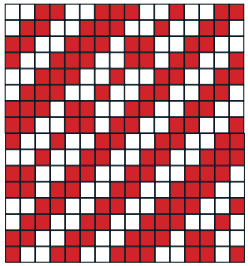
Material: Coarse polymeric optical fibers, wool yarns, wool and synthetic fancy yarns
Technique: Diamond twill weave on Dobby loom, laser engraving and LED color mixing.
Technology: Smartphone remote control via specialized application.
Dimension: 96 cm x 50 cm





Cusp

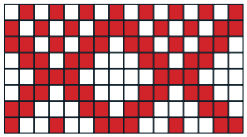
Cusp is woven with a figured twill weave structure on the Dobby loom. It possesses a diagonal ridged effect. The composed twills trace parallel oblique lines of varying intensities; the figured twills have motifs following these lines, giving the weave the appearance of an oblique pebble weave. The grid figure represents the weave structure with the red squares representing the warp and the white squares representing the weft.

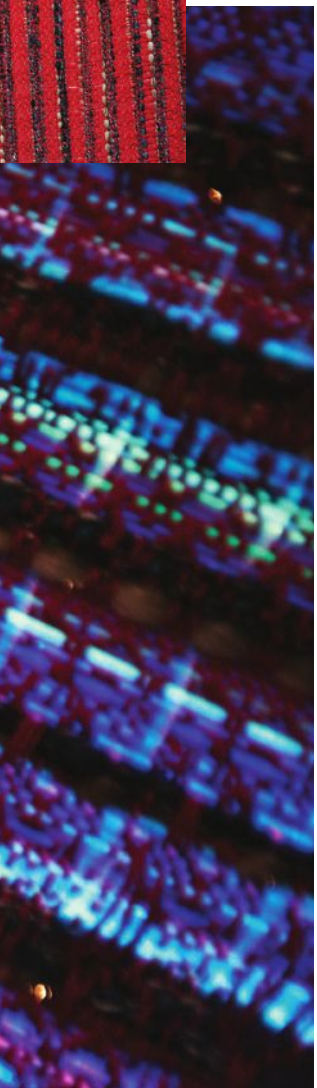


Material: Coarse polymeric optical fibers, wool yarns, wool and synthetic fancy yarns
Technique: Figured twill weave on Dobby loom, laser engraving and LED color mixing.
Technology: Smartphone remote control via specialized application.
Dimension: 98 cm x 50 cm

Mote

The weave structure for Mote is a twill derivative weave. This twill derivative weave is derived from fundamental twill weave and created on the basis diamond twill principle. The grid figure represents the weave structure with the red squares representing the warp and the white squares representing the weft.





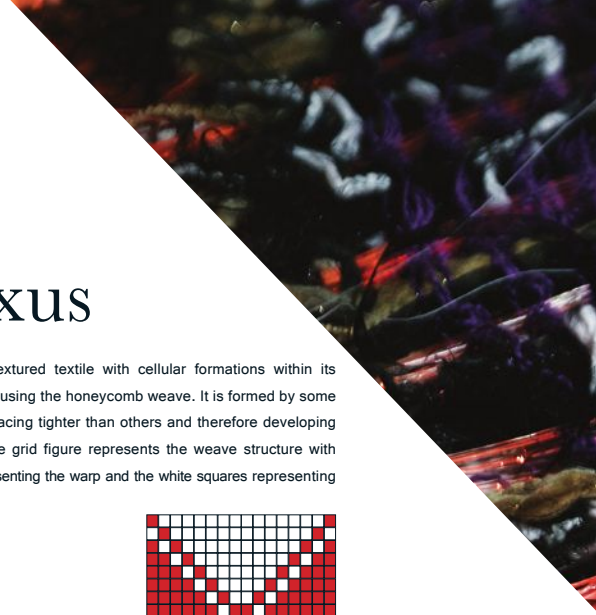
Mote

Material: Coarse polymeric optical fibers, wool yarns, wool and synthetic fancy yarns

Technique: Twill derivative weave on Dobby loom, laser engraving and LED color mixing.

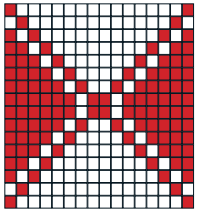
Technology: Smartphone remote control via specialized application.

Dimension: 88 cm x 50 cm



Nexus

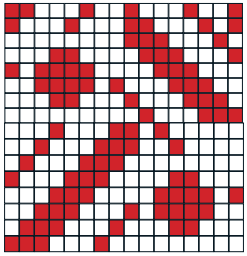
Nexus is a highly textured textile with cellular formations within its structure. It is woven using the honeycomb weave. It is formed by some ends and picks interlacing tighter than others and therefore developing a higher tension. The grid figure represents the weave structure with the red squares representing the warp and the white squares representing the weft.

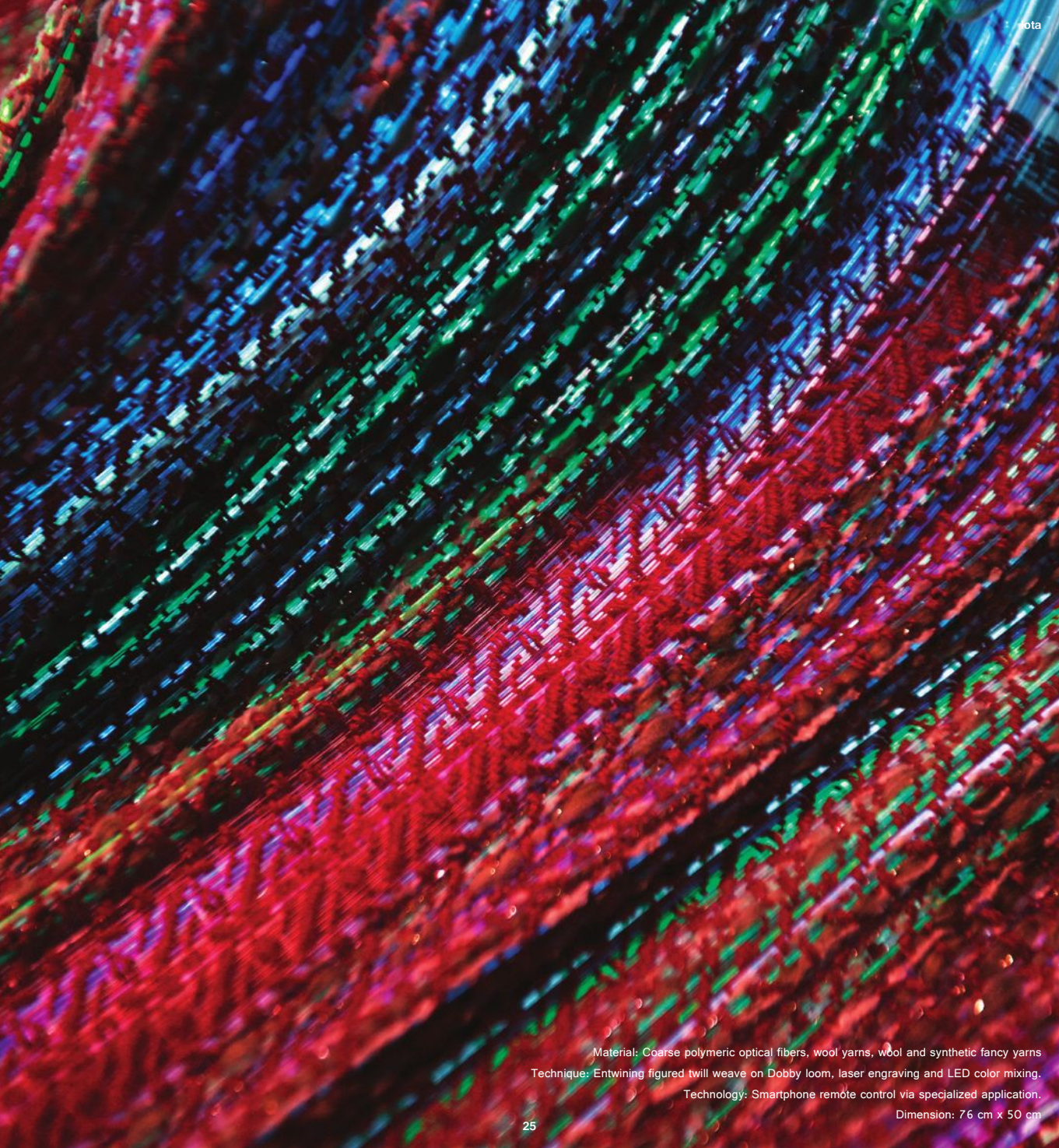


Material: Coarse polymeric optical fibers, wool yarns, wool and synthetic fancy yarns
Technique: Honeycomb weave on Dobby loom, laser engraving and LED color mixing.
Technology: Smartphone remote control via specialized application.
Dimension: 107 cm x 50 cm

Iota

Iota is woven with a fancy entwining twill weave structure on the Dobby loom. This is a variation of the broken twill. It is generally developed from a combination of even sided Z and S twills and gives the fabric a simulated lattice appearance. The grid figure represents the weave structure with the red squares representing the warp and the white squares representing the weft.

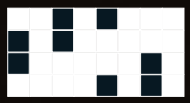


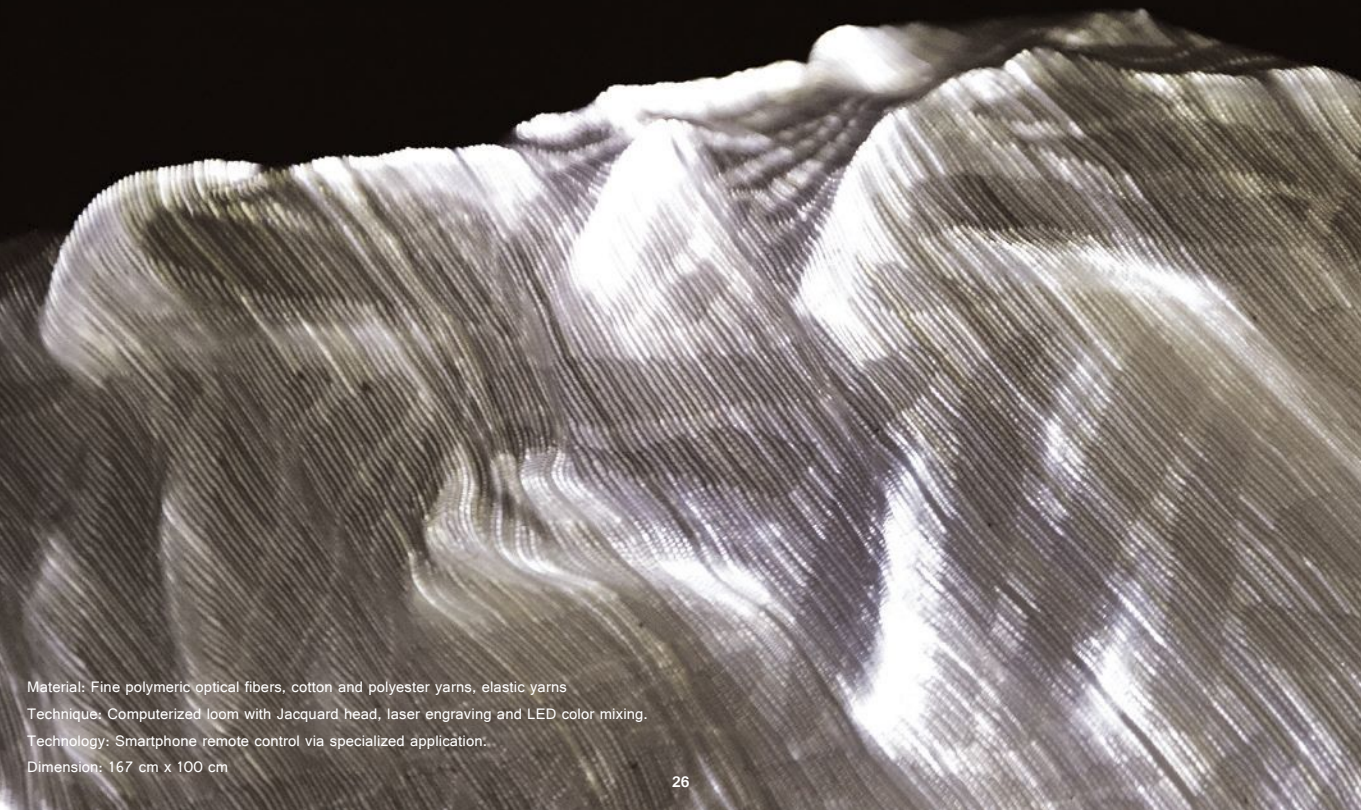


Material: Coarse polymeric optical fibers, wool yarns, wool and synthetic fancy yarns
Technique: Entwining figured twill weave on Dobby loom, laser engraving and LED color mixing.
Technology: Smartphone remote control via specialized application.
Dimension: 76 cm x 50 cm

Annex

Annex was woven with fine POFs, cotton yarns and spandex covered polyester yarns via the weft while the warp yarns are polyester. The ratio of the weft yarns are 1:1:1. The grid figures represent the weave structures of Annex. The black squares represent the warp while the white squares represent the weft. On the light emitting section, we used the 4 shaft satin, warp effect and 4 shafts satin, weft effect as the weave diagrams of cotton yarns and POFs respectively, to constitute the surface of fabrics by intersecting the warp yarns. In the meantime, 9 shaft satin, warp effect was used by spandex covered yarns with polyester on the underside of fabric. On the non-light emitting section, we chose 6 shaft satin, weft effect and Warp-backed weave, weft effect, with 2-weft and 2-warp twill on the underside.

	Ground	Light emitting pattern	Non-light emitting pattern
Weft I Cotton yarn	 Plain Weave	 4 shaft satin, warp effect	 6 shaft satin, weft effect
Weft II POF	 Plain Weave	 4 shaft satin, weft effect	 6 shaft satin, weft effect
Weft III Spandex covered polyester yarns	 Warp-backed weave, weft effect, with 1-weft and 3-warp twill on the underside	 9 shaft satin, warp effect	 Warp-backed weave, weft effect, with 2-weft and 2-warp twill on the underside

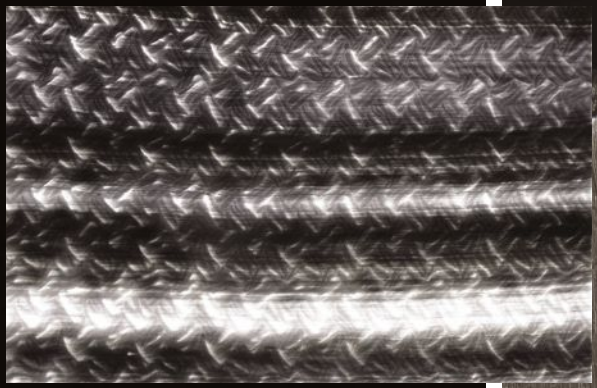


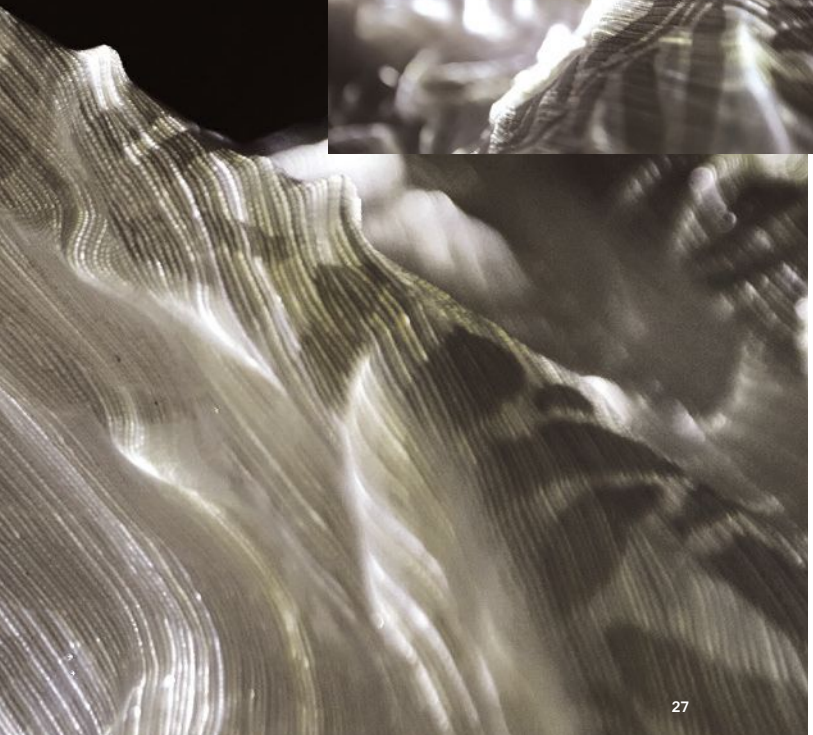
Material: Fine polymeric optical fibers, cotton and polyester yarns, elastic yarns

Technique: Computerized loom with Jacquard head, laser engraving and LED color mixing.

Technology: Smartphone remote control via specialized application.

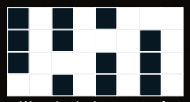
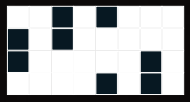
Dimension: 167 cm x 100 cm

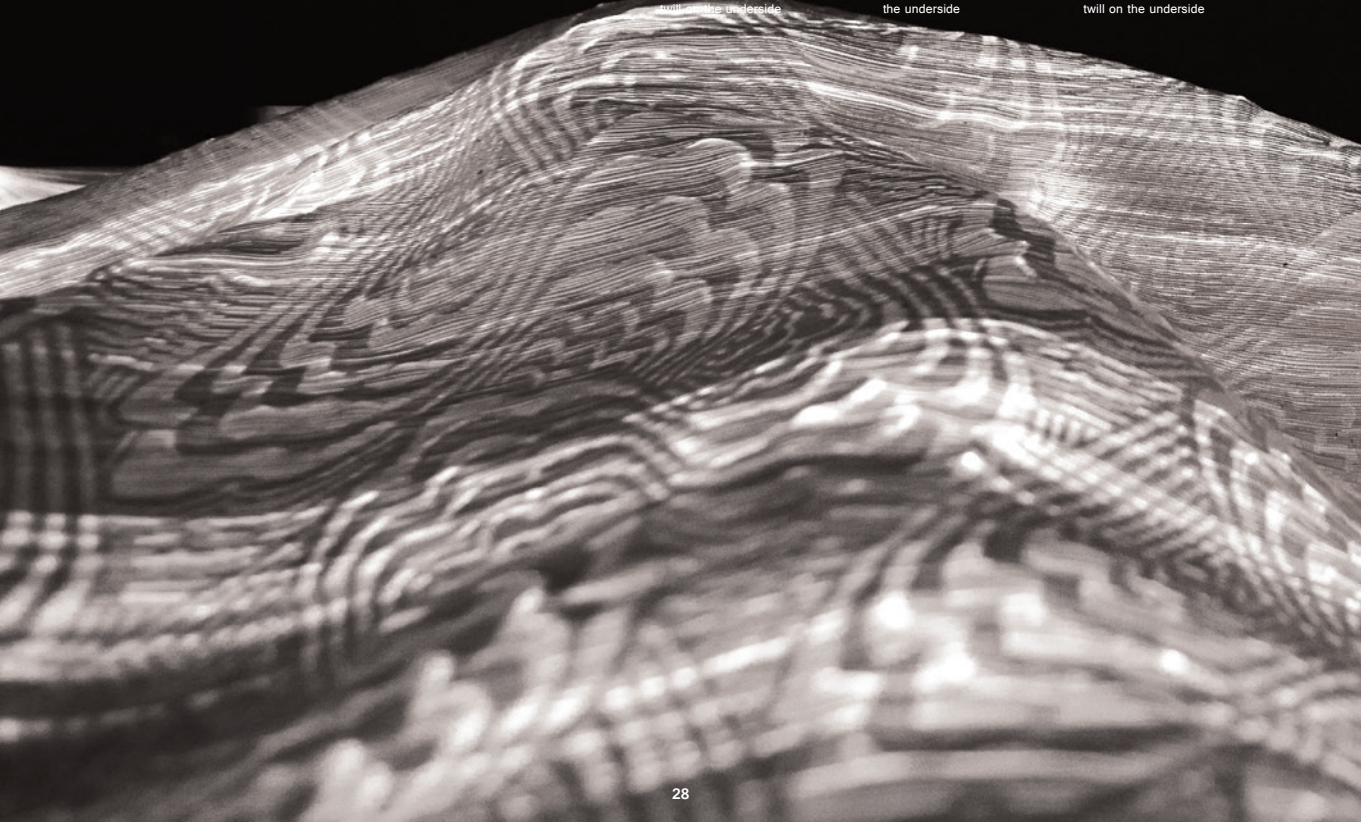


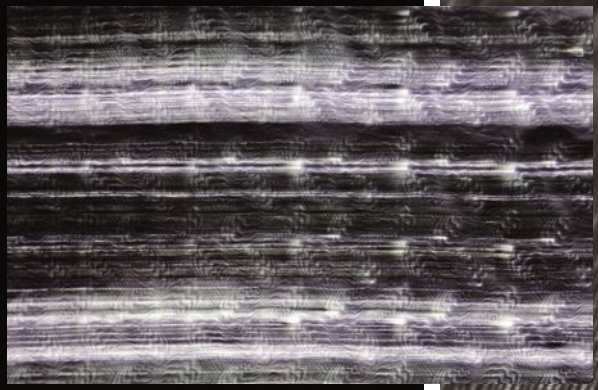


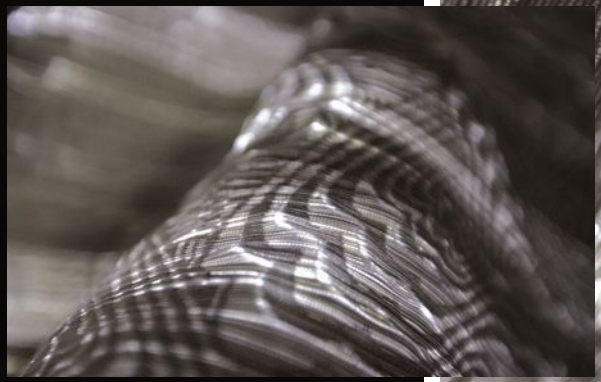
Chimera

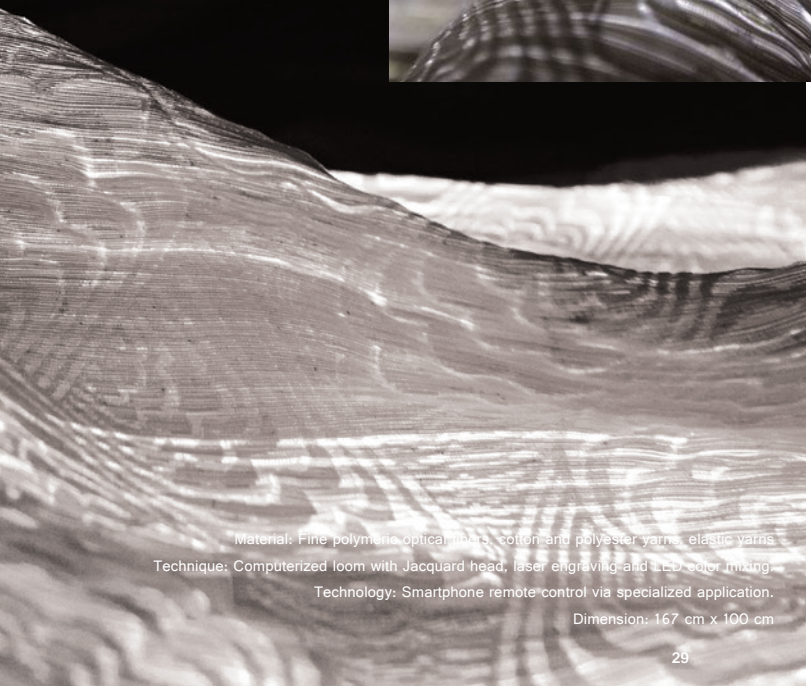
Chimera was woven with fine POFs, cotton yarns and spandex covered polyester yarns via the weft while the warp yarns are polyester. The ratio of the weft yarns are 1:1:1. The grid figures represent the weave structures of Chimera. The black squares represent the warp while the white squares represent the weft. On the light emitting section, we used the 4 shaft satin, warp effect and 4 shafts satin, weft effect as the weave diagrams of cotton yarns and POFs respectively, to constitute the surface of fabrics by intersecting the warp yarns. In the meantime, the warp-backed weave, warp effect, with plain weave was used by spandex covered yarns with polyester on the underside of fabric. On the non-light emitting section, we chose warp-backed weave, weft effect, with 1-weft and 3-warp twill on the underside and 8 shaft satin, weft effect and warp-backed weave, weft effect, with 2-weft and 2-warp twill on the underside.

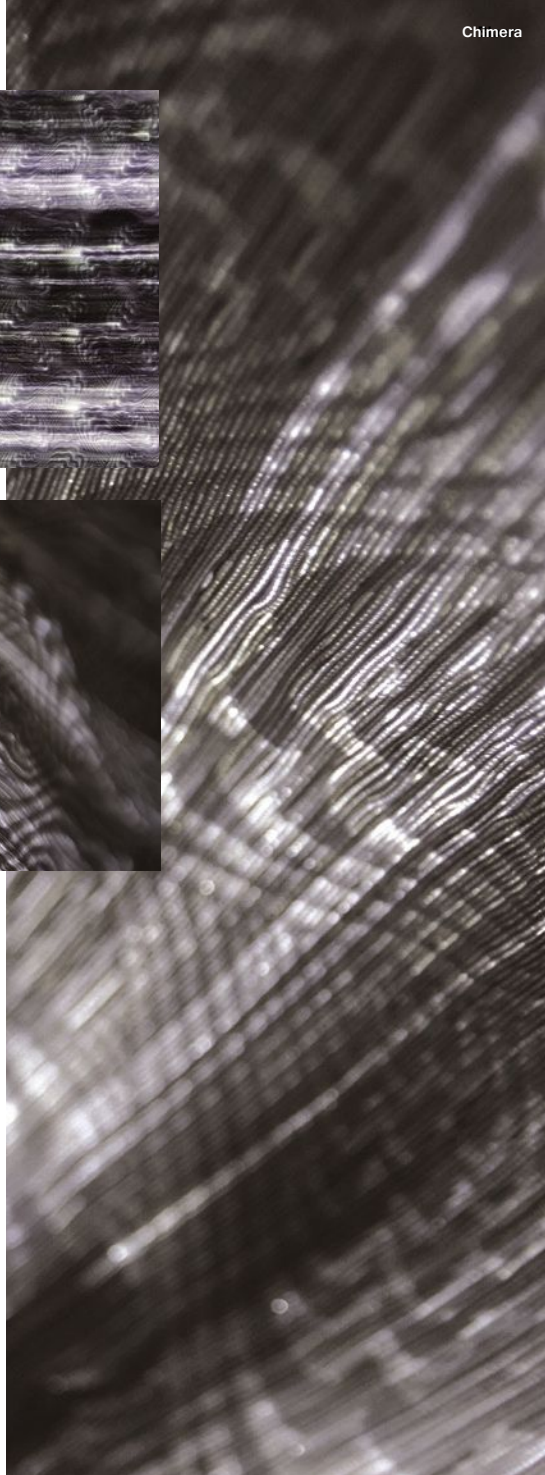
	Ground	Light emitting pattern	Non-light emitting pattern
Weft I Cotton yarn	 Plain Weave	 4 shaft satin, warp effect	 Warp-backed weave, weft effect, with 1-weft and 3-warp twill on the underside
Weft II POF	 Plain Weave	 4 shaft satin, weft effect	 8 shaft satin, weft effect
Weft III Spandex covered polyester yarns	 Warp-backed weave, weft effect, with 1-weft and 3-warp twill on the underside	 Warp-backed weave, warp effect, with plain weave on the underside	 Warp-backed weave, weft effect, with 2-weft and 2-warp twill on the underside











Material: Fine polymeric optical fibers, cotton and polyester yarns, elastic yarns.
Technique: Computerized loom with Jacquard head, laser engraving and LED color mixing.
Technology: Smartphone remote control via specialized application.
Dimension: 167 cm x 100 cm

BIOGRAPHY

Dr Jeanne Tan's research interests are photonic textiles/ fashion, surface embellishments and narrative fashion. Her works often utilize textiles and fashion as a communicative and interactive platform and using traditional aesthetics and techniques as the syntax of the creation's narrative. Dr Tan enjoys dichotomous roles as researcher and practitioner. Her works are experimental and often crosses the disciplines of design and technology.

Dr Jeanne Tan gained her PhD at the influential Glasgow School of Art and had presented her works and research within the format of exhibitions and published articles. Dr Tan had received prestigious awards for her work in research, design and teaching. Her design works have been showcased in museums and collected as part of permanent collections.

RECENT AWARDS & PUBLICATIONS

2015 Excellent Award. Scion at Textile Art of Today Textile Triennial 2015 organized by Slovak Ministry of Culture exhibited at Slovak National Museum, Slovakia. 18 September 2015-23 December 2015.

2015 Excellent Award. New Utopia at "Zhang Qian Bei" Home Textile Contest organized by China Home textile association, China Council for the Promotion of International Trade (CCPIT TEX), Messe Frankfurt (HK) Ltd, Nantong Government, China. September 2015.

2014 Outstanding Award. Luminescent Waves at the 8th 'From Lausanne to Beijing' International Fiber Art Biennale organized by the Fiber Art Institute of China National Academy of Painting. 30th September 2014

2013 Excellent Paper Award. Awarded by the Research Journal of Textile and Apparel on April 2013. Bai, Z.Q., Tan, J., Johnston, C. and Tao, X.M. (2012) Enhancing the functionality of traditional interior textiles by integration of optical fibers. 16(4), 31-38, 2012.

2011 Excellence Award. Linear at the 1st Contemporary Chinese fiber Art Exhibition organized by the China National Arts and Crafts Society exhibited at Jilin College Gallery. September 2011, China.

2011 Outstanding Research Paper Award. Tan, J. (2011) Stitching Stories: Embedding Narratives into Fashion. At the Arts and design: integration of the East and the West. 1st International Conference and Exhibition 2011. Ubon Rachathani University, Thailand. 9-10 February 2011.

Tan, J. (2015) Photonic fabrics for fashion and interiors. In Tao, X.M. (Ed.) Handbook of Smart textiles. (1005-1033) New York: Springer.

Bai, Z.Q., Tan J., Johnston, C. and Tao, X.M., (2015) Connexion: development of interactive soft furnishings with Polymeric Optical Fiber (POF) textiles, International Journal of Clothing Science and Technology, 27 (6)

Tan, J. (2014) Techy Fashion: Photonic Fashion Design Process. Proceedings from Global Fashion Conference, Ghent, Belgium.

Bai, Z. Q. & Tan, J. (2012). Innovative design of polymeric photonic fiber fabric for interior textiles. Research Journal of Textile and Apparel. 17:10-5

ACKNOWLEDGEMENTS

Crafting Photonics
The Hong Kong Museum of Medical Sciences
1-10 December 2015

The production of this exhibition and catalog is result from the support and funding from Institute of Textiles and Clothing, The Hong Kong Polytechnic University.

Dr Jeanne Tan is grateful for the support of Mr Wong Wang Wah and Mr Kevin Hui for their expert assistance with their technological assistance. Dr Tan will like to specially thank Mr Jimmy Chang of Micro Electric Electronics Engineering for his generous help, support and sponsorship of his electronic expertise. Thanks are due to Zhao Cheng Cheng and Wong Wing Chung for their assistance with the preparation of this exhibition and catalog.

ISBN: 978-962-367-793-6
Published in November 2015

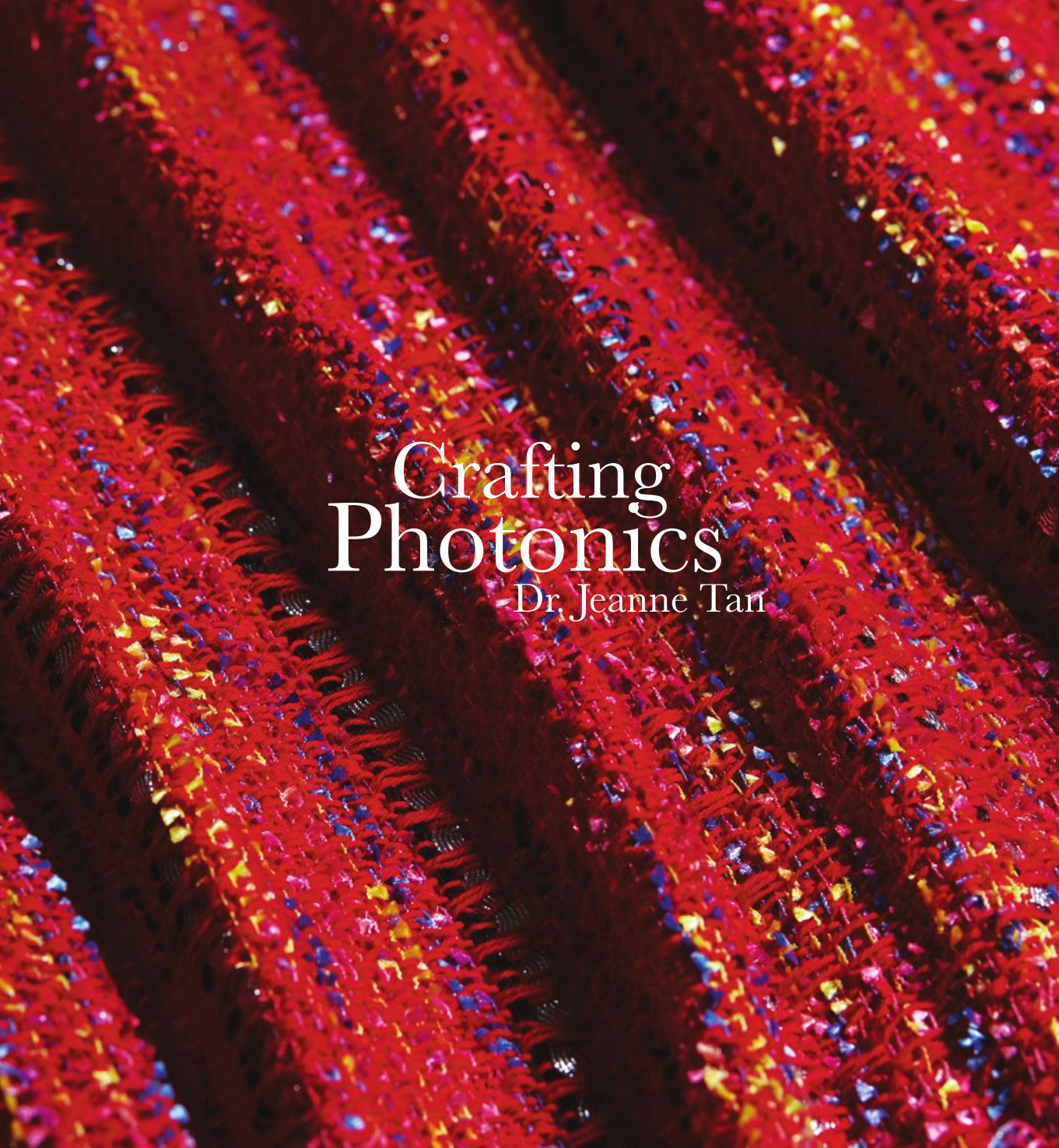
THE HONG KONG POLYTECHNIC UNIVERSITY 香港理工大學 INSTITUTE OF TEXTILES & CLOTHING 紡織及製衣學系 micro

RESEARCH TEAM

Dr Jeanne Tan
Associate Professor, Institute of Textiles and Clothing
The Hong Kong Polytechnic University
Tel: (852) 27664124
Email: jeanne.tan@polyu.edu.hk
www.drjeannetanresearch.com

Wong Wing Chung
PhD Student, Institute of Textiles and Clothing
The Hong Kong Polytechnic University
Email: miuwc.wong@connect.polyu.hk

Zhao Chengcheng
Research Assistant, Institute of Textiles and Clothing
The Hong Kong Polytechnic University
Email: qviolin7@gmail.com



Crafting Photonics

Dr. Jeanne Tan