



## Knitted Light – Space and Emotion

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In architecture, buildings were restricted, for many years, to few materials such as concrete, bricks, wood and stones. Even the concept of the curtain wall transformed the façade into a formal element that gave freedom in the material choice; until recently the aesthetic qualities of surfaces played a secondary role in building design compared to the importance of form and structure of the building (C. Schittich, 2006, p.586).

The recent developments in digital technology that introduced computer based renderings in the design process gave architecture drawing more freedom in surface expression. The depth of the surface is no longer expressed in just two dimensions through colours and patterns but also by three-dimensional exploration of the surface. The honesty in volume and surface expression present in the Modernist Movement has been dramatised in present architecture by the exaggerated scale of textures that appeal to our senses. Therefore, the visual and emotional qualities of the materials in contemporary architecture became as important as their functional qualities.

Rapid development in technology and communication in the recent years pushed architectural design towards rethinking the design process through spaces and materials for a better form of living closer to the human physical and psychological needs for well being. The tendency now, in building design, is to search for innovative materials that besides their aesthetic and functional values could act in dynamic ways offering a higher capacity of decoration, more flexibility, more functions and low weight to the building structure.

The latest developments in the material field changed the classical static perception of surfaces. Surfaces are capable to visual and physical transformation, to integrate specific functions regarding light control or technology, to transport information. Architectural surfaces became in this context "sensitive skins", a new concept inspired from the complexity of the organic life that defines materials that beside their esthetic value hide functional complexity due to their specialized cells (Schoof, 2006, p.25).

*Delia Dumitrescu has graduated from the Architecture Institute in Bucharest in 2005. Since then she continued her education as a master student in textile design at the Swedish School of Textiles. Her Master Degree work had as focus to offer an innovative view on textiles design. The project combines the knowledge of the two fields, architectural and textile design as a possible way to redefine our relationship with the physical environment.*

## Why textiles?

Textiles have been always around us in different forms. Textiles have both functional and aesthetic values for us just as the human skin. We associate them with the feeling of warmth and protection. Our perception of textile surfaces combines both visual and tactile emotions. From the use of textiles to cover the body, the role of textiles extended to exterior environment. Our multi sensory experience with textiles in the privacy of our homes or as body cover made our relationship with textiles very natural.

Alongside with glass, textiles are conventional material for architectural design that mediate our relationship with light. Their role in this context combines textiles' functional potential regarding light transmittance and aesthetic values as façade decoration. Developments made in the quality of glass excluded textiles as part of the building façade both for esthetic reasons such as openness and transparency but also for functional reasons as low resistance to sun light, to fire and low antistatic values. Their limited properties transformed textiles for many years into rather dull and classic material when used in this context.

The latest developments in textile design changed the classical image of textiles and reintroduced them in all fields of design as intelligent soft surfaces capable to integrate specific functions regarding light control or technology to transport information.

## Design vision

Starting from the relation between light, textile and space, the present project proposes a vision of textiles as an interface between interior and exterior as part of building façades. The purpose of the project is to reintroduce textiles as an alternative for the functional and esthetic layers in the glass by being applied to the interior part of the façade; to create a textile interface that through the interaction with light between the indoor and outdoor environment offers architects an advanced textile complement to the conventional materials in building design.

The present project is an investigative work that experiments with the combination of light and textiles in different ways having as objective to not a finished product but different prototype ideas. Through the exploration of different prototypes, the aim of project is to demonstrate the high potential of textile materials as alternatives to the classical surfaces used in architecture. The research focuses on the area of advanced textile materials that by their intrinsic properties or combined in different systems use the interaction between textiles and light in order to reach different functional purposes and space experiences.

The design process follows two general paths: one oriented towards function having as an aim to enhance the functional potential of the material by material choice and production technique; the other towards expression by using the emotional potential of the combination of textiles and light to enhance the user's interaction with the built environment.

The idea is to combine functional and emotional aspects of textiles and light in order to design diaphanous material that will filter the day light on the inside and reflect sun heat during the day and in the night will transform itself in a source of light.

The materials used such as polyester monofilament and metal yarns are on the border between textile and architectural design. The textile technique was used to create the bindings in between them was knitting. Although knitting is more connected to wearable garments the combination of materials as metal and transparent polyester gives knitting another approach.

Since a major thought during the design process was to use to the maximum, the emotional role of textiles in the build environment the inspiration for surface design has skin as major theme. During the design process cellular structures were constructed in different ways using partial knitting in order to give surface volume, an organic appearance but also enhanced tactile properties.

## Result

The result of the project consists of different prototype ideas that illustrate different possibilities to combine textiles with light in order to create an interactive environment. The design process explores different ideas generated by this combination starting from two relationships light prevails the textiles, the textiles prevails the light.

The resulted pieces generate different space experiences based on the relationship between textile and light as two elements that interact with each other in different ways. The first where textile piece prevails the light refers to the relationship between the natural light and the textile surface; here the textile piece acts as a filter for the light controlling its intensity through its structure. The second interaction, light prevails the textiles refers to the relationship between the artificial light and the textile piece; in this case the placement and the intensity of the light controls the perception of the textiles by making certain parts visible and other parts disappear.

Each of the prototypes develops a specific idea based on the effect created by light and its surface. Alongside with the aesthetical values given by the exploration of the relation between textiles and light, the project has a strong technical approach by exploring different possibilities to integrate light into the textile structures and to create three-dimensional surfaces using knitting as a technique.

## Streams of light

Streams of light is a translucent knitted textile that lets the light penetrating its skin through holes in its structure. The shimmering shadow transforms the interior space through its presence on the surfaces. Its three-dimensional shape is orientated after the sun. The metal inside acts as a protective skin that reflects the sun's heat to the outside. The moving panels are capable to adjust and redirect the light on the inside. The play with light and shadow on its surface adds more depth and value to the flat glass façade. The penetrating light together with the shadow left by the panels creates a dynamic pattern during the day on the interior surfaces as the light filtered by trees leaves.

## Interaction

Interaction: The piece could be part of a flexible metal system that adjusts itself after the direction of sun light as response to the user's movement in space. In this case the pattern left by its shadow on the interior surfaces becomes dynamic according to user's position.

Produced in electronic flat knitting machines

Gauge: E12 (12 needles per inch)

Prototype size=60/60

Technique: partial knitting and ridge pattern using plating yarn feeder

Materials: stainless steel  $\varnothing=0.10\text{mm}$ ,

polyester monofilament  $\varnothing=0.10\text{ mm}$

Repeat: width= 60 cm, height= aprox.5

Fig. 2. Close-up showing the cells and the structure of the surface

Photo Jan Berg



## Moon lighter

Moon lighter is a shapeable knitted textile that changes value according to the presence of light. It envelops the space like veil. In day light, its surface is translucent. Its functional value is to reflect the sun due to the metal inside. The glow in the dark yarn inlayed in the knitted structure charges from the UV component of light. In the night, the textile structure becomes invisible leaving the place for glow-in-the dark to gently light up the interior space. The glass façade gains materiality during the night due to light emitting wire. Parts of the pattern are interactive with the people passing by the building due to the electroluminescent wire present in some of the ridges. A sound sensor is connected to the wire. During the night the strips of electroluminescent wire light up parts of the pattern as reaction to the strong sound. The wires of electroluminescent light provide both the participation of the façade to the night atmosphere and also recharge with their light the glow in the dark stripes.



## Interaction

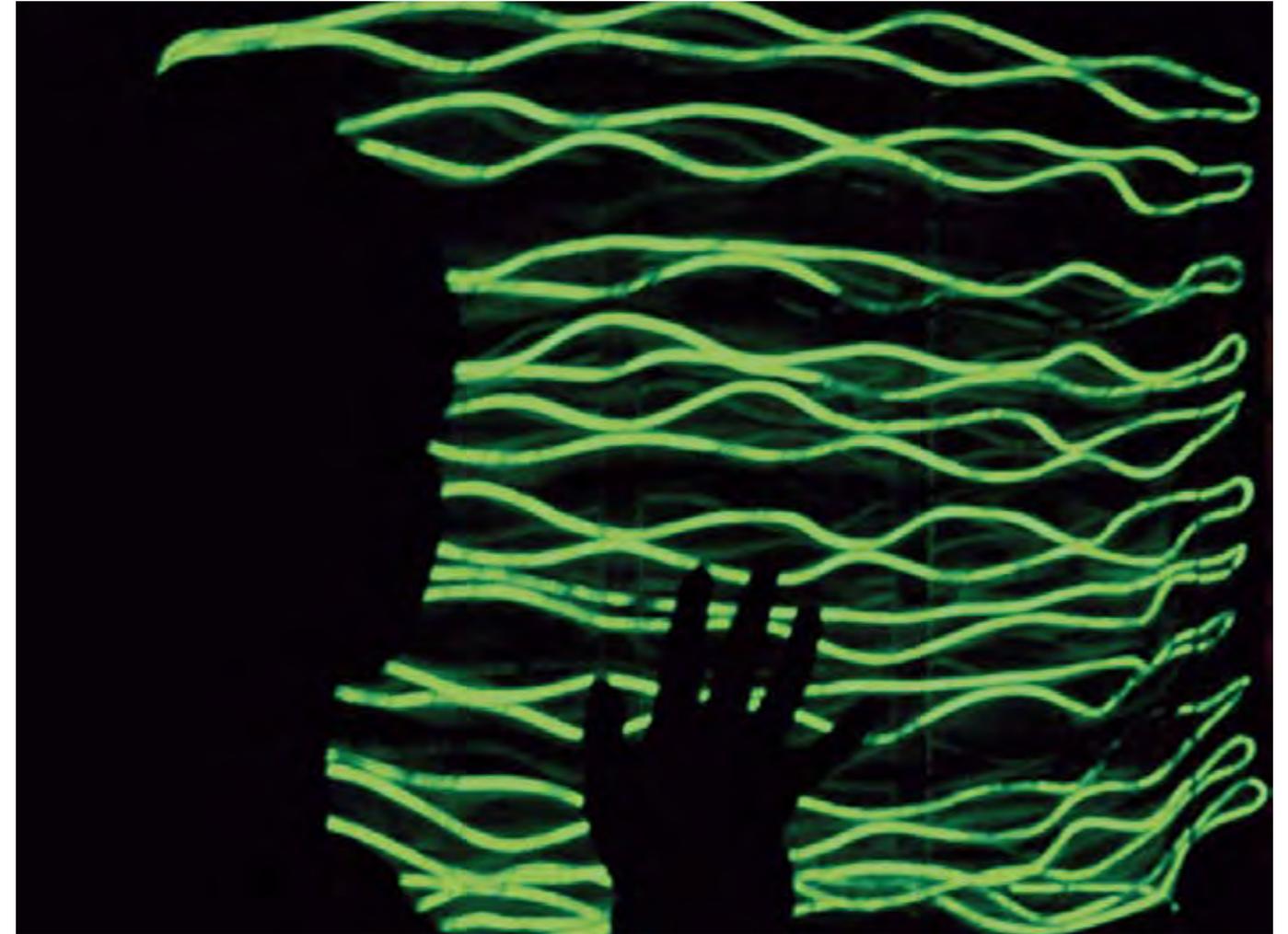
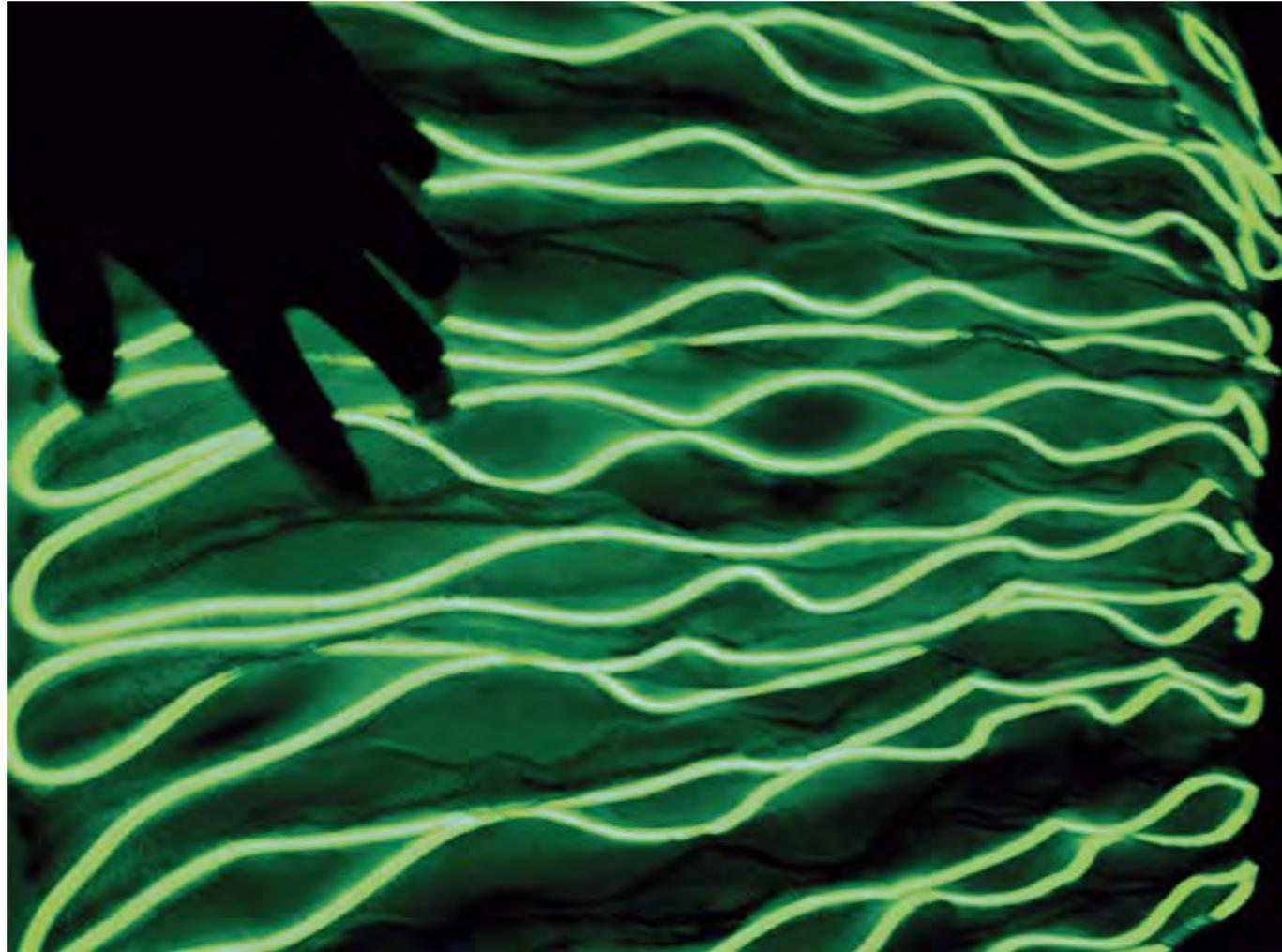
Interaction: Moonlighter is a textile interface that responds to sound by emitting light. Its dynamic pattern appears as a surprising effect in the night at high levels of sound made by the people passing by the building. The ridges of phosphorescent yarns become invisible when the electroluminescent wire is activated by the sound sensor. In the same time they are recharged with energy from the light emitted by the wire.

Produced in electronic flat knitting machines  
Gauge: E12 (12 needles per inch)  
Prototype size=60/60  
Technique: partial knitting and ridge pattern using plating yarn feeder  
Materials: stainless steel  $\varnothing=0.10\text{mm}$ , polyester monofilament  $\varnothing=0.10\text{mm}$ , inlay=electroluminescent wire  $\varnothing=0.9\text{mm}$ , phosphorescent polyester yarn  $\varnothing=10\text{mm}$  (7 hours of glow when charged properly)  
Repeat: width= 60 cm, height= aprox. 7 cm

Fig. 3, 4. Textural shadow effect left by the textile piece under the light

Photo Jan Berg

Fig.5, 6. Pictures showing the user interaction with the textile piece. The material lights up the space at high levels of sounds that activates the electroluminescent wire.



## Drops of light

Drops of light is a knitted piece with that integrates LED as sources of light. The intensity of the emitted light adjusts itself according to the values of the natural light measured by the sensor. The bindings separate the constituting materials metal and monofilament on the two faces. On the right side the presence of metal rejects the heat on the outside and serves as conductive material for the LED's connections. The presence of polyester monofilament separates the conductive ridges and gives the wrong side isolative values regarding heat. The material could be twisted according to the seasons. In the winter time the metal side is positioned on the interior and reflected the heat to the inside. On the summer time the metal side is oriented on the outside reflecting the heat. The light emitted by the LED varies as response to changes in the natural light values. Interaction: The piece responds to the changing levels of light by activating parts of its pattern. The piece is connected to a microcontroller. The light sensor placed on the interior environment measures light intensity of the space and sends the information to the microprocessor that according to the values in the program sends electric input to the LEDs.

Produced in electronic flat knitting machines  
Gauge: E12 (12 needles per inch) Prototype size=53/60cm  
Technique: ridge pattern  
Materials: stainless steel  $\varnothing=0.10\text{mm}$ , polyester monofilament  $\varnothing=0.10\text{ mm}$ , conductive thread stainless steel coated with polyamide, LED  
Repeat: width= 60 cm, height= aprox. 5 cm

Fig. 7, 8. Pictures showing the user interaction with the textile piece. The stripes of LED are controlled by a microcontroller programmed to send them electric input at low levels of the surrounding light. The shadow of the human silhouette activates parts of the pattern.

Photo Jan Berg



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