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## Skorpions

### Kinetic electronic garments

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**Abstract** Skorpions are a set of kinetic electronic garments that integrate the shape-memory alloy Nitinol and custom control electronics to move and change on the body in slow, organic motions. They are not interactive artifacts insofar as their programming does not respond to sensor data but are behavioral kinetic sculptures that exploit characteristics such as control, anticipation, and unpredictability. In order to successfully integrate the electronic components and the SMA in a textile substrate, it was necessary to develop an approach where the visual design and the construction of the garments became an integral component of the engineering design.

**Keywords** Electronic Textiles · Kinetic Garments \_ Nitinol

### 1 Introduction

Skorpions are a set of kinetic electronic garments that move and change on the body in slow, organic motions. They have anthropomorphic qualities and can be imagined as parasites that inhabit the skin of the host. They breathe and pulse, controlled by their own internal programming. They are not “interactive” artifacts insofar as their programming does not respond to simplistic sensor data. They have intentionality; they are programmed to live, to exist, to subsist. They are living behavioral kinetic sculptures that exploit characteristics such as control, anticipation, and unpredictability. They have their own personalities, their own fears and desires.

Skorpions integrate electronic fabrics, the shape-memory alloy Nitinol, mechanical actuators such as magnets, soft electronic circuits, and traditional textile construction techniques such as sculptural folds and drapes of fabric across the body. The cut of the pattern, the seams, and other construction details become an important component of engineering design.

Skorpions reference the history of garments as instruments of pain and desire. They hurt you and distort your body the same way as corsets and foot binding. They emphasize our lack of control over our garments and our digital technologies. Our clothes shift and change in ways that we do not anticipate. Our electronics malfunction and become obsolete.



**Fig 1** The “Enleon” dress

Skorpions shift and modulate personal and social space by imposing physical constraints on the body. They alter behavior, by hiding or revealing hidden layers, inviting others inside the protective shells of fabric, by erecting breathable walls, or tearing themselves open to divulge hidden secrets.

## 2 The Dresses

The design methodology involved various brainstorming techniques that included storytelling, sketching, and other play. Since we wanted the garments to have personalities, each one was modeled on the stereotypical characteristics of one animal, together with an adjective that exhibits transgressive and playful qualities. For example, Enleon was modeled on a chameleon and the excesses of envy whereas Skwrath was influenced by the exoskeleton of a scorpion and the word “wrath”.

In order to successfully integrate the electronic components and the SMA in a textile substrate, it was necessary to develop an approach where the design, the cut, the folds, the seams, the construction of the garments themselves became an important component of the engineering design. Skorpions integrate electronic fabrics, shape-changing materials such as Nitinol, mechanical actuators such as magnets, soft electronic circuits, and traditional textile construction techniques such as quilting, brocade, lining, stitching, and folding of fabric across the body.

### 2.1. Enleon

ENELEON is constructed out of heavy hand-made felt, creamy leather, and reflective lamé lining. It is shaped like a large bilateral symmetric pod that encloses the body from front and back. The materials are perforated with small decorative holes that allow some airflow around the body. Each side features six scattered scales that rise and lower in order to reveal a mirrored lining. The movement is activated by beaded shape memory alloy (SMA) coils, controlled through custom electronics. A sculpted felt mask obscures the face with reflective chain mail, further erasing the host’s identity. The front and the back are identical, so the host assumes an element of radial as well as bilateral symmetry.



Fig 2 The animation of the “Enleon” dress

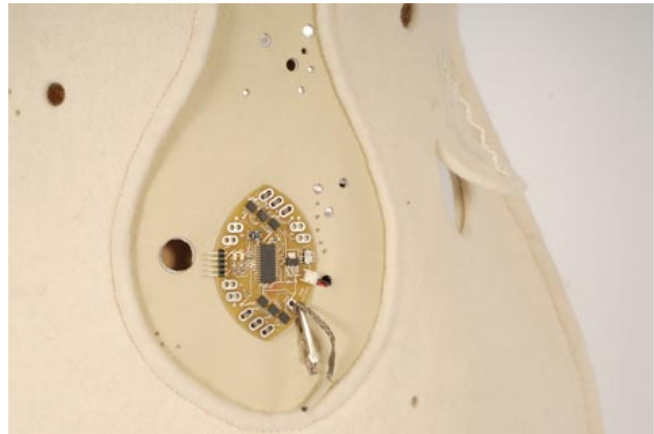


Fig 3 The controller board that runs the “Enleon” dress

### 2.2. Skwrath

SKWRATH is a quilted leather bodice, constructed out of stony leather lined with blood red silk. It integrates a sculptural wing-like collar around the head that can be used to conceal the face of the host and can be torn open to reveal the scarlet lining. The abdomen is made up of three interlocking leather segments or plates, embroidered with threads of shape memory alloy (SMA), which are activated through a custom electronic board to contract and curl back to reveal deep slashes of red silk.



Fig 4 The “Skwrath” dress

### 2.3. Slofa

SLOFA is the bastard child of a snail and an elegant upholstered divan. It is sculpted out of heavy upholstery foam, covered with a rich ivory-colored brocade and lined internally with dusty purple silk. The contours of the pattern swirl around the shell to intersect its form. Its padded shoulder piece provides a resting place for a tired neck. It is a wearable piece of furniture that slows down the host and promotes laziness. SLOFA has a slithery internal petticoat and pearly dongles that move in and out of the shell. Shape memory alloy (SMA) coils allow the dongles to rise and fall, giving the appearance of jeweled tentacles that creep out to experience the world and retreat back when they're satiated or afraid.



**Fig 6** The "Slofa" dress

### 2.4. Luttergill

LUTTERGILL is built out of soft quilted cotton with an elegant, cocoon-like silhouette, stitched to mirror the contours of the female form. Several seams slowly roll open and peel apart to reveal and release slices of iridescent color. The movement of these gill-like details is enabled by filaments of

shape memory alloy (SMA) stitched into the inside of the fissures. The SMA is controlled through our custom electronics board. LUTTERGILL twists and narrows around the waist, morphing into a belt that encircles the body and is fastened in the front with a bespoke leather clasp. LUTTERGILL is accessorized with a beautiful asymmetric skullcap that shields half of the face and curls around to accentuate the exposed eye.



**Fig 7** The "Luttergill" dress



**Fig 8** The animation of the "Luttergill" dress

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