Topographie Digitale

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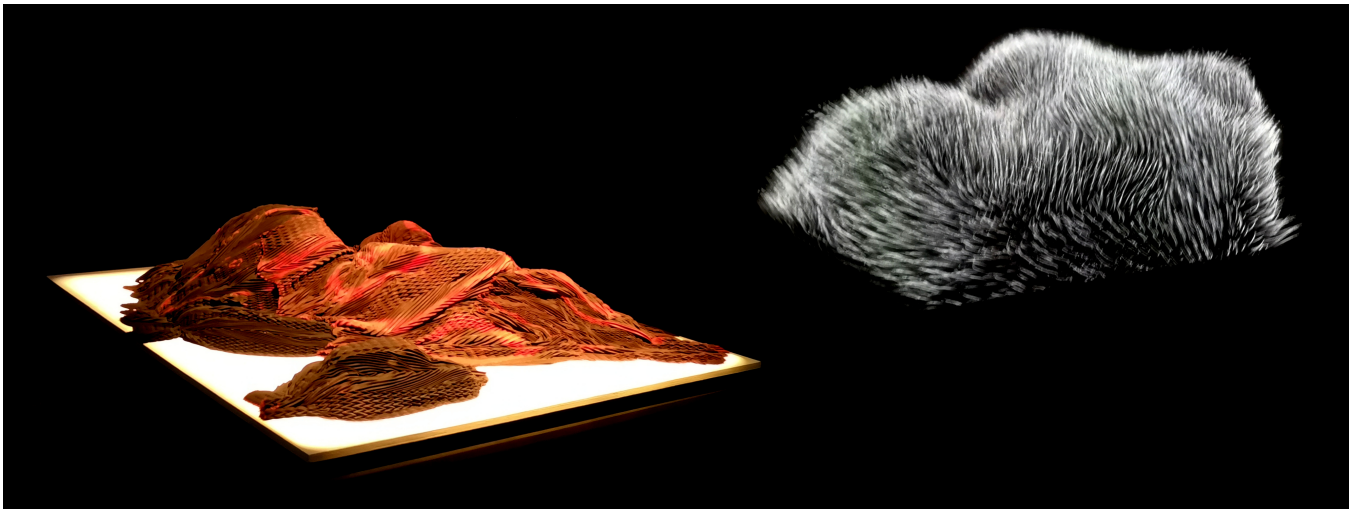

Figure 1: The installation: eTextile Sensing Interface (left) & Touch Visualization (right) - credit: Irene Posch / ARS Electronica.

ABSTRACT

Topographie Digitale is an interactive installation that illustrates a hybridization between science and traditional textile craftsmanship. It uses electrically functionalized and pleated textiles as touch sensitive surfaces for interacting with a video-projected visualization. The pleated fabric, augmented by our custom chemical process, and the electronic sensing system give birth to a material with a mixed heritage that is both technological and traditional, and prefigure an emerging craft.

The combination of craft and technology, which gives a creole technique, is an alternative way of thinking about the place of digitalization in our society in a more resilient way.

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CCS CONCEPTS

• **Applied computing** → **Media arts**.

KEYWORDS

Interactive installation, Material Functionalization, Traditional Crafts, eTextiles, Artistic Visualization, Media Arts; E-textiles; Tangible Interaction; Digital Craftsmanship

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1 INTRODUCTION

Electronic textiles (eTextiles) are not only a medium but a domain to explore. The name of this practice reveals the complexity and the juxtaposition of different fields. The combination and hybridization of craft, science and art, give birth to research projects with a mixed-heritage that is both technological and traditional. It encourages us to rethink the physicality of the digital and its place in our society in a more resilient way.

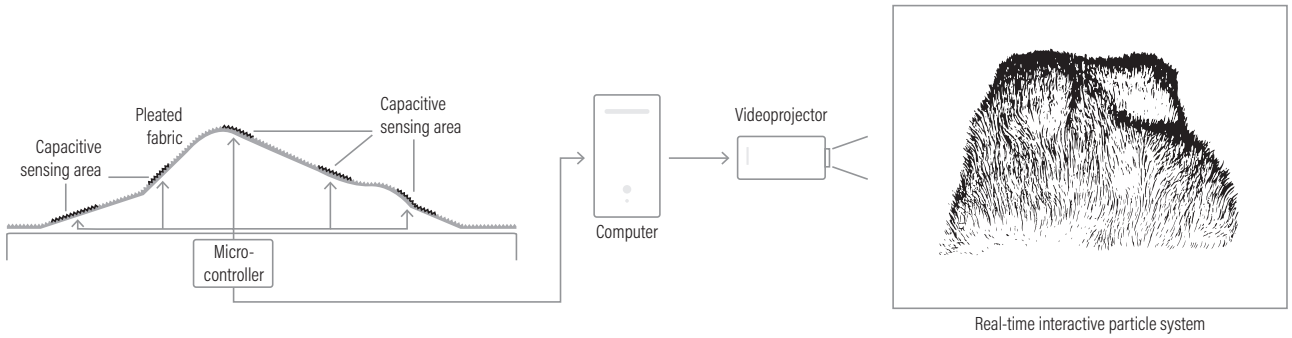

Figure 2: System Summary: sensing structure (left), computing and projection (right)

DataPaulette, the place where *Topographie Digitale* was created, is an eTextile research studio in Paris. Founded in 2014, it has taken the form of an independent laboratory operating as a hackerspace. This place stimulates us to mix our practice with other users' of the hackerspace, accelerating the emergence of this hybrid practice combining technology and craft.

Following this methodology, we have collaborated with the pleating specialist Maison Lognon. With them, we have investigated how to combine a sensing textile with the patterns and textures of the pleated fabric in order to create a new physical affordance. This pleated fabric, electronically functionalized by our chemical process and the electronic sensing system, creates a material which is an illustration of this process, combining craft and technology (see Fig 1).

2 CONTEXT

2.1 Pleated textiles

Pleats in textiles are known to give a large range of motion. This process of pleating requires that textiles are placed between two cardboard moulds in a heat chamber, which transforms fabrics into pleated volumes. Maison Lognon masters this craft and maintains the tradition since 1853 [6, 14]. Pleated fashion had a massive impact in modern societies in 1909, when Mariano Fortuny and his wife introduced the Delphos dress. This pleated dress, inspired by the antique chiton, a tunic worn by women and men in ancient Greece, offered ease to women and encouraged them to abandon the corset [2, 7]. Later, Issey Miyake developed pleated garments inspired by the fluency offered by the Delphos dress. The innovative Pleats Please collections introduce garments that are pleated after being assembled [10]. By using polyester, these garments are easy to fold, to carry, and to wear everyday.

2.2 eTextiles

In 1997, Maggie Orth and Rehmi Post introduced a series of physical computer interfaces and computational devices that are constructed from electronic fabrics and conducting threads [11]. Following this direction, Gilliland et al. presented in 2010 the Textile Interface Swatchbook using conductive embroidery [8]. One of the samples explores the potential of a pleated interface in which the user can stroke the rows of pleats left or right to control a visual or auditory display. The interface can also track the user's finger: to do so, several rows are embroidered between the pleats.

The combination of electronic circuits and in-situ polymerization to give electrical conductivity to the textile enhance the possible interaction with the pleated textile in a very discreet way. Polymerization is increasingly used to functionalize textiles, for example for creating bio-compatible batteries that are worn on the skin [3]. Inspired by this approach, the textiles used in *Topographie Digitale* were polymerized according to the process provided by Honnet et al. [9] mainly for pressure sensing [13]. Audrey Briot also used this process in Stymphalian Birds [5], an interactive installation in which functionalized feathers allow the sonification of touch.

2.3 Installations and visualisations.

In Soft Topologies [12], Kate Scardifield transposed pleated textiles to geography changes over time by inviting participants to reconfigure the arrangement of the sculptural forms in the exhibition space. Adding a technological touch to the idea, the Augmented Reality Sandbox [4] used sculpting with sand to interpret real-time change to a topographic map, by combining hand detection with a depth camera (Kinect) and video-projection on a tangible interface. Founded in 2008, the collective Anti-VJ inspired an entire generation of visual artists with a broad variety of immersive installations. For example, 3Destruct [1] gave materiality to a virtual space in which the visitors lose their bearings by combining thin layers of textiles with video-projection.

From traditional craft to immersive installation, *Topographie Digitale* builds on a variety of creations, but the work of the aforementioned scientists and artists constitutes the core.

3 IMPLEMENTATION & INSTALLATION

Polyester fabrics have been dyed using a chemical process which gives electrical conductivity to materials. These textiles integrated with conductive pads have been pleated and connected to a microcontroller. The data collected are transmitted to Unity using Uduino, and the interactions with the textile surface modify the virtual clone which is video-projected (see Fig. 2).

Figure 3: The chemical products used to functionalize our textile, Pyrrole and Iron Chloride (left). After functionalization, the textile is conductive, except where it was tied (right).

3.1 Textile

3.1.1 Functionalization. A 20 meter length of burgundy polyester fabric was carefully tie-dyed using our polymerization technique [9]. During the dyeing process the prior manipulation will give shape to contour lines. The textiles are immersed in water in which pyrrole and iron (III) chloride are added. This process gives electrical properties to the textile except where the fabric has been tied: some areas will become conductive and will be insulated from one another by the undyed textile (see Fig. 3).

3.1.2 Pleating. The dyed and treated textiles have been pleated by the historical pleating house Maison Lognon. The selected pattern, mimicking a peacock's tail, offers a great number of possibilities of manipulation: it can be squeezed and unfolded at any point on its surface. The polymerised textiles are then compressed between two cardboard molds (see Fig. 4 and 5-bottom) and placed in a heat chamber.

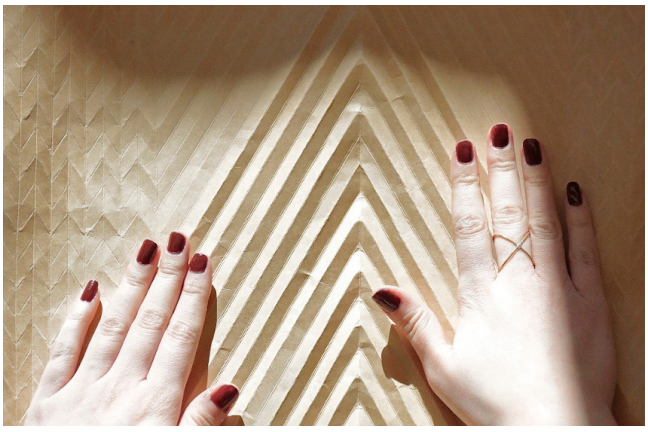

Figure 4: This cardboard mold is used to create the Peacock Pattern (credit: Anne Combaz, *Ateliers Lognon*).

3.2 Electronic

The textile combines specific conductive areas and a passively haptic texture effect. It is pinned on a polystyrene surface, creating eTextile capacitive sensors which emerge from the surface of the artwork. To animate the "algorithmic clone" of the textile, an Arduino detects capacitive touch events using an MPR121 sensor board. This touch information is then sent to a Unity application, in which the projected animation is controlled.

3.3 Visualization

The Unity app listens to the Arduino and attributes each measurement to a zone of the animation. A configuration file allows calibrating the sensitivity of each zone to their mechanical and electrical characteristics. The animation is composed of a swarm of particles, mapped over the virtual 3D surface, which is a digital representation of the fabric landscape. The particles fly away when their zone is activated by a sensor, and come back when another zone is touched, or after some inactivity. When two zones are touched in sequence, all particles between the two are "disturbed" and create a dynamic movement on the video-projected surface. This virtual twin diffuses through several layers of dark veils that give it an impression of depth (see Fig. 5-top).

4 CONCLUSION

Topographie Digitale stands between the tangible and the virtual worlds. This artwork, taking part in electronic textiles research, incarnates the meeting point of high tech and low tech, without any depreciation of the one against the other. It is the result of a creole creation process that explored possible connections between digital and textile craftsmanship. *Topographie Digitale* is a metaphor of these moving territories of creation that are constantly changing, as much as nature and human life, modifying our environment and landscape to unpredictable rhythms.

Figure 5: A close up on the shader visualization (top). A close up on the functionalized pleated fabric (bottom).

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