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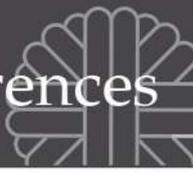
Audrey Gouy

Smart Textiles from Antiquity to Modern Times

28 to 30 April 2022, University of Lille, France, and online

This international conference organised by Audrey Gouy (University of Lille) and Yann Lorin (INRAP – Institut National de Recherches Archéologiques Préventives) aimed at investigating smart textiles through time, from Antiquity to our contemporary world. Textiles are smart materials, constantly responding to, adapting to, and interacting with their environment. They constantly communicate, they are optimised, they have active functions, they ease, assist, monitor, regulate, protect, reinforce, and raise capabilities. In this regard, the conference focused on how, why and to which extent clothes and textiles have been used and are still used as an extension, development and augmentation of human identity, intelligence, and physical capacities. We also questioned how textiles impact and what they require in terms of production, consumption and use. Based on the latest discoveries and research, this international conference was thought as an exploratory dialogue, with insights and stimulation between research on ancient textiles production and use, and research on modern textile performance and clothes' properties, resistance, and consumption. Held at the University of Lille, the event also built on
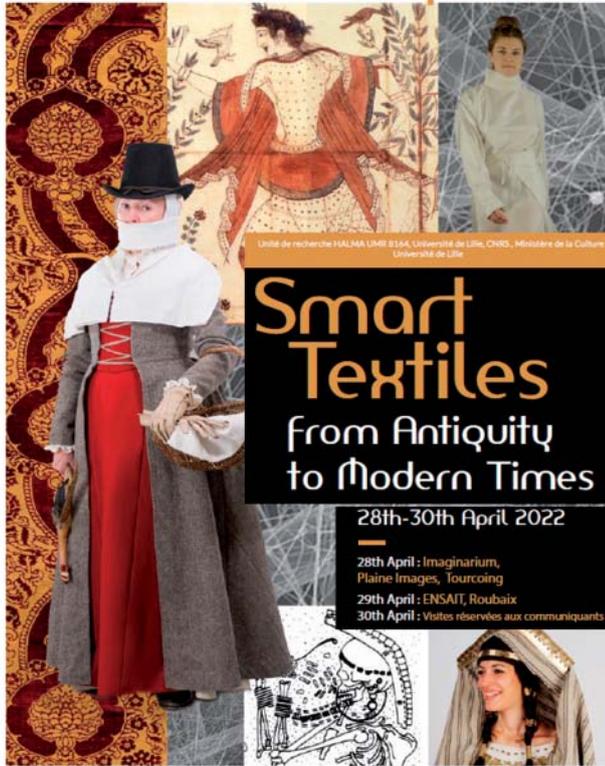
Fig. 2: The Smart Textiles conference announcement

the exceptional history of textile production, ground-breaking research, and innovations that have been at the heart of the French region Hauts-de-France for centuries. Three main topics were taken as crossover points: Personalised Textiles (What do clothes communicate? How and why?), Intelligent Textiles (What are textiles and clothes optimised for, and how? Do clothes have memory? Can we use them to retrace someone's behaviour, movement, and health, for example? How do clothes and textiles regulate, ease, assist?), and Digital Textiles (Which digital tools can be used for textile research and conception? How and to which extent do they enhance research, our understanding, the processes, and the intelligence of textiles and clothes?).

The first day of the conference, 28 April, took place at the Research Federation for Visual Sciences & Cultures (FR-SCV) in Tourcoing, which is a new hub associating researchers specialised in the historical study of visual and material cultures, the understanding of the psychological and neuroscientific processes of visual perception and cognition, and the production of innovative digital tools for the processing and visualisation of complex

multimodal data and their cultural mediation. The morning was dedicated to introducing the event. It started with the welcome of Yann Coello, director of the FR-SCV and Sandrine Huber, director of the lab HALMA UMR 8164, followed by a speech by Marie-Louise Nosch (University of Copenhagen) on smart textiles, and the introduction of the organisers, Audrey Gouy and Yann Lorin. The organisers replaced the topic in the textile history and perspective of the region Hauts-de-France, with an archaeological approach. The contribution of the French researcher Hubert Masurel, who started first in the textile industry and quickly decided to unravel the ancient textile production from the north of France, was recalled. Specific ancient production sites, such as Apremont (Vendée) and Amiens-Recancourt, were presented. Few textile tools are known but they allow to propose a *chaîne opératoire*, and pseudomorphs from protohistoric times attest the use of specific weaving techniques such as tabby. Three specific types of loom weights were in use in three different areas of the north of France: cylindrical (north-west), triangular (north and central), and pyramidal (north-east) shapes, until the pyramidal shapes were used above all others. The discovery of loom weight assemblages in several sites indicates the extraordinary presence of complete looms (site of La Montignette), which is interesting in order to understand the precise function of such looms and loom weights. A craft and domestic production were maintained for centuries, from the Neolithic until the emergence of a textile industry later on, especially in Picardie.

Two inaugural papers aimed at giving an overview of smart textiles, first from an ancient point of view and secondly from a contemporary angle. The paper by Susanna Harris (University of Glasgow) highlighted the different strategies at stake to enhance textiles for the human experience during Antiquity. She shed light on crucial periods of technological innovation based on plant knowledge, such as the appearance and the use of strings around 200,000 BCE, followed by the use of structures of twisted strings to be worn around 20,000 BCE, and then cultivation and animal husbandry around 8000 to 4000 BCE. It is the intersection of two or more distinct technologies, as well as human interactions and possible travels and trade that led to profound innovations and changes. Sensory and phenomenology approaches in textile research contribute in highlighting textiles as active components, as they "sense and respond to stimuli through an external sense feedback system". Finally, three case studies (linothorax and textile armours,
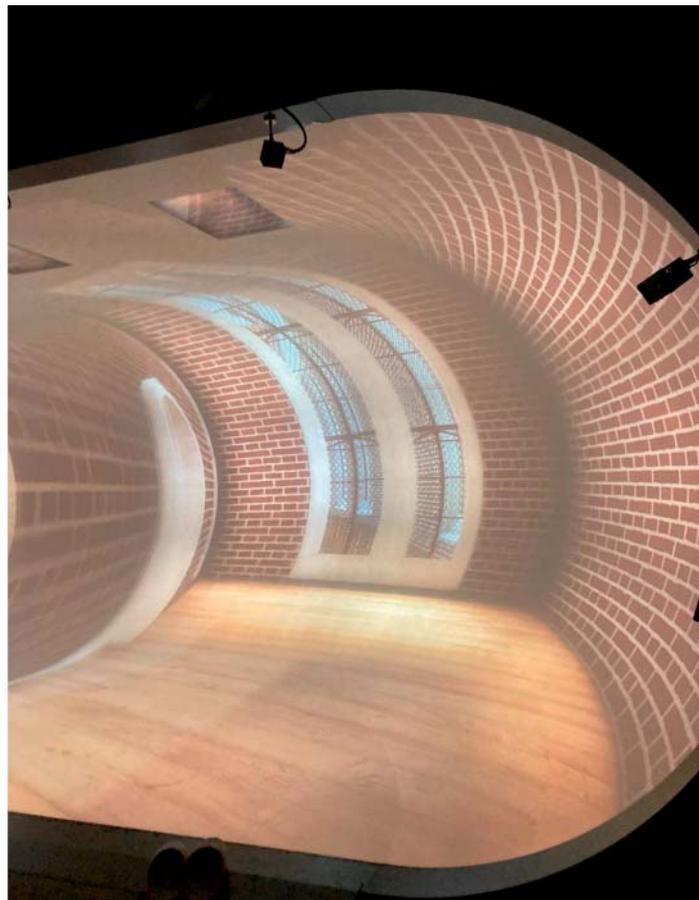
Fig. 3: Smart Textiles Conference: Upper left: presentation by Audrey Gouy on Digital Textiles for Ancient Dance on 28 April at the FR-SCV (© Audrey Gouy. Photograph taken by Susanna Harris). Bottom left: 3D reconstruction of the Field of Gold Cloth. Paper of Isabelle Paresys and François Roussel on 28 April at the FR-SCV (© Digital Field of Cloth of gold, Université de Lille). Right: detail of the TORE at the FR-SCV (© Digital Field of Cloth of gold, Université de Lille. Photographs taken by Audrey Gouy)

Viking Age sails from the eighth to tenth centuries CE, and Etruscan cloaks from 750 to 500 BCE) illustrated how ancient textiles were smart and how they were active in their relationship to people, other materials, structures, and the environment. The paper by Cédric Cochrane presented the ENSAIT (École Nationale Supérieure des Arts et Industries Textiles) and its labs. The ENSAIT is entirely dedicated to textile research and performance. It is conceived around three clusters: 1. Human centred design, 2. Multifunctional textiles and processes, 3. Mechanics of textile composites, which constantly develop projects for smarter textiles. Smart textiles are determined by a cause-and-effect relationship with their environment. The smart function can be provided by the material (shape memory material, thermochromic, etc.), the structure (biomimetic, microcapsule, etc.), the finishing (fluorescent, etc.), or an exogenous element (electronics, flexible sensors, e-textiles, etc.). In this regard, smart textiles

are extensions of technical textiles and they are conceived to improve, cure, protect, and connect the body. Today, smart textiles are highly valuable commercial products, but acceptability, end of life and sustainability are issues to be considered.

The afternoon was dedicated to papers presenting cases of *Digital textiles*. Laurent Grisoni (University of Lille) presented a new project developed between the IRCICA (Institut de Recherche sur les Composants logiciels et matériels pour l'Information et la Communication Avancée) and the CETI (Centre Européen des Textiles Innovants), called *CoFaDeVR – An exploration of 3D collaborative sketching for textile industry*. The aim is to help crucial actors of the fashion industry in the clothes-making process with a new software. More particularly, augmented reality is used as a tool for interactions between designers, manufacturers, and users to reduce costs as well as conception and design time. The paper by Audrey Gouy presented her new project *TEXMOVE* that is

developed in collaboration with IRCICA and builds on the results of her Marie Curie project *TEXDANCE* (https://texdance.eu) at the University of Copenhagen in 2019 to 2021. This project aims at digitally reconstructing and understanding the movement of clothes in performative rituals, especially during dance, in the Ancient Mediterranean. The paper by Isabelle Paresys (IRHIS, University of Lille) and François Roussel (LISIC, University of Littoral) presented the latest results of their project on the digital *Field of Cloth of Gold* that aims at understanding a remarkable event held in June 1520 in the south of Calais, France, when Henry VIII Tudor and François I decided to meet. For three weeks, they lived as if they were in castles, but in ephemeral installations and tents of gold cloth. The project aims to reconstruct the exceptional architecture of those tents by immersive 3D digital images and to reproduce as realistically as possible the luxury fabrics of the Renaissance. The paper presented the obstacles to this research, which

need to be overcome by both historians, computer scientists, and engineers in image synthesis.

The participants were then invited to visit the digital facilities of the FR-SCV, such as the globally unique TORE (The Open Reality Experience), before heading to the ANMT (Archives Nationales du Travail), located in the Motte-Bossut Factory, which is a jewel of textile industrial architecture in the north of France and listed as a historical monument since 1978. A former cotton spinning mill, it now keeps the national labour archives, and especially an important collection of archives related to textile production in the north of France. The evening event at the ANMT was particularly thought to question textiles in relation to work, production, industry, and trade. Thus, Tsiriniaina Hajatiana Irimboangy (Ensaama, Yavarhoussen Fund) presented his project re-evaluating the *lamba*, a traditional garment from Madagascar that took a turn to industrial manufacture. Nika Timashkova (Zurich University of the Arts)

Fig. 4: Smart Textiles Conference: Upper left: Zahra Kouzehgari's paper on 29 April at the ENSAIT, in the Honor Amphitheatre (© Zahra Kouzehgari). Bottom left: Visit of the Textiles Gallery in La Piscine Museum, Roubaix, on 29 April. Right: Textile samples from the Textiles Gallery in La Piscine Museum, Roubaix (Photographs taken by Audrey Gouy)
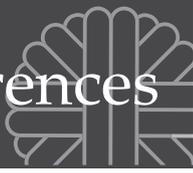
Fig. 5: Smart Textiles Conference: Upper left: ENSAIT's lab on thread production, experiments and spinning (Image: Audrey Gouy). Upper right: view of a jacquard loom at La Manufacture Museum, Roubaix (Image: Audrey Gouy). Bottom: performance of Hank Bamberger in the ENSAIT's courtyard on 29 April (Image: Hank Bamberger. Screenshot from Hank Bamberger's Youtube Channel)

presented her reinterpretations, as an art performer and researcher, of national costumes from Ukraine, Switzerland, and Uzbekistan. She stressed that those three countries have been historically connected since the 17th century, when Europeans went to Asia and brought back traditional hand-painted textiles that were copied in Europe and then reproduced in factories. The patterns were adapted locally and were traded back to where they came from originally.

On the second day, 29 April, the conference took place at the ENSAIT in Roubaix. The morning was dedicated to five papers, followed by a visit of one of ENSAIT's research labs for thread production and spinning. The paper by Aurélie Cayla (ENSAIT) proposed a presentation of the conductive polymer composites that are nowadays used in smart textiles applications, which offer extraordinary possibilities for future projects and applications. The paper by Jane Malcolm-Davies (Globe Institute, University of Copenhagen) took reconstruction as a viewpoint, allowing to present and understand the different strategies, datasets and disciplines at stake in Early Modern England's dress. Ulrike Beck (Berlin University of the Arts) presented some very well preserved textile finds from the 1st millennium BCE in Xinjiang, Central Asia. Thanks to a mix of textile design research perspective, reverse engineering, and forensics techniques, she showed how she could extract crucial data and discover unexpected structural changes in clothing production, such as tailoring, division of labour, and craft specialisation, which spread to other areas of the society. Those changes contributed to creating more dynamic, flexible, body-motion-adaptable, and efficient garments. The paper by Zahra Kouzehgari (Archéorient, Lumière University Lyon 2) focused on textiles as social status markers in the Ancient Near East, and especially on the *kaunakes* that were garments of high technological standard, woven in a tufted pattern suggesting overlapping petals or feathers, either by sewing tufts onto the garments or by weaving loops into the fabric. This kind of clothing, that considerably interacted with the body's motion, appeared especially on female deities and high-ranking women such as queens and priestesses. The paper by Romina Laurito (National Etruscan Museum of Villa Giulia, Rome) focused on the tools used in southern Etruria in textile production from the tenth to fifth centuries BCE. Based on a techno-morphological approach and experimental archaeology, she argued that spinning tools varied considerably over the centuries and from one area to another. This variability certainly suggests different types of textile production and indicates different traditions and demands through time. Moreover, some tools are more personalised (with signs, not functional, etc.).

This second day ended with two keynote lectures by Karina Grömer (Natural History Museum Vienna) and Joseph Lejeune (ENSAIT), and a dance performance by Hank Bamberger (Centre for Dance Research C-DaRE, Coventry University). The lecture by Karina Grömer highlighted the different strategies at stake through textiles to transform the body, altering its shape or surface, creating a language and non-verbal communication, and being functional in terms of motion. This paper particularly focused on how clothing has supported and restricted movement through time, based on case studies from Europe and Ancient Persia. In particular, it questioned the functionality of clothing that restricted movement. It appears that movement restriction is mostly an upper-class phenomenon and affects both men and women. There are four aspects in restricting movements: narrowing the stride, influencing the posture, impairing breathing, and heavy weight. Moreover, the motivations behind garments hindering mobility are: representation and status, awareness and perception, safety, discipline, and availability. The keynote lecture by Joseph Lejeune, based on current research at the ENSAIT, opened the discussion towards a more virtuous textile world that would reduce the high consumption of resources for textile production and conceive even smarter textiles. Two research approaches were presented: the *electrospinning* project of silk with the aim to reproduce the high quality of fibres with biodegradable, biocompatible technology, and the *photonitex* project that plans to create adaptative garments to prevent human body temperature loss through radiation, evaporation, convection, and conduction.

The performance of Hank Bamberger, in the ENSAIT's courtyard, resonated with all the discussions engaged and the papers presented during the conference. It particularly challenged the questions of identity, textile technology, and use. The full recording of this performance is available here: https://www.youtube.com/watch?v=RoZKY4OK7Do&ab_channel=HankBamberger.

The second day of exchanges and discussions ended with a visit to the remarkable Textile Gallery in La Piscine Museum, Roubaix, where an important collection of nearly 2,000 sample books and 30,000 pieces of fabric is assembled as testimonies to technical potential and knowledge, covering a large period from Coptic Egypt to the present day. Created in 1835 by the city, this Textile Gallery, or *Tissuthèque*,
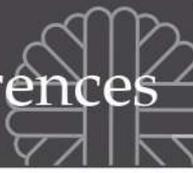
is constantly enriched by numerous donations and purchases of books, fabrics, textile designs and map layouts to offer the most complete documentation possible to researchers.

On the last day, 30 April 2022, visits were organised for the speakers. In particular, the visit to the La Manufacture Museum gave an overview of the textile production and research in the region Hauts-de-France from the Middle Ages until today. Different kinds of looms, which were in use until the 1970s and are all still functional today, were presented.

This international conference on Smart Textiles, that received exceptional support from the region Hauts-de-France, the University of Lille, and the INRAP, gathered eminent specialists and offered an interdisciplinary, ground-breaking, and fruitful dialogue that will be pursued. While textile research usually focuses on production, economy, and fashion, the Smart Textiles conference announces a third venue in textile research. Indeed, it has made an important contribution by looking at these interactions between humans and clothes, suggesting a phenomenology of clothes: how we can perceive them in different ways, and how textiles have a way to interact with us as well. Also, this event is pushing forward on a scientific level that CTR has marvellously contributed to do, creating a dialogue between past and present practices thanks to crucial projects such as *THREAD* and *The Fabric of My Life* (*FABRIC*). There is no doubt that the success of this new approach developed by the *Smart Textiles* conference will impact future research, as well as events, as it has been already the case with the *DRESSED* conference co-organised by Ulrike Beck in June 2022.

By Audrey Gouy