Designing eTextiles for the Body: Shape, Volume & Motion

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Abstract
In this studio, we will improve our tailoring skills in order to better integrate technology into clothing. Leveraging the volumetric nature of clothing, we will create eTextile interfaces that fit the shape of the body and are designed around how bodies move. This studio will consist of a short masterclass led by an expert fashion designer followed by materials experimentation and working on individual projects. We will introduce and demo a variety of ways to design and implement 3-dimensional eTextiles as well as how to integrate them with interactive systems.

Author Keywords
eTextile, tailoring, fabric, sewing, craft, wearables

ACM Classification Keywords
Human-centered computing~Human computer interaction (HCI) • Hardware~Sensors and actuators

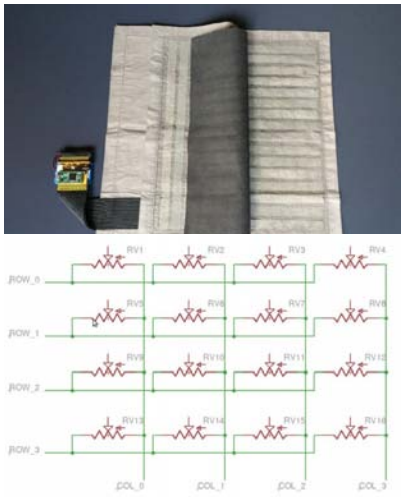

Figure 1 – Pressure-Matrix Sensor by Donneaud et al. [2] and corresponding schematic.

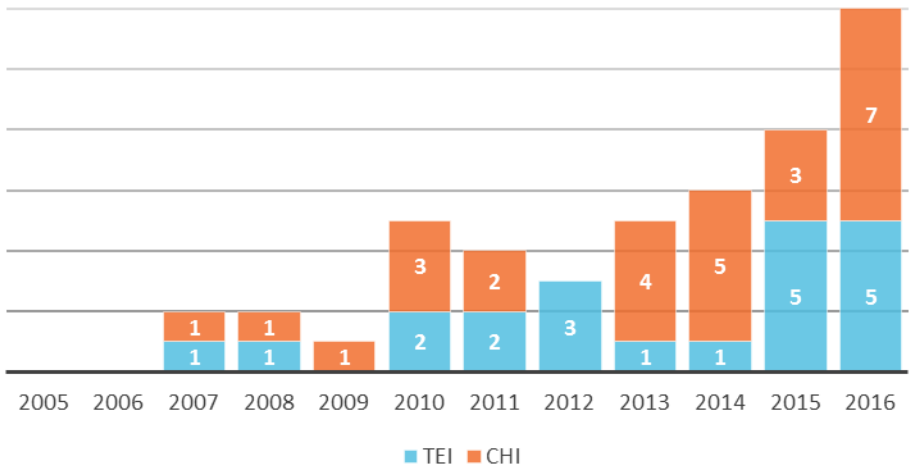

Figure 2 - Number of papers at CHI that refer to 'eTextiles', 'e-textiles' or 'electronic textiles' in their text (orange) and number of papers at TEI that refer to textiles or fabric in their abstract (blue).

(Tool for full-text search of the CHI proceedings is still under development and not yet published. CHI data for 2017 not yet available. TEI data based on manual search. Graph makes no claim to completeness).

Introduction

The academic interest in textiles as a design material is gradually increasing. This can be seen from the number of publications at TEI and less specialized venues, such as CHI (Figure 1). With some exceptions (e.g.: [1, 3]) this work appears driven by computer-scientists and designers who have little experience or training in working with textiles. The result are designs such as the popular multiplexed sensor matrix (e.g.: [2, 4, 5]). This is an obvious design from a computer-science perspective, but rather counter-intuitive from a fashion or tailoring perspective: individual textile elements of garments have complex shapes which are rarely square.

Such a sensor and its corresponding schematic can be seen in Figure 2. The organization of the schematic and the organization of the textile are almost identical. This is not required by the technology and, looking at patterns used for creating garments (see figure 4), possibly not desirable.

We believe that technology should adapt to the shape of the body and that compelling wearable technology is not a plastic gadget attached to clothing, but clothing which *is* technology. To achieve this, we suggest that considerations regarding the body's shape and movements must be made much earlier in the design process than is current practice.

We are hosting this studio to improve our own understanding of how to design fashionable and functional eTextile garments. While we share the workflows and methods which we have developed for ourselves, we hope to learn from the diverse background of the other participants of the studio.

While the workshop will be focused on fabrication skills, we will discuss potential applications for the near future as well as speculate on the long-term future of clothing and wearable technology.

Figure 3 – Traces are added to fabric by layering heat bonding method

Figure 4 – Fabric cut into pattern and laid out flat. Note the complexity of the shape

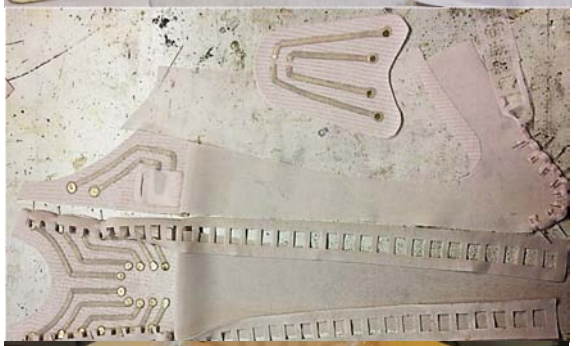

Figure 5 – Pattern assembled to volumetric garment, conforming to the wearer's body

Studio Proposal

This studio has a two-part structure, a masterclass designed by us and a collaborative prototyping session in which the studio hosts and the participants together apply the methods demonstrated in the masterclass.

Masterclass

We will start out with a master-class-crash-course on fashion-design and functional materials lead by Rachel Freire. Rachel will introduce the group to her method of using heat-bonding to integrate conductive fabric traces in her designs (Figure 3). She will discuss and share her approach to creating patterns (Figure 4) which eventually transform from two dimensional layouts into three dimensional garments (Figure 5 & 6).

Collaborative Prototyping

After the masterclass, the studio will split into smaller interests groups. These groups will use the rest of the day to explore ideas through physical prototyping.

All studio hosts have extensive experience in working with textiles. They each contribute unique perspectives and will share their experience with embedded development, sensor design, Sci-Fi prototyping, EMS-stimulation, haptic feedback and connected devices in the context of eTextiles. We hope that participants will diversify this further. Together, hosts and participants will create subgroups and spend an afternoon prototyping wearable concepts.

We will provide a selection of fabrics, mannequins and tailoring tools as well as basic electronics to facilitate the prototyping of novel eTextile technologies.

Figure 6 - Dynamic tulle sensor cape: pattern cutting can also be used to create dynamic garments with contrasting shapes. This can add functionality as well as compliment and augment the silhouette

Participant Profile

To start prototyping as fast as possible, we expect all participants to have prepared some concepts or ideas that they would like to explore. We will also only bring very basic electronic prototyping supplies and assume all participants will bring their prototyping platform of choice and any more advanced tools, materials or devices they might want to use.

We are looking for participants with an interest in eTextiles and basic electronic hardware or software prototyping skills. We assume that participants will have basic electronic prototyping skills. We do not expect participants to have prior experience or skills working with fabric, though if they do that is a plus.

Studio Topics to be Covered

We will discuss methods for designing eTextiles that both conform and contrast to the shape and motion of the body (see Figure 5 & 6). We will introduce participants to functional and non-functional materials which are used for designing eTextiles. We will present basic methods for designing patterns as well as measuring and fitting garments. We will discuss approaches for sensing in eTextiles and demonstrate manufacturing techniques based on heat-bonding as a quick and accessible way to prototype and iterate.

Studio Goals

We pursue goals on different levels with this studio. First off, we hope to help people expand their knowledge of eTextile design. In doing so we hope to also improve our own understanding of the domain.

Through prototyping we plan to achieve a tangible outcome consisting of a series of eTextile garments. Our intent is for such a tangible outcome to support future collaboration between participants. The workshop will foster ideation on current and near future applications of eTextiles as well as their future role in transhumanism and our cyborg evolution.

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