SMART TEXTILES SALON

A joint European workshop

25 SEPTEMBER 2009 Ghent Belgium

PROCEEDINGS

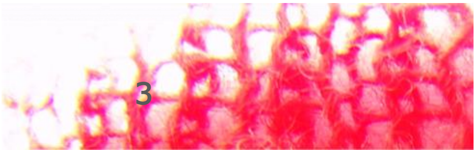
Welcome!

Lieva

Anne

Lina

Carla



Intelligent textiles are around now for about 10 years. Worldwide more than 100 research projects have been accomplished. Numerous papers have been presented in journals and at conferences. Now it is time to see what has actually been achieved.

PROeTEX is a major European project on intelligent suits for rescue workers.

SYSTEX is a European coordination action on intelligent textile systems. In both projects training and education is an important task.

Today's workshop is a joint training initiative of these two projects. Rather than listening to passive presentations, we want to give researchers and industry people the opportunity to experience working prototypes, to see and feel, to discuss on achievements and challenges.

Secondly we also want to highlight students' effort by the SYSTEX student award. Through this award, we want to raise students' interest in intelligent textiles. Their work contributes to the further scientific and technological developments, and being our future employees their drive will push our sector forward.

Enjoy the workshop!

Lieva

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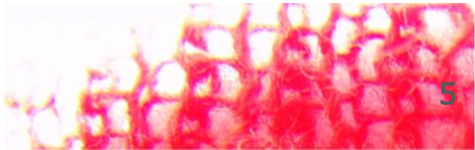

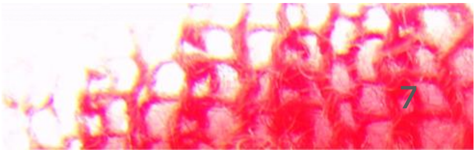

About the projects

SysTex
FP7 coordination action for enhancing the breakthrough of e-textiles and wearable micro systems in Europe

SysTex aims at developing a framework for current and future actions in research, education and technology transfer in the field of e-textiles and wearable microsystems in Europe to support the textile industry to transform into a dynamic, innovative, knowledge-driven, competitive and sustainable sector.

Project coordination:
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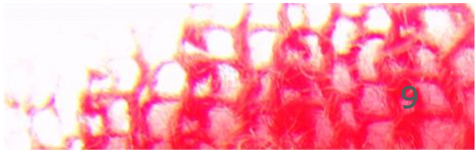
Project Consortium:
UGENT, SMARTEX, CEA, UNIPI, CNR-INFM, IMEC, PHILIPS, MULTITEL, IFTH BVBA ANNE DEMOOR, IHOFMANN, PLASTIC ELECTRONICS



PROeTEX
Advanced e-textiles for firefighters and civilian victims

Focusing on textile-based MicroNano technologies within a communicating framework, the PROeTEX 6th Framework IST Integrated Project is developing textile and fibre based integrated smart wearables for emergency disaster intervention personnel with a goal of improving their safety, coordination and efficiency. An additional system for injured civilians aimed at optimising their survival management. This focused application area will drive a wide range of key technology developments to create micro-nano-engineered smart textiles - integrated systems (fabrics, wearable garments) using specifically textile-based micro-nano technologies. These developments will feed through to a wide range of other markets from extreme sports, through healthcare to transportation maintenance and building workers.

Project coordination:
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Project Consortium:
UGENT, SMARTEX, CEA, UNIPI, IXSCIENT, ZARLINK, BRUNET-LION, ST&D, SOFILETA, TUL, PHILIPS, STEIGER, DIADORA, EU CENTRE, INFM, MILIOR, THUASNE, DCU, CSEM, BSPP, INSA, DDSC

Prototypes on Stage

SHHH..., Amplifying textiles

Berit Greinke

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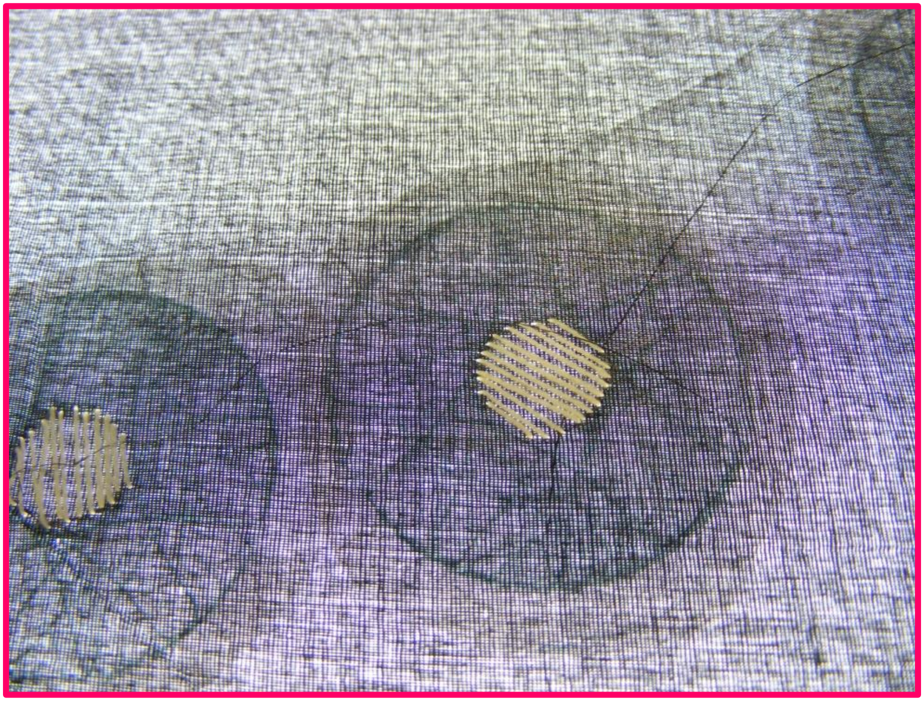

The sense of hearing might not be the first thought that comes to mind when thinking about textile and surface design. Like many other objects of our aesthetic environment we perceive textiles and patterns primarily visually and tactually.
However, there are a lot of shared expressions we naturally use for both the senses of sight and of hearing, including pattern, rhythm and composition. In my projects I am tracing back these analogies and investigating electronic and textile ways to translate from one sense to the other.
In my final MA project SHHH... I investigated a way of translating some qualities of traditional and conventional materials into sounds. With the help of self-built tools I revealed certain characteristics of the designs and made them auditorily perceptible – depending on the light reflection of the surface and/or the transparency of the design a pre-generated sound is changed in its pitch.
The patterns are unique and developed from the sound, a sound scanner is used to transfer it from sound to patterns, and the product works as itself as an artefact. The textiles become live performers in a sound machine.
I worked with a variety of media, including drawing, digital print, screen-print and embroidery on silk, cotton and paper. The sound is based on the Auduino code by Peter Knight and and photocells are used as the pattern readers.

Berit Greinke just graduated from the MA Design for Textile Futures course at Cebtral St. Martin's College of Art and Design in London. The prototype is an adapted model of her final MA project SHHH…

BIOTEX – Bio-sensing textiles for healthcare

Shirley Coyle, King-Tong Lau, Niall Moyna, Dermot Diamond, Fabio Di Francesco, Daniele Costanzo, Pietro Salvo, Danilo De Rossi, Nicola Taccini, Rita Paradiso, Jacque-André Porchet, Andrea Ridolfi, Jean Luprano, Cyril Chuzel, Thierry Lanier, Frédéric Revol-Cavalier, Sébastien Schoumacker, Véronique Mourier, Isabelle Chartier, Reynald Convert, Henri De-Moncuit, Christina Bini

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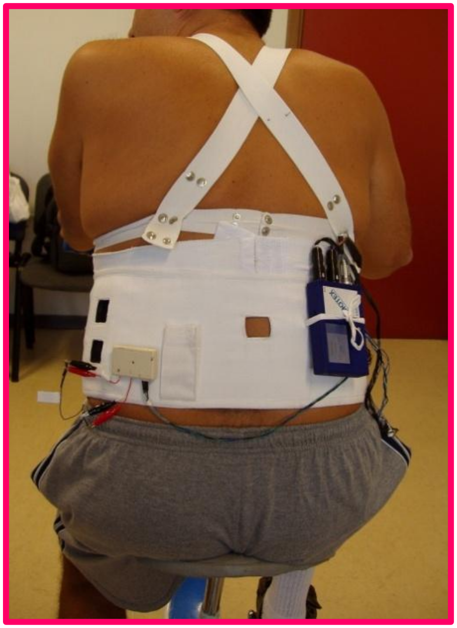

Chemical analysis of body fluids non-invasively is a novel and exciting area of personalised wearable healthcare systems. BIOTEX was an EU FP6 project that developed wearable textile sensors to collect and analyse sweat in real-time. A textile patch has been designed in such a way that it can successfully collect sweat from human subjects during exercise. The patch uses the inherent capillarity of fabrics to transport sweat through a fabric channel with integrated sensing capability. A super-absorbent material at the end of the channel is used to draw the fluid through the channel and store waste products. This provides a passive pumping action requiring no external power. Sensors integrated into the fabric channel measure sweat pH, sodium concentration and conductivity. In addition physiological measurements including respiration and ECG are measured using piezo-resistive fabric and textile electrodes respectively. A thoracic blood oxygenation sensor has also been developed using a woven fibre optic configuration. A central control unit is used to interface the sensors and transmit data via Bluetooth to a graphical user interface displayed on a nearby laptop for analysis.

Shirley Coyle is a researcher and designer in CLARITY: Centre for Sensor Web Technologies. This prototype was developed as part of BIOTEX, an EU FP6 project.

The smart sweat-band

CLARITY
clarity-centre.org

Fernando Benito-Lopez, Shirley Coyle, Robert Byrne, Alan Smeaton, Noel O'Connor, Niall Moyna, Dermot Diamond

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Real-time analysis of sweat loss is an exciting prospect for the sports industry. Replacing the fluids and electrolytes lost during exercise is vital to ensure adequate hydration which affects health and performance. We have developed a wearable device to provide immediate feedback to the user regarding the pH level of their sweat. An array of pH indicators are used to create a coloured barcode onto thin layers of poly(methyl methacrylate) (PMMA). pH indicators exhibit a colour change depending on the acidity of alkalinity of a solution. The barcode sensor is flexible and can adapt to the contours of the body easily and/or integrated into the sportsman clothes. In this prototype, the barcode is integrated into a sweat band to be placed on different body regions e.g. forearm, wrist or forehead. A visual colour change is observed depending on the sweat pH, providing immediate physiological information to the athlete or coach during physical exercise. This colour change could also be monitored by cameras which are often already in place for kinematic analysis. We have also developed a wearable microfluidic device to sample and analyse small quantities of sweat. This work follows on from the EU FP6 BIOTEX project.

Fernando Benito-Lopez and **Shirley Coyle** are researchers in CLARITY: Centre for Sensor Web Technologies. The prototype has been developed for TennisSense, to analyse sweat of tennis players.

How to get what you want

Mika Satomi, Hannah Perner-Wilson

distance lab

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"HOW TO GET WHAT YOU WANT" is a DIY Wearable Technology online documentation. The site aims to be a comprehensible, accessible and maintainable Internet resource, as well as a basis for further exploration and contribution. The site documents the range of wearable technology and soft circuit solutions that we have developed for our own practice since 2007. Many interesting techniques and possibilities never make it into a finished project. Many of our techniques involve fabric sensors and textile electronics solutions that are made with off-the shelf, off-the Internet materials. We wanted to share these with others as well as explore their possible use towards future ideas. The site also contains collections of material and tool resources and example projects that explain the integration of individual solutions for smaller projects, aimed at showcasing what is possible and how. By including a certain twisted criticism towards human-computer interaction in our own works we hope to inspire others to question current wearable technology trends.

Mika Satomi is a research fellow at Distance Lab, Scotland and a PhD candidate at University of Art and Industrial Design Linz, Austria. She has studied Graphic Design at Tokyo Zokei University, Media Art at Institute of Advanced Media Arts and Science (IAMAS), Japan.

Hannah Perner-Wilson is a research fellow at Distance Lab, Scotland. She holds a Bachelor degree in Industrial Design from the Art University of Linz, Austria. Since 2007, Hannah and Mika have been collaborating together under the name KOBA-KANT. Their projects often involve Wearable Technology, turning one's body into an interface, creating unusual interaction between humans and machines.

ITcares demonstrator

Nadine Jungbecker

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A newly developed textile integrated sensor shirt, called “ITcares” (Intelligent Textile for CArdio REspiratory Sensing), is presented. To realize the textile sensors, silver-coated polyamide yarn was used. It was knitted with spandex to make it stretchable. The positions of the electrodes were chosen as it is widely used in clinical research and also quite immune to artifacts due to small movements of the torso. Two 5 cm x 5 cm patches were applied to the inside of the T-shirt as the bipolar ECG electrodes. A larger third patch with a size of 8 cm x 18 cm was used for the driven right leg circuit. It was positioned on the lower right side of the T-shirt. Besides the ECG electrodes the same material was also used to manufacture the textile conductors. One end was stitched with a conductive yarn to the electrode and the other end had a metal push button for connection to the measurement electronics. The textile conductors were applied to the outside of the T-shirt. For the measurement of the ECG signals the t-shirt was connected with the electronic hardware device. From that hardware device the signals were sent to a PDA where they were analyzed and stored. The PDA is connected via Bluetooth with a computer to present the measurement signals.

Nadine Jungbecker works as a researcher at the RWTH Aachen University. Together with all project partners she developed the presented demonstrator in the framework of a public project at RWTH Aachen University.

Pressure activated electroluminescent fabric

Riccardo Marchesi

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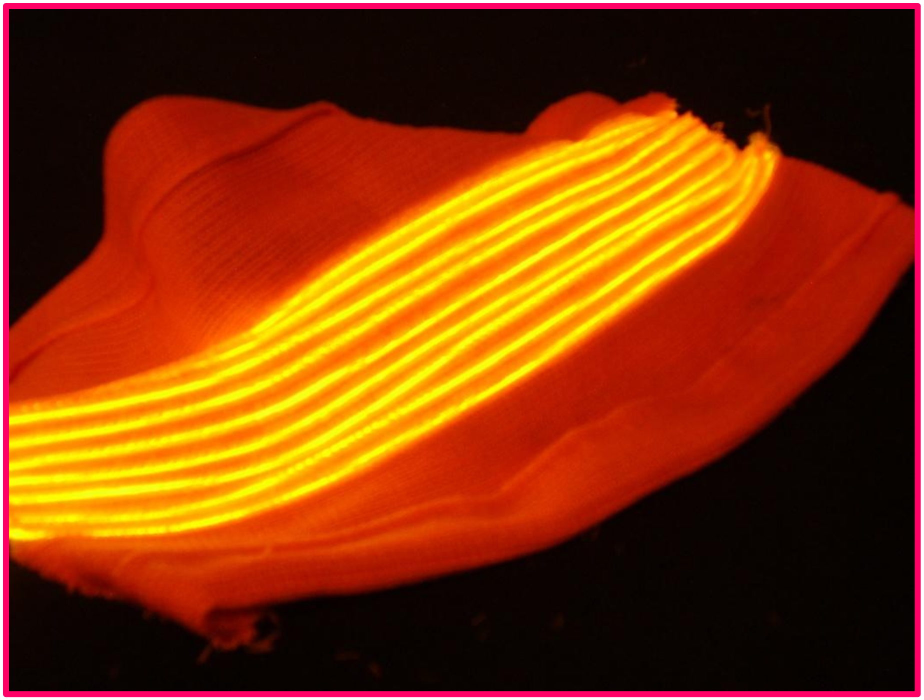

Purpose of the prototype: to demonstrate the possibility of producing pressure activated emergency lighting systems for escape routes, with a low incidence of manual labor.
This fabric is a combination of light emitting fabric and pressure sensitive fabric.
The light emitting fabric uses embedded electroluminescent fibers. The electroluminescent fibers are embedded automatically by the textile machine, without any additional operation. The fabric is knitted with a flat knitting machine and electroluminescent fibers are placed along the warp direction.This fabric has also two side pockets along its edges where two pressure sensitive fabrics are placed. Even the two edge pockets are produced automatically by the textile machine.
The pressure sensitive fabric is a three-dimensional knitted fabric with three layers, two conductive layers separated by a non conductive layer. The two conductive layers are made of stainless steel wire or copper wire in order to guarantee a low resistance to electricity. When pressed the two conductive layers touch, allowing a current flow and therefore the detection of the action. These sensitive fabrics are produced by the knitting machine without any additional operation. By changing the yarn diameter it is possible to obtain different values for the switch activating pressure.
Materials used for the prototype: polyester yarn, electroluminescent fiber, stainless steel wire, polyester monofilament yarn.

Riccardo Marchesi has a degree in Electronic Engineering. He is the Managing Director of Texe srl, a company specialized in technical textiles for EMI shielding and smart fabrics. The prototype is part of his research on knitted interactive textiles.

Illuminative Sonic Top

The Hong Kong Polytechnic University
香港理工大學

Joe Au, Jin Lam, Raymond Au, Kevin Hui, Travis Li

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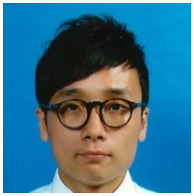
An "*Illuminative Sonic Top*" is developed and inspired by the aesthetic forms and functions of a ceiling lighting, "Splügen Bräu" that was created by Achille Castiglioni in 1961. The illuminative outfit combines with technology from an aesthetical and functional perspective that is able to sense the changing sound waves of the environment and express it through various flashing LEDs patterns. In this prototype, the edges of 3-dimensional collar are embroidered with a total of 128 pieces of 3mm ultra-bright blue, yellow, purple and white LEDs. The continuous sound waves (e.g. music) are detected by microphone inserted on the chest area and the received signals are then amplified by the pre-amplifier circuits for further scaling and processing. Different volumes or tones, or technically speaking, the frequency ranges, are then extracted and distinguished by a series of band-pass filters working in the audible range, generally from 20 to 20,000 Hz, which are preset by different values of resistances. The sensitivity of sound waves can be easily adjusted according to different situations by resetting the jumpers on the circuit board. When an identical range of tone is detected, the power supply circuit connected to the corresponding LEDs will be turned on. The LEDs will flash with respect to the tone changes and display as different patterns. Totally, 10 different flashing patterns can be displayed. The prototype is powered up by 3 pieces of 9V batteries and it can be lasted for 8 hours.



Travis Li currently works as a Research Assistant at the Hong Kong Polytechnic University. The prototype was developed from the research project entitled, "A development of interactive fashion collection by means of visual communications".

Dis.appear - an interactive coat

Fraunhofer IZM
Universität der Künste Berlin

Christian Dils, Theresa Lusser, Valeska-Schmidt Thomsen, Jana Paatz, Holger Neumann, Manuel Seckel and René Vieroth

christian.dils@izm.fraunhofer.de

The concept “dis.appear” was created by industrial design student Theresa Lusser and is inspired by urban streets at night, where artificial light of buildings, lanterns and cars illuminates the city, but people are “disappear” behind it. Dis.appear is a coat, which reflects this atmosphere through integrated light emitting diodes (LEDs). These LEDS create diffused light circles on the surface and give an interpretation of the city lights. When the wearer is not walking, the light circles are fading according to the intensity of the surrounding city lights. The light circles are fading out when the wearer is walking.

An integrated accelerometer activates the LEDs and the brightness of the light circles is controlled by two light sensors. The coat consists of several layers. The inner layer carries different stretchable copper boards (SCBs): a main board with controller unit and several stripes for sensors and LEDs. The interconnections are created with isolated copper wires that fixed to the fabric by sewing and then soldered on the contact pads. The second layer is a lining material with cavities for the LEDs which are placed to diffuse the LED spot into a light circle by a defined distance. A polyester fabric with a printed surface is integrated on it with round shapes left open for the LEDs. This creates a clear cut of the light circles on the surface. As surface layer, a polyester material is used which is transparent to the light when the LEDs are activated and hides the LEDs when deactivated. Thus in daylight the coat looks ordinary and only at night it „appears‟.

Christian Dils currently works as a researcher at the Fraunhofer IZM and took part in the e-MOTION project- an interdisciplinary project at the Institute of Fashion and Textile Design (IBT), The University of the Arts Berlin (UdK), Germany.

Klight - an interactive dress with stretchable circuit board technology

Christian Dils, Mareike Michel, Manuel Seckel,René Vieroth, Thomas Loeher

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Within the frame of the European project STELLA (*St*retchable *E*lectronics for *L*arge *A*rea Applications), a "stretchable copper board" (SCB) technology is developed at Technical University Berlin. But here rigid or flexible base materials are replaced by elastic thermoplastic polyurethane (TPU) foil. The copper interconnections between (still) rigid electronic components are designed in meander-shape to achieve stretchability up to 300 %. Such boards enable their attachment on curved or dynamics objects like the human body. The integration of the stretchable system into textiles is done by a simple lamination process. Based on this SCB technology an interactive dress has been developed in cooperation with the fashion design student Mareike Michel. The concept of the interactive dress is to translate the pattern of the body's movement into a light pattern. The body movement is detected by an acceleration sensor and processed by the microcontroller, which is used to control the illumination pattern of the light emitting diode (LED) display. The LEDs are placed under different layers of transparent and freely draped cotton cambric fabrics, in order to spread and diverse the light emission of the LEDs. The electronic system integrated into the dress, consists of 32 white LEDs, a sensor and a controller unit on miniaturized interposers with QFN-package design. Both, the LEDs and the interposer boards are directly assembled onto a single 30 x 40 cm large SCB using low-temperature solder alloy.

Christian Dils currently works as a researcher at the Fraunhofer IZM. He was part of a group of researchers who worked with fashion design student Mareike Michel in order to apply the stretchable circuit board technology to smart and interactive textiles. For this project the group was awarded with this year AVANTEX Innovation Prize in the category "New Fashion".

Pneuma - an interactive respiration dress

Fraunhofer IZM
Universität der Künste Berlin

Christian Dils, Synne Geirsdatter Frydenberg, Valeska-Schmidt Thomsen, Christina Klessmann, Holger Neumann, Manuel Seckel and René Vieroth

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Pneuma was created during the interdisciplinary project e-MOTION by the interactive design student Synne Geirsdatter Frydenberg. This project aims at encouraging the user of the dress to breathe in a deep and thorough way. The idea is visualized by designing an evening gown with an integrated respiration sensor by measuring the breathing movement of the wearer around the waist, where the output is transformed into light. Light emitting diodes (LEDs) integrated in the inner layer of the dress in an ornamental pattern, are fading in and out along with the breath movement and depend on the strength of in- and outhaling. A carbon filled rubber yarn is sewn on a tight fitting bodysuit and while breathing the change of elongation is leading to a change in the electric resistance of the yarn. The latter is used to detect the respiration rate which is processed by an active filter (fourth stage) and a microcontroller. All components are mounted on one 30 x 40 cm large stretchable copper board (SCB) which is laminated on the inner layer of the dress. The outer layer is inspired by air bubbles floating under the frozen surface of water used as a metaphor for air floating in the body. The repeating pattern is printed using a mixture of transparent binder and pearl shimmer. The display of the interactive breathing output takes form as an amorphous embroidery on the stomach consisting of soft and endless lines of needlework and Swarovski-crystals as soon as lighted up by the LEDs from the inside of the dress.

Christian Dils studied microsystem technology and currently works as researcher at the Fraunhofer Institute for Microintegration and Reliability, Berlin (IZM). His research is focused on developing new technologies for the integration of electronics into textiles.

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

EMPA
Materials Science & Technology

Tec InTex

nano-tera.ch

Conducting textile platform based on novel e-fibers

Dirk Hegemann, Manfred Heuberger, Kunigunde Cherenack

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A low-pressure plasma sputtering process is used to coat a 100-200 nm thick metal coating on common monofil- or multifil- yarns, which thereby do not change their properties, but become reliably conductive for low-current signals; this includes audio signals, computer interfaces (e.g. USB), low current supply, or, dissipative heating. Typical resistance is 5 to 50 Ohms per cm. The presented prototypes are coated yarns, fabrics or simple garment containing the coated fibers to demonstrate electric conductivity whilst maintaining an original haptics.

Dirk Hegemann and **Manfred Heuberger** work at the Empa laboratory of *Advanced* Fibers as Plasma-group leader and head or laboratory, respectively. Both are actively conducting research in surface science and were involved in the development and industrialization of the new low-pressure plasma sputtering process used to **Kunigunde Cherenack** is senior scientist at the ETH Zürich, wearable electronics lab, and, network partner, with Empa and other research institutes in the TecInTex project of the Swiss NanoTera program.

PROeTex Firefighter uniform

Annalisa Bonfiglio

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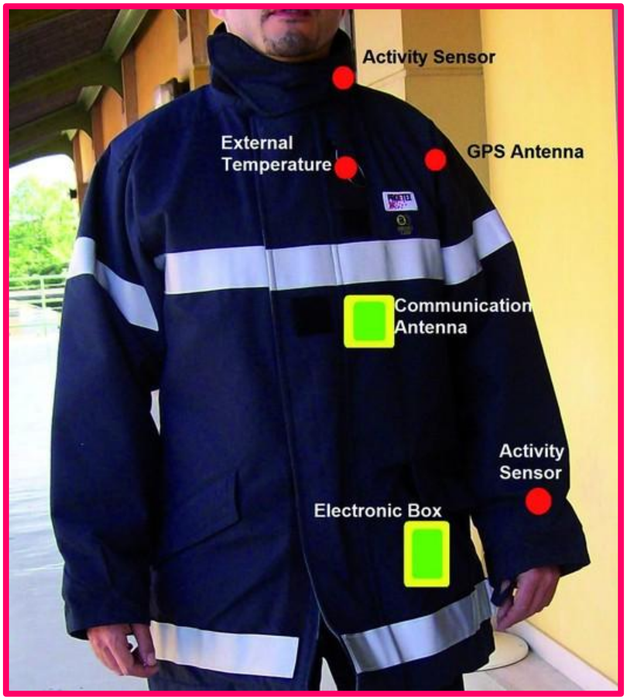

The prototype consist of 3 components: an inner garment (IG), an outer garment (OG) and a pair of boots (B). IG is able to record physiological parameters of the person, OG is able to collect posture and position information together with environmental parameters, B host gas sensors. All signals recorded are transmitted via an Electronic Box hosted in the OG to a remote station that coordinates the operation.

Annalisa Bonfiglio is coordinator of the European integrated project PROeTex which started during the 6th Framework Program and ends in 2010. The PROeTex Consortium is made by 23 partners from Academia, Research Centres and Industries whose competence span in different fields, from textile fabrication to sensor, energy generation, communication systems. In addition to technical teams, also end-users (i.e. fire fighters and civil protection units) belong to this Consortium.

Communicating textiles

Carla Hertleer, Lieva Van Langenhove, Hendrik Rogier

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The development of wearable textile systems will enable monitoring the physical state of a person through the clothes that he is wearing. To do so, several components need to be integrated into the garment: sensors, actuators, a data processing unit, an energy supply and a communication device . To enhance wearability of the system, these components should be made out of flexible materials or even textiles. Wireless communication is done by means of antennas. This prototype shows the feasibility of manufacturing antennas out of textile materials.

Within the framework of the European project PROeTex, dedicated textile-based antennas were developed for integration into the firefighter outer garment. These antennas communicate the information collected by the sensors in the inner and outer garment to a nearby base station where the physical state of the firefighter and information on his environment are kept under surveillance.

Carla Hertleer works as a research assistant at the Department of Textiles of Ghent University. The topic of her PhD research is the use of textile materials for the manufacturing of antennas to be integrated into wearable textile systems. This research is done in collaboration with the Electromagnetics Group of the Dept. of Information Technology of UGent.

Wearable CO_2 sensor

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CLARITY
clarity-centre.org
PROETEX

The prototype provides real-time continuous monitoring of CO_2 in a wearable configuration sensing platform. CO_2 sensors are integrated into a firefighter's boot to detect the presence of dangerous concentrations of CO_2 in the environment surrounding the firefighter. Sensor's signal are wirelessly transmitted and an alarm will be activated once dangerous CO_2 concentration is reached.

An appropriate commercially available CO_2 sensor was chosen based on its sensitivity, robustness and low power demand. These sensors contain reference and working electrodes, which are placed in an electrolyte that provides a reference CO_2 concentration. The measured potential is based on the difference in concentration between the reference electrode and the outside air. The sensor gives an accurate reading for concentrations ranging from 100 ppm to more than 90% CO_2. This provides for accurate detection of both low concentration levels of CO_2 (that may be hazardous over long exposure times) and high concentrations that pose immediate danger. Sensors are calibrated for CO_2 concentrations ranging from atmospheric to 42000 ppm and the alarm will be activated at 30 000 ppm. This was integrated onto an electronics platform that performs signal capture, processing and wireless communication, all within a compact, low-power, rugged enclosure. The system is placed in specially designed pocket on a boot of firefighters. Currently sensors are powered by a nickel metal hydride battery, which is rechargeable through a mini-B USB connection. It supplies power for approximately 5 hours.

Tanja Radu currently works as a researched in the Clarity research centre, at Dublin City University in Ireland. She developed the presented prototype in the framework of the PROeTex project.

Emotion Jacket

PHILIPS
sense and simplicity

Jack van den Eerenbeemd, Floris Crompvoets
Paul Lemmens, Frank van Abeelen

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With the emotion jacket a movie viewer can experience the emotions of the movie characters. The jacket is lined with vibration motors responding to signals encoded in a DVD or to a program designed to control it on the fly. It can do a number of things. For instance, if the main character is in a fearful situation, it can cause a shiver to go down the viewer's spine or create a pulsing on the chest to simulate the main character's elevated heartbeat. Or during a romantic scene, it can create butterflies in the stomach.
The jacket contains 64 independently controlled vibration motors distributed across the arms and torso. The actuators are grouped in 16 groups of four and linked along a serial bus. Each group shares a microprocessor. The actuators are capable of cycling on and off 100 times per second. The skin's neural wiring and the way the brain perceives touch make it possible to stimulate sensations between the motors as well. This phenomenon is called the cutaneous rabbit illusion.
The jacket is currently in a testing phase at Philips Research. The aim is to investigate how to create emotional immersion. If we come to an understanding of how touch relates to emotion and whether or not this relationship is different for each individual, we can help people in achieving a certain emotional state or mood. Besides providing an immersive experience during movie watching, we may help people relax, or create an environment in which a baby feels happy and safe.

Jack van den Eerenbeemd and **Floris Crompvoets** developed the emotion jacket. Both work as senior scientists at Philips Research. **Paul Lemmens** investigates emotions. **Frank van Abeelen** works on intelligent textiles and takes part in the EU project Systex for promotion of the breakthrough of intelligent textiles.

Stretchable and washable electronics for wearable signage

Thomas Vervust

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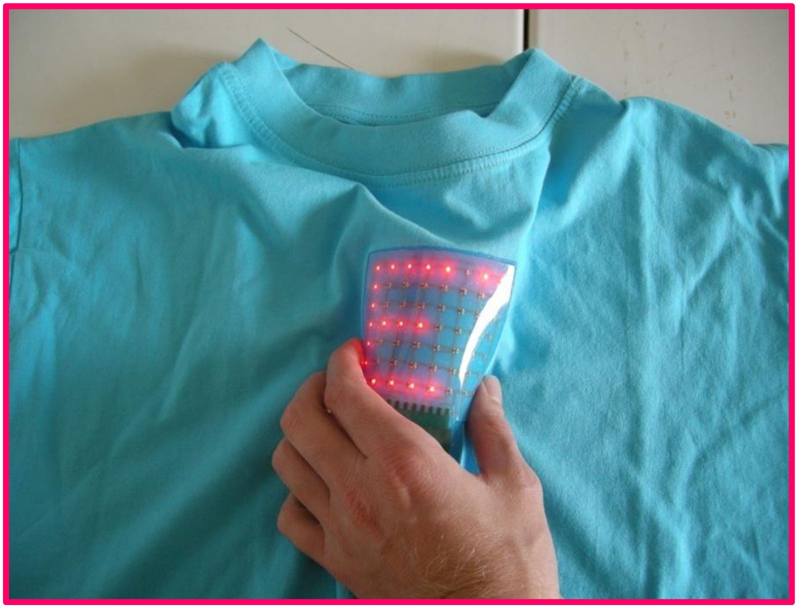

Today the electronics in “smart textiles” are attached as standard available modules or, when dedicated modules are preferred, are realized on traditional interconnection substrates, i.e. normally rigid Printed Circuit Boards (PCB’s) or mechanically flexible substrates at the most. It is clear that this is not ideal for integration in textile for two reasons:

- The circuit cannot or only in a limited way deform with the textile (e.g. cannot stretch)
- The garment cannot be cleaned / washed in a conventional way without first removing the electronics.

In order to achieve a higher degree of integration, CMST is developing technology for flexible and stretchable electronic circuits, completely embedded in polymer materials like PDMS (silicone). This unique technology creates the possibility for integration of electronics in textiles with a high degree of wearing comfort, and even opening the potential for washability without the need toremove the circuit.

The presented demonstrator illustrates the possibilities of the technology in the field of wearable signage. A 7x8 LED-matrix was designed to show a scrolling message. The LED islands are interconnected with meander shaped conductors to achieve stretchability.
The complete circuit is embedded in an elastic silicone and is integrated in textile.

Thomas Vervust currently works as a PhD student at Ghent University. He developed the presented demonstrator in the framework of his PhD about Stretchable and Washable Electronics for Embedding in Textiles at CMST.

Dynamic light transfer
The textile that sees you and blinks back to you

Danmarks Tekniske Universitet DTU
DIFFUS

Elisabeth Heimdal, Marija Andonovska, Priya Mani,
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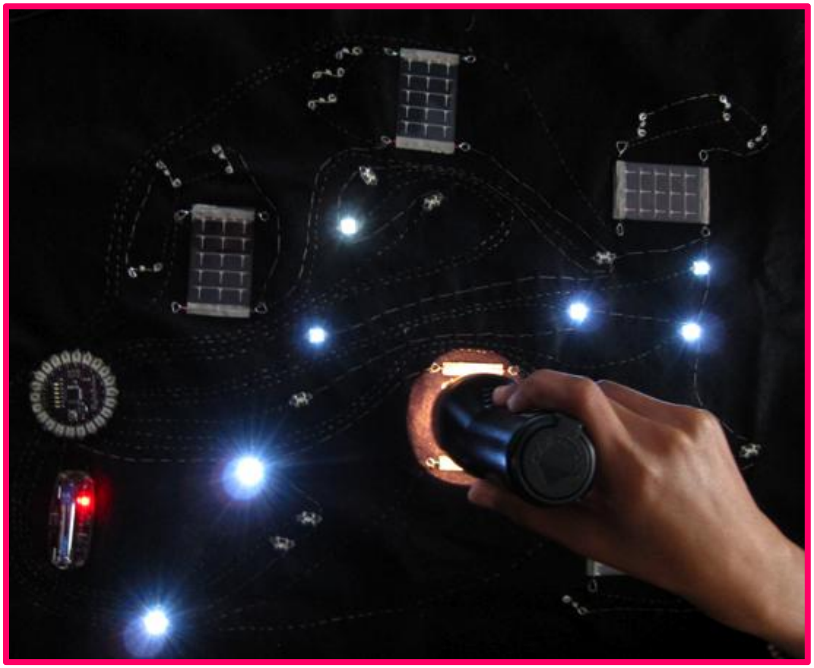

Each of the two textile prototypes tells a story, stimulates the senses and is intended to function as inspirational tool for designers and others who wish to start working with this kind of materials. They do not have a defined application in themselves, but should stimulate ideas about how the materials and the working principles can be used in other contexts.

1- **Dynamic light transfer - The textile that sees you and blinks back to you:**

Using a torch, the user lights on the textile, which responds with different light patterns, depending on which solar cell the torch is pointed at. The flexible solar cells work in two ways: A) They transform the light from the UV torch into power – giving light to 3 LEDs connected to the solar cell with conductive thread. B) They work as light sensors, connected to a microcontroller (a LilyPad Arduino) by conductive thread: for each solar cells, three dynamic light patterns have been programmed, using a network of 14 different LEDs, connected to the LilyPad using conductive thread.

Together, the solar cells, the LilyPad, the LEDs and the conductive thread constitute a soft circuit.

Elisabeth Heimdal is currently Ph.d.-student at the Technical University of Denmark (DTU). She developed the presented prototype in the framework of her Master Thesis at DTU. She has a BSc in Textile Engineering and a MSc in Design & Innovation.

Danmarks Tekniske Universitet DTU

DIFFUS

Touch generated shape change
The textile that can move

Elisabeth Heimdal, Marija Andonovska, Priya Mani,
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2- **Touch generated shape change - The textile that can move:**

When the user touches certain areas on this textile, it moves, and changes shape. Depending on which area of the textile he/she touches, different shape memory wires are activated; their contraction makes the textile move and changes shape. Cut lines in a flat fabric are opened and pulled apart when the shape memory wire contracts, to reveal an underlying material. Conductive fabric is used to create the touch sensors (soft switches); conductive thread assures the connections between the touch sensors, the shape memory wires and the microcontroller. The latter is a LilyPad, programmed to provide power to each of the shape memory wires depending on which touch sensor is touched.

Elisabeth Heimdal is currently Ph.d.-student at the Technical University of Denmark (DTU). She developed the presented prototype in the framework of her Master Thesis at DTU. She has a BSc in Textile Engineering and a MSc in Design & Innovation.

Transitional stripes

Sara Robertson

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The prototype will bring together the results of an AHRC funded design-led PhD project at Heriot-Watt University, School of Textiles and Design. The prototype highlights the use of laser etching and liquid crystal dyes on textiles. Combined with a programmed heat-profiling electronic system that activates the liquid crystal layers, it will demonstrate unusual 'colour play' when particular liquid crystals are layered one on top of the other. The prototype is designed to show the possibilities of new colour-change aesthetics on textiles through the use of liquid crystal thermochromic dyes and present the un-exploited potential of thesematerials in design. Two different 'series combinations' of liquid crystals will be applied in bands across the length of this piece, these combinations are activated at 25°C and go through a colour spectrum starting at pale green, changing to emerald green then lilac and turquoise. When the temperature reaches 35°C the prototype changes colour through purple, pink and back to emerald green as 40°C is reached. These colour changes will be controlled by the integrated electronic system that allows the activation of the specific temperature thresholds of the liquid crystals. The piece is made from black cotton satin that has been laser etched, screen printed and finally coated with layers of liquid crystals. This is mounted in a blackperspex border and has specially designed electronic circuitry integrated within the piece which is controlled via a DMX (digital mix) programmed system.

Sara Robertson is currently a PhD student at Heriot-Watt University, School of Textiles and Design. She developed the presented prototype to demonstrate results from her design-led PhD.

Filter the Filth

Chloe Albert

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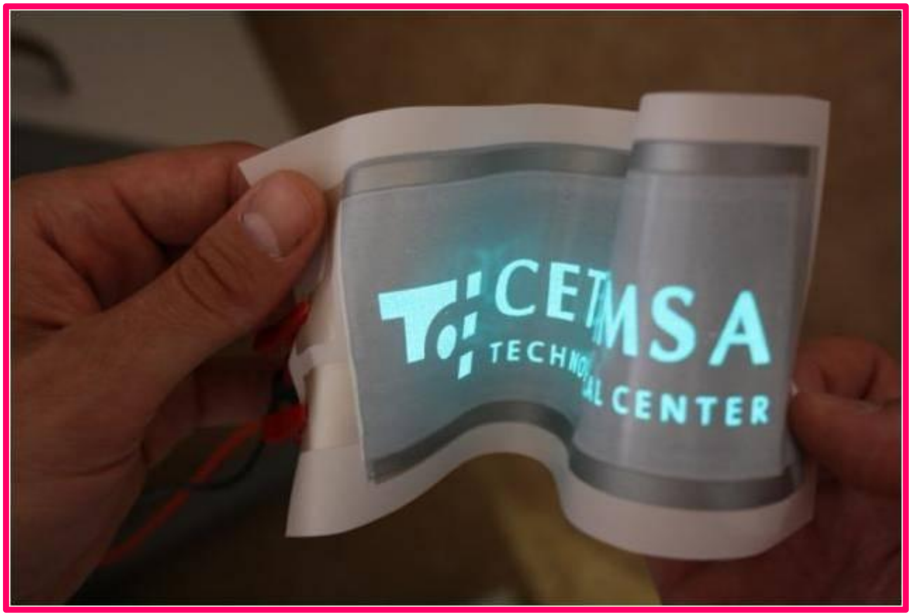
The idea of this project was to explore a new and innovative warning system for VOCs (volatile organic compounds) in the form of environmentally responsive wallpaper.
Volatile organic compounds make up a large part of air pollution and are off-gassed from a wide variety of materials within the home, VOCs also come with many health risks. When levels of VOCs rise the wall senses the change and comes alive with moving modules that signal levels are high. It makes the invisible atmosphere a visible and sensory experience as opposed to a dull beep from a plastic box. The modules invade your physical space much like the invisible VOCs for a dynamic wake up call to open a window and circulate fresh air.
As well as warning you about the VOC levels I investigated the idea of the wall incorporating a filter. Attached to each module is a disc of activated carbon fabric, which is proven to filter VOC gases; as the modules move forward and backwards through the air the carbon fabric grabs onto pollutants and in doing so lowers the VOC levels, once the modules stop the VOC level is safe. I wanted to provide a solution to the air pollution and not only bring attention to it. The wallpaper makes you more aware of the invisible atmosphere as well promoting healthier home environments to increase well being.
I used a variety of materials and processes including photography, film making, screen printing, digital print, motors, Arduino, and VOC sensors.

Chloe Albert has just graduated with an MA in Design for Textile Futures from Central Saint Martin's College of Art and Design. The prototype is a smaller version of her final MA project Filter The Filth

Electroluminescent European flag

Núria Guilera Grandes, Bertu Roig, Marc Torrent, Laia Francesch de Castro, Nicolas Renaud

nrenaud@cetemmsa.com



The prototype is designed to illustrate that textile can produce light and still keep its flexibility. The best illustration of textile flexibility being done by flags' behavior moving in the wind, Cetemmsa will present an Electro-luminescent EU flag as symbol of the European Endeavour to develop Smart textile.
The prototype will be presented aside of a fan which will blow air on it.

The prototype is composed of the electroluminescent flag itself, mounted on a flag pole that stands on the presentation table. The base of the pole hides the battery and the electronic required to power the flag.
The flag itself is composed of a polyamide textile support coated with different layers which form the electroluminescent device. This device is built using organic and inorganic materials having dielectric, light emitting and conductive properties, as well as encapsulating polymers.

The prototype nicely illustrates the potential of electroluminescent textile for everyday life (indoor lighting, signage, designed interior…), as well as for marketing and advertisement sectors.

Nicolas Renaud is EU Project manager at Cetemmsa and is the coordinator of the EL EU Flag project.

OFSETH – Optical Fibre Sensors Embedded into technical Textiles for Healthcare

François Narbonneau

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OFSETH will develop Optical Fibre based sensors to continuously assess the vital parameters of a patient. The objective is to demonstrate the validity of optical sensing solutions for healthcare and develop this technology taking into account the issues linked with textile and wearability for a future efficient and continuous care of patients.
While most developments up to now have been focused on the use of electrical sensors, the aim of OFSETH is to take advantage of pure optical sensing technologies for extending the capabilities of medical technical textiles for wearable health monitoring.
OFSETH research will focus on how silica optical fibres can be used for sensing vital parameters while being compatible with a textile manufacturing process.
As results, a prototype of the system based on a harness for patient monitoring during MRI scans and fully compatible with MRI environment was developed. This system composed of several optical fibre sensors for assessing the patient breathing activity and detecting all respiratory accident or incident will be clinically evaluated by the next days following a clinical protocol elaborated by the Hospital of Lille in order to validate the whole system. The sensing textile is combined to an original monitoring unit compatible with conventional sensor used in clinical environment.
OFSETH is a European project of the 6th Framework Program.

François Narbonneau, is coordinator of the project OFSETH He currently works as researcher at Multitel, Belgium multi-disciplinary research center.

Electrotherapeutic socks

Anne Schwarz, Jedrzej Banaszczyk, Philippe Moerkens, Ivano Soliani, Gilbert De Mey, Lieva Van Langenhove

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Due to the progress in technology and medicine in our world today, everyone of us awaits an increased life expectancy. With this proportionate increase of older people in our society, age-related illnesses accumulate, amongst them decubitus. A decubitus wound can be described as a chronic ulcer that appears in pressure areas in debilitated patients confined to bed.

In order to prevent and/or heal these wounds electrical stimulation can be applied to enhance the blood flow at the body parts of concern. Hence, the process of healing is speeded up.

In cooperation with the partners Bota, Soliani and Ghent University, prototypes of electrotherapeutic socks with integrated electrodes have been realized. The electrodes were either based on conductive silicones or elastic conductive yarns. A connection to the TENS instrument is provided by a pressure button.

The electrotherapeutic socks have been developed in the scope of the European project Lidwine. Lidwine focuses on the development of multifunctional medical textiles for the prevention and treatment of wounds.

Anne Schwarz is currently PhD student at Ghent University, department of Textiles. She focuses her research on the development of conductive textiles for medical applications.

Rights through Making – 9 projects

Veronica Cornacchini, Erica Battaglia, Youyou Yang, Pak Wing Man, Jesper Schwachöfer, Gilles van Wanrooij, Jeroen Witjes, Joran Damsteegt, Barbara Schächter, Sara Spolverini, Matteo Gioli, Niko Vegt, Jan Belon, Jasper Pieterse, Silvia Piantini, Michela Gadani, Giulia Mari, Axl Pizzinini, Federico Tecchi, Lilian Admiraal, Jelle Stienstra, Arne Wessels, Jeroen Brok, Anna Bonciani, Erika Cellai, Frank de Jong, R.J.W. Schatorjé, Joris Zaalberg, Saskia Bakker, Claudio Manetti, Fabio Novelli, Cláudia Peterle, Isabelle Kowalski, Maíra Scirea e Lígia Fascioni, Talles Oliveira, Tatiana Rodrigues, Bárbara Bianchini Vali, Pâmela Riva, Karla Cruz, André Ramos, Claudia Batista, Claudio da Silva, Fábio Teixeira, Luiz de Bettio.

Supervisors: Ambra Trotto, Kees Overbeeke, Caroline Hummels, Joep Frens, Elisabetta Cianfanelli, Stoffel Kuenen, Gabriele Goretti, Michael Cruz

ambra@plasmando.com

The projects:


beehugged


anaue


twintribe

yyrupigua


byou

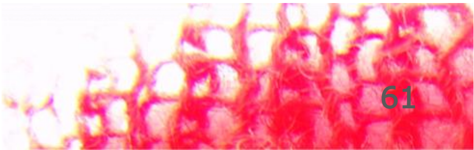

glowve


ugwa


intouch


freefalla

These designs are results of international workshops, realized by the Eindhoven University of Technology (NL) and the Industrial Design Department of the University of Florence (I), within the research project Rights through Making. During these workshops we developed products that aspire to promote the respect of human rights, as part of the everyday life of multicultural societies. Rights through Making designs aim to create awareness in users about the exercise of human rights: the bolero **InTouch** induces people to act towards one another in a spirit of brotherhood, transforming accidental physical contacts in crowded places into moments of amusement; the night glove **Glowve** supports kids in getting free from the fear of dark slavery, responding to unaware acts of fear during the night with reassuring personal light; the inflatable skirt **Byou** protects against interference with personal privacy, swelling and increasing people's personal sphere when they start walking faster and sturdily; the jackets **Bee-hugged** induce to solidarity by allowing people to share their electrical charge for electronic devices with other people in need of some; **Ugwa** transfer the capability of skin to mark time into clothing that show traces of their past, visually enhancing the development and expression of people's personality, as well as **Freefalla**, a garment that includes on one side a feeling of constraint and a sense of personal development on the other, showing ones' personality through a designed pattern and the integrated technology; **TwinTribe** is a multipurpose piece of cloth that creates awareness on people's belonging to social tribes and to their possibility of shifting from one group to the other; **Anaue** is a surfing gadget that induces workaholic people to get out of work, get in the water and share experience and performance with friends; **YYrupigua** is a line of clothing that promotes freedom of movements, transforming clothes into amphibious tools and intui-

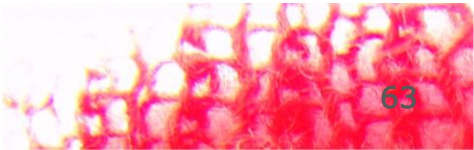


tive movements as activators of homeostatic support.

People involved in the projects:

Youyou Yang, Pak Wing Man, Jesper Schwachöfer, Gilles van Wanrooij, Jeroen Witjes, Joran Damsteegt, Barbara Schächter, Niko Vegt, Jan Belon, Jelle Stienstra, Jasper Pieterse, Jeroen Brok, Frank de Jong, Joris Zaalberg R.J.W. Schatorjé, Lilian Admiraal, Saskia Bakker, Arne Wessels, Silvia Piantini, Giulia Mari, Federico Tecchi, Erika Cellai, Matteo Gioli, Michela Gadani, Erica Battaglia, Axl Pizzinini, Anna Bonciani, Claudio Manetti, Fabio Novelli, Veronica Cornacchini, Talles Oliveira, Tatiana Rodrigues, Pâmela Riva, Cláudia Peterle, Isabelle Kowalski, Maíra Scirea, André Ramos, Fábio Teixeira, Luiz de Bettio, Bárbara Bianchini, Claudia Batista, Claudio da Silva, Joep Frens, Kees Overbeeke, Caroline Hummels, Elisabetta Cianfanelli, Stoffel Kuenen, Gabriele Goretti, Michael Cruz

The prototypes are presented by **Ambra Trotto**. She is a PhD student at the Eindhoven University of Technology, in the Designing Quality in Interaction Group and a fellow researcher at the Department of Technologies of Architecture and Design P. Spadolini of the University of Florence.



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Winchester School of Art

Celestial Hybrid

Laura Leanne Wilson

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The main concept that inspired my prototype was to create textiles capable of adapting to their environment and responding intelligently to the wearer. I considered sustainability to develop something that people can invest in - as capacity for change renders a fabric useful in a trend driven society, perpetually striving for the 'new'.

I explored technology as an innovative way to achieve these changeable surfaces. I was inspired by the captivating possibility of using technology to conceal and reveal hidden areas of surface interest. I wanted to form an exciting hybrid between new technology and a desirable fashion aesthetic.

My digitally printed fabrics employ thermochromatic inks that react to body heat creating synergy between wearer and environment. I also used LEDS and fiber optics to create colour change and a diffused glow in darkness. I considered the wearability of these fabrics by using conductive thread for my circuits to balance functionality with familiar texture.

Laura Wilson is currently completing the final year of her degree in Printed Textiles, Fashion and Fibre at Winchester School of Art. Her innovative designs were developed for a trend-focused industry brief.

Nominated for the SysTex Student Award 2009:

Georgina Bavalia

Nottingham Trent University, UK

"Stretch Sensor Skirt"

georginabavalia@hotmail.com

Kate Miles

Chelsea College of Art and Design, BA (Hons) Textile Design, First Class

"From Science Fiction to Reality: Super Humans, Smart Textiles and Wearable Technologies"

katemiles00@hotmail.com

Laura Leanne Wilson

BA(Hons) Textiles Fashion Fibre - Winchester School Of Art

"A Report About my Work Within Intelligent Textiles"

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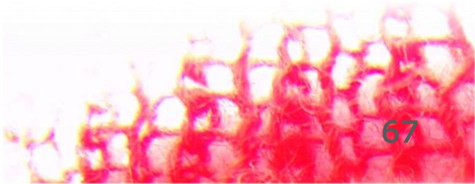

Bhavin Chamadiya

Research and Development, Daimler AG, Boeblingen, Germany Institute for Signal Processing, University of Luebeck, Luebeck, Germany

"Capacitive Coupled Electro Cardio Graphy measurements employing flexible electrodes in a car SEAT"

bhavin.chamadiya@daimler.com

Muhammad Dawood Husain

Textiles & Paper, School of Materials, University of Manchester, UK

"Development of Knitted Temperature Sensor (KTS)"

dawood.husain@postgrad.manchester.ac.uk

Nicki Eastbury

Northumbria University BA (Hons) Design for Industry

"Foria Intimate range"

nickiupnorth@gmail.com

Senem Kursun

Istanbul Technical University (ITU), Textile Technologies and Design Faculty

"Wearable Obstacle Detection System Integrated with Conductive Fibers for Blinds"

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