Designing Towards Inward-Oriented Fashion Technology: Demo Projects

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Abstract
Fashion technology designs typically combine sensing technology and actuators to register and respond to information about the environment and/or the human body. The ways in which designers use and integrate these data into garments, however, varies on a scale from highly theatrical and outward-oriented designs to subtle and inward-oriented applications. This pictorial presents five garment designs created between 2013 and 2020, that occupy the more utilitarian and inward-oriented end of the fashion technology spectrum. We demonstrate five designs that combine sensing and actuation, highlighting the benefits of direct biofeedback and of keeping the personal data within the garment. The selection of projects aims to search the right balance between sensing and actuation.

Author Keywords
Fashion technology; clothing design; personal biofeedback; balancing sensing and actuation.

CSS Concepts
• **Human-centered computing** ~ Collaborative and social computing ~ Empirical studies.

Introduction
Designers have been exploring the possibilities of integrating technologies into clothing [e.g. 1, 2, 4, 5, 7, 10, 11, 12, 13, 14, 16, 18, 21, 22]. The resulting garments, here referred to as 'fashion technology', typically combine sensing technologies with actuators that translate the collected data into some kind of output [18]. This demo presents five fashion technology designs created by one of the authors within the past ten years. The pictorial shows how the balance between sensing and actuation impacts the 'wearability' [3, 6, 8, 9, 15, 19, 20, 21].

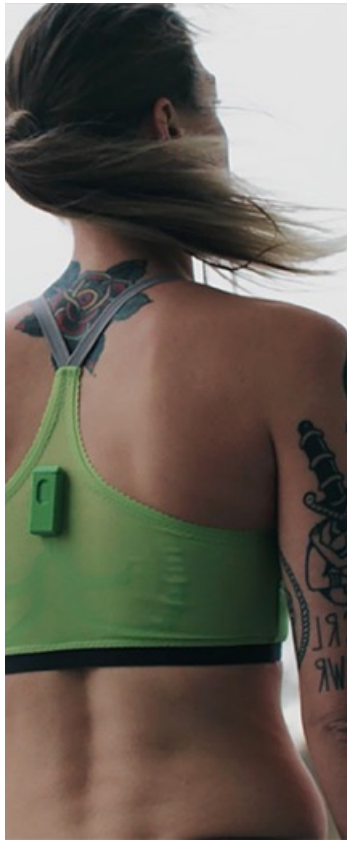

Figure 1: A bra from the biosensing sportswear, project 1.

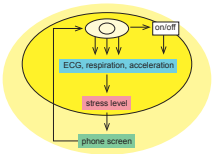

Figure 2: Schematic visual.

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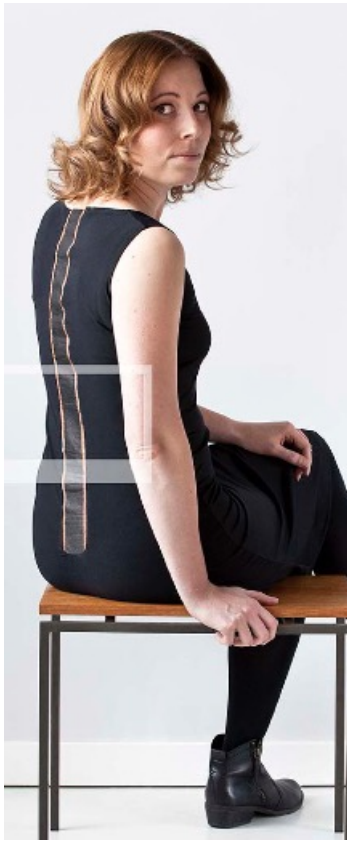

Figure 3: The spine-warming dress.

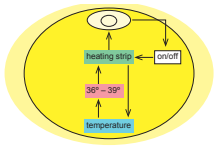

Figure 4: Schematic visual.

Project 1: Biosensing Sportswear

This project consists of a collection of women’s sportswear that uses heartrate, acceleration and respiration sensors to measure the wearer’s health, stress level and sports performance (Fig. 1). The heartrate and respiration sensors have been laminated and printed directly onto the textiles, allowing for unobtrusive, comfortable and flexible integration into the garment. The hardware (battery, communication, and acceleration sensor) is placed in a tiny removable container on between the wearer’s shoulder blades. The biometric data collected through the sensors are processed and visualized with the help of a fitness app that wearers can access on a mobile device (Fig. 2).

Project 2: Spine-Warming Dress

The second fashion technology project is a dress containing a band of conductive copper on the back, which gives tiny pulses that gradually warm the spine towards a comfortable temperature [17] (Fig. 3). The conductive non-woven material has a low resistance, the copper ribbons a very high resistance, and they spread the current vertically while the non-woven in the middle warms up when current passes through (Fig. 4).

Project 3: Smart and Supportive Garments for Caregivers

The third fashion technology project is a collection of workwear for caregivers and nurses [17]. The undergarment provides health professionals—who perform a very physical job—support to the shoulders, lower back and knees by pattern construction and choice of fabric (Fig. 7). The outerwear is equipped with an anti-bacterial coating, which helps reduce the risk of bacterial contamination. Electronic ‘wearables’ in the garments can issue a warning signal when the posture trackers register overload or unbalanced postures (Lumolift) (Fig. 8).

Project 4: Stress-reducing Shirts

The fourth design project consists of a collection of knitted alpaca yarn shirts that contain wearable technology geared towards avoiding work related stress issues [17] (Fig. 9). These biomonitoring shirts register the wearer’s heartbeat, movements and breathing and give direct feedback via a tiny vibration in the upper back. A specially developed app allows wearers to adjust the sensors’ settings, start training and check their data history (Fig. 10).

Project 5 Gesture-sensing Presentation Shirt

The final design project, the gesture-sensing presentation shirt, is still work in progress. We don’t present a picture in this demo paper, but hope that it helps to illuminate how sensing and actuation are related to the wearability of fashion technology. The shirt is equipped with hybrid printed micro-electronics that sense the wearer’s arm gestures via an acceleration sensor and thereby act as a remote controller during presentations. The shirt is functionally wearable as a direct feedback module that notifies the wearer via a gentle vibration when it senses a recognizable gesture and actuates the movement of the presentation slides. All hardware is positioned locally and unobtrusively on the wrist. (Fig. 5)

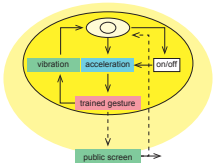

Figure 5: Schematic visual.

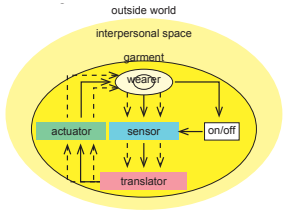

Figure 6: Legenda / Conclusion.

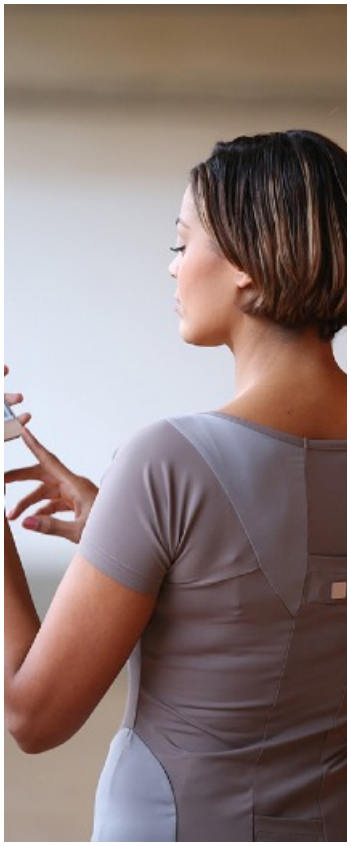

Figure 7: Underwear from project 3.

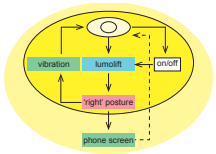

Figure 8: Schematic visual.

Conclusion

The connected pictorial concludes the following: To design fashion technology both effectively and ethically means to search for the right balance between sensing and actuation. Inward-oriented fashion technology that functions without the interferences of mobile screens and data visualizations allows the biofeedback loop to remain within the garment and with the wearer. This assures wearers of control over their personal data, as well as realizes the potential of both body and technology to 'speak' for themselves (Fig.6).

Demo Specifications

We prefer to present the garments on 4 female (EU size 36-38) and one male (EU size 50) mannequin. A demo on 5 clothing hangers is also possible. Accompanied with 5 cards with the above-mentioned information and one pillar for flyers and a card for written feedback.

Acknowledgements

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Figure 9: The black stress-reducing shirt.

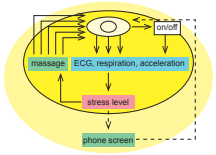

Figure 10: Schematic visual.

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