Cut from the Same Cloth: Fashion Featuring Technology

Author Details
Name: Lianne Toussaint, MA
Affiliation: Radboud University Nijmegen
E-mail address: l.toussaint@let.ru.nl

Author Biography
Lianne Toussaint is a PhD candidate at the Department of Cultural Studies of the Radboud University Nijmegen. She researches the socio-cultural aspects involved in the integration of fashion and technology, focusing on the embodied, expressive and aesthetic effects of the field referred to as ‘wearable technology’. Her research is part of the broader research project ‘Crafting Wearables’ that explores the design, application and production of wearable technologies.

Abstract
The emerging field of wearable technology posits a challenge to existing frameworks of fashion theory. Its merging of fashion and technology invites us to more thoroughly reflect on the way in which garments influence the perceptivity of the body. Proposing the phenomenology of Edmund Husserl and Maurice Merleau-Ponty as a methodological and conceptual framework for the study of wearable technology, this paper explores how the integration of technology into fashion affects the embodied and experiential qualities of clothing. More specifically, three examples from the field are discussed in order to explore how the embedding of sensors and actuators affects the relation between the fashion, technology and the body.

A growing number of designers are experimenting with the integration of sensors and actuators, which allow garments to detect signals from the wearer’s environment or body and to respond to these signals accordingly. In fact, these wearable technologies even allow garments to materialize or visualize signals that would normally remain unnoticed or imperceptible to the wearer. They thus stimulate and even extend the wearer’s bodily perceptivity. Rather than passively ‘dressing’ the human body, these garments are able to actively transform and shape the way the wearer looks, perceives or acts in the world.

Wearable technology highlights the intrinsically embodied nature of fashion. It emphasizes the reversibility of the relation between the body of the wearer, the garment and the integrated technology. Reciprocally perceiving and ‘touching’ each other in an ongoing process of interaction, wearer and wearable are neither independent, nor identical, yet always ‘cut from the same cloth’.

Keywords: Wearable Technology, Fashion and technology, Embodiment, Phenomenology, Perception.

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Lianne Toussaint

1. Introduction: Making Sense of Wearable Technology

Stating that wearable technology is closely connected to the body is stating the obvious. After all, technology cannot be termed ‘wearable’ unless it is actually worn on and by the body. In the last decade, fashion studies has increasingly paid attention to the way in which the things we wear relate to the body (Entwistle and Wilson, 2001). For example, wearing high heels is often considered to give a feeling of empowerment or elegance, while wearing itching or undersized garments foregrounds the sometimes uncomfortable corporeal dimensions of fashion. On the one hand, fashion and clothing thus clearly operate on and involve the body (Negrin, 2013). On the other hand, the bodily sensations that clothes may provoke often seem to be forgotten or taken for granted. While hastily cycling to the station or sitting behind my desk, I hardly pay attention to how my sweater, trousers or socks stretch around my body. If a garment is considered to be ‘comfortable’, that generally seems to imply that it is not consciously perceived as something detached or distinct from the body. Most of the time, clothes are somehow experienced as being an integral part of us, hence the prevalent metaphor of the ‘second skin’. In the case of wearable technology the intimacy between the human body and its garb is often indeed so close that it becomes difficult to “draw the line between nature and artifice” (Soper, 2001: 24), or to determine where the body ends and the garment begins.

The study of embodied experience is of particular relevance now that fashion is increasingly teaming up with technology (Smelik 2012: 154). Growing numbers of designers have been experimenting with the integration of sensors and actuators that allow garments to detect signals from the wearer’s environment or body and to respond to these signals accordingly. This so-called ‘smart clothing’ is part of the broader field commonly referred to as ‘wearable technology’ (‘wearables’ for short), which spans clothing and accessories that integrate technological features or devices. The incorporation of sensors and actuators allows garments to sense, materialize and/or visualize signals that would normally remain unnoticed or imperceptible to the human body. Rather than passively dressing the body, smart clothes may thus actively transform and shape the way the wearer perceives and experiences the world. They morph fashion into uniquely tactile interfaces through which broader sensory stimulus can be perceived (Quinn, 2010: 5; Dunne, 2011: 613).

In short, wearable technology represents a fusion of the embodied practice of dressing (Entwistle and Wilson, 2001) and the perceptual capacities of technology. In order to make sense of the possibilities and implications of the marriage between fashion and technology, it therefore is necessary to thoroughly reflect on the embodied and experiential aspects of wearable technology. This paper proposes the
phenomenology of Edmund Husserl (1952/1993)\(^1\) and Maurice Merleau-Ponty (1945/2002) as a fruitful starting point for this critical reflection. Moreover, I will argue that the phenomenological study of smart clothing can help to gain a better understanding of the bodily dimensions of fashion in general. Focusing on three different cases of wearable technology, I will explore how the embedding of sensors and actuators affects the relation between the fashion, technology and the body.

2. Prosthetic Protection

Protection, modesty or display and decoration are generally understood as the main functions of fashion and clothing (Barnard, 2007: 107). The basic reasons for wearing clothes, however, do not seem to be entirely exclusive to human beings. In fact, they have a lot in common with the function of animal fur and feather, which also serve both as protection and as display (Soper, 2001: 17). When it concerns the combination of fashion and technology, this analogy between human and animal ‘clothing’ often serves as a source of inspiration for designers. The ‘Robotic Spider Dress’ [figure 1] by Dutch fashion designer Anouk Wipprecht is a literal yet somewhat unsettling example of the type of biomimicry\(^2\) this may result in. Together with Austrian software engineer and hacker Daniel Schatzmayr, Wipprecht created a dress equipped with sensors, actuators and controllers that steer the spider limbs on top of the wearer’s shoulders. The robotic spider arms register and respond to any movement within the range of ten to eighty centimetres by protectively drawing their legs against the wearer’s torso and ‘attacking’ anyone that comes (too) close (Wipprecht, 2012). With this robotic anime-meets-high-fashion dress, Wipprecht and Schatzmayr take one of fashion’s basic functions — protection and security — to the next level. Although an analysis of this dress in terms of functionalities might help to understand its properties, it would fail to address what this wearable may do to and with the wearer’s body. The phenomenology of Maurice Merleau-Ponty, however, offers methodological and conceptual tools to explore these bodily aspects.

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\(^1\) Though Husserl already wrote his *Ideas Pertaining to a Pure Phenomenology and to a Phenomenological Philosophy, Second Book* (*Ideas II*) between 1913 and 1928, it took until 1952 for the book to be published posthumously.

\(^2\) The term ‘biomimicry’ refers to the imitation of the models, systems, and elements of nature (Biggins et al., 2011).
In *Phenomenology of Perception* (1945/2002), Merleau-Ponty elaborates on the idea that some of the fields of sensations can be extended by instruments. He illustrates this point with the example of the white stick that becomes part of the blind man’s sensing system: “Once the stick has become a familiar instrument, the world of feelable things recedes and now begins, not at the outer skin of the hand, but at the end of the stick” (Merleau-Ponty, 1945/2002: 176). I would like to argue that this insight illuminates how Wipprecht’s robotic spider dress relates to the wearer’s perceiving body. Due to the three sensors in the robotic arm, the wearer’s “world of feelable things” no longer begins at the outer skin of the body, but at the outer ‘skin’ of the garment. From a phenomenological perspective, wearer and wearable essentially become one: the garment has become part of the information flow and feedback system by which the wearer knows the world (Popat and Preece, 2012: 12, 168). The information about nearby movement flows from the sensors to the robotic spider arm that reacts accordingly, and alerts the wearer to approaching subjects. The integrated technology thus allows stimuli to travel from the environment, to the sensing garment, to the wearer within mere seconds.

Though Merleau-Ponty’s analysis of the blind man’s stick is helpful in understanding the way in which Wipprecht’s wearable becomes part of the perceiving body, there is one important difference. Merleau-Ponty notes that “the stick is no longer an object perceived by the blind man, but an instrument with which he perceives (...) [i]t is a bodily auxiliary, an extension of the bodily synthesis” (1945/2002: 176 [original emphasis]). Yet the stick is a passive instrument that has to be activated by its user, while the robotic spider limbs are self-acting objects that can function independently of the human wearer (Dunne, 2011: 614). Even if the wearer is inattentive to someone approaching, the mechanic limbs will ‘sense’ and react to the other’s proximity, allowing for a perceptual monitoring of what normally remains imperceptible. In other words, the robotic spider limbs enable the materialization of what I would like to term ‘prosthetic perceptions’3: perceptions “not strictly derived from a person’s lived experience” (Landsberg, 2004: 25), but made accessible through technological body extensions.

In Merleau-Ponty’s words, the body is “our anchorage” in the world (1945/2002: 167). He emphasizes that the body forms the material ground for interaction with the world. That the ‘Robotic Spider Dress’ can transform and extend the wearer’s embodied experience, thus indicates that “[t]he experience of the corporeal schema is not fixed or delimited but extendable to the various tools and technologies which may be embodied” (Broadhurst, 2012: 168). In this case, the smart dress acts as a tool that increases the capacities of the wearer’s body, enabling it to perceive and experience more than it could do in a ‘regular’ dress. Yet even though the impact of the little metal spider limbs is not actually threatening or harmful — at best it will alarm those already scared of spiders — their prosthetic perceptions do

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3 I derive the term ‘prosthetic perception’ from Alison Landsberg’s book on *Prosthetic Memory*, in which she describes the technologies of mass culture that “open up a world of images outside a person’s lived experience, creating a portable, fluid and nonessentialist form of memory” (Landsberg, 2004: 18 [emphasis added]).
potentially allow for a heightened alertness and feeling of protection by shifting the wearer’s corporeal and sensorial thresholds outwards.

3. When the Heart Skips a Beat
The ‘Robotic Spider Dress’ by Anouk Wipprecht has illustrated how the integration of outward-facing sensors can allow a garment to know something about the wearer’s surroundings, and to function as a technological extension of the “body-in-the-world” (Merleau-Ponty, 1945/2002: 164). The outward-facing sensors detect signals in the environment — in this case movement and location — that influence the wearer’s embodied and spatial perception (Subramanya et al., 2006). For another project, called ‘Intimacy 2.0’ [figure 2], Wipprecht experimented with the incorporation of inward-facing sensors that are used to monitor physiological signals of the body itself, such as heart rate, skin conductance, temperature, body position, or muscle tension (De Rossi et al., 2003 [emphasis added]).

Figure 2: Studio Roosegaarde and Wipprecht, A., ‘INTIMACY 2.0’ (2010-2011).

In cooperation with social design lab Studio Roosegaarde, Wipprecht designed garments made of black and white opaque smart e-foils that become more or less transparent in response to the wearer’s heart rate (Studio Roosegaarde and Wipprecht, n.d.). The sensors turn the ‘Intimacy 2.0’ dress into a bio-monitoring device (De Rossi et al., 2003) that registers the heartbeat in order to deduce how the wearer experiences certain situations. The project allows for a heightened body-awareness of the wearer by drawing attention to an inner and hidden body function: the heartbeat. In other words, ‘Intimacy 2.0’ enables the kind of “self-conscious self-surveillance” that Anne Balsamo considers so symptomatic of our hyper-mediated techno-culture: “(...) body awareness is amplified so that we can technologically witness, if not yet manage, the molecular functioning of bodily processes. (...) These devices function as a set of visualization techniques that contribute to the fragmentation of the body into organs,
fluids and ‘bodily states’, which in turn promote a self-conscious self-surveillance” (Balsamo, 1995: 216). By translating the behaviour of the wearer’s heart into the rhythmically changing opacity of the e-foils, ‘Intimacy 2.0’ visualizes a bodily state that would normally remain invisible. Although wearables monitoring, storing and visualizing physical data are increasingly used for sports and healthcare (e.g. the Nike fuelband or Misfit wearables), the output of the data is obviously quite unique in this case. The faster the heart beats as a result of for example excitement, arousal, tension or physical strain, the more transparent the garment becomes. Rather than using the detected signal to inform the wearer of his physical well-being and performance, they are used to communicate the affective and emotive dimensions commonly associated with the heart. I want to argue that a phenomenological analysis of this remarkable design can again help to reflect on the embodied and perceptual aspects involved in the wearer’s experience of this wearable.

In his *Phenomenology of Perception* (1945/2002), Merleau-Ponty specifically addresses the invisibility and visibility of clothing when he discusses the way his field of vision is limited to the outer surface of his garments: “If I did not take off my clothes I could never see the inside of them, and it will in fact be seen that my clothes may become appendages of my body” (Merleau-Ponty, 1945: 104). ‘Intimacy 2.0’, however, playfully questions the distinction between the outside and inside, visible and invisible. The moment that the e-foil turns transparent, the boundaries between what counts as the inside or outside of the garment in fact literally dissolve. The wearable is ‘outing’ usually invisible information, making the wearer an audience to the workings of his or her own inner body. At the same time, anyone present can also witness the wearer’s heart rate, due to the garment’s rhythmic and continuous metamorphosis. In this interaction with the environment it is the wearable, not the wearer, that has control over whether the body is fully visible or not. Even more intimately, the rhythmic becoming-(in)visible of the naked body underneath the garment may be influenced by interacting with the wearer. Witnessing the material’s transition from opaque to transparent and vice versa, people encountering the wearer will respectively catch themselves looking at or through the garment. The alternate transparency and opacity of the e-foils respectively reveal and conceal the garment and, in turn, the body underneath.

While ‘Intimacy 2.0’ challenges the notion of clothing as something that covers the body, the wearable also plays with the limits and possibilities of the perceiving body. In the second volume to his *Ideas* (1952/1993) Edmund Husserl, who is considered to be the leading theoretician and founder of the phenomenological movement, addresses these perceptual limits by focusing on the body as our “necessary medium” of perceptions:

My body is a thing among things, but its thingly appearance is unusual and imperfect: it is permanently there but can never be freely explored. I can get rid of all other things, distance myself from or demolish them, but all distancing and all demolishing that I am able to effectuate depends on the marginal presence of my own body. This one “thing” is the necessary medium of all my perceptions
and movements, and it is constantly here as the ego point of orientation in perceptual space. All other things are given in relation to it, they appear on different sides and over there at varying distances, far or near, above or below, left or right. On the other hand, the presence of my body is imperfect: some of its sides and dimensions escape my vision and touch, and others appear in fixed perspective. (…) Whereas with regard to all other things, I have the freedom to change at will my position in relation to them. (Husserl 1952/1993: 167)

Husserl here refers to the body as the central point of orientation in the world: things always appear to us in relation to our body, the “thing” that is permanently there. His notion of the body as the necessary medium of all perceptions clarifies why ‘Intimacy 2.0’ is attached to the wearer’s body in both a literal and figurative sense. The wearable is not only operating close to the body, it also fully depends on the physical presence and closeness of that body. Without the heartbeat of a wearer to register and respond to, the wearable would not be able to fulfil its particular function.

Husserl emphasizes that we can never distance ourselves from the body and therefore always perceive our own body in a restricted way. Certain corporeal parts and bodily functions can only be seen from a particular perspective while others remain altogether invisible to us: “The same body which serves me as means for all my perceptions obstructs me in the perception of itself and is a remarkably imperfectly constituted thing”, he writes (Husserl 1952/1993: 167). This attention to the “imperfectness” and restrictions of the perceiving body helps to understand what ‘Intimacy 2.0’ does with the perceptivity of the wearer. The project broadens and perfects the wearer’s limited perceptual range. ‘Intimacy 2.0’ illustrates how the integration of inward facing sensors into clothing can render the (in)sides or dimensions of the body normally escaping the vision, touch or attention of the wearer, visible through and on that same body.

4. A Touch of Wearable Self-Care
‘Vibe-ing’ is the third and final project that I discuss in order to outline the embodied and experiential aspects of wearable technology [figure 3]. This self-care garment is the result of collaboration between the Technical University Eindhoven, the TextilesMuseum and TextilesLab in Tilburg, and Metaronics (Jeon et al., 2013). The project explores the possibilities of vibration therapy through wearable technology, aiming to contribute to a non-invasive treatment of osteoporosis.

‘Vibe-ing’ is a knitted and felted wearable made of merino wool interlaced with conductive yarns. Touch sensors and vibration motors have been integrated into a series of pockets in the textile. The placement of these little pockets corresponds to crucial pressure points of the body. The exact location of the vibration motors creates different stimulation areas on the body, which can be programmed to activate depending on the specific person’s need for care, rehabilitation, and healing (Jeon et al., 2013).
What makes ‘Vibe-ing’ a particularly relevant example within the context of a phenomenological reading of wearable technology, is that it perfectly aligns with Husserl’s reflections on the topic of embodiment. In *Ideas II*, Husserl describes how the perceiving body experiences its own touch: when the right-hand’s fingers touch the left arm, this not only provokes certain sensations in the right-hand’s fingers (such as smoothness or warmth), but the left arm will also appear to have sensations of its own (Husserl, 1952/1993: 152). This phenomenon of *double sensation* highlights that “the living body is a physical thing that is able to entertain a system of sensations” (Heinämaa, 2012: 226 [original emphasis]). When applying this insight to ‘Vibe-ing’, it becomes clear that this therapeutic wearable is based on a system of sensations as well. Yet in this case several parts of the body, rather just a hand, are involved in the reciprocal touch between the wearer and wearable. The touch of the wearer activates the system of sensations: this touch not only evokes sensations in the wearer, it is also ‘sensed’ by the sensors. The sensors then activate the vibrations motors, which in turn evoke sensations in the wearer’s body. The system of sensations that Husserl describes thus clarifies the process of reciprocal touching ‘Vibe-ing’ thrives on. Yet there is also a significant difference between the double sensations this wearable evokes, and the ones that Husserl discusses. Since the sensors and vibration motors do obviously not directly belong to the living body of the wearer, one could be inclined to belief that they do not have any *bodily* sensations of their own. By returning to the work of Maurice Merleau-Ponty, I however want to argue that the technological sensations evoked and perceived by the wearable have an embodied dimension as well.

Like Husserl, Merleau-Ponty elaborately reflects on the body’s “equivocal status as touching and touched” (Merleau-Ponty, 1945/2002: 109). As explained, the therapeutic function of the vibrations in ‘Vibe-ing’ is based on this process of reciprocal touching: the wearer presses the painful or strained points of his body while
simultaneously touching the electronic pockets. The sensors then register the wearer’s touch and will in turn “touch” the wearer by starting to vibrate. Merleau-Ponty further develops Husserl’s idea of double sensation by clarifying that the perceiving and touching actor is an inherently incarnated actor: the touching hand foregrounds “the integument" of incarnation” of the perceiving hand (Merleau-Ponty, 1945/2002: 106). I therefore argue that in the case of ‘Vibe-ing’, technology can be understood as being incarnated as well (Heinamaa, 2012: 230). If touch and perception are intrinsically embodied phenomena, and ‘Vibe-ing’ integrates both of these functions, it follows that the wearer’s body and the wearable technology “must be of the same (…) ‘flesh’” (Komarine Romdenh-Romluc, 2012: 111). This is not to say that the perceiver and the perceived are identical, since the wearable and body are still two distinct entities, but that they are deeply dependent on each other (Ibid.). Their close and reciprocal connection points to the increasingly porous boundaries, and even intimacy, between the human body and technology (Smelik 2012: 183).

5. Conclusion
My reading of three examples, the ‘Robotic Spider Dress’, Intimacy 2.0’ and ‘Vibe-ing’, has shown that phenomenology as a theoretical framework and as a method of analysis, helps to define and better understand the workings of wearable technology. By focusing on the embodied and perceptual aspects of wearables, I have outlined how wearable technology can supplement and complement the perceiving body (Boddington 2012: 79).

Four conclusions follow from this analysis. First of all, we have seen how the sensing and actuating qualities of wearables expand the possibilities of, and introduce dynamic qualities to, fashion (Seymour, 2009). Rather than passively ‘dressing’ the human body, these garments are able to actively transform and produce the way the wearer looks, perceives and acts in-the-world. Moreover, by seeking inspiration in and mimicking the complex structures of nature, wearables like the ‘Robotic Spider Dress’ can add another dimension to the protective function of fashion. Secondly, wearable technology offers alternative ways to monitor, experience and visualize normally invisible or unperceived bodily states. In the world of wearable technology, the movement or transparency of a garment may express intimate information about the wearer’s inner body or feelings. In other words, by ‘sensing’ what is going on inside or the wearer or his environment, wearable technology offers the possibility to extend the sensorial and corporeal perceptivity of the wearer and his environment. In doing so, wearable technology transforms clothing into a technological prosthesis that enriches and intensifies the relation between object and subject, inside and outside, wearer and world.

Thirdly, wearable technology foregrounds that fashion and clothing are fundamentally embodied practices. The three case studies in this paper have shown that wearables have the potential to become an integral part of the wearer’s sensing

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4 The word ‘integument’ denotes a covering, coating or outer protective layer (Oxford Dictionaries, n.d.).
system. They can become technological prostheses that comfortably extend the wearer’s perceptivity and embodied experience. Other potential psychological and physical benefits of wearable technology (such as an increased feeling of safety or reduced muscle tension) lie in the way they can make the wearer more aware of his body and surroundings. It can therefore be concluded that much of the effect of wearables on the wearer’s embodied experience is about directing attention to or away from the body.

Fourthly, since the garments discussed in this paper all actively interact with the body and environment of the wearer, they stress the reversible and symbiotic character of the relation between the body and wearable technology. The wearer’s body not only senses and touches the garment, the garment, in turn, also senses and touches the body. Body, garment and technology are neither independent, nor identical, yet they are always ‘cut from the same cloth’.

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