

The emergent dress: fashion, performance and materiality

Michèle Danjoux

Abstract

The development of ‘emergent techniques’ in design is central to our interdisciplinary research which links physical performance (dance, theatre, live art) and material production (smart textiles, fabrics, and fashion design) to explore close-to-the-skin technologies and indirect interfaces such as motion capture. Our ‘emergent dress’ prototypes – garments which are not completed but change when in use by performers – adapt the transformative technologies of the digital media. They are tested in our telematic studio where we collaborate with other performers online. In the work, generated at the DAP Lab (design and performance laboratory), we move in the direction of producing interactive garments, garment prototypes to be explored and developed through performance. We question how the design of intelligent garment incorporating interactive media technologies can influence performance dynamics and choreography and act as interface for performers and specifically, the impact of extreme fabrication on fashion performance in the immersive projective environment. We shift and transform the wearer-garment relationship and garment state (physical/virtual), through our combined uses of materials, tools and technologies and interdisciplinary working practices. This extends the notion of materiality: the philosophical and aesthetical, the multivalence of material. The work integrates the materiality of new media technologies (such as the computer) and the functioning processes which themselves embody specific materialities into the tissue of the dress. Motion graphics (ScreenDress), wearable display (Explay), sensor (SensorDress) and motion capture technologies (CaptureDress) overlap with the dress to form its extreme makeup and extend its information-sensing-processing and -networking capabilities. Our work seeks to generate new knowledge in the field of progressive

Keywords:
materiality,
interactive,
digital technology,
motion capture,
sensors,
telematics

and intelligent fashion and potential garment interface capabilities and push creative and user boundaries. We study how the use of extreme materials of fashion, in their broadest sense, allows for the emergence of both a physical and a virtual artefact.

Introduction: intelligent performative fashion

The ‘Emergent Dress’ project¹ takes human performance, dance and creative behaviour and new media technologies as inspirational tools for the fashion designer and the garment design process. Creative and digital processes are fused in the aesthetic and structural forms of the garment; the technology is embedded into the fabric, the materiality of the dress, giving it new transformational capabilities. We question how the design of intelligent garment incorporating interactive media technologies emerges in the performative environment and then how it can influence performance dynamics and choreography and act as interface for performers and specifically, the impact of extreme fabrication on fashion performance in the immersive projective environment.

The focus is on conceptual fashion design, materiality of garments and wearable technologies as tools for exploration, sensory engagement and expression, in online performance, across distance. In networked space, the virtual or screen image and the imagined state can take priority over the real image and the materiality of the real garment can act as conduit to the screen, virtual and imagined space. It becomes the vehicle for visual communication and interface between performers in different geographical sites connected via the streaming media (telematics).

This introduces the category of the ‘wearable’ into the field of performance and choreography, drawing particular attention to the sensorial affect as interface, while it also alters the meaning of ‘designing wearability’ for fashion, as we are here addressing cutting-edge developments in wearable computing at the beginning of the 21st Century. Since this area is still very much experimental, there are few mature commercial products with a wide user base that can be evaluated. Artistic works deploying wearables and reaching a wider audience are equally rare.²

The research context centres on fashion materiality and interactive sensorial emergent design: wearable interfaces and smart materials in the digital age.

Touching materiality (The real and the virtual)

One important aspect of digital technology is the impact it has on materiality. Materiality in the digital age has two forms, its physical and tangible form located very much within the realm of the real and material world and its immaterial and digital form ‘digital materiality’ located within the virtual realm. One is concrete, i.e. it touches and can be touched and maximizes the sensory dimensions of interactivity, the other (digital materiality) a computational model for the expressive and emotional multimodal interaction experience. Digital materiality then is essentially about digital representation and the materiality of data. Digital technologies offer a shift of materiality away from reality – the real world into the dematerialized or immaterial state through data transfer and manipulation.³ The fantasy worlds of games are a primary example of this fusion and shifting between worlds and in some instances (‘Second Life’) all the 3D content and appearances of the virtual are created by the real user, the user who then inhabits or touches both worlds; the real and the virtual. Thus conventional understanding and parameters of materiality as having a material nature or quality of only existing in the material world are challenged and can no longer be so simplistically defined. Material as substance of which a thing is made or composed is no longer only physical but can also have a virtual nature afforded by the digital and the shift to a new media culture.⁴ At the same time, in interactive performance the crucial point between the digital and the human is the embodied enactment.

In this paper, I discuss how the collaborative Emergent Dress project with its interest in interactions between screen images and physical artefacts touches the two sides of materiality. The technological experience is mediated through the wearing of the dress by the performing body to yield interplay of the real and the simulated. In the engagement with physical or real tactile material and digital tools, the movement and human gesture map out the performance space. Digital representations of the wearing held within the virtual realm manifest as a ‘wearing of the digital’. Notions of transposition (the changing of elements from one significant condition to another) and dematerialization are explored through garment interface and digitization. The garment and character are shifted to an altogether different medium through our combined uses of physical and virtual materials, digital tools and new media technologies, they ‘rematerialize’ in the digital medium. The work is grounded in interdisciplinary working practices.

Fashion materiality

Fashion materiality involves concepts for creation, wearing and interpretation. The 'Emergent Dress' project has been initiated in a performance, media arts, and fashion design context, brushing shoulders with computer science, engineering and new developments in human-computer interaction design. It is equally fuelled by new material technology – new fibres, fabrics, and innovative processing techniques that allow the integration of sensors or smart functionality into clothing.⁵ The 'Emergent Dress' harnesses digital technologies to initiate material change, exploring issues of dematerialization and recomposition through the shifts of materials from the concrete to their digital form, (audio, and video/screen representations). This is studied whilst simultaneously addressing the question of how the technology itself can also shape and construct the material form and content of the artwork or object/the emergent dress. The computer is our primary tool of 'transformation', coupled with the software techniques and technologies specifically devised for dance. We explore strategies and techniques for combining interactive digital media and live performance, direct (sensors, switches, smart fabrics) and indirect interfaces (optical) – linking gesture to interactively controlled video and sound and other digital media in live networked performance. Data is captured from the garment-body-movements (interface as data stream), manipulated and dispersed to form a new data materiality (digital compositing) of fashion.⁶ We work with transformative technologies, dissolving and fractilizing images, reducing the substantive to the dispersed data or new data materiality. One of our primary software tools for authoring and manipulating media is Isadora.⁷ Real-time video and accelerated rendering, custom actors and live video and sound input/output for multiple video images and multi-channel sound features of Isadora facilitate a 'real-time fashioning' of images and performative input.⁸

Ideas for the 'Emergent Dress' are tested in our telematic studio where we work with distributed networks and extend collaboration to involve other performers online. The type of mediated performance we work with – telepresence or telematic performance – implies the experience of being fully present at a location remote from one's own physical location, generally involving a camera-based internet convergence (streaming media) between two or more sites. Someone experiencing telepresence would therefore be able to behave, and receive stimuli, as though at the remote site. The work requires networked audio-video convergence, with

the scenes at two distant sites becoming one. The architecture of such convergences in a studio or gallery thus always involves multiple screens and surround sound in the projection of the live web streams and real-time 3D Virtual Environments.

Embodied and intimate design

The garment design process is dynamic, placing emphasis on experimental and experiential movements with cloth and partial design states. The dancer and designer work together exploring the co-creation of garment. Movement reactions initiated by the tactile stimulus of the cloth and partial garment form are methods employed for the emergence of design. The approach is user-centred and dynamic, working with moving tools of the human body and video sketchbook and photographic records. The cloth/garment becomes further sensorialized through the embedding of sensors (SensorDress), optical markers (CaptureDress) and other wearable technologies and the movements begin to generate numerical data that can be used to physically alter output and environment. The potential of the dress enters a new realm of wireless networking and augmented reality. Emphasis is placed on 'emergent behaviours' and the analysis of movement/gesture and the impact this has on design both of garment and responsive interactive and immersive space. Through an intimate and embodied wearing of the cloth, interlinked and actively participating and networked bodies explore a hi-tech reworking of the transformative wearing concepts of the 1960s Neo-Concretist artists⁹

As the emergent dress reveals itself, the notion of the traditional garment recedes and takes on a new technological identity. Working within the domain of embodied experience; the body as site of enquiry for the development of technological fashion, technological and interactive systems are integrated into garment. We look for technologies to engage with the body in not just a purely functional dimension, but also in an aestheticised and poetic way and to establish a dialogue between the wearer and the immersive environment. Thus, to borrow a statement from Bradley Quinn, we hope to establish "a new affinity between the human and the environment, mediated by clothing designed to be intimately involved with the wearer's activities".¹⁰

This approach to the generation of interactive wearables is dynamic and intimate. The moving body and technologies are part of the emergence,

simultaneously impacting on the form that is fashioned whilst the fashioned form then impacts on the sensing moving connecting bodies. Energised and sensitized cloth is used as a conceptual tool to mobilize sensual and intimate participation in digital design processing. One could argue that all this ultimately leads to a more intimate wearing (of data manipulation), since the processing is informed by a sensorial-corporeal participation by the dancer working within the immersive projective environment.

Intimate wearing of intimate apparel generally means a wearing close to the skin: lingerie, underwear. With intimate and close to the skin apparel comes touch, the garment or textures act as stimulus to our sensory and mediating systems. Touch gives rise to feelings (affective states of consciousness) triggered by physiological changes arising from both sensory perceptions and memories. Sensory receptors act as triggers for experience and in turn experiences and perceptions act as trigger for an automatic emotional response. Jo Berzowska records visible conversations between physiological and computational input on the surface of the dress, through her uses of intimate electronics and "soft computation" within garments. Berzowska states that human use can have an impact on the integrity of digitally-augmented objects, her "memory-rich" digitally-augmented clothing such as PURE PLAY and FEATHERY DRESSES explores this impact through the use of technologies such as integrated touch sensors and microcontrollers, thermo chromic inks and LED's for visual display. Here Berzowska observes and is interested in the social patterns that emerge, especially when the costumes invite touch and give visual feedback in a playful way.¹¹

This relational and visually revealed intimacy of wearing is central to the emergent dress project (and the human touch on the digital), as we work with projecting outward, through large scale installation screens and online connectivity, the shared moments of body-garment-digital exchange. For us, touch is not just about the physical impact, since we are also interested in emotional touching. The touch that extends inwards and outwards from the fabrics, the textures, shapes, colours, details and the physical contact with the skin to the intimacy of movement and gesture and of personal exploration through wearing. The intimacy can come then not just through the process of creation, but also through the act of wearing and of moving. We emphasise the

potential transformational possibilities of physical and psychological movements in time.

The specific emergent garments enable or challenge specific movement characters and moods and specific conjunctures of 2D and 3D images and 3D real bodies and 3D environments of data (creating ghosts and refracted images of the dancer in the screen world). The act of wearing within the tele-immersive environment looks for the moments of exchange, the gestures and openings that allow new knowledge and understanding, modes of expression and relationships to form as we move between the real and imaged state. Real-time interactions in the telematic studios at Brunel explore online connectivity through this extended notion of wearing - movement and gesture now spans multiple telepresent bodies, making fashion an intersubjective experience of real and virtual presences.

Intimacy also links to desire, a theme seldom if ever touched on in most of the discourse on cultural exchange or globalization. Kaat Debo argues that "inherent in all desire is a measure of fantasy...decorative and superficial, yet at the same time it is deeply rooted in our cultural and social consciousness."¹² The prototypes ScreenDress, SensoryDress, CaptureDress specifically aim to link fantasy with reality, as the relationship of cloth to body affects the textures of the film or animation and the immersive virtual space: the computer generated artificial environment. These prototypes endeavour to take the wearer on a part real, part imagined or virtual journey of exploration and expression into the imaged and imagined landscape. It is an exploration of the (digital) medium as "a means of temporary release from habitual perceptions and culturally based assumptions about being in the world, to enable us, however momentarily, to perceive ourselves and the world differently".¹³ We work with the skin, movement and the visceral senses and extend the relationship beyond just the standard wearer-garment relationship, to the broader relational aspects of wearing. These wearables explore new forms of self-expression and fantasy play, interactive play with the environment. The wearer of the wearable acts to enframe digital information, giving body to digital processes and thus to her or his own intimately and affectively experienced sensation of 'wearing the digital' of becoming digital(ized). Fashion is thus positioned in a video/cinematic and digital arts context where the participant wears clothes that can "solicit" images and sound. We envision that the wearer can potentially fashion new worlds and create new environments.

The prototypes

ScreenDress

ScreenDress is constructed from Chromatte, a technical light-reflecting cloth for chroma key production in TV and film. This material, designed to work dynamically with a LiteRing (a camera mounted device featuring LED's) utilizes the retro-reflective properties of its fabrication for live effects/image replacement, fusing motion graphics with onscreen performance.

The *technological garment* is a real garment, the physical form of the garment, existing in the real world, and in its isolated state (uncoupled from the LiteRing), is gunmetal grey. Here the focus is on the material facts of fashion, the applied aspects and technical solutions to produce an artistic result. We are concerned with the cut and the fabrication, the detailing and finishes and the overall silhouette statement, the structure of the garment and how the body engages with the piece, i.e. how it is worn/performed and is choreographed into movement. Pleats: expanding and contracting, layers, seams and a modular approach to garment construction are used, and garment and movement are inseparable, in that one extends the other, becomes the other. The moving body has an impact on the form of the design and the form of the design has an impact on the moving body.

The *iconic garment* is a screen garment and virtual version of the dress. The garment, according to Barthes' analysis of the body-garment relation, is extended as a body.¹⁴ He discusses this through his study of Erté's fashion drawings and specifically the Ertéan silhouette where the woman becomes the garment, is somehow biologically fused into the woman-garment. The body can no longer be separated from its adornment and decoration. The woman and the garment become one. ScreenDress, with the morphic mandate of the motion graphics, is extended as a body, poetically shifting its surface of moving patterns and textures. It invents and substitutes, simultaneously masks and reveals, is animated, becomes alive and organic with multiple juxtapositions of image and color. The filming and "camera eye" remove us from one reality into another, one where dancers (Song, Ren), organic tissues and animation become fused into expressive visual statement: an indissociable mixture of body, garment and graphics, bleeding forms, one into the other. This is a dialogue between the natural and the artificial, brought together in an intimate relationship to create a new

object or artifact, the iconic garment. The *iconic garment* becomes a spectacle in its own right, a mechanism for display and experience.



Figure 1. Nam Eun Song with animated ScreenDress, Videostill © 2006 DAP Lab

The process of design begins with movement, introducing partial garment structures and cloth to the initial frame. Song was invited to discuss how she felt about the Chromatte. Movement behaviours/reactions initiated by the tactile stimulus of the cloth were observed. Song found the touch of this cloth somewhat harsh and aggressive, it felt hostile to her movements and unforgiving. Slashing of the fabric was explored to ease restriction/the sensation of restriction. Cut lengths of the cloth were coiled and wrapped to produce rudimentary sleeves and other garment features. Pleats introduced a more structural dimension to the surface, enabling expansion and contraction with each affected move or gesture.

Song experiments with different movement qualities and energies to explore how the 'digital sketches' – incorporating the digital graphics into her movement consciousness and proprioception – affect her ability to frame the constant flow as time-image and image-movement. A particular screen poetics has evolved, and although Song's unconscious experience cannot be verbalized here, it is apparent that she investigates the ScreenDress as an interaction instrument, a kind of membrane between the real and the projective, between herself and her other. However, the relative stiffness of the chromate material and its dull appearance in real space gain mysterious textures and luminosities in

the animated screen graphics. The fabric material thus creates a contradictory pleasure. Or, rather, the motion graphics behave in an almost contradictory manner, concealing the true nature and identity of the fabric and revealing a more organic, biological, emotional response. Control shifts from fabric to dancer, and the experience becomes visibly more visceral and sensually involved as the relationships shift in motion.



Figure 2. Nam Eun Song with animated ScreenDress, Videostill © 2006 DAP Lab

The process is taken one stage further with the integration of the motion graphics and the dancer's intimate engagement with her own animated self, the likely interaction of control and submission. The garment becomes capable of mediating interaction and encouraging new social relationships (between online partners). ScreenDress is ornamental and expressive, a union of design and technology. Transforming patterns grow and contract, interstitial forms, pulsating rhythms move across the surface, digitally emulating the biological body, the nerves and membranes and natural flows of energy. It is a shape-shifting kinetic form, constantly morphing, moving from concave to convex, one minute the dancer is wearing herself, her own emotions, the next she is displaying a (remote) partner's imagery, becoming interwoven and intermeshed. Positioned as progressive fashion, this is not conventional clothing, but clothing for display and experience.¹⁵

SensorDress (Fantasy Filmdress)

Barthes's historical theory of the different structures involved in the fashion system – the real garment, the iconic structure, and the written

garment – can now be extended to include the digitally animated garment and inversely, the intelligently worn film. The shifting between forms of the garment in our project is effected by digital technology and real-time transformation: the garment is transposed from cloth to moving graphics and a fluid, sculptural, kinetic and cinematic form that resembles the visual kinetics of earlier experimental film (Moholy-Nagy, Léger)

SensorDress, or fantasy filmdress, is a sensory garment concept, combining traditional and sensuous fabrics (silks, leathers, linens etc.) and organic textures with wireless and sensor technologies integrated into garment (and accessories).



Figure 3. Katsura wearing SensorDress Prototype of mixed textures and sand tones, photograph © 2007 Michèle Danjoux

The notion of “wearing the film” was first used by Jane M. Gaines in her analysis of specific film dresses that draw attention to the elaborate design in excess of the narrative or narrative function.¹⁶ In our case, SensorDress is a garment constructed with intelligent fabrics (sensor fabrics) allowing the motion with the garment and the body to transmit wireless signals to the computer. Rather than re-appearing as an iconic garment in the screen environment or virtual space, SensorDress allows the dancer to animate and edit filmic scenes from a responsive database environment now activated, ruffled and moved in real-time. SensorDress is a multi-layered, multi-textured interface which uses

sensor choreography, to send data messages wirelessly for 'editing' of the audio/visual media of its, or another's (remote partners) immersive environmental landscape.

The interactive relationship of dress to film bears some resemblance to Gaines' notions on "wearing the film" in its studies of (material) body as place of intersection (between the real and the projected world) and of the relationship between spectator and the "embodied screen design-in-motion".¹⁷ Our wearing however becomes a wearing of film materiality, of frames, projected light, colour, textures, forms etc. SensorDress draws its narrative from Kobe Abe's novel, *Suna no Onna* (Woman in the Dunes) and the Japanese monist view of nature.¹⁸ We can now extend this idea of fusion to also include digital technologies.

The various sensors in the garment/cloth respond to different types of body movement (orient, flex, tilt, rotation sensors). The movements detected by the sensors trigger the sending of data impulses, wirelessly (via a transmitter) to a computer/network of computers. The control processing of incoming midi data is written in PD patches or Max/Msp patches that can activate filmic, graphic, and sonic 'scenes' from the 'stage' (data-bank). The sensor data from the bodily and fabric movement are used to activate and control image and sonic outputs in the interactive environment. The interface system between wearer and the filmic landscape is activated by the wearer movements, thus emerges a tension between movement and stillness and a knowledge and embodiment of the wearing of a virtual projected environment. Embodiment binds two worlds and involves mental and physical processes and behavior. The wearer (dancer) affects via a system of impulses, movements and transmissions an order or disorder of a visual/sonic landscape. 'Perceptual side' and 'motor side' of behavior communicate to affect the environmental change.¹⁹ The technologically enabled dress specifically converts certain motor essence, into tactile data for sending to the screen image (via computer). Thus opens up an interactive playground for the subject (wearer): the artist exploring the emergent design, the 'participant' or 'immersant'²⁰, can project her fantasized and sensorial experience and expression into the media environment (of our computational communicational world). The dancer has the capability to 'edit' her visual environment; it is her point of view.²¹ Frames organize and re-organize, bodies morph and dissolve and enter fantasy landscapes. We see the onset of immersion, as visual

images formed inside the body (from the tactile sensations of wearing and the knowing touch) overlap with those external images on the projection screens, to create an experiential intermingling of a shifting scenic virtual landscape of bleeding, transforming images and colours.

As with the work of Davies and the breath balance interface (*Osmose* and *Ephémère*) we explore a "strategy for having the immersive experience dependent on visceral process".²² Attached to a motor sensory function and to an extent, to expressive gesture, motion sensors are placed in the dress to enable the wearer to access the virtual realm and affect change. What becomes interesting here is the causal relation that is emerging between stimulation and perception in the inter-sensing body and the ability then to act on re-creation or re-constitution of the material environment, through the virtual world we project. One could begin to postulate that a form of emotional wearing is beginning to take place here, as sensory receptors may act as triggers for automatic emotional response.

The design of SensorDress and the interactive space is driven by a shared and interdisciplinary narrative. The lifestyle and perpetual habits of the female protagonist (an entrapped woman, continually shovelling shifting sands that threaten to bury her home) inform our creative and shared thinking and initiate the various design and choreographic processes for sand habitation. "For all the monotony of her existence, the woman is a multi-layered character. It is one role of her unwilling house-guest to unpeel these layers for the reader".²³ We explore the embodied relationship of the wearer to screen design and the various feedback loops and transformational capabilities and dissolvable potential of the digital technologies.²⁴ The body and the worn garments become 'dissolved' into a representational state of the psychological existence of the woman, her work, her labour and expectations.

Design thoughts are exchanged and developed, where choices of materials: colours and textures relate to the space as a whole (the surrounding space and the 'space' of the projections, and the colours to be used in the film). For additional design inspiration, we study the organic photographic images of Edward Weston and the multi-layered, multi-textured knowledge based dress systems of the Japanese Samurai Warriors and traditional kimono. The layering and tying of these systems afford design potential which offers the dancer the scope to alter the nature of the garment statements during performance. Garment surfaces

are to be worn through a sandblasting finishing process, to give the impression of time and effort and of a 'wearing' by the woman and the environment of the dunes. Colour palettes shift through tones of sand, ochre, sienna and rich earth colours. Exploratory garment states are deliberately not fixed, but in a fluid state of transition. For instance, a utility coat with hood can become a sculptural, organic and abstract form when wrapped differently around the body. Each shifting form of garment brings about a new form of interaction and movement choreography.



Figure 4. Katsura Isobe in T-pose, wearing Mocap suit with optical markers, photograph © 2006 Michèle Danjoux

CaptureDress

The concept for CaptureDress is of a custom built motion capture suit, to take centre stage at given points in the Suna no Onna narrative. The suit incorporates 48 optical markers, small light reflecting spheres, positioned strategically and symmetrically at landmark points on the body. The markers traditionally are connected using Velcro and can be repositioned for each wearer, the standard suit is made from black Lycra and has adjustable features. We look to create a garment that is both developed aesthetically as well as functionally and is tailored to an individual wearer for maximum efficiency in terms of data feedback. The data comes from the body movements in the suit, the markers can be seen by special

cameras (Vicon system). As the dancer moves, the data captured from the body by the cameras can be used to drive animations. The 3D animation software breaks the body down into a series of dots and triangles and this digital information can be used to animate an on-screen avatar. Here the designer can begin to transpose some of their craft into the animation, the working on textures in the 3D animated world.

CODA

Mark Hansen argues that:

The defining material cultural shift of our time - the shift to the digital - has suspended the framing function performed by the (preconstituted) technical image (photograph, cinematic frame, video scanning, etc) and has accordingly empowered the body, in a truly unprecedented way, as the framer of information.²⁵

In all phases of prototype development our broad concept involves the coupling of the garment-body and screen within the immersive digital environment. The evolving and emergent garments are part of a system designed to enable the wearer to embody the 'wearing of the film' or more precisely as Hansen says act as "framer of information" and wearer of the "wearable space". Each dress employs a different digital-body interface examining how the various techniques and gestures can be combined to explore screen interfaces and connectivity between the real and the projected. SensorDress integrates sensor technologies to move the film, alter the sequential flow and disrupt the course of the narrative. CaptureDress can animate the film through motion capture technologies and 3D modelling software. Explay aims to display physiological data in artistic ways on small screens integrated into the surface of the garment whilst also transmitting physiological data via soft circuits to devices to drive other forms of output. ScreenDress can use wireless and Bluetooth technologies to create an interactive event where the wearing is extended to the audience.

Notes

- 1 "Emergent Dress" has been in prototype development at the DAP Lab, a research partnership between Brunel University and The Nottingham Trent University (<http://www.brunel.ac.uk/dap>). The prototype collection under development includes ScreenDress, featuring collaborative design concept for garment by Michèle Danjoux (fashion) and Jon Hamilton (motion graphics). "Explay" features collaborative design concept for garment by Michèle Danjoux and Demosthenes Koutsogeorgis (microelectronics);

"SensorDress" (FantasyWear) is developed by Michèle Danjoux, Johannes Birringer (choreography, sensor design), Paul Verity Smith (sensor design), with Helenna Ren, Nam Eun Song and Katsura Isobe (dance), and additional corset design fabrication by Susanna Henson of Eternal Spirits. "CaptureDress" is to use motion capture technology and will begin development by the interdisciplinary team in 2007.

- 2 For a provocative concurrent experiment in wearables, especially focusing on the somatic aspect of sensor technology integrated into fabrics, see Thecla Schiphorst's description of her *exhale* exhibition (Schiphorst 2006). Jane Harris' work, on the other hand, explores the presence and portrayal of characters through dress and textiles in the realm of 3D Computer Graphic visualization. The digital animations (*Potential Beauty*) she exhibited in the UK in 2002-2003 focused on the poetic and dreamlike movement of the dresses alone, insofar as the actual wearer of the garments is "deleted" in the final screen version. However, one could argue that the body is not deleted as much as it is implied as the "source code". The dancer's movement for the animations was motion-captured, and the animation of the dress rendered through making the physical/real body invisible. See <http://www.janeharris.org/>.
- 3 Rick Voithofer (2005) discusses concepts of materiality and dematerialization (in the context of education research and digital technology) in terms of digital representation and the materiality of data, acknowledging the shift to a new media culture and the impact this has had on design, namely the creation of "digital materialism." Digital materialism 'for the computerization of culture', suggested by Lev Manovich's definitions of the five characteristics and cultural categories of the digital medium, includes the following "principles of new media": numerical presentation, modularity, automation, variability and transcoding (Manovich 2001, pp27-48). Voithofer states that because all new media are expressed through numerical representation (i.e., digitization) and therefore can be manipulated and programmed, they lend themselves to individual customization. Still images, 3D virtual environments, words, sounds, videos, animations can all be combined and perpetually recombined in various configurations.
- 4 Mahesh Senagala ("On the Nature of Digital Materiality") presents the case for both a physical and virtual material lending themselves to different ways of imagining, defining and building the world. He calls the virtual materials "Softerials". See http://www.tkk.fi/events/ecaade/E2001presentations/13_04_senagala.pdf
- 5 Sharon Baurley (2005) provides a broader context by introducing some of the advances in technical textiles production but especially in pervasive computing and the shift towards wearables, mobile devices, and the embedding of computer intelligence within everyday objects and environments. Referring to scientific research in affective computing and interaction design, Baurley points out that pervasive computing indicates the dissolution of electronics into the material environment where the interface is constant, while "affective computing," grown out of wearable computing,

aims at educating intelligent systems to recognize physical and physiological patterns and translate these into emotions.

- 6 The Isadora website states that Isadora is a graphic programming environment for Macintosh that provides interactive control over digital media, with special emphasis on the real-time manipulation of digital video. Because every performance or installation is unique, Isadora was designed not to be a "plug and play" program, but instead offers building blocks that can be linked together in an almost unlimited number of ways, allowing you to follow your artistic impulse. Isadora was designed by composer and media artist Mark Coniglio (of the New York company Troika Ranch) and as such, it reflects over 10 years of practical experience with realtime interaction. (<http://www.troikatronix.com/isadora.html>)
- 7 Over one hundred building blocks, called actors, are available within the Isadora environment. Some actors perform simple functions like watching for a MIDI event, while others allow sophisticated functions such as warping video imagery. By connecting several actors together you determine how the program will respond to a live performer or viewer. You can also combine a group of Isadora's actors into a custom User Actor. <http://www.troikatronix.com/isadora.html>
- 8 "Digital compositing exemplifies a more general operation of computer culture: assembling together a number of elements to create a single seamless object". Any new media object can be composited from its modular parts (modularity). On the subject of digital compositing see Manovich, "Compositing, or Modularity of Media". Available at: <http://rhizome.org/thread.rhiz?thread=1528&page=1#1791>
- 9 The collective potential of intimate transformative ecstasy experienced in wearable fabrics (parangolés) enmeshing the participants, enveloping them in carnivalesque play of spatial and social relations, was advocated by Brazilian artist Hélio Oiticica in the 60s. Fellow artist Lygia Clark also explored the transformative potential of engagement with material artefact or object in *The I and the You: Cloth-Body-Cloth* series. More recently, designer Lucy Orta has explored such participatory experiences through the inter-linked bodies of her *Nexus Architecture* series.
- 10 Bradley Quinn (2002:51) whilst discussing the work of Hussein Chalayan acknowledges the potential impact of integrated wearable "intelligent systems" on "twenty-first-century bodies".
- 11 For more in depth discussion of prototypes see Joanna Berzowska (2005:36-39).
- 12 Kaat Debo in *Beyond Desire* (2005:21) discusses desire in connection with the meeting of two cultures and the subsequent exchanges that are made. She makes reference to the adopting of visual languages of the other and the significance of fashion as connector and vehicle for projecting ones longings and fantasy images. This links closely to our own ideas on intimate wearables and engagement at a distance (with remote partners).
- 13 For the impact of the immersive environment on the "immersant" see Char Davies <http://www.immersence.com/>

- 14 Whereas Hegel seems to have preferred a formless surface as "ideal" in clothing the body for the expression of the "spirit," Barthes voices his critique of Hegel by way of the silhouette in Erté's alphabet-drawings of women. "Hegel has noted that the garment is responsible for the transition from the sensuous (the body) to the signifier; the Ertéan silhouette (infinitely more thought out than the fashion mannequin) performs the contrary movement (which is more rare): it makes the garment sensuous and the body into the signifier; the body is there (signed by the silhouette) in order for the garment to exist; it is not possible to conceive a garment without the body" (Barthes 2006: 153). The body, in other words, is the support for the garment.
- 15 These findings are based on earlier research in the Lab and are to be published in forthcoming issue (11.4) of *Performance Research Journal*. Birringer, Johannes and Danjoux Michèle (2007).
- 16 Jane M. Gaines (2000:159)
- 17 Gaines (2000: 160-161) discusses phenomenological concept of embodiment in relationship to the screen and cinematic images drawing on writings of Vivian Sobchack and theories of Merleau-Ponty.
- 18 The Japanese monist view of nature sees animals, plants, natural phenomena, and human beings as being all part of a single world.
- 19 Merleau-Ponty (2005) on "Sense Experience" and the empirical self as part of a system of experience where the perceptual behavior and motor reactions link. p. 240-282
- 20 Cf. Davies, "Virtual Space." <http://www.immersence.com/>
- 21 Paul Verity Smith (2006) who has developed the sensor programme for Katsura Isobe in *L'Instant Décisif* has explained his approach to sensor programming in "Working with sensors: the dancer as video editor". In: Johannes Birringer and Klaus Behringer, eds. *Spielsysteme*. Saarbrücken:PoCul-Verlag, 30-36.
- 22 Cf. Davies, "Virtual Space." <http://www.immersence.com/>
- 23 David Mitchell (2006) "Introduction" to Kobo Abe, *The Woman in the Dunes*, trans. Dale Saunders, London: Penguin.
- 24 The transformations come through the technology, the hardwares and softwares such as Isadora. Transformative technologies are not a media/medium in their own right, nor are they "liminal" as concrete state changes result from (re)encoding/transcoding of media not mutation. See The Curators' posting on the dance-tech maillist (dance-tech@freelists.org, Oct. 22, 2006).
- 25 Mark Hansen (2002:322).

References

- Abe, K. (2006), *The Woman in the Dunes* trans. Dale Saunders, (London: Penguin)
- Barthes, R. (1990 [1967]), *The Fashion System* trans. Matthew Ward and Richard Howard, (Berkeley: University of California Press)

- Barthes, R. (2006), *The Language of Fashion* Stafford, A. & Carter, M. (eds.), (Sydney: Power Publications)
- Baurley, S. (2005), "Interaction design in smart textiles clothing and applications", in Xiaoming Tao (ed.) *Wearable Electronics and Photonics* pp. 223-43. (Cambridge: Woodhead Publishers)
- Berzowska, J. (2005), 'Memory Rich Clothing: Second Skins that Communicate Physical Memory', in Candy, L. (ed.) *Creativity & Cognition* 12-15 April 2005 London. New York: ACM, pp. 32-40.
- Birringer, J. & Danjoux M. (2007), "The Emergent Dress: Transformation and Intimacy in Streaming Media and Fashion Performance," *Performance Research* (forthcoming)
- Brand, J. & Teunissen J. (eds.) (2006), *The Power of Fashion. About Design and Meaning* (Belgium: Terra and ARTeZ Press)
- Davies, C. (2004), "Virtual Space", in *Space: In Science, Art and Society* Penz, F., Radick, G. & Howell, R. (eds) pp. 69-104. (Cambridge: Cambridge University Press) Available at: <http://www.immersence.com/>
- Gaines, J.M. (2000), 'On Wearing the Film', in Bruzzi, S. & Church Gibson, P. (eds.) *Fashion Cultures* pp. 159-177. (London: Routledge)
- Dixon, S. (2007), *Digital Performance. A History of New Media in Theatre, Dance, Performance Art and Installation* (Cambridge: MIT Press)
- Hansen, Mark B.N. (2004), *New Philosophy for New Media* (Cambridge: MIT Press)
- Hansen, Mark B.N. (2002), 'Wearable Space', *Configurations*, **10** (2), pp. 321-370
- Koch, C. (2005), 'The Movie in Your Head', *Scientific American Mind*, **16** (3), pp. 58-63
- Lee, S. (2005), *Fashioning The Future* (London: Thames & Hudson)
- Manovich, L. (2001), *The Language of New Media* (Cambridge, MA.: MIT Press)
- Marshall, L. (ed.) (1987), *Erté at Ninety-Five, The Complete New Graphics* (London: Weidenfeld and Nicolson)

Merleau-Ponty, M. (2005), *Phenomenology of Perception* (Oxford: Routledge)

MoMu – ModeMuseum (2005), *Beyond Desire* (Belgium: Ludion)

Quinn, B. (2002), *Techno Fashion* (Oxford: Berg)

Schiphorst, T. (2006), 'Breath, skin and clothing: Using wearable technologies as an interface into ourselves', *International Journal of Performance Arts and Digital Media* 2:2: pp. 171-86

Senagala, M. (date unknown). Production of Digital Space: On the Nature of Digital Materiality [online]. *Education & Curricula – 13 Design Methods 2* Available from: http://www.tkk.fi/events/ecaade/E2001presentations/13_04_senagala.pdf [Accessed 1 March 2007]

Smith, P. V. (2006), 'Working with sensors: the dancer as video editor', in Birringer, J. and Behringer, K. (eds.) *Spielsysteme* pp. 30-36. (Saarbrücken: PoCul-Verlag)

Voithofer, R. (2005), 'Designing New Media Education Research: The Materiality of Data, Representation, and Dissemination,' *Educational Researcher* 34 (9), pp. 3-14

About the author

Michèle Danjoux is a fashion designer, illustrator and Senior Lecturer in Fashion at Nottingham Trent University's School of Art & Design, she is also the research co ordinator for the Fashion subject. Danjoux is primarily interested in the generation of creative, flexible learning environments which foster new and innovative approaches to design. She is co-director of DAP (Design & Performance) Lab.

michele.danjoux@ntu.ac.uk

The Nottingham Trent University
School of Art & Design
Bonington Building
Dryden Street
Nottingham
NG1 4FX UK