
FASHION IN THE DIGITAL WORLD – THE FUTURE IS NOW!

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ABSTRACT

In this paper and presentation I will discuss the growing relationship between fashion designers and digital technologies. Still in its embryonic stage, fashion that embraces digital technologies forecasts a future in which our selves, fashion and technology are one.

It is easy to forget, that in the modern era marriages have comfortably existed between fashion and technology, running contrary to the popular belief that fashion design and advanced technologies are mutually exclusive. Many innovations at the dawn of the industrial revolution were responses to changes in the production of textiles; among them, the flying shuttle, spinning jenny, spinning frame, and cotton gin. These inventions facilitated the handling of large quantities of harvested cotton, much of which resulted in clothing. The first sewing machine appeared more than 150 years ago; an invention which made possible today's fashion system.

At the beginning of the twentieth century the Futurists demanded the inclusion of technologies in clothing to celebrate the beauty of speed, dynamism and the machine. The Constructivist also ventured into fashion design demanding consideration of function and technology. Schiaparelli included elements of 'advanced technologies' in fashion in the 1930s as did Courrèges in the 1960s, using textiles developed by NASA.

The idea of partnering cutting edge technologies and the body in the form of fashion is by no means new. It is something we have lost sight of within the broad concept of fashion. Many recent designers who have responded to digital innovations and built them into fashion concepts, have done so as a reaction to the ideas of supermodernist, Marc Augé who describes the supermodern condition as an overabundance of space, of information and of individualism. Designers like Vexed Generation and You must Create have included digital technologies into garments to address Augé's concept of 'transitional spaces' and 'non places' which are part of the supermodern condition.

Digital fabrics have application in fashion addressing health, fitness, communication and identity. Although many were developed for military use, the potential application in design is only limited by the imagination. Hussein Chalayan has extensively incorporated digital technologies into couture in response to the concepts expressed by Marc Augé, manifesting ideas inspired by the 'transition space' of flight and aerodynamics. LEDs, optic fibres and digital fibres all lend themselves to the medium of couture.

Fashion designers are no longer reluctant to brainstorm with digital designers and the global fashion industry. Starlab saw a blue skies collaboration of France Telecom, Courrèges, Adidas and Samsonite in 1999. Since May 2000, Belgian designer Walter van Beirendonck has been working with the i-wear consortium to develop intelligent clothing that embraces digital technologies.

Within my teaching practice, a studio has been created in which students include digital technologies in fashion design and a trans-disciplinary interactive design studio is being set up for later this year in which RMIT fashion students and industrial design students at

TU Eindhoven in Holland, communicate design solutions through digital space.

As a designer and a fashion academic, I believe fashion designers should take the initiative in concepts of digital design. Why remain passive, ‘aloof’ from the possibilities afforded by digital technologies. Imagine the wonder of being able to wear a computer, i.e. your garment is a computer, whether it is a sports jacket or an evening gown. It may be a traveling jacket that instructs/navigates you through the procedures of the airport, regulates your temperature within and without the airport, identifies the person meeting you, notifies your family of your arrival and tells you how to get to your hotel. This is not science fiction. It is possible and someone has to design it.

1. INTRODUCTION

In this paper and presentation I will discuss the growing relationship between fashion designers and digital technologies. The explorations within such partnerships have resulted in many visionary/blue sky projects that have seen fashion designers, industrial designers and digital designers speak in a common collaborative language. Although the concepts born out of these projects have not always been realised in terms of fully functioning commercial products, the energy, imagination and commitment to the truly digital has been unrestrained. The principle obstacle in this integrated design quest has been the development of electronic textiles. At present, much of the product conceptualization to emerge from the blue sky collaborative projects is unable to be brought to fruition because of the problems with integrated independent power systems, washability and comfort of fabrics. By comparison with the conceptual prototypes born out of the blue sky collaborations, functional garments that have been produced that address the demands of fashion and digital technologies may seem quite low tech and prosaic. They may appear to be no more than wearable luggage. Undeserving of such criticism, these garments still indicate a response within fashion to the changing environment of the digital age and a dialogue between seemingly incompatible design disciplines. The vision of digital clothing has permeated all levels of fashion design, from sports wear through to couture.

Much of what will be discussed in this paper concerning fashion in the ‘Digital Age’ may be viewed as residing within the ‘supermodern’ condition, a term coined by anthropologist Marc Augé. He describes the ‘supermodern’ as an overabundance of space, of information and of individualism. He identifies roads, railways, airports and the street as ‘transitional spaces’ or ‘non-places’ accommodating the flow of human traffic on a local, urban and global scale.¹

Still in its embryonic stage, fashion that embraces digital technologies forecasts a future in which our selves, fashion and technology are one.

2. FASHION AND TECHNOLOGY IN THE MODERN ERA

It is easy to forget, that in the modern era marriages have comfortably existed between fashion and technology, running contrary to the popular belief that fashion design and advanced technologies are mutually exclusive. Many innovations at the dawn of the

¹ Augé qtd. A. Bolton, *Supermodern Wardrobe*, V&A Publications, London, 2002, p. 124.

industrial revolution were responses to changes in the production of textiles; among them, the flying shuttle, spinning jenny, spinning frame, and cotton gin. These inventions facilitated the handling of large quantities of harvested cotton, much of which resulted in clothing.² The first sewing machine appeared more than 150 years ago; an invention which made possible today's fashion system.³

Charles Babbage is often called the father of modern computing. In 1834 he conceived the idea of the Analytical Machine. His machine was inspired by Joseph Marie Jacquard's textile loom which was operated by a punch card system. The first generation of mega computers in the mid Twentieth century still employed punch card systems in their operation. Although never built, the Analytical Machine recognised that inherent in the Jacquard card method was the perfect binary system for his calculating machine foreseeing much of the logic of present day computing. Ada Lovelace, daughter of Lord Byron, worked with Babbage and said "The Analytical Machine weaves algebraic patterns just as the Jacquard loom weaves flowers and leaves".⁴

These innovations reflect a problem solving design philosophy that was born not only out of necessity, but also an inclusive approach which has been alien to the world of fashion for much of its recent history.

2.1 EARLY TO MID TWENTIETH CENTURY FASHION TECHOPHILES.

At the beginning of the Twentieth century, the Italian Futurists movement demanded a re-evaluation of dress/fashion and the inclusion of technologies in clothing to celebrate the beauty of speed, dynamism and the machine. Giacomo Balla, in 1914, talked of 'modifiers' that would allow the wearer of garments to "not only modify but also invent a new dress for a new mood at any instant". Filippo Marinetti called for "tactile resonant metaphorical dress tuned to the hour, the day, the season and the mood to convey sensations of dawn, noon, evening, spring, summer, winter, ambition, love etc."⁵

However, the public and most designers were not as willing as the Futurists to embrace new technologies within fashion.

From their inception, man-made or 'artificial' fibers and textiles were regarded with suspicion. The public perception was that they were 'substitutes' and therefore inferior to natural fibres and textiles. Rayon was understood as an artificial silk.⁶

Part of the problem was that the fashion world was still led by the Parisian couturiers, who in turn depended on the French textile industry, which was committed to the production of luxury, high status, natural fibres.⁷ However, a handful of radical couture designers embraced the design possibilities of these otherwise shunned technological textiles.

Not surprisingly, considering her liaison with Surrealism and Modernism, Elsa Schiaparelli responded with unrestrained enthusiasm to the opportunities afforded by the marriage of textile and technology.

² http://en.wikipedia.org/wiki/Spinning_jenny (viewed June 2006)

³ http://en.wikipedia.org/wiki/Sewing_machine (viewed June 2006)

⁴ S. Lee, *Fashioning the Future: Tomorrow's Wardrobe*, Thames and Hudson, London, 2005, p. 46.

⁵ *ibid.*, p. 115.

⁶ S. Handley, *Nylon: The Story of a Fashion Revolution*, The John Hopkins University Press, Baltimore, 1999, p. 26.

⁷ *ibid.*, p. 26.

Rejecting elitism in choice of textile, she collaborated with the French textile company Colcombet. The glass cape made from Colcombet's 'Rhodaphone' was one of the outcomes. 'Rhodaphone' was a brittle, transparent, spun, synthetic textile. Another of Colcombet's experimental textiles was 'Rhodia Satin', which had fluorescent qualities. An illustration of the courage of the inclusive response of Schiaparelli and her clients to developing textile technologies and couture is seen in the experience of Vogue editor Diana Vreeland who took her Schiaparelli gown to the dry cleaners, and in return picked up a bucket of sludge – the result of the experimental textile making contact with the dry cleaning fluid.⁸ It was also Schiaparelli, together with designer Charles James, who first included zips into couture even though the zip, or slide fastener had been around since 1834.⁹

It was not until the 1960s that an open relationship between fashion, technology and textiles was developed.

Begun in the 1950s, the space race culminated with a man walking on the moon in 1969, one of the first global spectacles and watched live by a fifth of the world's population. The flag, made by Dupont, still stands unflappably on the moon's surface. Couture was given new life by Courrèges, Cardin and Rabanne, who embodied the 1960s spirit of the 'Space Age'. They expressed their spacey design philosophy through a combination of radical minimalised silhouettes, and the use of textiles produced by NASA for the Moon missions.

Courrèges' 1964 'Space Age' collection embodied all that was daring in the collaboration between design and technology. Cardin collaborated with Union Carbide in 1968 to create his own bonded fabric 'Cardine'.¹⁰ He is reputed to have exclaimed on watching Neil Armstrong's famous walk on the moon "You see, I was right".¹¹ Although there have been applications of new textile technologies since the 1960s, such as Lycra in the 1980s, it is only now that we are seeing a new and vibrant relationship between fashion and new technologies. Whereas the 1960s were identified as the 'Space Age' in design and innovation, it is widely understood that we are living in the 'Digital Age'.

2.2 THE NEW COUTURE TECHNOPHILES

Before discussing actual research and development in the area of digital fashion, it is appropriate to talk of a new generation of designers in the area of couture embracing the potentials of digital technologies and incorporating them into their work, albeit conceptually.

Hussien Chalayan is the most notable couture designer to be consistently engaging with new technologies in a conceptual context. Chalayan is not inhibited by the absence of technological developments that might accommodate his creative vision.

His work sits very comfortably in the world of Marc Augé's 'Supermodern'. The recurring motif in his work refers to flight, both aerodynamic and political. He speaks of

⁸ *ibid.*, p. 27.

⁹ A. Bolton, *op. cit.*, p. 124.

¹⁰ S. Lee, *op. cit.*, p. 28.

¹¹ S. Handley, *op. cit.*, p. 88.

the ‘transitional space’ of airports, of the displaced and of the diaspora.

“For me technology essentially broadens my language as a designer. I’m interested in languages that allow you to go beyond consideration of the body or ‘normal’ clothing to create new ways of looking. The importance of technology in my work is that it presents a fresh means of expression.”¹²

As part of his Autumn/Winter 1995 collection, ‘Along False Equators’, Chalayan integrated tiny Light Emitting Diodes (LEDs) into jackets printed with holographic flight paths. The LEDs were programmed to sparkle in a sequence that suggested not only global passage of human traffic, but also the individual’s journey through life.¹³

Chalayan’s ‘Echo form’ Autumn/Winter 1995-2000 collection featured a showpiece Aeroplane dress. Made of fibre glass and resin, it concealed a battery, gears and wheels that were activated by an internal switch operated by the model on the runway. Like the moveable flaps on the wings of an aircraft, sections of the dress slowly slid open to reveal the flesh beneath.¹⁴

In his Spring/Summer 2000 ‘Before Minus Now’ collection, Chalayan showed a remote control resin dress which implied that intangible forces were at work. The hard resin shell at the back of the dress suddenly opened to expose a cloud of pink tulle.¹⁵ The remote control was allegedly operated by an 8 year old boy.¹⁶

Chalayan has collaborated with textile designer Eley Kishimoto who designed a pixelated print fabric for the ‘Nothing/Interscope’ collection. The starting point for the print was hand drawn flowers which were then scanned and colour accentuated through Computed Aided Design (CAD). The effect was deliberately exaggerated pixelation familiar to anyone who has work with computer graphic softwares or who recognises similar quality imagery on the internet as having low resolution.¹⁷

As many of the problems with e-textiles, power sources and wearability are resolved we may feel secure in anticipating Chalayan to embrace them and integrate them into his work.

Alexander McQueen has also incorporated digital technologies into his work, albeit as a passing reference. For his futuristic Givenchy collection, dozens of LEDs were embedded into a molded transparent acrylic bodice. It was worn with photo-luminescent circuit-board trousers.¹⁸

Victor & Rolf’s Autumn/ Winter 2002 ready to wear collection created the illusion of something that research laboratories the world over are working on for real – a fabric variously described as chameleon camouflage, digital cloth or textile display. As the models passed the audience, the fabric of the clothes streamed film footage of traffic in the street and clouds racing across the sky. Brilliant blue of the outfits was replaced by digitally projected images, a process known as blue screening. Simultaneously, each model was projected onto giant screens on either side of the runway placing the girl in a filmic background against which she appeared invisible. Blue screening is a special

¹² S. Lee, op. cit., p. 95.

¹³ *ibid.*, p. 98.

¹⁴ S. Lee, op. cit. p. 52.

¹⁵ *ibid.*, p. 116.

¹⁶ S. Frankel, *Visionaries*, V&A Publications, London, 2001, p. 70.

¹⁷ A. Bolton, op .cit., p. 120.

¹⁸ S. Lee, op. cit, p. 97.

effect more commonly used in film and television but in the hands of Victor & Rolf it became the inspiration for a fashion collection.¹⁹

Although 'low tech', the strategy in design indicated a desire to engage with and express fashion ideas through digital technologies that many research laboratories are striving to develop.

It is more than likely that Victor & Rolf are aware of the concept of invisibility as the ultimate camouflage being explored within the Future Warrior program by the U.S. Army Research Centre in Massachusetts. Researchers are developing textiles/ uniforms that will transmit visual information- about colour, light, even pattern- through the fibre. The objective is for military personnel to blend into the background and literally become invisible.²⁰

Walter Van Bierendonk in 2004 said. "It would be fantastic if Haute Couture could again become a laboratory for fashion. That would make it relevant once more. I really do like the research and statements that Cardin made in the 1960, he was my hero. Fashion, science, technology, craftsmanship and fantasy should work hand in hand. I am a volunteer if a big couture house is willing to invest in such an adventure....Cardin, Courrèges...?"²¹

3. A NEW GENERATION OF VISIONARIES: MIT, STARLAB AND PHILIPS.

The answers to Van Bierendonk's prayers may come from visionary research partnerships that are inclusive of the digital, the body and fashion. The pioneers of this strategy were MIT, Starlab and Philips.

3.1 MIT

In 1996, the director of the Media Laboratory at the Massachusetts Institute of Technology said "Computing corduroy, memory muslin and solar silk might be the literal fabric of tomorrows dress. Instead of caring your laptop, wear it."²²

Three years later, Neil Gershfeld, the then director said "Moving computing into clothing opens a new era in how we interact with each other, the defining characteristic of what it means to be human."²³

MIT pioneered the idea of wearable computing and paved the way for a generation of researchers keen to transform elements of the personal desktop computer into something that could be worn and operated on the body.²⁴ In 1995 at MIT's Media Lab, Thomas Zimmerman and Neil Gershenfeld came up with the idea of using the electrical conductivity of the body to send data or signals to another person or device. This so called 'Personal Area Network' (PAN), created with the aid of a small computer concealed on the body, sends harmless electrical signals through the body. Any device we carry around can potentially act as a PAN device, for example watch, mobile phone or

¹⁹ *ibid.*, p. 81.

²⁰ C. Newman, 'Dreamweavers'. *National Geographic*, vol. 203, no.1, 2003, pp.50-73.

²¹ S. Lee, *op. cit.* p. 52.

²² S. Handley, *op. cit.*, p. 186.

²³ S. Lee, *op. cit.*, p. 41.

²⁴ *ibid.*, p.43.

even credit card²⁵.

In June 2004, Microsoft patented the human body as a computer network. The term PAN is now widely used to describe a network on and around the body, i.e. linking up a series of mobile devices using Bluetooth or *infrared* technology.²⁶ Instead of using a person's body to transfer data, their clothing could perform the task.

3.2 STAR LAB

Star Lab, based in Brussels, is a private blue skies, multi-disciplinary research laboratory. Through its creation of the i-Wear consortium in 1999, a working design dialogue was established. This involved a range of companies interested in developing products that brought fashion and digital technologies. These included Adidas, Courrèges, France Telecom and Samsonite. I-Wear concentrated on developing intelligent clothing to act as a 'second skin', enabling individuals to connect their bodies their activities and their environments.²⁷

As a result of this collaboration, the 'Spy Glass' was developed; a device that acts as an interface to intelligent clothing. The user can ask for data or give commands to the outfit. Operated by only four buttons, it permits faster key based input than a mobile phone.²⁸ Belgian fashion designer and academic, Walter Van Beirendonck has been involved since 2000, experimenting with intelligent clothing composed of several layers which formed part of his 'Dissections' 2000-2001 collection. Six shirts were layered for one prototype. Each shirt had a particular technological function. There is a memory shirt, an energy supply shirt and a motion sensing shirt. Since wireless communication between these layers is essential, researchers at Star Lab developed the Fabric Area Network (FANTM), a wireless infrastructure that enables networking of sensors and data within the clothing.²⁹

The outcomes of Star Lab were conceptual prototypes, daring in their vision but unable to be fully realized as commercial product.

3.4 PHILIPS

In 2000, *New Nomads* was published, which outlined Philips advance on MIT's 'wearable computing' into 'wearable electronics'. The book details the outcomes of Philips' 1997 'Visions of the Future' project which brought together fashion designers, industrial design engineers, and electronics engineers in an attempt to transcend their traditionally conflicting and antagonistic design philosophies, and establish a revolutionary interdisciplinary dialogue.

CEO of Philips Design, Stephano Marzano, stated "What we are talking about here is a new lifestyle and business revolution – one that will require the electronics industry to 'think emotionally'. To guarantee human focused solutions, we cannot expect the fashion industry to adapt itself to technology. Rather, the technology industry will have

²⁵ *ibid.*, p.48.

²⁶ *ibid.*, p.49.

²⁷ A. Bolton, *op. cit.*, p. 18.

²⁸ A. Bolton, *op. cit.*, p. 18.

²⁹ *ibid.*, p. 18.

to learn how to deal with fashion”³⁰

Philips utilized miniturisation of existing digital and wireless (Bluetooth) technologies, eliminating duplication of function in the process, as a means of more effectively incorporating the digital into garments. The results often resembled accessories or jewelry design, or were incorporated into traditional fashion/garment components e.g. the cuff.

Philips ‘Blue Sky’ approach produced conceptual garment prototypes determined by the ‘user’. For ‘Nomadic Working’, digital suits for professionals featured a fabric keypad, a small phone earpiece, and a speech device incorporated into a button.³¹

For ‘Connect’, electronics incorporated into garments acknowledged the conflict between clubbing and unwanted baggage. Pagable knickers, for the ‘Queen of Clubs’, featured flashing buttons to signal the presence of ‘interested parties’ and a top that could interact with the music and lighting.³² Philips addressed childcare, air travel, sport, business and health etc. within the designs for their wearable electronics.

The only tangible products to have emerged so far as a result of Philips New Nomads project was the Philips-Levi Industrial Clothing Division Plus range (ICD+). Launched in 2000, it included four jackets that contain a Philips Xenium GSM mobile phone and a Philips Rush MP3 player. They are both controlled by an independent, unified, soft touch remote control pad that allows users to switch between the two. These capabilities are linked in a Personal Area Network (PAN) through wires integrated into the fabric of the jacket. Each jacket also featured earphones integrated into the collar. When not in use the headphones sit in rubber housing below the collar on the front of the jacket. Once the hardware is removed, the jacket and wiring system is fully washable.³³

At a cost of US\$900, with limited numbers produced, the jackets sold out within a very short time. The jacket is no longer available

4. THE “SUPERMODERN WARDROBE”

In his influential 2002 book *The Supermodern Wardrobe*, Andrew Bolton ascribes much of the fashion product that has emerged from the dialogue between fashion and digital technologies to ideas expressed by anthropologist Marc Augé, especially the concept of ‘transitional space’. Marc Augé describes the ‘supermodern’ as an overabundance of space, of information and of individualism. He identifies roads, railways, airports and the street as transitional spaces or ‘non-places’ accommodating the flow of human traffic on a local, urban and global scale.³⁴ The concept of the ‘supermodern’ has made a great impact on designers for youth, street and male fashion in the last half decade.

The majority of realised garments showcased in *The Supermodern Wardrobe* may be identified as wearable luggage effectively resolving the problems of mobility/travel whilst accommodating existing digital technologies which are part of mobility.

Garments which house CD players, MP3 players, mobile phones, laptops and personal organisers whilst minimising the ‘carrying’ of these technologies within transitional

³⁰ S. Lee, op. cit., p. 46.

³¹ D. Eves, J. Green, C. van Heerden, J. Mama and S. Marzano, *New Nomads: An Exploration of Wearable electronics by Philips*, 010 Publishers, Rotterdam, p. 28.

³² *ibid.*, p. 91.

³³ A. Bolton, op. cit., p. 19.

³⁴ *ibid.*, p. 9.

spaces are successful fashion solutions to the demands most of us experience in accommodating digital technologies and mobility within our busy lives.

Samonite, the iconic luggage brand has been very effective in collaborating with fashion to provide solutions for travel in the digital age. In 1999 the Samonite collection designed by Neil Barrett, formerly of Gucci and Prada, included a 'Time Jacket' with built in travel alarm.³⁵ This was followed in their subsequent collection by 'Reading Jacket' which had an optical fibre built into the collar and a detachable book bag.³⁶ U.K. designers, Adam Thorpe and Jo Hunter for Vexed Generation, brought together luggage and clothing in their 'Wrap Generation' piece for Autumn/Winter 2000-2001 collection. 'Wrap Generation' is a non gender specific, transformable garment which may be worn as a stole, jacket or waistcoat depending on how it is zipped together. It has pockets which accommodate mobile phone and personal music system. 'Wrap Generation' had evolved from earlier concepts. 'Vexed Bag', part of their 1995 debut collection was directed at cyclists and addressed safety concerns. 'Vexed Bag' is a one strap, cross torso rucksack. Significantly, the strap houses a detachable mobile phone pocket fixed by Velcro®. The bag is large enough to accommodate a laptop and is waterproof, made from Cordura® laminated with polyurethane. The bag is much copied and one of the first attempts to address maneuverability, safety, and the housing of digital technologies.³⁷

CP Company for Winter 1999-2000, worked with Sony to produce the 'R.E.M. Jacket'. The jacket has a pocket on the sleeve fitted with a Sony Dictaphone. Developing the idea further, Their Autumn/Winter collection, 'Urban Protection', featured the 'Yo' parker fitted with a Sony Discman.³⁸

Issey Miyake Men's collection, Autumn/Winter 2000-2001 saw designer Naoki Takizawa produce a range of travel clothes which included jackets featuring removable inside pockets and built in rucksacks. The jackets were shown on the catwalk with models retrieving and playing with mobile phones and game boys.³⁹

At present, this approach (although apparently low tech and obvious) is the most effective immediate strategy in product development that addresses the combined demands of clothing, mobility and digital technologies. Solutions still require dialogue between fashion designers, industrial designers and digital technology designers for best possible outcomes.

This strategy is the basis of my teaching philosophy in the 'Portawear' undergraduate studio which will be discussed later in this paper.

5. E-TEXTILES

The Holy Grail in research to enable the realisation of truly digital fashion is the electro textile or E-textile. E-textiles are fibres, yarns, ribbons and fabrics that can conduct electricity. These fabrics can sense when and how they are being touched, acting as

³⁵ *ibid.*, p. 35.

³⁶ *ibid.*, p. 35.

³⁷ *ibid.*, p. 44.

³⁸ *ibid.*, p. 49.

³⁹ *ibid.*, p. 49.

sensors, switches, transistors, power cables, antennae and displays.⁴⁰

Traditional fashion and textile techniques such as coating, printing, embroidery, appliqué, quilting, weaving and knitting can create conductive fabrics and clothing using carbon, stainless steel, silver and even gold.⁴¹ Without the development of these E-textiles, we are limited to inserting hardware components into garments as detachables to deal with the problems of wash ability, power and comfort.

The biggest stumbling block to the development of E-textiles is the problem of an inbuilt power source. Solutions may lay in power generated by the human body. A range of possibilities are being explored including the 'harvesting' of the heat differential between the body's surface and the garment, kinetic power produced by walking that could be taken from the shoe, harnessing static electricity or using the body's large surface area to capture and store solar power within the fabric. Photovoltaic (solar-powered fabric could mean an entire garment becomes a battery capable of powering electronic functions within itself. Future fabrics may be woven from polymer fibres manipulated on a molecular level to capture light and turn it into electricity.⁴²

Carbon nanotubes, for example, are sub-microscopic hollow fibres of pure carbon and are 50,000 times thinner than a human hair. Fibres composed of Carbon Nanotubes may be woven into textiles and made into garments capable of storing electrical energy and consequently acting as the E-textiles own power source.⁴³

6. THE FULLY FUNCTIONING DIGITAL GARMENT

Almost as though officially declaring the new millennium as the 'Digital Age', research and development in wearable electronics has mushroomed within the last six years. After a tentative start with Philips ICD+ range, a tantalizing choice in commercially available digital fashion has appeared.

Many new companies have continued the tradition of dialogue and research between design disciplines. Some continue to work within the conceptual/blue skies context, whilst others have manufactured fully realized, working apparel that fit within the definition of the supermodern and the digital.

On the 10th of March 2005, German textile company, Rosner launched its 'mp3blue' jacket. It was not revealed at a fashion catwalk parade but rather at a computer fair in Hanover. Only 600 units were produced world wide in 3 colours and 5 sizes. They priced at €600. Many jackets were already reserved before the mp3blue's release. Rosner's press release stated, "The wearable-electronics-concept is getting through. The very first multimedia-lifestyle-jacket worldwide with a complete integration of electronic functions will be introduced in the market"⁴⁴

The 'mp3' jacket incorporates an integrated electrically conductive fabric. This fabric connects a compact electronics module with a textile keyboard on the left sleeve to the

⁴⁰ S. Lee, op. cit., p. 46.

⁴¹ *ibid.*, p. 46.

⁴² *ibid.*, p. 50.

⁴³ <http://www.pa.msu.edu/cmp/csc/nanotube.html> (viewed June 2006.)

⁴⁴ <http://www.mp3blue.de/frameset.htm>. (viewed June 2006.)

headphones and microphone which are integrated into the collar. The module contains an MP3 player with 128 megabytes of memory, a Bluetooth gateway to operate a mobile phone, and a rechargeable battery supplying the electronics with power up to 8 hours. As soon as the wearer of the jacket wants to make a phone call, the stereo system becomes a head set and the music is automatically interrupted when it detects an incoming call.⁴⁵

The development of the jacket was the result of a partnership between, Rosner, Vodaphone, Muthmann Communication Design, Somneo Programming and Infineon Technologies AG. The latter is at the forefront of much blue-sky digital fashion collaboration. They are one of the leaders in researching the body as battery for E-textiles.

SCOTTeVEST (SeV)@Inc have developed jackets that combines traditional clothing, electronics and luggage. Up to 42 pockets enable the wearer to carry and connect many portable electronic devices. The innovative removable PowerFLEX solar panel, developed by Global Solar means the user can recharge USB compatible devices on the move.⁴⁶

February 11th 2006 saw the launch of 'Code M', a new wireless footwear system. LL International, parent company of Dada footwear promotes 'Code M' as "a proprietary, patent-pending wireless technology application for footwear that delivers both audio and data."⁴⁷

In this first application, the 'Code M' system is integrated into the shoe's heel and tongue. Its memory gives the device the ability to hold up to 100 songs with a 6 hour battery life. A USB port on the lateral side of the shoe allows downloading of music and re-charging of the battery. Another important element in the system is the wireless head set, which picks up music from the shoe as far away as 30 feet.⁴⁸

The shoe was developed for those who desired hands free, wireless leisure and work. Lavetta Willis, President and CEO of LL International, predicts a near future applications utilizing GPS devices, navigational systems and the incorporation of LED display that will give the ability to stream video and enter the 'game' market.⁴⁹

7. THE DIGITAL FASHION ACCESSORY - MOBILE PHONES AND I-PODS

In the last decade, two everyday digital technologies have been absorbed into the fashion environment as 'digital accessories.' Consumers increasingly make choices in purchasing a mobile phone based not on its technological/ functional point of difference, but rather its design within the fashion context.

Brands of mobile phones are now promoted in fashion publications along side fragrances and watches to appeal to the diverse lifestyles of consumers.

Fashion photographer, Tim Brett Day, worked on a 2003 campaign for Xelebri mobile

⁴⁵ *ibid.*

⁴⁶ S. Lee, *op. cit.*, p. 50.

⁴⁷ <http://www.dadafootwear.com>. (viewed June 2006)

⁴⁸ *ibid.*

⁴⁹ *ibid.*

phones. Digitally enhanced male and female models appeared to be wearing beautiful human skin suits with open zips in them, exposing quite flabby or scrawny bodies within. Each model possesses a Xelebri mobile phone, worn as a fashion accessory. The campaign theme, 'Beauty for Sale' made not only reference to the skins of the models but also to the design of the mobile phones as fashion items.⁵⁰

The I.M.S. (Individual Music System), for example the Discman and Mp3 player, has become an omnipresent personal technology but has yet to be exploited within the fashion context in terms of design.

On the cover of its March/April 2006 edition, I.D. (The International Design Magazine) featured the i-Believe. The concept of Scott Wilson, creative director of Nikes Sports Technology group, the i-Believe is an i-pod in the shape of a cross worn around the neck as a fashion accessory. The cruciform i-believe replacement cap and lanyard for i-pod shuffles signals unlimited possibilities in the area of digital fashion.⁵¹

One can only speculate what would emerge from collaboration between manufacturers and fashion designers such as Dolce and Gabbana, Vivienne Westwood or Rei Kawakuba in fashion designed digital products. Perhaps, given that many producers of sports shoes have invited fashion designers into collaborations in recent years, this may be the most immediate, functional product development area of digital fashion.

8. THE ACADEMIC ENVIRONMENT

It is imperative that the design dialogue between disciplines exist, not only in a commercial research context, but also be fostered within the exploratory academic environment.

Fashion schools are increasingly exposing students to ideas that lie within the 'digital'. The September/October edition of I.D. (The international Design Magazine) featured a cover article entitled 'Generation Wild' reporting on a catwalk presentation called Seamless, a show of 'Computational Couture'. The parade featured the outcomes of experimental projects by students from MIT, Harvard, Parsons and the Rhode Island School of Design.

Jessie Scanlon, for I.D. Magazine, recounts of a model screaming, before she goes on the runway, that something is smoking. The designer reaches down the models pants and pulls out a circuit board that has shorted, overheating the voltage regulator. She then leads the model to the Computing Culture Lab, where she "disconnected the battery, revived the circuit and added some insulation."⁵²

The mishap graphically demonstrated the daring marriage of disciplines and its inherent dangers.

The models emerged through a door marked Lego Learning Laboratory. Garments shown included a jacket with small touch buttons on the cuff which were actually input

⁵⁰ A. Naoilles, 'Extravaganza'. *L'Uomo Vogue*, no 344, October 2003, p. 58.

⁵¹ www.devoted1.com. (viewed June 2006)

⁵² J. Scanlon, 'Tinker, Tailor'. *I.D. The International Design Magazine*, vol. 52, no. 6, September/October 2005, pp. 48-53.

devices that controlled an MP3 player and an undergarment that, via LED display played back the designer's experience of being searched by immigration officials.

Perhaps the most successful piece was 'Build Your Own Bag', a so called modular textile system. The designer pieced together 4x4 inch squares of smart fabric embedded with a micro processor, a light element, RFID (Radio- frequency identification) tags and sensors that can detect light levels and temperature. They are connected by a conductive hook and loop design that allows data and power to be transmitted form square to square. The result is an intelligent purse that, for instance detects, via RF (radio-frequency), whether the user is leaving home without her keys. Moreover, the modules are aware of their configuration meaning they know whether they are being connected in the form of a bag rather than window curtains and behave accordingly. The curtains could sense change in the weather and inform the bag that it should contain an umbrella.⁵³

In the audience was Maggie Orth, an MIT Media Lab graduate and founder of Seattle based electronic textile firm, International Fashion Machines, currently working on the development of Electric Plaid (patent pending) which combines electronic circuits with thermochromatic inks using the former to heat the inks and thereby change colour over time. This causes the pattern to change slowly over time.⁵⁴

Electric plaid shows great potential for application within the fashion context but, again, the major problem is the generation of a power source, wash-ability and comfort.

8.1 MY TEACHING PRACTICE - 'PORTAWEAR'

Within my teaching practice, a core studio, 'Portawear', has been created to encourage undergraduate students to not only develop an awareness of growing trends within 'Digital Fashion', but to also embrace the concept within their design strategies.

I site 'Generation Wild' and 'Computational Couture' as an inspirational example of an outcome that can be achieved within the undergraduate academic environment as a result of trans-disciplinary dialogue in digital design. This experiment is an indication of what I seek to achieve within my own teaching practice.

'Portawear' is an RMIT Fashion, third year exploratory studio that addresses the requirements of fashion, mobility and communication/leisure digital technologies. It further responds to the 'supermodern' theories of anthropologist Marc Augé. They are to identify a 'user' within these parameters and arrive at design solutions that address the 'users' needs. Students are encouraged to think convertible, multifunctional and adaptable and to consider function, form, frugality and fashion.

Examples of users identified by students are the frequent flyer, the commuter cyclist, the nomadic surfer, and the weekend clubber.

Students received training in the RMIT Industrial Design workshops to encourage them to embrace 'non fashion' media, technology and solutions.

As part of a long term strategy to establish a trans-disciplinary design culture within RMIT University School of Architecture and Design, I am also mentoring students from

⁵³ *ibid.*, p. 52.

⁵⁴ S. Braddock, and M. O'Mahony, *Techno Textiles: Revolutionary Fabrics for Fashion and Design*, Thames and Hudson, London, 2005, p. 50.

Industrial Design and Architecture.

An interactive design studio is being written for next year in which RMIT fashion students and industrial design students, at TU Eindhoven in Holland, communicate design solutions through digital space.

This project proposes a trans-disciplinary approach using clothing, as wearable technological consumables, to engage users with lifestyles/spaces around them. The studio will explore clothing design, fashion, interactive design, system design, product design and/or service design and ambient technologies. The studio will create new humanistic methods of communication for users in need of greater interaction with surrounding spaces. These new methods will include the use of wearable technologies.

9. CONCLUSIONS

As a designer and a fashion academic, I believe fashion designers should take the initiative in concepts of digital design. Why remain passive, “aloof” from the possibilities afforded by digital technologies. As is being continually demonstrated within research, collaboration and the academic environment, fashion and cutting edge technologies are not mutually exclusive, nor do they stifle each other. Imagine the wonder of being able to wear a computer, i.e. your garment is a computer, whether it is a sports jacket or an evening gown. It may be a traveling jacket that instructs/navigates you through the procedures of the airport, regulates your temperature within and without the airport, identifies the person meeting you, notifies your family of your arrival and tells you how to get to your hotel. This is not science fiction. It is possible and someone has to design it.

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