

Digital Imagination: the impact of digital imaging on printed textiles

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Cathy Treadaway is the Research Assistant (Textiles) at the University of Wales Institute Cardiff, U.K. and is currently investigating the impact of digital imaging on textile practice for a PhD research project.

Trained as a surface pattern and textile designer she has worked digitally since 1982 and was an early exponent of computer-aided surface pattern and textile design within UK art education in the early 1980's. She has worked as a surface pattern and textile designer for industry worldwide for the last sixteen years and has exhibited regularly internationally.

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Computers are changing our world and in the industrialised nations, the impact of digital technology can be seen in almost every area of daily life. The ways in which we communicate and the speed with which we are able to do it, is affecting our culture, reshaping labour, providing new currency and values that are shaping our society¹. Speed, access and privacy are major concerns. As we spend increasing amounts of time with the technology, the importance of physical interaction with the world diminishes and the virtual space becomes a new arena in which digital imagining may take place. It is inevitable that these influences will manifest themselves in the creative products we manufacture and craft.

The role of the machine has always been to reduce labour, increase production speed, and provide consistency in product for economic benefit. The changes being wrought by digital technology are subtly different. The digital tool is not simply replicating human manufacture but creating and communicating new data within and about the process. As a communication tool it is revolutionising industry and impacting heavily on the processes of design, manufacture and marketing. It is providing a means for collaboration and intervention in processes that before its deployment were individual rather than corporate. It facilitates discussion, joint decision-making and rapid testing of responses within companies and in markets as well as twenty four seven working practice. The implication is that digital technology is much more than simply a tool; 'an implement that is used by hand' (English Dictionary (1999))

Kay argued back in 1984 that the computer is 'not a tool though it can act like many tools' but rather a metamedium possible of conjuring 'media that cannot exist physically... with degrees of freedom for representation and expression never before encountered' (Kay 1984). Others who are aware of the potential of the technology have affirmed this view and Harris², Briggs³, Bunce⁴ and Leak⁵ have noted the technology's potential as a metamedia in the design and simulation of textiles. The blurring of the boundaries between production tool and metamedia in the domain of printed textile design is resulting in changes in working processes, development of new hybrid craft techniques and a changing visual language of pattern and colour on cloth.

Within the printed textile industry the development of computer aided design technology has been largely driven by its use as a production tool (Leak 1998). Its implementation for innovation of design concepts has been less rapid than its adoption for the reworking of hand rendered artwork for colourways, repeats and for prototyping and sampling of fabric. Even in companies such as Liz Claiborne who have pioneered the introduction of the electronic design studio, digital innovation continues to be supplemented by hand rendered paper or fabric artwork that is scanned and manipulated electronically. There is not always a temporal advantage in working in this way as it can often take as long to render artwork electronically as by hand but the opportunity to alter colours, scale and repeat is greatly enhanced once the design exists in the virtual domain (Crawford 2000). **Figure 1** It also facilitates the communication of design visualisation between designers within the company and to suppliers and retailers, providing opportunity for intervention in the design process prior to manufacture. Crawford refers to this as 'design by committee' (Crawford

2003). The visual impact of these changes on commercially manufactured printed textiles is less evident than the reduction in product development cycle time and economic benefit accrued. This however is likely to change as the developments in digital ink jet printing provide systems that meet industrial production speeds and become economically viable.

Throughout history, textile design practice has been linked with production methods and tools. Each technological change has impacted on the visual outcome of the textile produced⁶ and the technical skills required to use the technology have inevitably created a distance between the designer and the product; the original artwork being interpreted and adapted to meet the requirements of production. Bunce argues that the use of digital imaging software and ink jet fabric printing is providing an opportunity for this trend to be reversed:

‘By removing the intervening stage of engraving, jet printing can create closer relationships between the designer CAD, and the textile product. This may impact upon design processes and also change what designs are for and how they are seen’ (Bunce 1999). It is becoming evident through the work of a number of contemporary innovatory printed textile artists and designers from around the world that the integration of digital processes are changing the visual characteristics produced and stimulating a renewed interest in physical interaction with the cloth. The digital tool is becoming a media for digital imagining.

A changing language

Briggs and Bunce contend that throughout history the legacy of technological progress has been the adoption of stylistic change into the textile design practitioners’ visual vocabulary⁷. Each change creating “a visual language that contains a wide range of dialects and which expands as new developments occur” (Briggs 1995). Briggs argues that the use of photography and digital imaging in the design of printed textiles is producing a “new visual language” (Briggs 1997). Changes are becoming evident in the characteristics of expressed visual language within the domain: in the nature of the imagery used, the complexity of image produced and the vocabulary of colour.

Digital ink jet printing has eliminated the need for repetition in a textile design since the traditional constraints of roller printing no longer apply⁸. It is proposed that this new found freedom should inspire the use and generation of new complex pattern forms (Bunce 1994). Bunce argues that CAD has the potential for providing new types of repeating pattern,

“Computer image manipulation capabilities provide fast, accurate and flexible methods of pattern construction...In this way CAD could be used to create new types of design with non-mechanized appearances” (Bunce 1994).

Hilary Carlisle, a researcher at Nottingham Trent University is exploring the use of computer-aided randomisation techniques to apply variations to small-scale motifs. The digitally printed fabric outcome has the initial appearance of repeated image but with “continual visual variety” (Bunce 2003). Hele Abild, a Danish designer, has taken a similar approach. Her digital textiles appear to contain repeating elements but in fact they change subtly across the surface of the cloth (Campbell 2003). The textile artist

Hitoshi Ujii, has explored both the use and non use of repeating pattern in his textile art. In his textile piece “Falling” [figure2](#) he is able to convey the rhythm of repeat through non-repeating image and at the same time explore the concept of movement through image and motif. The textile “Everybody” [figure3](#) which makes use of letterforms dismisses the notion of both repeat structure and conventional textile motif. The installation textile pieces that were exhibited by Ujii at the Textiles as a Catalyst exhibition at the Washington Textile Museum in 2002 contain single large-scale motifs based on digitally manipulated photographic imagery of natural forms. They contain no elements of repeat but are rhythmic in their arrangement within the installation [figure 4](#).

Photographic imagery has been integrated into surface pattern and textile designs for the last decade as a result of four-colour process and heat transfer printing (Briggs 1997). The potential of digital cameras to capture images has inspired a number of designers whose main concern is exploiting photography to create textile design imagery. Briggs’ research at Nottingham Trent University explored the potential of photography in relation to digital printed cloth questioning the applicability of such complex visual images in the structure of a textile design (Briggs 1997; Bunce 2003). The research of J.R. Campbell at Iowa State University has focused on the use of photographic imagery and its use in the integration of digitally engineered garment design. The work produced by Campbell and the students he teaches at Iowa State University reveals his interest in the use of photographic source imagery both close up and far away, digitally manipulated and adapted for garment and interior printed fabric [Figure 5](#). The use of photographic imagery on textile is not new⁹ but the recent ability to digitally print millions of colours on to fabric is inspiring artists and designers to combine photographic realism within their work. The textile art of the Dutch artist Wilma Kuil exemplifies this.

Designers are using digital cameras and video to capture imagery within the design process. Their use is providing a rich source of visual data that can be utilised to inspire and to create design imagery. Rebecca Earley, Senior Research Fellow at Chelsea College of Art, has described the role of the computer in the development of her visual concepts as “a massive scrapbook, a massive sketchbook” (Earley 2003). Working with a digital camera and scanner she is able to make use of collected visual data from a variety of sources and blend them into one in the electronic dimension.

The American textile artist Susan Brandeis uses both a physical sketchbook and photographic imagery scanned and manipulated digitally to amalgamate and blend a variety of images from a particular geographic location to convey her sensuous response to that particular place. Her aim is to produce an image that gives the viewer multiple simultaneous glimpses of the original location comparable with the way the eye informs the mind, as it perceives a place in time. The image is digitally printed and then embroidered to provide additional layers of meaning and narrative. The computer facilitates a “more literal image” of her chosen visual environment (Brandeis 2003). It is evident that the use of visual imagery of such complexity could only be considered as a direct result of access to digital printing technology. [Figures 6 & 7](#).

The use of photographic data digitally printed on to silk became the inspiration of a new body of work for the textile artist Alison Bell. The detail of the imagery captured and reproduced in her work would not have been possible using her pre-digital textile techniques. She uses layering to build and manipulate imagery that is photographic, hand rendered and electronically generated to form a complexity of image that could not have been achieved any other way. Bell describes the use of digital imaging as a “totally new visual language” which is “full of words that I didn’t know existed” (Bell 2003). **Figure 8.**

The work of Joan Truckenbrod has revealed an exploration of image, both photographic and digital, in the creation of textile art since the 1970’s. Her recent installation textile art strives to “produce a richly layered experience for the viewer through a confluence of numerous media: video projection, digital imagery, fiber and sound” (Ullrich 2003). The ease with which the technology can provide connection between electronic devices is aiding the development of the vibrancy of the visual language evident in her work.

Colour

It is likely that the impact most strongly felt upon the changing nature of the visual language deployed by practitioners is that of colour. These changes involve the detail and tonal range of colour that it is now possible to achieve as a result of digital printing. Using analogue printing systems it has been economically prohibitive to use large numbers of colours in a printed textile. Digital ink jet printing facilitates the use of thousands of colours in any one printed image. There are, however, limitations on certain colour and tonal ranges; flesh tones and beige are difficult to print for example.

Bell describes the developing visual language as comprising of new “colours, textures, surfaces, subtleties” (Bell 2003). The availability a large colour gamut as well as the ways in which colours can be arranged within the image, impact upon the visual language. In describing the use of colour in her work, Earley states, “The design work being produced now compared to 1996 is just so radically different... the use of colour is more ambitious, it’s more varied, the amount of texture and detail within one design is much, much broader.The inclusion of so much detail and colour on one piece of fabric is what the language is all about”(Earley 2003).

According to Leak, “The number of colours the human eye can differentiate is unknown. Scholars believe between one and ten million colours can be differentiated” (Leak 1998). Computer monitors however, are capable of producing up to 16.4 million colours; far more than the human eye can see. This seductive and vast colour range available on the monitor inspires practitioners with the desire to achieve the same results as printed product. It fires the imagination in the virtual domain but is also the source of great frustration. The colour output from digital printers is frequently disappointing, as their colour gamut does not match that of the monitor¹⁰. Colour is also changed by the substrate onto which it is printed and the light source by which it is viewed. The issues of colour management and communication are having a significant impact within industry and research is currently underway to overcome these difficulties through the provision of a global digital colour communication

standard. The aim is to provide accuracy of spectral data that can be used in software, comparable with Microsoft Word in its ubiquity, which will provide a universal language of colour. The Society of Dyers and Colourists are carrying out this enormous task in conjunction with the American Textile Chemists and Colourists Committee.

For the textile practitioner there are currently two ways of approaching the problems of using digital colour. Leak argues, “Designers using systems, soon realise that there are restrictions in terms of colour and, therefore, they work with and around them, dependent on the specific working context. When a CAD system is treated as a medium, these restrictions become characteristics of the system. From this perspective poor colour fidelity may not necessarily be so problematic. Indeed what are termed colour mistakes, when looking at a CAD system as a production tool, can be seen as catalysts for change if they are approached from a different perspective” (Leak 1998). This is Bell’s approach to the issue of digital colour. When she encounters a problem she will “work with it” and use the lack of colour fidelity in the printed outcome to stimulate further her creative process. This is done either by fine-tuning the image first on the system that is to print the fabric or by over painting the printed product by hand.

New Craft Techniques

The assumption that ever improving technology replaces craft¹¹ can be challenged by a number of textile artists who are incorporating digital technology within their process and evolving new hybrid craft techniques. For some practitioners the frustration with the cloth outcome as a result of digital printing has led to a new enquiry into surface ornamentation via various craft techniques; for others the technology itself has inspired development of a particular craft. The lack of hands on crafting in physical space is regarded by some as being detrimental to the printed textile outcome. Many have commented on the digitally printed cloth as being flat¹² and lifeless due to both the effect of colour and the lack of physical intervention in the process. Brandeis writes:

“To work with these kinds of fabrics we will have to find ways to re-establish a relationship with the materials, to reclaim the images from the machine, and to convert the monologue of the machine printed product to a dialogue between artist and cloth” (Brandeis 2003).

For Brandeis this dialogue is re-established through the embellishment of the textile surface by a variety of textile crafting techniques. She refers to the need for embellishment of the digitally printed surface that is “more gestural and expressive, in order to keep the surface rich and tactile” (Brandeis 2003). Bell regarded the lack of dialogue with the cloth initially as inhibiting; “I was transfixed by the quality and it stopped me looking beyond it.” For Bell the digital print was impersonal and lacked the creator’s touch. When she received her first digitally printed fabrics she was “gob smacked” because they were too “perfect” (Bell 2003). The drive to regain the

dialogue with the fabric surface drove her to explore a technique in which she combines her silk painting craft with digital printing.

Earley describes digitally printed cloth as being “too flat” and having “no sensual product quality about it” and regards it as being “a stage in between” rather than a finished product. She advocates further manipulation of the fabric surface involving over printing, laser cutting or the design of a product or garment utilising the printed cloth.

Some artists are incorporating digitally printed images within their work as an expressive means of communicating their narrative. The artist Michael James is now able to use his own digitally generated and printed imagery, rather than artisan produced fabrics in his art quilts and can apply imagery that is more personal and appropriate to the pieces. The detail that he can include is changing the visual outcome of his work. James explores the mystery of *infantile amnesia* discussed in one of Freud’s essays on the nature of memory in a work called “A Strange Riddle” **Figure 9** created in 2002 (James 2003). The textile explores the recurrent theme in James’ work of the intrinsic importance of patterns and their interpretation. In this piece a CAT scan image of James’ own brain is combined with letterforms developed from a quotation from Freud addressing the enigma of *infantile amnesia*. These have been distorted into abstract repeating pattern echoing the sounds heard by a baby but not understood. Access to digital technology enabled a black and white photograph, taken during his infancy to be scanned, enhanced and manipulated. The wallpaper from the original photographic image has been re-coloured and printed digitally on cloth to convey the subliminal effect of patterns viewed in early childhood. The digitally printed imagery is constructed and embellished with machine embroidery and quilting detail and provides continuity and depth to the expression of the narrative. **Figure 10.**

The bead artist Amy C. Clarke digitally manipulates the photographic imagery that is used to generate the narrative in her work. Her pieces, which explore story telling, myth and legend, are narrated both through the imagery used and the ancient Native American spiral-embroidered craft technique that is symbolic of eternity. The image to be beaded is photographed, scanned and manipulated in Photoshop®. Once digitally printed, the image is applied to fabric and the beads are applied by hand stitching. The choice and positioning of the beads relates to the light reflecting qualities of the digital pixilation on the computer screen. **Figure 11**

The use of digital imaging as a media to layer photographic, scanned, electronically generated imagery and colour in the virtual domain provides opportunities for the artist to imagine and explore concepts, narrative and visual arrangements without commitment or expense. Images can be amended, constructed and deconstructed providing multiple explorations and iterations in much the same way as imaginary thought is explored in the mind. The digital media captures the visual product in a virtual space, a semi reality, making it possible to be communicated back to the artist for reflection and to other artists and designers providing a means for creative collaborative intervention.

Collaboration

The textile designer J.R. Campbell explores the collaborative potential of the digital media in his 'art to wear' developed with the fashion designer Jean Parsons. Their work involves the integration of textile design into garment shape to produce bespoke printed garments (Campbell 2002). A recent project included collaboration of a third designer, Susan Strawn, whose contribution of a knitted section to the garment used the printed imagery created by Campbell in the garment pattern designed by Parsons (Strawn 2003) **figure12**. The Campbell and Parsons collaboration built on previous research at North Carolina state University and by designers at [TC]2, the Textile Technology Corporation, investigating the use of photographic imagery with complex garment pattern forms striving to overcome the difficulties associated with the alignment of odd shaped pattern pieces, darts seams and their disruption of the surface pattern of the print. The Campbell Parsons collaboration is continuing in current research exploring the possibilities of creating bespoke customised children's wear marketed and sold entirely through the internet.

The possibilities of bespoke or customised product is also being researched by Philip Delamore at the London School of Fashion who is concerned with the application of three dimensional printing of garments using rapid prototyping technology. His collaboration is a scientific one and reveals a new type of digital imagining possible through three-dimensional modelling process¹³.

Another recent collaborative research project involved Elaine Polvinen a textile designer from New York State, USA, Shen Li a designer from Beijing, China and Yimee Wang from Taiwan. The aim of the project was to 'use email to develop a collaborative digital design culminating with a Chinese-inspired theme exhibition' (Polvinen 2003). Imagery was communicated via email as tiny thumbnail images and via a private website. The digital media provided the platform for the meeting of minds, sharing of visual information and development of concepts as well as existing as a tool for communication.

Imagining in a make believe world

Imagination is defined as the *image forming power of the mind* or the *power of the mind that forms conceptions* (English Dictionary). Its role is that of visualising in a domain outside the physical world in order to "create" a new idea, description or artefact. (Collingwood 1958). The virtual world of cyberspace could be said to provide an extension to the image forming power of the mind, providing a further means for the development and visualisation of concepts. The virtual world is however the product of the imagining of others; *make believe* is central to the conception and design of software¹⁴ (Trend 2001). Design software provides the user with the make believe world of the utopian studio in which airbrush and oil paints can blend onto the same paper surface. The symbolic and iconic language perpetuates the metaphor. The breadth of scope provided by the virtual studio contains so much embedded knowledge and skill that it has been described as being 'knowledge beyond replication' (Gale 1994) since its sum is greater than that possible for any individual

to acquire. There are however hidden dangers in this domain. There is the possibility of being enframed in the software engineers' logic (Marshall 1999) and of being seduced by the visual effects of particular functions and techniques rather than the pursuit of creative exploitation to achieve the artists aesthetic objective (Braddock and O'Mahony 1998).

For many textile practitioners the greatest difficulty lies in their ability to enter into this world. Access is gained through an understanding of the programmers' logic and the interpretation of symbols. It requires acquisition of tacit skills to provide the freedom to interact with the embedded knowledge and tools intuitively so that the imaginative power is released to form the image. This requires time for practice and exploration and in a temporally challenged society this is may create difficulties due to the complexity of software applications. As a result, some artists prefer to limit themselves to certain functions of the software so that fluency in these techniques provides opportunity for creative thought.

The textile artist Alison Bell thrives on spontaneity and she has developed a digital working practice that engineers this to happen. Her love of the silk painting technique resulted from the desire for freedom and unpredictability in line and colour in her work. The order and logic implicit in digital imaging is in sharp contrast to this. Although she does not profess to be expert at the Photoshop software that she uses, she has developed a fluid working process that provides her with a form of spontaneity. Using scanned hand painted silk fabric samples and multiple layering Bell is able to intervene in the image using digital painting and erasing functions. Her layers are built from line work that is input into the computer using a tablet and pen, collected images in scanned photographic form and electronic images from the Internet. The use of the virtual space for layering of images enables her to capture and trap memories that form her expressive response to the environment her textile art reflects. The images are digitally printed on to silk and often over painted and sometimes elaborated with stitch and appliqué. They are inspired in the digital domain and developed through the interaction of materials and hand crafting techniques.

Figure 13.

Imagine the future

Software has been described as a "collaboration between the imaginations of the creators of a program and the people who use it" (Trend 2001). It is the potential of the virtual space to be entered and shared for the communal imagining which is so intriguing. As the imaginative and computational power of the virtual world expands so do the possibilities for digital imagining. Immersive reality is providing opportunities to enter the image space and interact and intervene creatively with it in real time (Grau 2003). The development of haptic sensors and research into the humanisation of technology being carried out at Media Lab MIT (Seelig 2003) may provide new types of interface that will ultimately provide greater accessibility for textile practitioners to enter into the digital virtual domain.

Today's commonly used design hardware systems are not geared to the normal working practice of artists and designers and interfaces such as mice and keyboards

feel alien and unresponsive. For many practitioners sketching with a pencil and paper is one of the fundamental means of generating ideas and where the interface is complex, slow and restrictive the creative flow may be inhibited or even halted. The research work being carried out as part of the Tacitus project at Edinburgh University is using haptic sensors to explore the issues surrounding development of interfaces that “would enable idea formulation and creative activities to be performed with the same intuitive and fluid transmodal interaction as sketching on paper” (Shillito 2002). The ability of practitioners to touch, sense and craft their ideas in the virtual space is likely to provide an even deeper stirring of the digital imagination. The effects of this on the printed textile outcome must remain for now conjecture, a figment of our own imagination.

Notes:

¹ This is discussed by David Trend in “Living in the immaterial world” (Trend 2001)

² (Harris 1999)

³ (Briggs 1997)

⁴ (Briggs 1995)

⁵ (Leak 1998)

⁶ (Bunce 1994)

⁷ An example of this is the way in which floral designs have dominated printed textile designs since the importation of Indian prints in the seventeenth century. The emulation of techniques and stylistic influence resulted in the European ‘Indienne’ designs that were subtly adapted visually to suit a European market. Prior to this floral motifs did not predominate.

⁸ The repeat of an image or pattern on cloth was historically necessitated by the circumference of the roller (the drop) and its width, which determined the size of the unit of repeat.

⁹ Amanda Briggs details this in her PhD thesis (Briggs 1997)

¹⁰ Leak writes: “Printers create colour by subtractive optical mixing, the majority using a mixture of cyan, yellow and magenta inks...The printer is unable to reproduce all the colours that the average human eye can see. While some colours are common to both devices, there are printer colours not covered by the monitor and vice versa” (Leak 1998)

¹¹ (Dormer 1997)p.3

¹² Brandeis comments: “ The digital prints looked more like paper than cloth. They seem flat, literal and not tactile” (Brandeis 2003)¹³ See

<http://www.freedomofcreation.com>

¹⁴ Laural, B. in Computers as theatre pp 111 (Trend 2001)

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