## Craft and digital technology

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### Abstract

In this paper I will attempt to argue that a craft-based methodology of designing through making that embraces the capabilities of digital technologies is highly relevant to an emerging post-industrial culture of customisation in 3D production and consumption.

The introduction reflects on the incompatibility of a methodology of designing through making associated with craft practice, with the economic constraints imposed by the mass manufacturing technologies of industrial production. As a result, in the context of 20th century mass production, customisation and individuality were largely the territory of crafts based production. However, in a post industrial society, constituted by advances in information communication technologies, the mass customisation of products to individual need is now on offer from huge multi-nationals such as Nike and is being explored by product designers across the world.

Section 1 refers to the historical and philosophical relationships between craft and technology including an understanding of technology as a destructive force in society. This is followed by a critique of a polarised relationship between craft practice and technological advance, linked to contemporary research concerned with a re-evaluation of the crafts in 21st century culture. This research clearly suggests that a methodology of designing through making is significant in developing user-oriented digital interfaces for Computer Aided Design and Manufacturing; and also that a craft-based methodology and its products embody an 'authenticity' that is highly desirable within a post modern society suffering a loss of individual identity and fractured sensibilities.

Section two introduces the work of a selection of 3D designer-makers who have embraced digital technologies such as Computer Aided Design (CAD) software, Computer Aided Manufacturing (CAM) hardware, Rapid Prototyping (RP) and other Information Communication Technologies (ICT) as part of their creative practice. Through contemporary examples of work, this section serves to illustrate the innovative potential of synthesising digital technologies into crafts based practices.

The final section outlines current practice-based research in this area at Falmouth College of Arts and concludes with a series of questions raised by this paper by way of opening up a discussion.

**Introduction**

The skilled and sensitive human interaction with technology that is involved in poetic object making is arguably central to the maker's art. A direct relationship with tools enables the maker to engage intimately with materials and process to create finished objects with a high degree of autonomy and control over quality. Makers approach technologies in open, creative and playful ways to develop individual and often idiosyncratic visual vocabularies used in the expression of ideas. Crafts people build reputation and credibility within their relatively esoteric fields of practice through this exploitation of technologies in the production of ideas

The economics of 20th century mass production technologies and the uniformity of their products have had the effect of disconnecting people from both the process of manufacturing and the products themselves. While mass production has brought us cheaper, desirable goods, there has been little space for the individuality and poetic quality of craft-based production. The backlash of this particular form of modernisation of technology has, in a late 20th century context, been an exponential growth in consumer demand for more personalised and unique products. In product design this has resulted in a greater attention to details associated with craftsmanship such as material and surface qualities, but, with the exception of a relatively small number of design products, this has resulted in a greater emphasis on styling than on an integrated relationship between function, aesthetics and personalised production.

**Mass Customisation**


**1.**

The development of digital technologies in the late 20th Century for both 2D and 3D production has had a huge impact on the economics of customisation, enabling the production of one or many products from digital data, and greater economic flexibility in relation to supply and demand. While specialist customised production was previously the remit of highly skilled crafts people, big brands such as *Nike* are now claiming this territory. On the *Nike* website you can customise a pair of trainers by selecting colour, fabric, laces and adding your name or ID. (http://www.nike.com/)


At Tendence trade fair in Frankfurt (August 30 – September 03, 2002), a design consultancy Vogt and Weizenegger, presented their ***Sinterchair***, made in ***PLAN-A, A Factory of the Future***. They invited visitors to their stand to:

*imagine buying your furniture like made-to-measure suits.*

**2.**

*It goes something like this: you walk into a shop, tell the assistant what you are looking for, have him draw out something corresponding to your individual wishes on his computer and he manufactures it for you on the spot. You receive a one-off product tailored to your personal taste and your requirements that is ready for you to take home with you within 24 hours*.

Visitors were asked to fill in a questionnaire recording colour and style preferences and were then invited to watch their customised chairs being digitally designed, generated and manufactured live. This process used Computer Aided Design (CAD) software and Computer Aided Manufacturing Hardware: a selective laser sintering process of Rapid Prototyping that up until now has been almost exclusively used for building prototypes in the car and aviation industries. (http://www.vogtweizenegger.de/sinterchair/press.html).

Paul Atkinsons', Future Factories project (2003) at Huddersfield University aims to demonstrate the ways in which complex 3D forms can be generated by combining the product design skills Lionel Theodore Dean, with computing algorithms. In this project consumers are able to select a form from a continuously evolving and mutating 3D CAD model and have it manufactured for them (http://www.futurefactories.com/)

**3.**

These examples of customisation made possible through digital technologies represent the beginnings a closer relationship between digital production and consumption that enables the creation of one-off designs from users specifications. However, the design methods employed in the creation of these forms does not yet exploit the full potential that digital technologies offer for creating unique, hybrid, individually designed forms.

**Authenticity**

David Boyle (2003) sites a revival of craftsmanship and its products as 'true' representations of individuality and integrity in a culture dominated by global brands that espouse these values. He also describes a current cultural phenomenon in which people are seeking to embrace 'reality' while simultaneously benefiting from technological 'progress'.

A number of contemporary cultural commentators in the UK are suggesting that 'craft' products and practices have a particular relevance in a post industrial, post-modern society. Liz Hoggard (2004) suggests that the *Crafts are shedding their folksy image and entering the market of highly desirable, consumer goods*. *Craft products are gaining greater respect in the world of Art, commanding higher prices in the market place and are prized by top ranking celebrities*. Louise Taylor, Director of the UK Crafts Council, has stated that the 'Crafts' are in the throws of a 21st Century Renaissance (Radio 4, August, 2003). Through an examination of craft activities from new perspectives (such as ethical consumerism, symbolic production, and as a 're-humanising' activity), Alison Cusworth & Mike Press (1996) pose the question of whether craft can address the problem of loss of individual sense of identity and increasing dehumanisation that has been related to developments in new technology, and is recognised as a characteristic of postmodern culture[1]. Amongst their questions to be addressed in further research they include the following: *"Does the impact of an 'information society' - supposedly a 'dehumanised' society call for a reassessment of the place, and the role of craft as a human element. To what extent can the application of craft address the problems of a 'loss of a sense of identity' and increasing dehumanisation?"*

[1] *"The word postmodernism generally refers to a form of contemporary culture, whereas the term postmodernity alludes to a specific period. Postmodernity is a style of thought which is suspicious of classical notions of truth, reason, identity and objectivity, of the idea of universal progress or emancipation of single frameworks, grand narratives or ultimate grounds of explanation. Against these enlightenment norms, it sees the world as contingent, ungrounded, diverse, unstable, indeterminate a set of disunified cultures or interpretations which breed a degree of scepticism about the objectivity of truth, history and norms; the givenness of natures and the coherence of identities. This way of seeing, some would claim, has real material conditions: it springs from an historic shift in the West to a new form of capitalism - to the ephemeral decentralised world of technology, consumerism, and the culture industry, in which the service, finance and information industries triumph over traditional manufacture, and classical class politics yield ground to a diffuse range of 'identity politics'. Postmodernism is a style of culture which reflects something of this epochal change, in a depthless, decentred, ungrounded self reflexive, playful, derivative, eclectic, pluralistic art which blurs all the boundaries between 'high' and 'popular' culture, as well as between art and everyday experience." Eagleton, T. (1996) 'The Illusions of Postmodernism'. Blackwell.*

In order to begin to establish a clearer link between craft and technology it might be useful to give some definitions:

**A definition of craft**

For this paper I would like to define craft as an essentially human and humanising process. To craft something involves human interaction with technology whether it's a pen, hammer, or computer software and hardware. In the experience of a maker it involves a high level of autonomous control over a holisitic process of designing through making. Crafting something, involves what Mihalyi Csikzentsmihalyi calls 'flow' activity, an activity that engages an individual to the extent that they lose track of time and have a strong sense of fulfilment and achievement through this process of engagement. Csiksentsmihalyi claims that it is 'flow' that enables people to be happy, fulfilled and successful in their lives, as opposed to material gain or even 'intelligence'. Craft is then both process and product. And as professional makers both processes and their products are embedded in a continuous internal dialogue between maker and technology while being both consciously and subconciously influenced by the external forces of the cultures of craft, design and beyond. Craft also exists as flow activity on a human level in the generation of objects and social systems that are understood to be beyond the realms of professional craft practice and belong in the territory of 'amateurism' or folk art.

**Defining Technology**

In 'The Question Concerning Technology' Heidegger (1953) asserts that the essence of technology is nothing technological and suggests that purely technical modes of thought and discussion do not suit it [Farrell Krell (1953)]. The essence of technology is ultimately a way of revealing the totality of beings[2], but in contemporary society technology has the effect of disenfranchising human's from nature (disguising reality) and while perceived of as a means to promoting the supremacy of man is an inevitable and overwhelmingly destructive force. Technology is viewed by Heidegger as an imposed ordering of nature and man, a defiant

[2] *"From earliest times until Plato the word techne is linked with the word episteme. Both terms are words for knowing in the widest sense. They mean to be entirely at home in something, to understand and be expert in it. Such knowing provides an opening up, a revealing. Techne is a mode of revealing. It reveals whatever does not bring itself forth and does not yet lie here before us. Whoever builds a house or a ship or forges a sacrificial chalice reveals what is to be brought forth...This revealing gathers together in advance the aspect and matter of the ship with a view to the finished thing envisaged as completed and from this gathering determines the manner of its construction. Thus what is decisive in techne does not at all lie in making and manipulating, nor in the using of means, but it is as a revealing, and not as manufacturing, that techne is a bringing forth."*

challenge to being rather than a revelation of being. He argues that technology is simultaneously a means to an end and a human activity: concerned with defining intentions and ascertaining and utilising means to achieve them. The Greek root of the word ‘techne’ is the name for the activities and skills of the craftsman as well as the art of the mind and the fine arts.

**Craft is Technology?**

Albert Borgmann, whose philosophical writings on technology are primarily concerned with its damaging effect on our society, describes a fundamental need for ‘focal practices’ within our daily lives in order for us to identify with and raise our awareness of significant realities. In very broad terms he argues that ‘hands on’ practices such as cooking, making a fire, and physical exercise in the great outdoors have the positive effect of disclosing the world to us, whereas the technological wizardry of microwave ovens, central heating systems, television and computers renders reality invisible. Borgmann’s position, which builds on Heidegger’s philosophy, is that technology threatens our autonomy by making us too dependent on devices.

Borgmann also argues that it isn’t just devices that are conspiring against focal practices. Focal practices have intrinsic internal goods and are not motivated by external forces. This, Borgmann argues, is key to their ability to result in meaningful cultural production. Any change that leads people to engage in their practices for entirely instrumental reasons will result in loss of those internal goods, loss of integrity and consequently loss of meaningful production.

Borgmann’s antidote to the destructive nature of technology is to suggest that technologies should be used to serve our needs: their judicious use will free up our time to engage in focal practices. If, as crafts people, we were to adopt Borgmann’s position on technology, which seems reminiscent of William Morris position, we would consider computing as a technological advance too far. Computers and their related software and hardware could only be considered as a group of devices that would effectively remove us from the direct and personal dialogue with materials and processes necessary for the production of meaningful artefacts. Added to this we could not countenance material gain as part of our practices. But

perhaps the most difficult implication in Borgmann's argument is that focal practices, understood as fundamental to an autonomous sense of human well-being, can only exist in a parallel, unconnected and potentially exclusive strand of human existence.

However, amongst Borgmann's critics, Kellner (2000) argues that new and digital technologies in particular can provide experiences and interactions that *"are just as real and life enhancing as conversation, gardening, taking a hike in the wilds, or caring for animals – examples positively valorized by Borgmann.* Kellner believes *"that Borgmann's distinction between the real and the hyperreal and his denigration of hyperreality are problematic, that we need to deconstruct such oppositions, and that we should see how new technologies make possible the sort of focal life-enhancing experiences and activities that Borgmann himself calls for…we need a dialectic optic on technology, and crucially we need to focus our energies on the devising of uses for new technologies that will enhance our lives and serve the values that we hold in common."*

McCullough (1996) suggests there is a close relationship between digital work and craft practice, arguing that hand and brain activities involved in computer use are analogous with making activities involving personal commitment and tacit knowledge. McCullough builds his thesis through examining handicraft, design vision, and tool usage as fundamentally human activities, emphasising the importance of personal commitment and tacit knowledge implicit in hand work. McCullough's argument is significant in presenting the idea that hand and brain activities involved in computer use are specifically analogous with craft practice. He argues that computer systems should be developed from the perspective of the user allowing them greater flexibility to work in the computer medium through the use of more refined and sensitive software tools, and eventually through haptic devices and virtual reality.

McCullough argues that:

> *"...the computer has become a visual medium..computing has not so often introduced the strict formal methodologies for which it was initially notorious as it has opened up possibilities - for involvement, for expression, and for individual talent. Visual computing has provided a new form of hand-guided continuous processes. Its dynamic representations invite incremental refinement of artifacts...Increasingly computing shows promise of becoming the medium that could reunite visual thinking with manual dexterity and practised knowledge."*

Most recently, McCullough (2004) suggested it was vital to have knowledge of making in the real world in order to be able to design creatively and effectively with CAD software. He suggests that in a post industrial society close observation and understanding of human experience of the material world and of each other are central issues in designing for the 21st century.

Coyne (1995) examines the relationship between the development of information technology and postmodern thinking and has written extensively on a shift in approach to computer systems design from the theoretical to the pragmatic. He defends his case against the theoretical supremacy of Cartesian rationalism through a critique of the philosophies of Dewey (1859 -1952), McLuhan (1911-1980) and Heidegger(1889-1976); and an appraisal of the limitations of the dialectical approach employed by critical theorists. His description of pragmatism resonates with the philosophical approach to practice of the crafts person:

> *" a school of philosophical thought that embraces the primacy of human action, the practicalities of human involvement, the materiality of the world, the interaction of the senses and the formative power of technology ... "*,

Coyne (1996) and McCullough (1996) discuss craft as an integral activity in the design and use of computer systems. This link is also noted by Press & Cusworth (1998) in their investigation into 'the value of craft education in the information age' and they suggest that this similarity requires further investigation in order to discover if thought processes, work patterns, and mental attitudes of craftspeople can be usefully related to the implementation, and exploitation of new technological developments.

These ideas about the relationships between craft, technology and in particular digital technology would suggest that crafts practitioners have a lot to offer in the development of new cultures of design production. What Borgmann says about the qualitative relationship between focal practices and focal products ie. that practices must be motivated by an internal need to 'know' in order for them to produce real goods, rings true in the experience of the maker. This perhaps leaves us with a difficult question: how can the autonomous character of crafts practice be mapped onto a design processes that address the wider human need and desire for autonomy?

**Digital technology in Designer-Maker practice**

In the previous section I have tried to show that crafts practices and their products are of particular relevance in a post-modern, post-industrial society and that in particular we need to pay attention to the ways in which the human uses of, and interactions with digital technologies may be developed through a crafts based methodology. In this section, my aim is to illustrate the ways in which a number of makers and designers have effectively integrated digital technologies into their creative practices as part of a personal dialogue between maker, material, process and form.

***Gordon Burnett***
http://www2.rgu.ac.uk/criad/burnett/main.htm

**4.**  **5.**  **6.** 

Burnett is a Senior Lecturer and Researcher at Gray's School of Art, The Robert Gordon University, Aberdeen.

The clocks illustrated here were created using a computer numerically controlled 3 axis milling machine to create form and texture in the production of clocks whose surfaces are anodised.

In terms of the use of computer technology Burnett exploits the quality and marks created by adjusting computer generated programmes in slightly different ways. The computer modelling software he uses (Quicksurf) cannot visually represent the quality of surface that programmed tool paths will create, and this resulted in the need for a lot of experimental work to extend a controllable personal visual vocabulary. The resulting texture, at first glance, appears hand carved, but on closer inspection its uniform complexity reveals the use of the machine.

Burnett became interested in the use of the computer to generate highly complex cutting paths through his understanding of direct numerical programmed which provided a strong basis from which to extend his knowledge of craft processes into computer technology. The success with which he has been able to integrate computer technology into his work is a reflection of his prior understanding and high level of craftsmanship as a metalsmith.

***Drummond Masterton***

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Masterton is a Senior Lecturer and Researcher at Falmouth College of Arts and was a student of Gordon Burnett. Masterton's objects address themes ranging from perception, memory, landscape and representation to mathematics and patterns and are for the most part created through processes that involve CAD/CAM. Masterton says:

*"I am not concerned with hand crafting my ideas into solid forms …because a high proportion of the objects that I imagine would be too difficult or too time consuming to create by hand. However a large part of my work is to understand how the machines I use to create my objects work, through an intense process of testing numerous machine settings, adjusting large segments of machine code and changing or making tools for the machine to use. These practices can be seen in the light of a craft tradition and could be compared to how a silversmith might use a range of hammers and stakes to create a certain form or texture; I consider the machines as tools to create objects".*

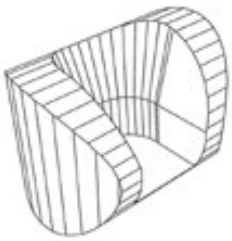
***Liam Hinshelwood***

**10.**

Liam Hinshelwood is a recent graduate of the 3D Design for Sustainabilty programme at Falmouth College of Arts and as a student of Drummond Masterton created design work for his final degree using a Rapid Prototyping Machine to realise CAD forms generated by software that mimics genetic evolution. Hinshelwood says:

*" My work is deeply rooted in nature. I find inspiration in the computers ability to model natural systems and make invisible natural processes tangible. Using these systems to design with opens up a huge amount of creative potential, in the case of the vessels using a 'genetic' process to explore the potential in breeding, hybridising and genetically modifying objects. To me the computer and its peripheral devices are a tool to be subverted. When viewed in this way the most mundane computer operations can become a creative opportunity, printers, mice, monitors, scanners, and even outdated peripherals such as pen-plotters offer a great deal of creative opportunity. When looking at CNC and Rapid Prototyping technologies from this perspective its clear to see that there potential is truly immense and will only grow as the technology develops".*

***Fred Baier***
http://www.fredbaier.com/



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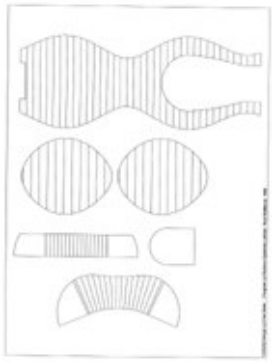


**12.**

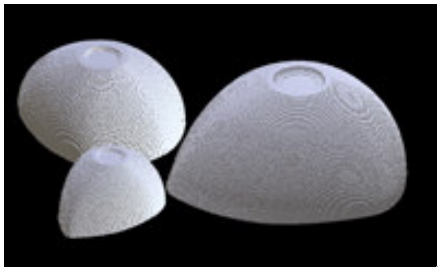
**13.**

Baier is a contemporary furniture designer and has been using CAD and CAM since the 1970's when he developed a specifically designed CAD/ CAM software programme, VAMP (visualise and modelling programme) for the production of furniture designs. This programme produces plan forms of the skin/surface panels of furniture designs generated on screen, and then numerical data is used to control the cutting of panels (CNC). The surfaces are

numbered and marked by the computer and the panels are machined nearly all the way through leaving a thin skin where the panels are to be folded.

The influence of computer technology can be clearly seen in the geometric forms that Baier manipulates to create his designs geometric primitives are the basic building blocks of 3D modelling software. The translation of these shapes into the solid and familiar medium of wood results in objects that look as if they come from the science fiction worlds of “Mad Max” or out of “Barbarella’s spaceship”. This distinctive look seems to some extent to have become Baier’s trademark: creating a physical and conceptual link between traditional craft practice and futurist technology. You can download some of his design sheets from his website.

***Justin Marshall***



**14.**

**15.**

Marshall completed a Ph.D in 1999 entitled, *The Role and Significance of CAD/CAM Technologies in Craft and Designer-Maker Practice: with a Focus on Architectural Ceramics*. Marshall’s research and artwork has explored the integration of CAD/CAM in the creation of relief tiles, tessellations, and the use of shadow to create illusions of form. He likes to subvert the use of digital interfaces in order to be able to interact with technologies in more open and experimental ways.

Recent projects funded by the Arts and Humanities Research Board (AHRB) have explored the use of computer technology in the production of organic ceramic surfaces and complex tessellating tiles.

***Katie Bunnell***

**16.**

**17.**

**18.**

Bunnell completed a practice-based PhD entitled *The Integration of New Technology into Ceramic Design-Maker Practice* in 1998. She leads a cluster of research activity at FCA in 3D Digital Production. Her work has used digital technologies to create complex patterns layered into the surfaces of ceramic. She creates lace like patterns that incorporate unexpected imagery. A single CAD pattern may be used to a create objects in a variety of materials eg. ceramics, glass and fabrics to create a range of products from one set of data. Bunnell is interested in developing more open and accessible ways of interacting with CAD/CAM technologies in order to prototype complex products reproducible in a commercial contexts.

***Brian Adams***

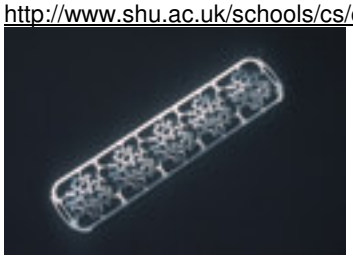
**19.**

**20.**

Adams is a Senior Lecturer in 3D Design at the University of Plymouth. He emphasises the dialogue between the virtual and the material world as an important aspect of his use of the computer: models are created and translated back and forth. Like other makers he uses the computer to generate multiple design variables *"at a speed that keeps pace with thinking and development of ideas"* which he feels is not possible with traditional modelling processes.

Adams initially found the output mechanisms for realising 3D forms from CAD files to be problematic, but with the development of Rapid Prototyping technology he is now able to produce complex 3D models directly from his CAD visualisations.

***Christoph Zellweger***
http://www.shu.ac.uk/schools/cs/cri/adrc/research2/christport.html



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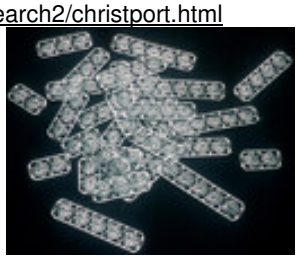
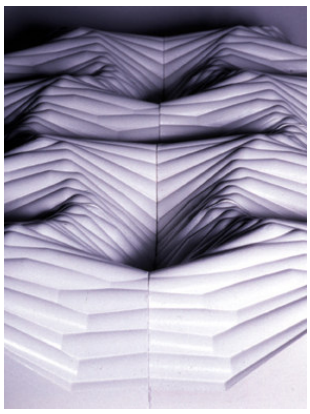


**22.**

Zellweger's is Associate Professor of Art and Design at Sheffield Hallam University and runs his own design studio in Zurich in Switzerland. His work explores new territories for craft practice. These 'jewels' were created by CNC laser cutting stainless steel.

***Graeme Findlay***
http://www.dlay.co.uk/



**23.**

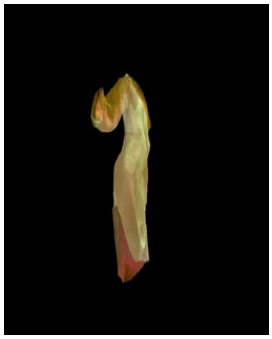
**24.**

Findlay graduated from Grays School of Art in Aberdeen in 1999 then from the Royal College of Art in London during 2003. He is now involved with freelance product design, CAD consultancy and research. The baadaa® tiles are based on the basic principles of mathematics: addition, subtraction, multiplication and division. As more tiles are added to the sequence so the design grows and creates pattern. Some sequences have been designed to

change their structure under different lighting conditions. These tile designs are early examples of Findlay's exploration into Computer aided design and manufacture.

***Jane Harris***
http://bruno111.valuehost.co.uk/pixelraiders/jane.html
http://www.museumoflondon.org.uk/MOLsite/exhibits/empress_new_clothes/


**25.**


**26.**


**27.**

Harris completed a practice-based PhD in 2000. Her virtual textiles are concerned with the value of material skills in aesthetically altering the potential of digital imaging media. She crafts virtual textiles and animates them using 3D computer graphic (CG) technology. The folds and shadows in the 'fabrics' reference the traditions and representations of cloth in the context of fine art and design historically. The visual reference to the body in these animated works deliberately renders the garment as a cast, emphasizing the beguiling nature of fluid material and form.

Harris's research has involved her in collaboration with other visual and performance artists. In a recent piece, The Empress' New Clothes: computer animation of 18th century dress, exhibited at the Museum of London she collaborated with a dancer and Computer Graphic artists *to bring life to a fragile historic dress, to see how it may have looked and moved when it was originally worn*.

***Tord Boontje***
http://www.tordboontje.com/

**28.**

**29.**

**30.**

Boontje trained as an industrial designer, and was shortlisted for the Design Council's Designer of the Year Award 2003, works creatively with digital production processes to create complex design pieces with a 'craft' aesthetic. His work, exhibited in both craft and design contexts effectively crosses the boundaries of craft, design and industrial production: his *Wednesday* light created using CAD/CAM technologies has been successfully mass produced for Habitat (Garland) without losing any of the original integrity of the limited run produced for exhibition.

**Research in to Digital Technologies in 3D production**

Research into the use of middle to high end digital technologies in the materialisation of three-dimensional objects has largely been limited to industrial manufacturing and has focussed on the increased speed of product to market made possible through 'rapid' prototyping (RP). HEI Centres for Research and Development in the use of Computer Aided Design and Computer Aided Manufacturing (CAD/CAM) have largely developed through Faculties of Engineering and/or Technology rather than through Faculties of Art and Design. An increase in accessibility of technologies (resulting from reduced costs and funded collaborative research projects) is enabling a growing number of designer-makers to explore the possibilities that new technologies offer in relation to realising ideas in 2D/3D forms as we have seen illustrated today.

There are pockets of research activity in Art and Design HEI's in the UK that specifically link designing through making with new technology. These include the <make> Research Unit located at University of Plymouth, research into digital technologies and craft practice at

Gray's School of Art, The Robert Gordon University, Aberdeen, The Centre for Art and Design Research, Sheffield Hallam University, and Edinburgh College of Art, amongst others. Ann Marie Shillito at Edinburgh College of Art is leading Tacitus an AHRB funded project concerned with the development of three-dimensional haptic and multi-sensory computer applications for creative processes in applied arts and design. Research by Professor David Herrold, De Pauw University, Indiana, USA in 2002 resulted in this 'Slipjet Printer' - a computer controlled 3D printer that uses soft clay to create a model.

**Research at Falmouth College of Arts**

**31.**

A suite of cutting edge equipment now in place at the Design Centre at FCA represents a unique opportunity for the development of a distinctive area of craft-based research that explores the relationships between the cultures of designing through making and digital technologies.

The key objective of this practice-based research will be to evolve new methodologies of designing through making that integrate digital technologies and through this contribute to the wider development of sustainable 3D production. Our aim in Borgmann's terms will be to develop focal practices that integrate the use of digital technologies which result in knowledge that may be applied in real world design contexts.

Our activities at FCA are motivated by what we perceive as both opportunity and need for a coming together of design manufacturing with crafts sensibility through digital technology. Through our research we hope to test out ways of creating three dimensional production processes and products that are able to respond sensitively and innovatively to a widening social and cultural demand for individualised and customised production.

This paper raises a number of questions that we are interested in exploring further:

**Research Questions**

To what extent can the application of craft be effectively used to create complex customised products?

Can the methodological approach of a designer-maker be effectively used to develop more human-oriented interfaces with digital processes and their products?

Does digital technology make it possible for designers to employ a methodology of making in the design and production of commercial products?

How can designer-makers synthesise digital technologies into their creative production in order to develop new contexts for their practice?

How can designer-makers use ICT to develop effective collaborative design processes with both specialist and non-specialist 'designers'?

Can users of ubiquitous digital technologies such as mobile phones, digital cameras, internet and email use these as tools to engage in the co-production of three dimensional forms?

In the examples of work illustrated in this paper it is possible to ***see*** that digital technologies offer a great deal of potential for designer-makers to develop their practices. While digital technologies may not appeal to all makers, the emerging exploration of their use enables us to re-address the contemporary value of craft. Crafts practitioners already know a great deal about creating individuality in products. The real question is perhaps how, or if they can use this knowledge in tandem with digital technologies to develop more commercial forms of customisation that meet the demands of 21st century culture.

**References**


**Amin A** (1994) *Models, Fantasies, and Phantoms of Transition,* in Amin A (Ed) (1994) *Post-Fordism: A Reader*, Blackwell

**Atkinson, P**. (2003) *Future Factories: Design Work by Lionel Theodore Dean*, University of Huddersfield

**Borgmann, A** (1984) *Technology and the Character of Contemporary Life*, University of Chicago Press

**Boyle, D** (2003) *Authenticity: Brands, Fakes, Spin and the Lust for Real Life*

**Bunnell, K** (1998), *The Integration of New Technology into Ceramic Designer-Maker Practice*, PhD Thesis published on CDROM, The Robert Gordon University, Aberdeen

**Coyne, R.** (1995*) Designing Information Technology in the Postmodern Age, From Method to Metaphor*. MIT Press.

**Csikszentmihaly**i, M. (1996) *Flow: The Psychology of Happiness*. Rider.

**Eagleton, T**. (1996) *The Illusions of Postmodernism*. Blackwell.

**Haworth, L** (2000), *Focal Things and Focal Practices*, in Higgs, E., Light, A & Strong (Eds) (2000) *Technology and the Good Life*, The University of Chicago Press

**Hoggard,** L (2004) *Look, No Kaftans***,** 08 February 2004, The Observer, Review: Arts p.5

**Kellner, D**. (2000), *Crossing the Postmodern Divide with Borgmann, or Adventures in Cyberspace*, in Higgs, E., Light, A & Strong (Eds) (2000) *Technology and the Good Life*, The University of Chicago Press

**Marshall, J** (1999), The Role and Significance of CAD/CAM Technologies in Craft and Designer-Maker Practice: with a Focus on Architectural Ceramics. PhD thesis, UWIC.

**McCullough, M**. (1996), *Abstracting Craft, The Practised Digital Hand*, MIT Press

**McCullough, M** (2004), Keynote Speech for Pixel Raiders 2 Conference, Sheffield Hallam University.

**Press, M. & Cusworth,** A (1997) *A New Vision in the Making: exploring the value of craft education in the information age*, in the European of Academy of Design Conference Proceedings, also available at http://www.shu.ac.uk/schools/cs/cri/adrc/research2/page_link_pages/ltm ead.PDF

**Sabel, C** (1994) *Flexible Specialisation and Regional Economies*, in Amin A (Ed) (1994) *Post-Fordism: A Reader*, Blackwell

**Taylor, L** (2003) Today programme, 3rd September, BBC Radio 4

***Websites***

**Fred Baier:** http://www.fredbaier.com/

**Tord Boontje:** http://www.tordboontje.com/

**Future Factories:** http://futurefactories.com/

**Gordon Burnett:** http://www2.rgu.ac.uk/criad/burnett/main.htm

**Graeme Findlay:** http://www.dlay.co.uk/

**Jane Harris:** Pixel Raiders: http://bruno111.valuehost.co.uk/pixelraiders/jane.html

Empress New Clothes: http://www.museumoflondon.org.uk/frames.shtml?http://www.museumoflondon.org.uk/MOLsite/exhibits/empress_new_clothes

**Nike:** http://www.nike.com/

**Vogt & Weizenegger:** http://www.vogtweizenegger.de/sinterchair/press.html

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27. Jane Harris, CAD generated textile fabrics animated using Motion Capture and Maia software

28. Tord Boontje, Screen/Streamer, laser cut silk

29. Tord Boontje, Wednesday Light, a 1.5 meter garland which is attached to the wire above the lamp with a simple clip and wrapped around the light bulb, a bit like flower arranging. The light can be extended and freely formed to any scale. 20 x 20 x 40 cm approx It is made by photographically etching stainless

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The Author of this paper, Dr Katie Bunnell, leads out a cluster of practice-based research at Falmouth College of Arts concerned with digital 3D production.