PLYMOUTH COLLEGE of ART

Making Futures

The designer-makers craft - ecologically principled practice.

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Introduction

The ‘return of the maker’ conference theme suggests that artists, craftspeople as well as designers are re-considering their approach to their practice. This paper presents details the ways that ecologically principled textile designers and designer-makers use their creative acumen and individual skills and knowledge to creatively shape their practice. Craft models of practice are used to eliminate issues encountered in attaining sustainable practice at every stage of the design and making process.

Analysis of a select group of designers and designer-maker case studies revealed a range of individual methods and approaches in use. The methods have been grouped into types of practice using ways of synthesising materials with making to form a new process. This paper states how a design constraint creates design potential, how the use of advanced manufacturing processes are an effective a tool in realising creativity and how introducing an element of risk - with no silhouette in mind, at the commence a design or making process holds enhanced creative and wellbeing outcomes.

The approaches and practical examples are relevant to practitioners looking to negate the negative impacts in creative textile practice. Craft models of practice used to identify and follow a balance of guiding principles, from within individual approaches to address issues in design and production.

Case study research illuminates how aspects of ecologically principled practice can be interpreted as a craft model of practice that can be applied in a wide range of contexts to meet ecological and sustainable principled practice.
The emergent model reflects perspectives held by ecologically principled designer-makers that enable further flexible individual interpretation. Details of the approaches, actions and practices have evolved from within fused design and making processes. This illustrates a range of experiences that form reflection-in-action practice and involve making practical decisions on encountering issues whilst working to maintain ecological and sustainable practice.

The practical examples were extracted from open interviews with carefully selected designer-makers and form part of wider research into ‘The Fabric of Wellbeing’ to develop and apply a craft model of practice to investigate the wellbeing potential of newly emergent biopolymer textile fibre with constructed textile design.

Developing a craft model of practice

The range of different strategies disclosed by the designer-makers have been arranged to reflect the different aspects of their practice. Key areas indicate the approaches taken to meet individually perceived issues in textile practice. Overall approaches involved differing degrees of commitment to addressing issues across a range of areas within their practice. Logical grouping of the decisions-in-action made during the design-into-production process, has been placed under headings to enable analysis.

Designer-makers begin with an understanding of **pluralistic contexts** and take a holistic approach to address each element of practice. Design Constraints are used to realise **creative potential** that leads to fused design and making processes. **Ecological principles impact** on design and making activity, a process that includes an element of risk and the result of which is interpreted and valued creatively. **Knowledge of advanced materials and processes** is used to manipulate and/or regulate quality in production. It is used as a tool to introduce or to extend manipulation or production and evaluation of resulting effect is judged principally for creative application.

The strategies that emerged from open discussions demonstrate the type and range of principled approaches that designer-makers use to meet ecological and sustainable textile practice which can be termed as craft model of practice.

This paper calls for us to examine designer-maker use of craft models of practice more extensively to understand how and why a ‘return of the maker’ holds wellbeing potential in wider application in meeting our future needs.

Ecologically principled designer-makers.

Prior knowledge of designer-makers used to identify ecological and sustainable practitioners as case studies that provide an effective method of examining and understanding of the complexities of what takes place in principled ecological and sustainable practice. Open interview discussions to identify “how” and “why” type questions (Yin 2003:6) put to ecological and sustainable practitioners provided insight into the nature of strategies used in design practices.

A group of 42 ecologically and sustainably principled textile designers were selected. Ranging from large to small-scale textile businesses, distinguished from conventional practice by the manner in which they worked and/or conducted their business.

Profiles of six selected designer case studies are presented on the next page. Explanation of how their practice relates to understanding the context and need for alternative forms of practice in relation to current ecological and sustainable textile practice. This process led to identifying strategies that could be applied to evaluating creative practice and the potential of newly emergent sustainable fibres.

Table I and II shows the type and nature of each practice.

Group A	DESIGNER-MAKERS	TYPE OF PRACTICE	RELEVANCE
	Holly Mc Quillan	Zero Waste Pattern Cutting (ZWPC) A new model for garment design and production. Eliminates waste in clothing production.. ZWPC uses workshops and pattern templates. Each garment is simple to make, can be modified in multiple ways to suit changing fashion and user needs.	· Uses design constraint. · Sustainable design prac tice within a contemporary material culture framework. · Fashion design practice that embraces uncertainty. · Challenging egocentric, hierarchical design models. · New model for garment design and production. · Changing fashion and user needs. · Craft-based methodology
	Jane Taylor	Seam free knitwear for women. Embraces a craft-based method as a design tool for knitwear designers. Bridges the skills gap in computerised seamless flatbed knitting by investigating the impact of advanced technology on the design process. Seeks to challenge established models of knitwear design and manufacture.	· Uses design constraint. · Bridges skills gap in com puterised seamless flatbed knitting. · Impact of advanced technology on the design process. · Craft-based methodology. · Advanced technology as a design tool.
	Keep & Share Amy Twigger Holroyd	Experimental knitwear and open craft practice. Explores relationship between fashion, making, design and sustainability. Creates knitwear for individual customers. Makes experimental and conceptual one-off pieces Develops resources for re-knitting.	· Open craft practice. · Relationship between fashion, making, design and sustainability. · Creates and Supports other people's making. · Craft-based methodology · Communal nature of knit ting culture. · Develops resources for re-knitting practices.

Table I. Independent designer-maker practice case studies.

Group B	DESIGNERS	TYPE OF PRACTICE	RELEVANCE
	Ayuvastra	Company specialising in fabrics and clothing infused and dyed using medicinal plants from the Ayurvedic tradition. 100% organically dyed, kind to the environment, the people who make them and the people who choose them.	• Demonstrates best sustainable practice Uses ancient Ayuvedic properties to replace pollutant chemical dyes. • Enhances well-being from wearing clothing made from natural materials. Uses well-being properties as a driving force for achieving sustainable design. • Uses traditional crafting processes effectively in current industrial practice. • Industrial sector knowledge of sustainable alternatives. • Source Global Sustainable Fashion Award finalist in2013.
	Bam Clothing David Gordon	BAM Clothing makes performance and comfortable active wear. We use the natural antibacterial resistance of bamboo for good moisture transmission, drape and effective colouration for lifestyle. Everyone gets treated fairly and responsibly, from the garment factory workers to the customer.	• Uses design constraint. • Bridges skills gap in computerised seamless flat-bed knitting. • Impact of advanced technology on the design process. • Craft-based methodology. • Advanced technology as a design tool.
	Gudrun Sjödén	Gudrun Sjödén makes colourful clothes and home textiles in natural materials with an emphasis on Scandinavian design. Functional and versatile mixed and matched in both the short and long term in looks to suit women of all ages, shapes and sizes. “Clothing design with a green soul”	• Environmental consideration in mainstream industrial practice. • Sustainable materials selection. Care & product lifecycle • Holistic approaches in practical decisions • Customer centred design, designs for a broad age and size range. • Designer responsibility in ethical materials supply. Education of customers through effective labelling

Table II. Designers in large scale industrial practice.

Table II above shows a second group of principled designer practices selected from industry. These designers form larger scale practice but share strategies in working practice.

Pluralistic contexts and holistic approaches.

Designer-makers' key role has a positive impact on industry (Pittman and Townsend 2010) taking a holistic approach to their practice realises a reduction in environmental impacts beyond material and process selection, designers use creative acumen to shape their practice.

Zero Waste Pattern Cutting designer Holly McQuillan states, 'as designers we need to work out how to satisfy our wants and needs without trashing the environment. We need to consume less; buy better quality and then work out how to deal with economic consequences'. McQuillan also stated; 'Designers have a big part to play, in taking a holistic approach. We can't just address it from a fashion industry perspective; it's a global, multifaceted problem'.

Ongoing awareness and influence of cultural change impacts on our society and directly upon the designer.

'I think that we, as a society, have been re-programmed to recycle and it's become really part of my conscience now, you are very conscious of waste, throwing stuff away and then obviously of fast fashion because of the job'. [Taylor]

The ideas and awareness that we form as individuals influence work of the designer. The degree of influence is a result of the conscience and responsibility of the designer. This is determined by the amount of control over practice and a direct, positive impact on the way that designers approach their work.

'The waste is in the sampling, and I am very conscious of it but I am sure that 20 years ago it would have just got binned, but it is that thing now where you just can't throw stuff so it does bother me that I am producing such a lot of fabric in the sampling for this collection. The whole reason for 'sustainable fashion' the buzz word, is from outside influence'. [Taylor]

Designers are aware of waste generated through the nature of the making process. This is aspect that is inevitable, but an opportunity. Generated waste, used swatches can be unroved and reused, re-assembled into products and natural fibres biodegrade in the earth (landfill).

Synthetic fibre and yarn samples are kept to a minimum in the 3-D knit process. Choices of yarn used for sampling are overlooked; this indicates opportunity for biopolymer yarns used as a substitute in place of synthetics. Cost is prohibitive and related to scale of production in comparison to natural fibres. One of the best alternatives to generating waste is to design products that can remain in use. Designers have their own names for this method; transformability a term taken from the social-ecological system of resilience, adaptability, transformation, change. Taylor states; 'It is just about being adaptable for the wearer being able to play with wearing the garments and how they are worn'. [Taylor]

The responsive designer demonstrates awareness of client garment use to bear influence on the design of clothing, to meet specific needs to 'play' and explore new ways of dressing and wearing clothing. Taylor's 3-D knit collection is designed with the intention and explorative interaction, is part craft and crafting - the use of one's imagination and creativity to extend use and enjoyment of each item. This is exemplifies an extension of the design ethos which is thoughtfully, carefully and individually assembled.

Design constraints lead to creative potential

Reducing impacts on the environment does not impose negative constraints on designer-makers as in conventional industrial textile practice;

'I feel far more constrained by the standard clothing industry, as soon as I knew how really bad the clothing industry was, I thought I either had to leave the industry, or try to change it. In fact there are fewer opportunities from an aesthetic and conceptual perspective.' [McQuillan]

The linear structure of industrial practice (Gwilt 2011:68; Sinha 2002:61) has been challenged and places the designer at the centre of the process which enables control over production and materials choices.

McQuillan does not see designing for the environment as a constraint but as an opportunity for success 'if you told me that I had to design in the standard fashion industry manner, then I'd feel constrained and would quit'. McQuillan explains 'it's very much a human centric design process; often the body is part of the design, while at the same time being a kind of disembodied visual mathematics'.

As the design process becomes more complex, designers retain control over form, by rising to the challenges presented (Woolley and Huddleston 2015) and turning them into opportunities to explore creative potential, by using technical knowledge with tacit handling skills to control outcomes.

'By working with your hands and your imagination to both predict the outcome and control it on the body, with practice, knowledge and sometimes chance, you've got to be ok with not having control, and working with what comes of it'. [McQuillan]

Aspects of designer-maker practice motivates exploration, a one step process in designing and making method, becomes a playful way of realising further potential.

'Firstly because once you get into it, it's fun! Also, they might be environmentally motivated. Or perhaps they are pattern cutters or textile designers first and like to use a process that privileges those. Some see the potential advantage in designing, pattern cutting and working out the construction sequence of a design in one step'. [McQuillan]

Designers prioritise all of the aspects of their practice when they are designing and making these are brought into play simultaneously, 'Aesthetics, fit, waste elimination, sustainable fabric choice, market are all considered at the same time. At different points one might be more to the fore than another, but it is not a hierarchy'. [McQuillan]

Designer makers are motivated to change aspects of the materials and processes used to improve achievement of priorities

'My processes and material use changes overtime as I learn from my mistakes. If I never allowed myself to make mistakes then I wouldn't learn. The more I develop my practice and learn new nuanced ways of achieving particular goals the better I get at applying the right approach for that particular design idea right from the start'. [McQuillan]

Designer-makers use this approach proactively to design transformational (Korn 2015:126) garments that afford the customer extended wear and nuanced ways of using clothing.

'I call it my transformability, which I must admit, not all my pieces have got that but most of them have some form of that, that's what I am aiming at; people treat them as a piece or garment that they don't mind investing in - they know that it is not going to be out of fashion in next year'. [Taylor]

The designer identifies that high quality products may mean investing a little more money in garments that will last longer and remain in use for longer. The fibres and designs need to meet performance demands with regard to care and use. The incentive for designer choice stems from experience in performance and client knowledge of correct care in use. Luxury natural fibres have known wear and performance capabilities. Knowledge of newly emergent fibres handle, wear, care and stability potential is gained from first hand experimentation. Tacit handling to gain knowledge and experience of alternative fibres and yarns must be creatively explored to contextualise and reinforce understanding of emergent fibres creative potential.

This applies to product designers too; Chapman (2005: 43) cites examples of successfully fulfilled product design briefs met by using craft methods to meet the brief. Working with quality materials, fashioning tools and processes and application of tacit handling and experimentation to achieve innovative design solutions design processes become more complex but the designer retains control over form.

'my design process isn't complex! I sit in a room, design and make prototypes using the same machines and skills that I will use to produce garments for individual customers'. [Twigger Holroyd]

Twigger Holroyd the nature of process is simple and logical to follow and manipulate. Tacit knowledge of knit process has been explored so fully that it can be dominated totally. All possible outcomes are known and execution a formality. The challenge to individualise and customise the end product, to subvert the original item rendering it altered. Innovation is sought through imagination. Creative impetus gathered from meeting the challenge of customer need, in place of inspiration from materials tools or equipment.

Designer-maker knowledge is a service to match customer need with garments already made, but for a different person and purpose. The actions are not to repeat the outcome or image, the process achieves a means to a different end. Designer's 'know how' used to subvert the pattern, shape or style to individual requirement. This creative practice is craft.

Ecological Principles Impact on Design.

Creative action is exploration of the inner depths of craft. Craft is often written about by non-practitioners and as a result limited or restricted by non-practitioners. Outside observers of craft practice is restricted by lack of tacit knowledge. Adamson (2007) and Sennett (2008) plot the application of craft across a wide range of disciplines within art, design and craft practice and attempt to unlock the inner workings of creativity but fail to convey the meaning as intended by the craft practitioners. Designer-maker observations, comments and reflections of the inner workings involved at the heart of craft practice emerges from within their creative thoughts and decisions.

Craft practitioners and designer-makers rarely write about their modus operandi. Communicating it in words does not interest them their craft is their expressive outlet. What interests them is what they can do within their practice, which becomes an obsession, a pursuit. They hunt it down with a thirst or as a hunger for an elusive flavour that can quench their appetite for creative innovative actions and reactions.

When interviewed about their practice, designer-makers are not able to convey the nature of the intimacy of contact with materials and tools. They are not interested in communicating that aspect of their practice the action of design-making outside of it working well for the item they are making. They are not used to speaking of it. They just make it. It is migrated to the product by their attention to details of tools, materials and process, by their tacit experience of their craft. Designer-makers know this because as a practitioner-as-researcher 'that is what I do, that is how I do it and there is the product of it'. [Pittman]

The action of design-making is not new - we now use it more widely and freely. Openness means use of internet and social media are key drivers in this change of use (Manzini 2015: 74). We are all encouraged to try our hand at making things from what we have to hand, seek ways of doing things by experimenting or by changing things to match specific and personal need with available resources.

Designing then using machines to manufacture removes a perceptive method of materials knowledge. Resulting products are high quality and uniform and can be repeated and replicated ad infinitum. Designer-makers are interested when there is a malfunction which results in malformation. The subverted pattern or shape formed from serendipity. The glitch or unexpected event, a technical fault is what enables skilled designer-makers to innovate. Designer-makers embrace this event and exploit it. It is adopted it as a tool with which to divert from the norm. They experiment until they can control or dominate it. It becomes a crafted design strategy and making method. They adopt use of ecologically improved materials, advanced processes or the adoption of a sustainable design that can impact on the aesthetic styling and silhouettes of products.

'I aim for my pieces to look a little different, in a way that is hard to define… Because I use unconventional methods of manufacture that would not be used in industrial production – so they are quietly disruptive of the mass-produced norm'. [Twigger Holroyd]

This craft design strategy is an unconventional method of manufacture not followed in industrial production processes. A designer's craft design strategy becomes their trademark, signature or thumbprint. Designer-makers carefully craft to disrupt the norm in innovative and individual ways that cannot be replicated en masse.

Further explanation from within practice is given by another designer-maker

'it is so complicated to programme a super-efficient seamless garment for industry, because they have to think about it three-dimensionally, that they have created this database based on very traditional shapes, but to produce something that is more of an unusual shape, when you have to think about the whole thing, it is one thing to design it but then for a technician to know where to find that information on the database, it's just not going to marry up.

There is no time and there is no space to innovate at that stage in industry. It is possible if you have got the time, like I have, to create stuff, but it just takes a long time and it's going to need tweaking'. [Taylor]

Taylor's comments reflect insight into design approaches used in industry, to create garments in three dimensions. Traditional construction techniques in both fabric and knit are undertaken in a traditional template form and then assembled with seams and create around 15% waste (Risannen 2011).

Seam free knit, 3-D design and zero waste pattern cutting techniques are similar, all eliminate waste and require creative input to achieve shape and fit. In 3-D knit this is a complex process that originates from within knitted fabric process technology through programming yarn path. In Zero Waste Pattern Cutting techniques, creative methods are used to tessellate component forms to eliminate waste and fit the body.

The designer uses skills and reflects with knowledge of technical expertise to find effective practical solutions in a highly constricted time frame. Creativity takes time (Rissanen 2016), trial and error and also requires imaginative responses to realise effective solutions. The creative impetus is crucial in meeting original designs with technically successful construction. Creating with advanced technology is complex, challenging and inspiring and sits well with advanced fibre process technology. Creative designer thrive on limitations and constraints that challenge technology. 'Craft skill will always retain the possibility of its own reinvention' Adamson (2013: 45). This is exactly why designer-makers create with technically advanced process technology.

Historically, craft is seen as a 'hand skill' but now it is applied as an intellectual tool with which to manipulate advanced processes and equipment. A new hybrid in practice, fusing craft approach in manipulation of technically advanced tools and to materials.
The next section gives evidence of other methods that designer-makers create with tacit skill and how they apply their knowledge with advanced materials and process technology to realise creative outcomes.

Application of Advanced Materials and Processes.

Designers make informed decisions based on experiential knowledge of one process having less impact on the environment than another but this needs to be backed up by their education.

'It's a matter of knowledge. The more you do it, the easier it becomes, as in all skills. We need to give designers a full set of skills and the knowledge to be able to chose the right approach for any given design, market, goal etc'. [McQuillan]

Learning by doing, gaining experiential knowledge enables a better understanding of the world around us. Learning ways to make things that are useful and meaningful gives a value, gained at first hand.

Advances in technology can alter or remove the hands on stage of making and that subtracts a level of understanding that informs our future actions and reactions. The open dialogue nature of the interviews enabled exploration of perceptions of advanced technology. Designer-makers indicated a limited knowledge of newly emergent fibres, were unaware of new process technologies, green biotechnology or white biotechnology currently being used to develop performance fibres.

They were aware of the ecological benefits but not the 'bio' properties and benefits in relation to biopolymer's capacity to work in harmony with the body and simultaneously with the environment, or of the additional benefits to their products and clients. Designers were generally use mono-fibres in their practice consideration of availability of alternatives were an issue.

Fibres selected through an intuitive application of designer's tacit knowledge of the appearance and handle of fibres and yarn were then meshed with the garment's performance expectations and functionality. This activity at sampling stages of production and again at scaling up to sized garments. Cost of new and unknown fibres and availability prohibited wider experimentation and application.

Small-scale businesses are not limited by availability because, the spinners of British yarn are also small and therefore responsive.

'I think that the fact that I would be working with small spinners would marry up quite nicely with a small business because what perhaps what we would consider to be a smallish order, for them, would be quite a big order. I have been talking to small spinners in Cornwall and they sent me some samples which are not quite right but I think the possibilities are there but it is also about getting the right fibre... even the softest British sheep fleece, like the Blue faced Leicester is still quite difficult to work with'. [Taylor]

Independent designer-maker practices have the potential to explore newly emergent fibres and yarns, which in turn influence larger scale businesses. Growing customer knowledge influenced by NGO's and social responsibility indicate a shift in direction too. Greater customer demand for traditional natural yarns and fibres cannot be met by mass markets due to land use availability. So luxury alternatives offer solution to meet this need. Locally produced production of milk PLA for example could meet small-scale demand for natural alternative fibres, which could stimulate take-up. Small-scale spinners and dyers have a role to play here too.

'I had considered Blue faced Leicester and Alpaca. But Alpaca can be spun finer and that's what I mean to develop a product with a spinner, it is a case of getting it spun for the machinery that I am using and the gauge that I need'. [Taylor]

Meeting the needs and expectations and being responsive to need is more profitable for designers looking for locally produced yarns.

Small-scale production allows creativity to experiment with and small runs which can be adapted to respond quickly to seasonal trends.

'At the moment I am a one man band, so to buy in yarns is expensive so the more or the bigger the range of yarns so the compromises are to do with cost at the moment so I am pretty much using one yarn'. [Taylor]

Colours are a secondary issue in terms of sustainability by dyeing small batches of trend-set colours for small scale production and exploring further incentives (Townsend 2004:4-38) using colour through the use of natural dyes or through the health giving or allergy prevention techniques as exemplified by Ayuvastra www.Ayuvastra.ie
'I am always looking to use new technologies and better understanding to improve the naturalness and health of processes and lower costs' [Lackman at Ayuvastra]

'I am using pure wool at the moment. I was thinking about using cotton which will not be eco cotton at this stage for the same reasons, getting it in the right colours and right weight'. [Taylor]

Comparisons made to other fibres are important and need to be equated through a range of technical tests. Comparing properties with cotton, wool and silk gives a broader understanding to newly emergent fibres' potential. Sourcing large quantities of organic cotton is difficult to meet current high demands but renewable alternatives such as Milk PLA might offer an effective environmental solution. Designers are held back by many aspects; the limited availability of yarns, colours, gauges, qualities and by costs.

'I am held back by availability and cost because if you did get someone to make it for you, how much is that going to cost for something special, a short order and dyed too.... because I am not doing it in white'. [Taylor]

Environmentally sound products are restricted by current expectation of colour limitation. Ayuvastra evidence a wide range of colours can be achieved through natural products

Designer-makers use traditional yarns; wool and cotton because they are unaware of how unsustainable and un-ecological current yarn manufacturing processes are. But designer-makers maintain control over those decisions.

'I think that the bigger Italian spinners all produce numerous qualities but they only select the really common ones for full stock service, which is what you need. So that's why Uppingham (yarn supplier to domestic market) buy up end of lines'. [Taylor]

The bigger spinners could offer more qualities and more interesting yarns and fibres like milk and bamboo as they are in a position to carry smaller quantities of a wide variety of yarns. Yarn suppliers need to be more responsive to designer needs, which are also led by client need it's a mutual relationship between all three sectors, designer, manufacturer and end users.

'I wanted to use Eco-cotton, but I don't think that they even had any on the books let alone stock service, so I used just a standard cotton that was stock service, but you know a big agency like that (Robert Todds) are a bigish agency for many spinners in Italy. I was asking about eco friendly merino and they didn't have anything like that, she knew a bit about it, but it wasn't massively on their radar'. [Taylor]

The scale of yarn supplier is appropriate to ecologically aware designers. Their perspective of how newly emergent yarns meet their client's needs is a factor which influences selection materials choice. 'If they had a wider selection of eco yarns I would use them'. [Taylor]

'I buy organic cotton rather than normal cotton if I can, and UK-produced wool/alpaca if possible, but that's not always possible at the scale I'm working at (because of minimum orders, time required for sourcing etc. I prioritise getting quality materials that suit the needs of my customers in terms of the wearing phase'. [Twigger Holroyd]

Decisions about materials and commitment to sustainability influence customers too. Supplementing organic cotton for another that holds additional properties for the wearer with comfort and wellbeing characteristics would enhance the enjoyment and longevity of the garment.
Designers need to know more about the properties and characteristics of newly emergent yarns. Information should be migrated to small producers, because they are ideally placed to lead in collections designed for longevity.

Designer-makers take time to establish what their clients want and how to match needs with materials and products.

'You know the other compromise that is made is quality: I mean handle, softness, characteristic....and if that's going to stop people buying your product, it does not matter how sustainable your product is, if no one is going to buy it, you are not going to make a difference. So...for me that is really important'. [Taylor]

The designer's knowledge of the hybrid qualities of the handle of biopolymers offers choice for luxury women's wear. It could also hold an appeal for wool allergy sufferers too. Factors motivate designer-makers to explore newly emergent yarns particularly in small business situations.

'If there were short runs of yarn available, then I would be interested in using and exploring more yarns, but the problem is that the gauges are for domestic market really and not suitable for use on industrial machines'. [Taylor]

There is a limit on small quantities of supply of Milk PLA fibre, which are available for the domestic market. Fine gauges are available and can be blended with other fibres for multiple effects e.g. Lycra to give compression and structure. Other gauges such as double knitting for use on hand-flat knit machines are available but as yet unused, which illustrates the limited industry knowledge.

In designer-maker practice the making skills dictate the ability to use any yarn so long as it's the right gauge/ handle and to match it to technique.

'It has got to be knit-able, if it is not knit-able, you can't use it and you know with any yarn, you need to see how it behaves and how it reacts, and that it will be able to cope with what you design, but I don't know about the process.... well that influences or maybe inspires your design. Yes, how drapey it is, and is linked to the gauge obviously'. [Taylor]

Designer-makers limited knowledge of the performance characteristics of newly emergent fibres highlights the necessity of craft in design practice. The process of experimenting with a range of yarns and processes is used to create a desired effect, or to identify new ways of creating with different yarns and machines. Knowledge gained from tacit handling is fundamental in gaining insight to how the new fibres handle and initiate design inspiration from the fibre.

'I haven't tried milk or bamboo but I think again its availability and it is very easy to get wool. Cotton I just had left over and although it's probably the least eco friendly yarn, but I have to say in the future I would like to try to source it'. [Taylor]

It is human nature to desire newness (Chapman 2011: 43) is a basic human need that stems from (Maslow's taxonomy) and as availability of alternative resources emerge in response to demand for more sustainable alternatives to traditional fibres. We live in a technological age, we are dependent upon technology for control in our society. Technology is developed to drive this change and the ways we apply that technology can realise shared goals.

'This is problematic, I miss a lot that might be applicable but I don't know it - you don't know what you don't know! I just don't have a lot of time. The more advances in technology occur, the more I realise my practice has to change over time. There is no one great perfect answer. There are many small perfect answers and I hope to explore many of them over my lifetime'. [McQuillan]

The flow of knowledge about technological advances could be improved by designers talking and sharing.

'There is a lot being done that isn't being shared effectively. I think we need to make the format for communication easy to access and easy to digest. It needs to be two way and collaborative exchange between designers and technology'. [McQuillan]

Technical advances in materials processing and finishing it is becoming increasingly difficult to determine from the labelling the exact provenance of a garment. In response to this, designers such as Gudrun Sjödén seek to expose their environmental policy.

Gudrun Sjödén, a large-scale textile designer solves the issue through informative labelling and by promoting use of green biotechnology as alternative processes. Sourcing sustainable and biodegradable resources in large-scale textile industry is possible. Size matters here, large companies maintain control over production. Principled designer-makers lead the way to explore strategic manufacture and demonstrate how ecological imperatives enable holistic solutions that can be extended into industrial scale production.

Summary

The summary headings determined by interview discussion areas are inter-connected but are placed in this order for clarity.

The individual responses of the designer-makers revealed how and why they sought to shape their practice. They revealed the decision-making processes encountered during each stage of design, materials and process selection whilst maintaining ecologically principled control of production.
The open discussion interviews with designer-makers revealed a range of different perspectives of the role of designer-maker practice. The different approaches and patterns of designer-maker behaviour indicated intricate actions and reflections from within their practice. The designer-makers' shared insights on practice based and led reflection-in-action research processes. The iterative and incremental design decisions and shared insights initiated the reflection and action process encountered when using a craft model of practice.

Pluralistic Contexts and Holistic Approaches

Analysis of the responses revealed the range of strategies in practice but all interviewees shared pluralistic and holistic approaches. Analysis of the responses built a clearer understanding of their perceived issues (pluralist approaches) and their resourceful ability through holism to identify and modify their practice to resolve individual issues. Close analysis also exposed gaps in knowledge about availability of materials and process technologies.

Design Constraints

Important connections and correlations arose from the interview process. To clarify and these and show parity within the range of designer-maker practice indicated that there is a common and shared understanding of the complex actions within their practice and within the main issues related to achieving sustainable and ecologically principled textile practice
Designer-makers use tacit knowledge gained through past experience to make design decisions about materials handle and process techniques and to establish how it equates to attaining a quality product.

Ecological principles' impact on design creativity

Designer-makers are work closely with clients to identify and respond to specific needs in relation to ecological and sustainable principles. Designer-makers use innovative and 'risky' design approaches to design and make ecological products, rather than selecting advanced and newly emergent materials.

Use of newly emergent materials relates to cost and availability; it is expensive to trial new and unknown yarns. Designer-makers balance their decisions against conflicting ecological principles.

Barriers to take up of newly emergent materials stem from a lack of clear information relating to the ecological production processes used in process manufacture of fibres and materials. Designer-makers find it difficult to make principled and ecologically informed decisions without detailed information on the origin of the fibres and processes used in their production. Designer-makers' limited knowledge of the additional benefits within biopolymer yarns, prevents them from selecting biopolymer yarns to enhance their products. Materials selection is currently reached by maintaining a balance of performance over cost. There is some experimentation within yarn types but impacts upon overall handle for achieving a quality product is restricted to cost.

Application of advanced materials and processes

Designer-makers demonstrated their awareness issues in attaining ecologically principled textile practice and stated that their decision making is based on a lack of knowledge of alternative fibres, yarns and process technology. This subsequently results in their continued use of traditional fibres and yarns where there may be more sustainable and ecologically balanced alternatives.

This knowledge gap indicates that there is a cessation of materials knowledge and awareness of newly emergent ecologically specific fibres yarns after their educational contact. This issue is addressed by some designer-makers attending trade fairs and yarn shows but is restricted by time availability they are more likely to use internet searches and internet social networked communities.

Designer-maker responses highlighted knowledge gaps across all aspects of their practice, which were perceived as a further barrier to their achieving sustainable practice. The gaps, which may stem from their past education and early research, could not take into account the impact of current designer-maker practice of open knowledge sharing and regular networked information exchange and updating practices. Even so there still seems to be a time elapse that could be overcome to afford designer-makers access to recent developments. For this to take place it is important to acknowledge the need for a shift in the structure and working practices of fibre, yarn and process technologies as this is crucial to gain effective cascade of information about developments. There is shift taking place in the interconnections and open nature of designer-maker practice.

The designer-maker reflections on their practice, the materials and the processes they used, highlighted knowledge gaps in each of these areas. Designer-makers are not able to keep abreast of technological developments and there is no opportunity to explore the aesthetic handling of newly emergent fibres and fabrics. These highlighted issues are connected with the traditional linear structure and commercially secretive nature of textile industry and illustrates how designer-makers use craft models of practice to transcend barriers to achieve ecologically principled textile practice.

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