

Digitally Printed Textiles: New processes & theories

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Abstract

Advances in technology are increasingly defining the character of knowledge (Harrod 2007), and highlighting the opportunities that exist for artists, designers, craftspeople and researchers to use new technologies for extending the breadth and scope of contemporary practice. An example of this is the digital printing of textiles. Not only are the printed images themselves open to novel forms of manipulation and interpretation, through the use of innovative fabrics, dyes and techniques, but the technologies involved in the digital printing process increasingly provide designers with a wide range of new options. On the one hand, it is possible to take an aesthetic approach to textile design while on the other technology-based or process-driven perspectives may also be exploited (Potter 2002). However, what happens in the studio environment when these disparate domains overlap?

This paper investigates the relationship that is forged when traditional craft practices and advanced technology are brought together through studio inquiry. In order to challenge this phenomenon and the subsequent issue of subjectivity, my practice-based research uses grounded theory to reveal how the use of traditional materials and techniques can be integrated within digitally printed textile design to develop a general theory relating to contemporary design practice. A range of experiments were undertaken to encourage convergence with neighbouring disciplines, and a series of questionnaires, then semi-structured interviews conducted with skilled practitioners from adjoining fields to confront current perceptions of design practice, and challenge non-objective research positions in the creative industries (Frayling 2011).

Keywords: *digital printing, textiles, craft, design, theory*

1. Introduction

Design researcher and embroiderer Karen Nicol maintains that few of today's designers have the traditional skills and practical knowledge essential in her specialist field (2009). This means that when designers attempt to combine traditional practices with new technologies, their lack of expertise often results in the balance shifting towards advanced technology. Furthermore, writer and former curator Rachel Weiss warns us that if care is not taken, the process of mastering craft skills may be overlooked, resulting in designs that lack the very qualities that often make them unique (2008). The intertwining of meaning achieved by joining the handmade with the digital, the material and the nonmaterial, can provide new opportunities for textile designers; although, as with any new technology, the novelty factor may initially engulf the very practices it invades. Artist and researcher Barbara Bolt suggests that the 'privileged place of art' is a result of its unique position as an environment in which making, using tools and materials takes place in the naturalistic setting of everyday life (Bolt 2006: 5). It is from within this unique studio setting that I have been exploring the use of different types of traditional crafting methods and processes alongside advanced technology, including the use of natural dyes plus inks specifically developed for large format inkjet printers, and experimenting across a range of substrates from the hand-spun and woven to high-performance synthetic fabrics. Although, as design theorist Ken Friedman points out, if we are to fully comprehend how a discipline, such as textile design, can operate within the context of 'processes, media interfaces or information artefacts' (Friedman 2008: 153), it is first necessary to develop a theory. However, a formal theory is developed out of a very different set of conceptualising tools than those generally found in the studio environment, therefore I decided to use my own design practice to determine what there was about digital textile printing that might be revealed by taking an in depth, personal view of how I work. As Victor Margolin recently pointed out, designing creates new products and so any investigation into design should, to a certain extent, focus on 'how that is done, what new products might be produced, and how' (Margolin 2010).



Image 1: Untitled silk digital prints, Susan Carden 2011.

2. Research Question and Problematic

First I needed to develop a system for making explicit the tacit and intuitive types of knowledge that I, as a textile designer, produce. Friedman explains, 'only explicit articulation permits us to contrast theories and to share them' (Friedman 2008, p. 158). He warns that some designers mistakenly confuse practice with research, pursuing their normal design activities rather than using inductive inquiry to develop theories. As a way of approaching what I do when I work, and in a manner that allows theory to be formulated, I began this Ph.D. research by proposing a question that was both open-ended and achievable through self-conducted practice, so that I could place myself at the centre of the researchable environment. This question was: *How can craft practices be used as interventions in the digital printing of textiles?*

Working in the studio constituted a natural form of inquiry, so this project sat between realist and relativist ontological positions (Gray & Malins 2004), and a key requirement was, therefore, that the research needed to highlight exactly what was going on at the same time as the creative work was being carried out. Designer and researcher Kristina Niedderer explains that knowledge generated during the making process, procedural knowledge, can partially be communicated through verbal means, and sometimes by providing others with detailed descriptions; but, she maintains that much of this information can only ever be transferred, or made explicit, by demonstrating either in-person or by using a video recording to enable someone other than the practitioner to learn how it is created (Niedderer 2009a). Furthermore, Michael Biggs and Daniela Büchler point out that the research question, to a certain extent, can imply a particular answer depending on the context (Biggs & Büchler 2007). For example, my research is located in the field of textile design and therefore a scientific answer would not be appropriate; however, during the initial stages of the studio inquiry a process was discovered that allowed cooling properties to be incorporated into the surfaces of the digitally printed textiles. This process, although interesting and prompting suggestions from myself and peers about future possible research projects, after being written up with a patent attorney, was in danger of leading the research down a scientific route, and away from the original Ph.D. proposal and research question. A patent application was subsequently drawn up in order to truncate the idea for use at a later date, and the documentation of how the process came about was analysed to explain how practice could generate abductive thoughts suitable for inventions (Polanyi 1974), rather than the traceable inductive reasoning required for research purposes.

3. Methodologies and Methods

My project uses creative practice in a manner that suits the nature of my own particular discipline. This is a non-objective stance and is therefore an issue of much widespread debate and discussion (Durling & Niedderer 2007). The methodologies I chose were studio practice, and Barney Glaser and Anselm Strauss's grounded theory (1967). I felt that reflection on creative endeavour in action combined with an explanatory qualitative approach would best enable me to generate suitable data for developing theories from within digitally printed textile design practice. I wanted to ensure that procedural knowledge was made available through research methods that were compatible with the way I normally work and permitted the use of materials and techniques in as natural a manner as possible. Artist-researcher Nithikul Nimkulrat informs us that the majority of recent art and design research projects in Finland are practice-led and, in her experience, the research component is generally kept separate from the practical side. She found that documenting through writing helped her to highlight 'thoughts, intentions, and decisions' (Nimkulrat 2007: 5). In my research I also embraced these recording methods and found that by using textile design practice as both method and methodology meant that the project's data generating tools were different from conventional methods found in other disciplines (Niedderer 2009b).

Also, Biggs and Büchler claim that practice-led research comes under the umbrella of academic research, and is therefore similarly required to seek out concepts from practice that are transferrable. By exploring the relationship that exists between the outcomes of my work and that of other designers, I was able to acknowledge the subjectivity of each participant, including myself, while also using a common language to begin to confront the problem of non-objective viewpoints (Biggs & Büchler 2008). Although many experienced researchers, like Carole Gray and Julian Malins, provide a compelling case for the practitioner-researcher to explore this area, they also admit that the real world is not predictable, it is immensely complex, and, as a reflective practitioner, our passions and insights can help us tackle the constructed realities of the human existence, while acknowledging that 'no two human beings are identical' (Erlandson et al. 1993: 21). The challenge for my research was thus to attempt to use the grounded theory approach to ongoing practice in order to intertwine theoretical knowledge with practical knowledge (Bourdieu 1990: 26). To do this I found it necessary to reduce my practice to a form of designing a research outcome from the practice of designing, while simultaneously documenting in as many different media as possible, encouraging different interpretations, so as to gain as much rich data as I could (Erlandson et al. 1993: 31).

To address these concerns, the research methods I adopted were the reflective journal, grounded theory, observation, questionnaires and semi-

structured interviews. I discovered that by documenting ongoing production details in a reflective journal, written notes, photographs, sketches, making fabric samples, plus my everyday experiences as a practicing designer on a regular basis over a period of more than two years, I was able to record both minute facts as well as emerging ideas. These details were also recorded in a temporal manner that helped ensure that retrospective entries were avoided. However, the processes and responses created by me were influenced by many factors, such as my own cultural background, visual memories, and previously mastered skills, including those that are well embedded and were therefore acted out as second nature. Also, the use of grounded theory meant that I was constantly revisiting the documentation, making observations from the data and realigning my practice according to previous judgments and noting substantive theories as they emerged. As Stephen Scrivener states, research in design is undertaken with the requirement of contributing to design practice, so the outcomes of research must be integral to what designers create and how they do this (Scrivener 2009). Ceramicist and researcher Katie Bunnell recalls that during her Ph.D. *Viva Voce* her examiners repeatedly raised concerns about the unique nature of her single case research, questioning its transferability to the wider realms of practice (Bunnell 2001). She maintains that she defended her chosen methodology, stating it had been disseminated through international exhibitions and her publicly accessible thesis. Her stance supports with that of researchers Yvonne Lincoln and Egon Guba who declare that the value of such forms of inquiry are gauged by the extent to which any outcomes can be transferred to other situations (Lincoln & Guba 1985). However, for a designer, using grounded theory as a methodology, their experience is not the same as undertaking normal design practice because, for one thing, the process of creating needs to be repeatedly interrupted with the direction altered each time to encompass new conditions of emerging substantive theories: this was a slightly different way of working for me, but one that became more natural as the project progressed. As many of my past experiences fed into this current project, I believe the characteristic of the research was constructed, rather than determined (Willig 2008: 13), and hence it could be described as post-positivist critical realism, because reflecting on observation is always open to debate, and can never be completely certain or predetermined. It was therefore necessary for this research to employ multiple research methods to ensure that triangulation was, as far as possible, allowed to compensate for the irregularities that existed in the data, its analysis and synthesis.

The desire to generate a theory from practice meant that I selected the full version of the qualitative research method, grounded theory (Glaser &

Strauss 1967); this enabled me to more deeply investigate what happens during the process of designing within my studio. Unlike Descriptive Phenomenological Analysis (Langdrige 2007), in which the phenomenon under investigation could only be described, not explained, with Interpretative Phenomenological Analysis (Willig 2008), it was possible to allow the data to be analysed for explanations, thereby unearthing why the phenomenon under scrutiny had occurred. I used IPA as an accompanying research method because it enabled me to incorporate, through questionnaires and semi-structured interviews, the opinions and reflections of a range of practitioners from adjoining disciplines, including printmaking, illustration, photography, cinematography, graphic design and typography. For these methods I selected 24 participants, four from each area, for the questionnaires and then a further six skilled practitioners, one representing each discipline, for more in depth, semi-structured interviews.

As empirical inquiry sits between social science and critical reflection on practice (Friedman 2008: 158), the challenge for me as a practitioner-researcher was to strike a balance between making explicit knowledge that was instinctively tacit, and documenting the creation of practice as honestly, fully and transparently as possible, so that rich data were generated from both sides. Initially this was from a wide range of categories, to help develop fledgling substantive theories; then, increasingly, I narrowed the focus so that a more general conceptual picture developed into a formal theory.

4. Substantive and Formal Theories

By evaluating the data from consecutive digitally printed samples, it became clear that the structure of the substrate, the type of material used in the substrate's manufacture, the luminosity of the fibres, the resolution of the image, the range of colours used for the final image, the choice of dyes, the fixing process, the pre-coating solution applied prior to printing, the particular digital printing process, and even the type of printer, all played a significant role in determining the success or failure of the final aesthetic of each sample; further digital prints were then produced, narrowing down the variables within each sample group. New levels of properties from the evolving categories were revealed, eventually focusing on the substrate, the dye, and the printer. It was possible to extend the category designation when an emerging category seemed to be incomplete, yet showed promise (Guba & Lincoln 1981). By using IPA, involving questionnaires and interview transcripts, I attempted to discover if there were any common themes from the phenomenon highlighted by the digitally printed textile samples, by comparing the series of outcomes with the reflections from each of the participants regarding their own practice. If my intention had been to describe the concept then mere

description would have sufficed, but my interest lay in discovering a theory that could help explain why outcomes of creative practice involving advanced technology are often not as interesting or exciting as they could be, in order to provide practitioners in general with information that might help them create more desirable artefacts and reach out to wider audiences.

4.1 Reflective Position of Researcher

Philosopher and sociologist Pierre Bourdieu highlights that a major concern for researchers like myself involved in practice-led inquiry is the problem of objectivity (Bourdieu 1990). While many researchers encourage the potential for unique insights to be revealed from this type of research (Sullivan 2005; Gray & Malins 2004; Durling 2000; Yin 1994; Erlandson et al. 1993), all concede that the researchers' aim of reproducible objectivity can never be fully realised. However, a number of safeguards are suggested to avoid unbalanced views and to acknowledge, negotiate and engage with other professionals, to gain 'feedback, support and advice' (Gray & Malins 2004: 21). Bourdieu also states that, 'knowledge does not only depend [...] on the particular viewpoint that a 'situated and dated' observer takes up vis-à-vis the object' (Bourdieu 1990: 27), and he acknowledges the baggage that an objective observer brings to their relationship with the object, including their preferred forms of communicating, or language. While I can never be an impartial spectator, I have found that by reflecting on the various documented outcomes, my role as a designer allows me to gain a unique perspective on my particular practice, and as my aim is to create an understanding in relation to digitally printed textile design, even though I am not seeing the whole picture from every angle with all possible eyes (Nietzsche 1969), I am at least observing and experiencing it from the point of view of someone on the inside who makes, rather than merely watches, records or surveys. The internal processes can possibly be compared to the shadows in Plato's analogy of the cave in which, without the benefit of light from all sides, connections and associations are read into the interactions and relationships that are formed between two-dimensional shapes in a three-dimensional environment (Plato 2000). I would argue that with my own practice there is enough information, albeit not all of it wholly explicit, that similarly allows associations and theoretical assumptions to be made. After all, as Gray and Malins point out (2004), the use of creative practice is a subjective process, and there may not be any clear universal truth to be had anyway.

Artist and researcher Stephen Scrivener suggests that Donald Schön's theory of the reflective practitioner (Schön 1983), gives us a means of accessing the way creative thought works from the inside, including

influences from previous experiences, by allowing multiple perspectives of the act of creating to be revealed (Scrivener 2002). Scrivener and Chapman then propose that this reflective practice is grounded in current work, and is subsequently realised through future projects (Scrivener & Chapman 2004). What this means is that 'an interactive cycle' carries the reflective practitioner forward from an initial phase through consecutive stages, when the various issues being dealt with by the practitioner may be repeatedly revisited and revised to seek out additional 'knowledge and information' in support of the outcomes of the project (Scrivener & Chapman 2004: 3). Only once the reflective practitioner feels confident that the aims of their project have been achieved will this cyclic action come to a close with one final, all-inclusive, reflective stage. This last phase, say Scrivener and Chapman, pulls together the various aspects and outcomes of the entire project, including rich thoughts and reflections on how it was conceived, received, perceived and actually carried out. At this point, they maintain, the process of reflection provides information from three main areas, those from, 'pre-, within- and post- project', and supplies the practitioner with extensive documentation on the work, details of the outcomes and the decisions that were made (Scrivener & Chapman 2004: 3). As a reflective-practitioner myself, I suggest that Scrivener and Chapman's argument concerning the interactive cycle appears to be remarkably similar to the practice-led research I have been conducting along the lines of grounded theory. For one thing, both are driven and carried out through the act of practice, as a primary methodology; for another, the reflection and cyclic readjustments made at repeated intervals are also a common theme; the need to seek, or look for, additional information following each of these reflections is also similar for both; and, once a final stage has been identified, as with consolidating the saturated category of the grounded theory, one last reflective act is undertaken to ensure that all possible options and perspectives have been taken into consideration. It is also interesting that Schön's original reflective-practitioner theory (1983) has been stretched by Scrivener (2002), as it mirrors the option to stretch the theory if necessary provided by Glaser and Strauss in 1967, at the end of their original proposition of grounded theory; and, all three time-lines are taken into account before, during and in the future, allowing transferability. It would appear that the value to research of this type of investigation into a subjective area allows the problematic, non-objective position of research into practice to free itself and come out in support of the subjective voice of the reflective practitioner by grounding the research in practice, conducted through practice, by practitioners, for practitioners.

Schön also outlines the professional practice of a psychotherapist who, he explains, 'anchors the inquiry in the patient's transference' and thus, 'the

relationship between patient and therapist can serve as a window on the patient's life outside therapy' (Schön 1983: 119). It is worth noting that psychoanalysts and their patients do not engage in visual contact during sessions. The fact that the psychotherapist can, as Schön believes, access the environment of the patient through their relationship, shows another field in which, like my own, a subjective single-case scenario can be understood in a viable way. Even though my design practice is far removed from the disciplines of psychotherapy or psychoanalysis, as Schön makes a case for architecture having a number of similarities with the former profession, my extensively documented engagement with textile design practice can be shown to act similarly as a window into how I work (Schön 1983: 129).

4.2 Diagrams

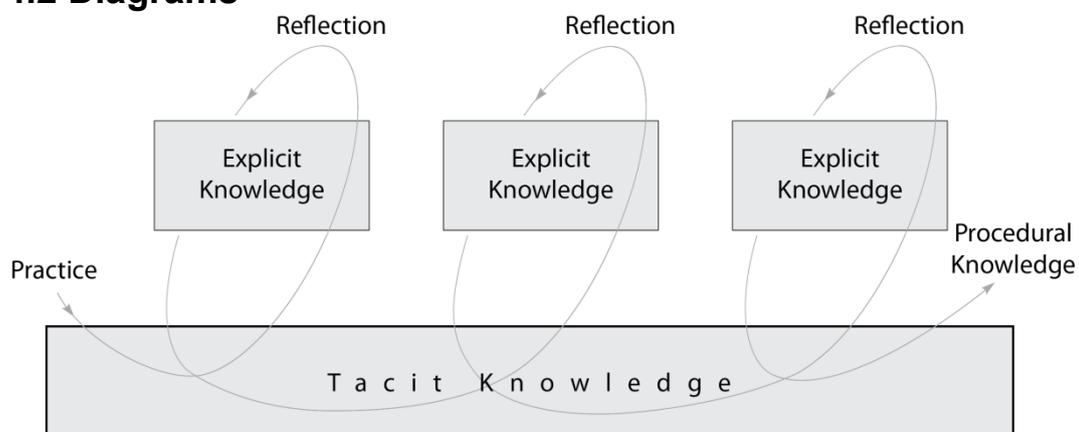


Diagram 1: Making tacit knowledge explicit.

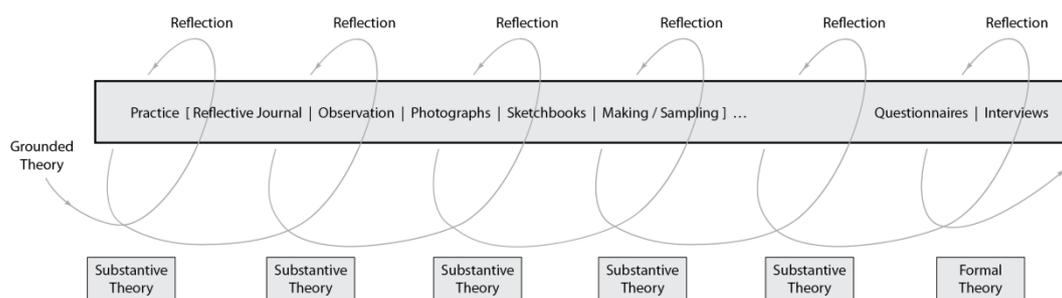


Diagram 2: Developing theory out of practice.

4.3 Theories

Artist and author Graeme Sullivan wrote that, ‘both knowledge production and the functions to which knowledge is put’ are most useful when theory and practice are integrated (Sullivan 2005: 87). He maintains that the benefit of this approach to research is that it helps to reveal intricate details about a practitioner’s own understanding and the impact of their work on the life-world. Although he advocates a critical reflection and continual questioning of the value of practice within the research setting, he also highlights the potential for certain aspects of design to be ignored or misrepresented in the critical debate if care is not taken, and he suggests that it is only by repeatedly challenging the outcomes of practice-led research that the truth can start to be revealed.

Designer-researcher Michael Hohl’s recent Ph.D. research uses *Radiomap*, ‘a graphical user interface’, as the environment for gathering data for use within an adapted version of grounded theory (Hohl 2009: 189). He claims that it is useful for prior knowledge to determine how an artefact is appreciated or received, and that the use of advanced technology, as in his case, can cause this balance to shift, leaving the relationship between the medium of expression and the concept unclear. As the technology becomes more familiar to the artist or designer, as well as those perceiving an artwork, he says that may result in the idea, rather than the advanced technology, taking the lead (Hohl 2009). Similarly, in my project, while I used the full version of grounded theory so that I could repeatedly revisit the studio environment for further data gathering, I also found that the lack of prior knowledge regarding certain aspects of technology and materials was problematic when it came to interviewing participants from neighbouring disciplines.

Revisiting the data meant that a distinct idea started to be formed about how digital prints differed from traditional screen prints. Once this could be communicated in abstract terms (Peirce 1878), it allowed me to conduct further experiments using digital printing intertwined with hand-crafted interventions to see whether or not there existed tangible ways of narrowing the aesthetic differences between samples and results.

5. Analysis and Discussions

Two important aspects of naturalistic research are that data are gathered in the research environment, but it is important that the process of analysis takes place away from this site; and, Erlandson et al maintain that the ‘interaction between data collections and analysis is one of the major features that distinguish naturalistic research from traditional research’ (Erlandson et al. 1993: 114). I found that this away-time gave me the chance not only to reflect on the work outside the studio, but also allowed

me to discuss current issues and seek advice from other practitioners before heading back to gather further data. Often unforeseen outcomes or discoveries were noted, for example, during a period of experimentation in a glass workshop I developed a novel and sustainable process for transferring digitally printed images to secondary substrates. As Sharan Merriam observes, this kind of flexibility provides data with a richness that would not have been possible with more established research methods (Merriam 1988).

I found that my aim of understanding and explaining what it is I do during studio practice was assisted by the common conventions of perception, language and methods of articulation that I experienced when I formed relationships across the adjoining disciplines (Niedderer & Roworth-Stokes 2007). As such, through these interactions I found that peer responses provided me with useful, albeit similarly subjective, contrasting views of design practice involving traditional processes and advanced technologies. Also, naturalistic inquiry, while taking place in the real world of the various studio settings was only as real as the practitioners themselves were willing to reveal (Erlandson et al. 1993) so, while practitioners created, they needed to reflect freely, without constraints, if meaningful data were to be generated. However, each of the interviewees possess skills and knowledge that have taken years to master, so these aspects were relatively difficult to communicate as explicit knowledge in interview settings, even within their own studios, and it was this particular knowledge that I was attempting to capture.

Taking a reflective-practitioner's position during the project gave me the ability to understand and challenge my practice in action, sequentially, thereby enabling me to become involved from inside the environment of inquiry and to create a window through which to access documentation in various forms of media. The outcome of the analysis was a working theory: *While digital can enable practitioners to be less worried about making mistakes, it usually requires an outcome to be predetermined at the outset, so there is less scope for random exploration.*



Image 2: Untitled silk digital prints, Susan Carden 2011.

6. Conclusion

Sullivan recently highlighted that the challenge for practice-led researchers is to alter the boundaries of their research to ensure that it is more adequately aligned with the creative work they produce (Sullivan 2008). For me, using grounded theory alongside my studio practice for my current doctoral project has enabled me to develop a number of new processes, including a novel method for producing fabrics with cooling properties, and an original sustainable way of transferring digital images from reclaimed inks, while simultaneously documenting and reflecting on the ongoing studio inquiry. This led from substantive emerging theories to a more formal theory being developed, allowing me to extend the scope of the research while simultaneously minimising the differences within the boundaries of the categories being analysed. In this paper I have outlined how I approached the development of a formal theory out of my own studio practice of digitally printed textile design. Specifically I have focused on my experiences of the issues of subjectivity and transparency. I have also endeavoured to interact with practitioners from neighbouring disciplines in an attempt to create transferable skills and ensure that the documentation is appropriately communicated. In this way, I have shown that grounded theory within textile design practice can offer a real-world opportunity for theory development out of contemporary design practice.

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As a designer, her practice combines craft, structured and digitally printed textiles. She was awarded the 'International Linen Woven Textile Bursary', the 'Incorporation of Weavers Award', the 'Habitat Award for Printed Textiles', & the 'E.J.D. Poole Memorial Award', Bradford Textile Society. Her practice-led doctoral research explores the use of craft processes as interventions in the digital printing of textiles, challenging existing boundaries and confronting contemporary perceptions of textile design practice.

She has recently presented at a number of international conferences, including: 'DPPI' (Designing Pleasurable Products & Interfaces) Politecnico di Milano, Milan: 22-25 June, 2011; 'Making Futures' (The Crafts as Change Maker in Sustainably Aware Cultures) Plymouth University, Plymouth: 15-16 September, 2011; 'CIPED' (An Agenda for Design) Fundação Calouste Gulbenkian, Lisbon: 10-12 October, 2011; 'TRIP' (Textiles Research in Process) Loughborough University, Loughborough: 16-17 November, 2011; with publications including: the 'Journal of Craft Research' (Vol.2), 2011; and 'Making Futures' (Vol.2), 2012.

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