A material-led investigation into the creative potential of British 'waste' wools for fine craft felt-making.

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Accordion pleated Wool Paper (2012) Liz Clay

Abstract

This thesis describes the practical investigation and analysis of traditional materials and processes used in the production of hand made felt. Specifically, the research examines the potential of certain British wool types that are currently undervalued (and often overlooked in the production of fine craft felt). These wools are frequently referred to as 'waste' wools. The research further explores aspects of the UK's wool economy and the problematic issue of waste wool. The aim being to locate and articulate the creative potential of a selection of these wools within the field of fine felt craft practice, and in so doing raise an awareness of their potential diversity and relevance.

The investigation questions felt's marginal status within the textile hierarchy, and problematizes notions of the familial and self-conscious attributed to felt craft by some of its makers. By examining distinctions between craft and industrial felt production, the research considers both the opportunities and limitations of these relationships within the context of designer maker practice. The purpose and focus of this material-led examination is to develop inventive, progressive methods in fine felt craft and couture application seeking material currency with appropriate use of waste wools for handwork production.

The practical experimentation was conducted using a practice-led research approach through which materials and sampling methods emerged within a studio-based environment. The study focuses on the use of carding, wet and dry felting and post felting manipulation of surface design using hand-pleating applications. Whilst not specifically suggesting new techniques in felt-making, the modification of existing processes has formed a central part of the contribution to new knowledge created within the work. Therefore the qualitative nature of the research methodology establishes a new perspective on both the value and integrity of British waste wools for the production of fine craft felt-making. The portfolio of fabrics produced confirmed the suitability of materials for fine craft felt-making and further suggested their appropriateness for product development and use.

The fabric prototypes and exposition collection evidence new design concepts, situating the practical investigations in a cultural and critical context and in so doing reposition the material in a more valuable and original light.

The sampling process identified key areas for innovation and aesthetic appeal suggesting that further research could be developed using other wools and wool blends. From this thesis emerges a vibrant platform for fresh interpretation and potential for British waste wools in fine craft felt-making, further strengthening the creative interplay between material and technique.

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Introduction

Research narrative and enquiry

This practice-based and material-led investigation questions whether it is possible to create fine craft felt fabric using undervalued British waste wools. The research concurrently addresses the qualities and potential of the material in placing these wool types within a high craft setting. Thus, the thesis title reflects my interest in and commitment to sustaining practices whereby material, process and creative endeavour may offer scope for practical alternatives in design concepts and participatory creative development of fine craft felt-making.

The research is situated within the field of les métiers and haute couture development and as such, responds to a sophisticated consumer demand. It is within this specific area of practice that this research can contribute positively to perceptions of felt craft and create awareness of material authenticity,[1] as well as claiming the potential usefulness and desirability of specific British wools through knowledge of materials, experimental and imaginative practice and original application.

The investigative analysis of material and process, as presented in the methodological approaches, will contribute to an understanding of the characteristics and qualities of the chosen wools. The aim is to seek their potential employment in the finest felt production for couture design and comparable high value fabric applications.

The implication of such research may suggest that the focus on British wool could strengthen the socio-cultural context and contribution this research will offer to felt craft within a wider context; therefore positioning both the raw material and discipline within a new perspective, cultural viewpoint and consumer conscience that conveys a uniquely expressive contemporary dynamic. The artistic integrity of a finished cloth, and the potential of creating such a cloth using a raw material that is often considered an industrial by-product, pose interesting research questions.

Within this thesis the terms ‘undervalued’ and ‘waste’ are used in reference to the low value attributed to certain wools within the textile industry, specifically addressing British small farm and smallholder production and the difficulty of placing such wools in end products. Additionally I use the term ‘underused’ to acknowledge the limited popularity of British wool types in current felt-making practice. At the start of this research wool prices were low, fleeces being predominantly a by-product of the meat industry, having little or no value to the farmer. Disposal of fleece from small flocks is expensive and so farmers discard at source by burning or digging them into the ground. Wool is a global commodity and in recent years with shifts in economic patterns there has been a rise in wool prices and therefore, the potential and capacity for

1 By authenticity I mean provenance, refer to section below: ‘Academic field and research framework’.

undervalued and waste British wools may be considered prospective and timely in light of recent interest in wool products, material sustainability, provenance and a demand for high value craft.

My interest in renewable resources and localism, based on my knowledge of the wool industry, has been influential in addressing my principal aim, specifically with the focus on British wools[2] and in particular the under-use of rare breed[3] wool for felt-making. Contact with farmers and experts in wool production during the early stages of this research greatly informed the decisions made regarding the choice of British wools, the potential of the raw material, and its application for bespoke fibre processing. At this time I received donations of fleeces from farmers desperate to find some return or small financial reward to cover the cost of shearing. Sheep are bred mainly for meat and therefore wool quality is not the main concern to farmers, consequently there is little awareness of the potential value of this renewable resource. In order to experience and gain knowledge of the different perspectives of wool production and end use, in the first instance, I made visits to large industrial outlets, mills and wool processing plants in the UK, extending to opportunities further afield in Europe and beyond. This formative endeavour comprised wool sorting, scouring, carding and spinning, woven fabric and carpet manufacturing, needle felt, underlay and other nonwoven products that helped focus the research with regards scale of production, machine operation and constraints imposed by economic efficiency with fibre type, quality, supply and demand. Attendance at conferences, specialist wool events, trade shows and research symposia enabled discussion and dialogue in response to the issues raised by this thesis.[4]

Comparisons between small and large scale manufacturing opened new questions in how this project could be delivered, illuminating more difficulties than solutions to the research problem. In order to permit and affirm the focus on British waste wool for fine felt-making, I looked at past initiatives and collaborations with felt and industry amongst felt practitioners and designers. Additionally, research developments with nonwoven materials and the fusion of traditional techniques with unconventional materials, inspired my investigation into potential treatments and finishes that might ‘add value’ and potentially elevate the status of a low grade or waste material, and thereby challenge general assumptions concerning felt-making with these wools.

From a practical perspective, and in relation to hand-based textile processes, the stability and durability of the fabric is of utmost importance, thus raising several questions that needed to be experienced through practice such as: What constitutes a quality felt object? What defines a well-made piece of felt? Does a quality fabric have to be well made? By what method should

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2 Over 80 different sheep breeds exist in the UK, more than 70% of these are 'native' breeds (those which have not been introduced from other countries) also known as Heritage Breeds. Information accessed from www.thesheeptrust.org

3 The term 'rare breed' denotes native breeds that are numerically scarce.

4 See Appendix H for specific research activities attended

this quality be determined and on what authority can this be judged and authenticated? These inspired me to pursue my haptic material investigation.[5]

The first area of practical research interrogated the commercial availability of British wools, identifying methods of processing and availability to the felt maker. The practical sampling indicated that a broad range of wools was considered suitable but difficult for hand felt-making, recognised by the differences in fabric appearance, touch and the wools' felting potential. However, the choices available did not reflect the range and diversity that exists with British wools, initial field research substantiated these findings, identifying that although some variety of wool types were commercially available, through choice, there was limited use of British wools by felt makers and further more identified that imported Merino was favoured above all.

The next stage of the practical examination sought to clarify the undeveloped potential within a selection of British rare breed wool types[6] so to identify qualities and characteristics that might offer a different integrity that could be applied in fresh ways. The research investigates ways of developing a sophisticated and quality felt fabric with such materials and thereby aims to override the preconceptions that exist.

Despite an increasing awareness and interest in wool in recent years,[7] and opportunities to exhibit and sell work at newly established wool events, there remains resistance amongst felt makers to explore the inherent possibilities and characteristics offered by British wool and to rely instead on imported materials, primarily Merino wool.[8] Merino is valued for its fine quality and, from a felt-making perspective, its readiness to felt. It is the most widely sold and used wool available to felt makers in Britain.[9] In contrast and because of their inherent fibre properties, many types of British wool do not felt well.[10]

The intention is to show how these wools can offer value and further more stand up to scrutiny against imported wools, especially Merino. I aim to demonstrate this through experiential and haptic practice methods through rigorous sampling of materials.

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5 For discussion of haptic issues see Chapter 2: 'My haptic interpretation - a personal research tool'.

6 The selected British wools: North Ronaldsay, Zwartbles, Ryeland, Devon & Cornwall Longwool, Swaledale and Dorset Horn. Also, from British flocks, Shetland and Merino, included as control wool types.

7 Since 2003 in the UK, annual wool focused events include: Woolfest, Wonderwool, Fibrefest and with international exposure, the Campaign for Wool.

8 At the time of writing (2012) World of Wool estimate their sales of imported Merino at 36 tons annually; Blueface Leicester at 10 tons and Shetland at 6 tons, compared with Swaledale at 200 kilos annually and Devon and Cornwall Longwool 500 kilos annually. They currently do not supply Ryeland, Dorset Horn, Zwartbles, Greyface Dartmoor or North Ronaldsay.

9 In a conversation on 20th August 2012 R. Morsley confirmed that 'imported Merino wool accounts for 70% of retail sales of Europa Wools Ltd.'

10 It is not economically viable to process wools in small quantities, especially less popular British wool types. Processing wool is expensive, at the time of writing (2012) a typical cost to process a single fleece would be in the region of £30-£40 per kilo of carded wool produced. Additional costs would be purchase of raw fleece and transportation.

In comparing British wool types, I investigate whether they can offer a luxury feel and visual aesthetic that may be considered 'sophisticated' and therefore create exclusivity and enhance their value.

Within my practice and professional ambitions, an awareness and knowledge of material is fundamental to fabric development and the potential for innovating design concepts. The abundance of renewable wool resources within the UK and the difficulties of obtaining individual wool types, other than established commercially processed fibres, becomes a central focus to my enquiry. It further explores problems of processing small quantities of British rare breed wool and waste wool for small batch production and niche markets.

The notion of using discarded wools and waste wool for fine felt craft was problematic in the first instance. Historically, in haute couture, the employment of the finest raw materials is a matter of the greatest importance. Fine quality wools generally felt well and produce fine quality surfaces. Coarse quality wools, by definition, are less likely to perform in this way. Because the success of the felt-making process is dependent on certain physical properties of the fibres and actions required,[11] questions emerged that challenged the fundamental acceptance of what is a true felt and how this might be re-defined or, if the case, placed in a new context: hence the need for a rigorous and robust method of data collection and evaluation.

There arose many layered and complex issues within the supply of materials and indeed sustaining sufficient material for the in depth investigations to progress at each new level of enquiry. The physical individuality of each fleece presented a uniqueness that was special with regards hand craft production but also problems of identity and clarity that emerged when applying industrial processing techniques - which in turn caused the subsequent loss of intimacy with the material. These issues were overcome by consistent and scrupulous attention to provenance throughout my fibre processing and so in relation to this investigation, the notion of repurposing the raw material became the key objective in addressing the general assumptions of these wools for felt-making.

This work seeks a route towards redefining felt as a more complex cloth and aims to expound the value of hand-made felt as an integral process in design practice. And it is within this experiential framework that this thesis challenges established felt-making traditions, aiming to re-define materials and technique through a contemporary practice.

The research aims to draw upon personal accounts, conversations, visits to factories, processing plants, museums, libraries and research departments in this field of practice. The limited reference and literature available[12] was augmented and supported with face to face meetings and discussions with experts in their field, felt makers and the generosity of individuals whose shared interest, knowledge and material collections were made available to me.

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11 See Appendix D for felting methods and descriptions used. For a comprehensive overview of standard British wools (BWMB classification) and fibre suitability for wet felt-making see Smith and Walker (2005) pp 46 - 51.

12 See Chapter 1: Literature Review for discussion on published texts and extant research for this area of study.

This research addresses ways that British waste wool might be considered for niche felt products potentially (in time) promoting an awareness of renewable resources found locally. For the purpose of comparative experiments in this research project I have used British Merino and Shetland fleece grown near my studio in Somerset.

Status and materiality

The impetus for the research is to communicate the potential of undervalued wools and to juxtapose their potential for developing innovative solutions in fine felt craft. This highlights a potential need to address the view that exists of a marginalized, low value craft, regarded primarily for its industrial applications or its attraction as a hobbyist craft activity. This negative sense of the term further reflects the traditional association with industrial production and mass manufacture of needle felt fabrics for low-end markets. In identifying craft and industrial perspectives in respect of nonwoven products, textile designer, Faith Kane suggests that 'textile products produced through craft practice usually function in niche, high-end market areas due to their exclusivity' (Kane, 2007 p.15). I would argue that despite recognising this there remains poor reference to felt in couture and a lack of awareness in the versatility of the process and different qualities of felt that are possible.[13] Felt craft is compromised in this context and it is therefore reasonable to ask the question, why do contemporary hand crafted felt objects rarely convey a fine craft approach?

In western cultural terms, the common perception of felt can be negative: thick, dense, lumpy, scratchy and coarse are words readily used to describe felt fabric and clearly reference felt's historical and industrial mantle. The expectation and understanding of felt's materiality is often disappointingly negative. There is plenty of evidence for this shown in its use as carpet underlay, insulation, gardening materials, hobby materials [Fig 1], felt tip pens and so on. 'Fuzzy Felt'[14] toys of the 1950s and felt craft fabrics still haunt felt's image.

13 In an email on 10th July 2013 C. Tough at Balenciaga stated that 'I am not that aware of felt in couture. When I think about felt in high end fashion I normally associate it with the Japanese designers.'

14 'Fuzzy Felt' toys were launched by Lois Allan in 1950. Pre-cut felt shapes could be pressed onto a flocked card to make themed pictures. A new theme was manufactured each year.

Fig 1 Felt toy (c. 1963), industrial felt, Liz Clay

Artist, writer and art historian Gerry Craig comments, 'Historically, felt is a less legitimate or valued material in Western culture, but in non-western culture it mediates the everyday and the spiritual' (Craig 2002, p.12). Such a view is projected by authority on the subject Mary Burkett who, speaking on felt cultures of Asian countries, says 'in the past felt was much more part of the fabric of society and held a deeper significance to the makers than it does in our modern world' (Burkett 2010, p.7). We in the west have been selective in our acquisition of this culture importing only the technology. The cultural complexity has been lost and we are left with concepts of the material as merely useful, mundane and utilitarian; values which project a sense of the unsophisticated and insignificant.

Felt's 'low status' and 'low tech' associations are further supported by reference to felt's industrial application that focuses on the practical and useful elements of the fabric. Felt has been and still is a key product in industrial development, a common product with multiple applications. Felt's impact absorption makes it ideal for packaging, footwear, furnishings and car manufacturing processes. Felt's manufacture both manual and mechanical lacks sophistication. Unlike other textile disciplines such as weaving and embroidery where the construction and application of materials is more easily perceived and understood, felt-making is a hidden process, neither obvious nor self-evident.

The idea of felt possessing 'a transplanted historical tradition' (Eiland 2007, p.263) perhaps contributes to its attraction as a contemporary craft in western culture, where we have borrowed the tradition to satisfy the craving for self-sufficiency, wholesome living and working with nature.[15] Nonetheless, it is perhaps a lack of understanding of what tradition can teach that hampers felt, whereby felt's negative image is isolated within technique. In relation to practice,

15 Environmental concerns and the trend for sustainable living over recent years have popularised the nomadic yurt in projects such as The Yurt Farm (www.theyurtfarm.co.uk) and The Sustainability Centre - Project: Yurts (www.sustainability-centre.org)

felt maker, Heather Belcher explains 'an intelligent understanding of tradition provides a platform on which to develop and move forward' (Belcher 2012).[16]

According to felt maker, Yuli Somme, felt 'is considered 'woolly', mad, dipsy, frothy, women's stuff.'[17] Somme further suggests there is something very extraordinary about felt that contributes to its popularity amongst hobby felt-making and to more serious felt-making, claiming 'people tune into it without even realising this.' She describes this involvement as 'lying on the surface' based on the general lack of understanding about the properties of wool, its history, culture and potential as a sustainable fibre.

The versatility of the medium presents opportunities to openly explore materials and techniques in innovative ways. Textile conservator Willow Mullins warns against becoming fixated on the history and geography of felt creation and advises choosing the best of all felt-making traditions and what is available from all felt makers worldwide (Mullins 2009). In relation to this project and my practice, the literature review focuses on the mechanics of felt-making, comparing hand and machine applications and the significance of wool quality.[18]

An objective in this thesis is to identify and determine if fibre quality is an essential attribute for functional and aesthetic purposes aiming to address the notion of undeveloped opportunities for waste wools for fine felt craft. This thesis will consider ways of processing and finishing that might be modified or indeed stimulate innovative production techniques in order to overcome potential manufacturing limitations. I aim to put aside pre-conceptions of felt-making in the 'traditional sense' and investigate ways in which materials and techniques may challenge and yet be responsive to established views. In doing so, adherence to the defined felt-making processes does not (primarily) concern me. Rather I seek to address a new understanding and interpretation of the material and its creative potential.

On a cautionary note, I do not advocate innovation at the expense of understanding the technical aspects of a material; as Dormer points out, working 'at the edge of pre-existing definitions' (Dormer 1997, p.199) even whilst adhering to a refined and skilful application may bring attention and attract critique. Whatever the intent and purpose from the practitioner's viewpoint such criticism engages from an outside perspective and draws attention. In pursuit and recognition in fine craft felt-making, materials can be rejuvenated by placing them within a previously unimagined context.[19] Inventiveness frequently involves using resources that have been undervalued and disregarded. When utilised as couture fashion fabrics, these materials

16 In an email on 29th July 2012 from H. Belcher

17 In an email on 20th August 2012 from Y. Somme

18 Material diversity and wool quality is discussed in the Chapter 1: Literature Review

19 Allied research methodologies for sustainable textiles using decorative applications have been researched widely in recent years. Emma Neuberg's (née Salmon) practice based research (2000) examined embellishment techniques with vinyl, to give the material a new aesthetic meaning and identity. Working in the area of materials research and development for recycling, textile designer Kate Goldsworthy's practice based PhD (2012) focuses on the concept of 'life-cycle design' and cradle-to-cradle strategies for design, exploring new finishing technologies for recycled polyester.

are attributed a higher value, acquired 'from a sense of quality, tradition and customisation' (Yair 2001 cited by Kane 2007, p.15). Acknowledgement of such high-profile status is validated by couturiers in recognition of felt fabric in their collections [Fig. 2]. The same can be said of acquisition by major museums and collections. My aim is thus to seek a fine craft approach placing materials central to the investigation.

Image redacted in this digitized version due to potential copyright issues.

Fig 2 Feathered Cocktail Dress, Givenchy Haute Couture, Vogue (2005, p.308), handmade felt Liz Clay

Academic field and research framework

In seeking parallel role models in my practice I survey the extant research in terms of published texts, practice methods and materials used by other makers in felt and the contribution of allied materials and technical and industrial research in this area of textile production. In contextualising the enquiry I aim to reflect on the sources that have supported my research in the studio and the cultural geographers that continue to inspire and disappoint by turns, thus opening practical ideas regarding issues of wool and material thoughtfulness.[20] I examine felt's familial and cultural histories associated with material importance that drives my enquiry through which I unpack and question if felt's craft origins contribute to its value or are an endorsement that perpetuates felt's low status.

Fine felt craft implies notions of exclusivity and luxury with reference to haute couture. The research therefore is concerned with examining and describing the work of fine artists, fashion designers and practitioners whose principal material is felt but not exclusively the hand made. This is to illustrate the diversity of the material and to show how expectations of the material have attracted attention and comment in often negative ways.

20 The Literature Review identifies the main archival, library and museum resources for this area of study, referencing literature, magazine articles, exhibition reviews, fashion editorials, objects and makers' testimonials.

In relation to my own research journey, I hope that by undertaking a haptic engagement with materials that it may enrich and develop new handcraft perspectives and provide a deeper meaning within my practice. Savouring the moment of creativity that stems from a deeper understanding of material and process is undeniably significant and resides at the core of my thesis. Through this spirit of investment it could open dialogue for creating inter-disciplinary opportunities between industry and handcraft initiatives that could enrich sustainability and renewable product development in further areas of research.

Finally worth noting is that provenance can make significant contribution to the value of a material, if only through perception. In researching such a broad field I maintain awareness of the provenance of the raw fibres, primarily to add value to the material through documentation and to offer the history of ownership. Establishing this concept of authenticity through material and the hand made process could strengthen the perception of value and originality of hand crafted felt. It is through a materials-led investigation that this research is examined and makes contribution.

Sampling methodology and materials database

The aim of developing a rigorous body of samples is to provide evidence of the tactile processes of felt-making and to convey the physicality of the process as demonstrated through the maker's tacit knowledge, persistence and dexterity with material and process. By using such evidence in a comparative style, hopefully a new vernacular for the British wools may emerge showing how traditional techniques can be applied in new ways. This represents an integral objective of the research, which is to redefine the use of disregarded or difficult wool in felt-making.

Sampling is the known language of expressing ideas 'in the making' and is 'about the connection between an action and a result' (Rowley 1997, p.86). The importance of the samples is that they provide a tangible platform from which discussion can take place. Sensory (haptic) experience of the 'doing' is the emotional response to tactility. Haptic experience with materials is critical to felt makers, because of the immediacy between raw fibres and a finished product - the maker is therefore integral to the process. Over time such haptic experience earns the maker tacit knowledge, which is valuable but difficult to articulate.[21]

The handcrafted quality of the samples is important because it can preserve and enhance the individual characteristics of the materials. This can be more difficult with fabrics created through machine manufacture, which by definition are more uniform. The process of hand making samples is also instrumental for the practitioner, not only in gaining haptic experience and thus tacit knowledge, but also in that the opportunities to identify areas for further exploration can be determined.

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21 See Methodology for discussion on tacit knowledge and interpretation of the physical process.

A substantial body of samples will be produced and made available as a database and archive material. This resource will reinforce the written component of this research and demonstrate the value of haptic engagement with the materials, prioritising through touch a clearer understanding of the qualities and unique outcomes of the research findings, demonstrating where these have produced a very different understanding and expectation of material and fabric.

Contribution to knowledge

The methodological approach and the research evaluation clearly identifies practitioner specificity, however, the project findings demonstrate a relevance and benefit beyond the personal contemplation and ambitions as practitioner.

The contribution and claims of the research findings are summarised below:

1. The foundation of a felt-specific historical, technical and contextual framework in regard to practice related research. The literature review identified extant research in felt craft and couture, specifically addressing materials used by craftspeople of British rare breed wools. The survey focused on industrial processing and technologies that relate directly to hand based methods of felt production and materials not previously understood.
2. An interrogation of hand and machine based practice methods of: fibre preparation; dry and wet felting methods; heat press, needle punch, laminating, stiffening and hand pleating methods. All of which enable hands on knowledge of specific wool resources to be developed.
3. The establishment of design possibilities for waste wools and British rare breed wools that are not currently documented or used in fine craft felt-making.
4. The establishment of innovative felted textile surfaces using traditional hand pleating methods. Introducing experimental three-dimensional post-pleating surface manipulation using complex hand felting applications. Customisation of surfaces with post pleating options that respond intuitively to touch tempered by the fabric characteristics, thus retaining a distinctive and considered hands on approach.
5. A robust sampling methodology and data archive of materials and methods to be made accessible for consultation to researchers and craftspeople in hand felt production.
6. The feasibility of innovative hand production methods within high end markets and the potential for small scale bespoke manufacturing for fashion and interiors.
7. Confirmation of niche product potential for British waste wools for fine craft felt-making. By seeking a fine craft approach with waste wool materials the research will demonstrate the potential for highly imaginative, complexly crafted and superbly finished unique fabrics.

Thesis overview

The written body of work is divided into five chapters presented in two parts.

Part 1 begins at **Chapter 1** and provides an expansion of the literature review outlined here and contextualises the enquiry where I set my position and identity as a felt maker within the research narrative. Here I discuss felt and felt-making as two separate but contiguous subject areas. I provide an overview of felt-making practices and use of materials that have relevance to my research questions and therefore have shaped my thinking and from which I have drawn inspiration. I examine the raw material and impact of supply of materials and working with British wools. I consider both artisan and industrial felt-making processes that have contributed to the development of high value craft. I particularly focus on how the raw material is represented from the craft perspective and the engagement and its significance with makers and how this might reflect on the general perception of felt craft in the wider textile arena. These concepts have been key in shaping my argument and framing the research questions.

Chapter 2 explains the research methodology and affirms my interpretation of haptic engagement with materials and process. I examine the complexities of articulating a coherent system of methods through sampling that becomes a personal research tool. This approach focuses on my experimental design practice with sampling of selected British wools. I work with specific techniques to develop a range of fabric surfaces that inform the development of interim exposition pieces called prototypes.

Part 2 defines my studio practice in three chapters supported by visual documentation of the samples and prototypes on a CD. The first, **Chapter 3**, Formative Practice, presents a discussion of former experimental techniques and ideas that provides investigative currency for possible development. This first area of research employs a broad approach with materials in order to establish the territory and unpack what could be realistically considered manageable and relevant to the thesis enquiry within the allotted time. It soon became clear that in order for the research enquiry to expand and progress in a meaningful and practical way, the choice of British wools would need to be reduced and selected in accordance with the main breed definitions. This would give consistency for the sampling to be both robust and flexible. Auxiliary investigations for this research have provoked and enriched the enquiry and are introduced here. These include two independent projects exploring material and process: British wools with paper and British wools with vitreous enamel. Samples from this early research satisfied short-term encounters and resulted in ideas that could offer potential or otherwise for further research associated with the aims of this research.

Chapter 4 is the Established Practice that describes the most substantial area of the research enquiry. It is at this stage of the research that attention is focused on six British wool types representing waste and undervalued wool types. Of significance is the location of the flocks in proximity to my studio and the fact that each type was a throw away or discarded by the farmer. The ensuing sampling gives a detailed analysis of materials, technologies, processes and surface manipulations. This is achieved in three separate stages of sampling where haptic

qualities and material outcomes are discussed and evaluated following the methodological approach outlined above in sections described individually as: sampling, evaluation and recording. The results are documented as physical samples with supporting results tables and photographic records for each sample made.

Chapter 5 is where the research sampling identifies and establishes a new identity for these undervalued wools and presents an opportunity for demonstrating the potential of post felting applications and further the creative boundaries of the sampling framework. The Developed Practice records the sample prototypes and methods used for expanding the research findings in established practice. The aim is to enhance the sense of newness and originality through the choice of wool types and to overcome any physical limitations posed by handling, scale and fabric structure of wool type through exploitation of the three dimensional surfaces. Issues of practice are analysed and identify the subject of enquiry in new light.

In the **Conclusion** I reflect on the multi-faceted contributions that have characterised the research enquiry and draw attention to specific areas where methods, materials and craftsmanship may suggest new directions of research.

Appendices include supporting material and information on wool types, practice methods, equipment and ancillary materials with references to processes that have directly or indirectly influenced this research, from translucent plant fibres in paper making to the seemingly incompatible discipline of vitreous enamels.

Accompanying CD - inside back cover. This disc complements the written text and contains results tables and images for all sample development undertaken in Part 2. I refer to the CD throughout the text and it would be appropriate for readers to familiarise themselves with its layout at this juncture.

Finally, the perspectives and methods of enquiry culminate in an **Exposition** of original work in which the key attributes and purpose of innovation of my creative practice are made known. This explication validates the stages of research thinking by providing a reflection of the thesis direction, revealing the incremental steps of the sampling process in ways that demonstrate the potential of the developed fabrics as fine felt craft.

The thesis as a whole seeks to widen the creative potential of selected wool types for fine craft felt-making through a material awareness and subsequent development and modification of established techniques, thus suggesting potential uses for previously insufficiently valued and recognised wools for felt-making.

PART 1

Chapter 1 – Literature Review: Contextualising the Enquiry

> *'The importance of establishing a creative identity through the natural features and cultural climate of one's native land is, I feel, of real significance in the full development of originality.'*
>
> *Kawashima K. (2005) p.9*

Introduction

The literature review examines the contextual, historical and materials based framework in which my creative practice is positioned. It establishes previous and current work within the field of enquiry and positions the academic background of the thesis and subsequent research commitment to the project.

In contextualising the enquiry I have surveyed current production of felt within craft and couture,[22] concentrating on specific materials and processes through which the practical and evaluative research is demonstrated in Part 2 of the thesis.

The review begins by providing discourse on felt and felt-making, its origins and visibility within current academic debate, mapping felt's histories and contemporary applications.

Further, by positioning this project within that of existing practitioner undertakings, I will be able to express the remits of the literature review; to contextualise the enquiry, but also simultaneously demonstrate innovation by discussing how I have moved beyond the themes emanating from this material-led investigation.

The review seeks to understand the importance of material within a cultural context and examines how, and if, this is relevant in current felt-making practice.

As outlined in the Introduction, the aim of this thesis is to investigate the creative potential of undervalued British wools in the production of fine craft felt-making. The discussion draws on references to current practitioner research in the field and seeks to address the relevance of materials, specifically waste wool and the use by craftspeople of British rare breed wools. One of the aims of this project has been to find ways in which to reveal new and expressive applications for hand crafted felt fabric by exploring the material potential and its decorative

22 I use the term 'couture' in relation to high fashion and the production of handcrafted fabrics, as defined in the thesis Introduction. I also refer to haute couture and made-to-measure creations for couture houses.

processes both aesthetically and culturally that could suggest an illustrious textile for a bespoke, high-end market.

The research investigation does not specifically suggest new techniques in felt-making terms but examines unconventional use of established techniques and materials. Significant in establishing the focus and rationale for this project, the parallel practice methods of others to elevate the status of a low-grade material have inspired my investigation in terms of research and development in the field of couture and fine craft felt-making. The review examines how (some) felt makers have used British wools and questions why British wool is under-used in current felt-making practice.

Given the number of areas of investigation and the substantive nature of some of these topics, the aim here is to provide a broad based context for the research focus, differentiating key concepts in felt-making and material development in order to validate this area of research. The discussion argues the need for this type of research by emphasising a distinction between what exists and highlighting where there are gaps in knowledge, which this thesis seeks to address.

The review seeks to understand the context in which wool processing and industrial wool production is relevant in identifying undeveloped opportunities for the hand-based processes that are central to this study. In this particular field of enquiry (fine craft and couture) I have looked at comparative work in other textile disciplines where surface manipulation and machine-led applications have inspired new methods of working using waste or low grade materials. In this materials led investigation, wool and sustainability are key issues that validate this area of research in the development of re-purposing material and supporting a response to innovation, resourcefulness and originality.

The literature review does not examine the mass production of felt per se because the enquiry is focused on handcraft and couture. However, in order to represent a balanced view in the progress of felt applications in contemporary practice this chapter provides a brief overview of industrial felt production and its manufacture with examples of recent popular exposure in current design practice. Although contiguous to the research objective I focus specifically on ways that existing large scale production methods and technologies, including industrially produced nonwovens, harness and juxtapose traditional hand-based textile processes. This is because I aim to utilise a research methodology that may be sustained within a practice-led investigation that is essentially hands on. This research is aimed at benefiting craft production. Traditional methods and technologies therefore provide a starting point for the practical investigations.

The review outlines established processing methods of British wools and examines current processing procedures and the potential offered for small-scale bespoke production methods. It is this area of the material-led investigation that I am concerned with in my practice and in directing the practical research in light of the focus on fine craft felt-making.

Throughout the discussion I draw attention to significant archival, library and museum resources relevant to this area of study.

The practical investigation and the gathering of primary evidence is supported by numerous discussions and correspondence with sheep breeders and relevant associations; researchers; manufacturers, technicians and industry experts; fashion houses and craft practitioners, including key exhibitions, craft specific events and subject related conferences and seminars.

Origins and historical overview

In order to assess the necessity and originality of this research project, it is essential to consider the following existing approaches to the subject: historical and practical. By examining the historical narrative of felt and its makers, the significance of material within these cultural and critical contexts is exposed. This research project is about felt practice and wool and, within the fine craft arena, the two are inextricably bound in the common pursuit of excellence. The investigations will emphasise a distinction between what exists and what may be identified as a development or break away from existing approaches. By discussing the breadth of the field and focusing on pertinent developments and approaches within it, I will be able to thoroughly demonstrate the position of this thesis.

Felt's early history and traditional past is accounted for and well documented in three seminal books on the subject (Burkett, 1979, Turnau, 1997, Bunn, 2010). The authors describe the historical and practice traditions of felt and Bunn, through ethnographic studies, claims the first ethno-history of felt in context with contemporary felt practices worldwide. Undoubtedly Burkett's work, introduced felt to a lay audience. Burkett documents felt within an historical context and most importantly discusses the significance of felt as an 'ongoing tradition' and not requiring remake or revival. The evolution of felt as a contemporary craft medium remains for the most part bound by these ancient roots. Referencing the past and keeping ancient traditions alive requires balance.

Felt may arguably be considered man's first textile, yet in her survey, Burkett states that 'scattered references to felt tell us little about its origins' (Burkett 1979, p.7). Textiles, specifically wool and other natural fibres 'are rarely part of archaeological finds' (Hyde 1988, p.567). Despite this common understanding, archaeological evidence and historical accounts[23] reveal that felt was prized as a significant textile, a standpoint verified by Barkova (2000)[24] appraising the Pazyryk[25] felts as 'remarkable for their high level of technical and artistic sophistication'

23 For ethnographic studies of hand felting techniques in Europe and the Middle East during the 1970s and 1980s see Gervers & Schlepp (1997) pp.93-116.

24 Ludmilla Barkova, curator of the Pazyryk materials at The State Hermitage Museum, St Petersburg: an article based on a paper given at the 9th International Conference on Oriental Carpets (ICOC) in Milan, read and adapted for publication by Elena Tsareva of the Russian Ethnographic Museum.

25 The Pazyryk felts dating from 7th-2nd c. B.C. are housed in The State Hermitage Museum, St Petersburg. Other references to this collection are made in the ethnographic studies of Bunn (2000,2010) and Turnau (1997). Less formal and more prosaic descriptions provide introductory historical accounts in felt project based books over recent years.

(Barkova 2000, p.74) in which she asserts without doubt 'testifies to a long felt-making tradition' (ibid., p.79).

Felt-making has progressed over hundreds of years from an ancient art, as in the Pazyryk felts, to a highly technical process for industrial purposes.[26] Yet, despite felt's long history, existing research within the field and extent of knowledge and provenance of material is sparse,[27] a fact acknowledged by Burkett who says 'not enough research has yet been done in anyway categorical' (Burkett 2010). Contemporary evidence on felt literature is dominated by a plethora of hobbyist craft and project books inspired by 'the Western reaction to the reintroduction of felt' (ibid).

The literature of felt and felting embraces these two approaches, both of which could be described as anthropological. On the one hand literature, such as Burkett's and Turnau's, emphasise tradition, heritage and pre-industrial or nomadic peoples. The predominance of this emphasis in succeeding literature (including 'how to books') is not only well worn but also, by use of language and illustration, posits felting as a near lost tradition that is in need of revival. Legitimate as this focus was in early writings (Evers, 1984, 1987, Freeman, 1988, Smith and Walker, 1995, 2005) these narratives and patterns firmly situate felt in the mind of the reader as 'of the past'; a traditional process and fabric that has not moved beyond its humble beginnings, offering the present nothing more than an easy to do hobby or exemplar of simpler times (Bunn, 2010). Indeed, the preservation of felt-making traditions in practical terms - through the focus on history, heritage, and nomadic culture – also links felt-making to notions of the primitive. Felt technology is fundamentally simple, without the need for equipment and the supply of wool from domestic and wild sheep make it likely that the ability to create felted textiles was discovered well before constructed textiles (Sjöberg 1996, Ryder, 2007, Bunn, 2010).

The literature of felt, as outlined, has been fundamental in creating a perception of both practice and object in popular memory. Stereotypical assumptions, for example, thick, misshapen, naïve, hand-felted slippers or hats, in muted natural tones, currently available throughout the UK, perpetuate the notion of felt as 'rustic' or 'traditional' in comparison to machine made counterparts. Sophistication, fashion or modern are terms that defy such objects. Likewise, the use of machine felting in car interiors or as an insulating fabric, highlight a functional, but insignificant material, that is useful but neither avant garde nor aesthetically pleasing. Walter (2010) portrays felt as an ubiquitous material found in daily life whilst Sjöberg (1996) describes felting as 'an uncommonly useful technique' (Sjöberg 1996, p.4). This perception of felt is

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26 For a brief overview of felt's industrial history see Walter (2010). For technical aspects of industrial felt production see Simpson (1997, p.305)

27 Historical felt artefacts and Central Asian felt collections are held at: the British Museum and Horniman Museum, London; Pitt Rivers Museum, Oxford; State Hermitage Museum, St Petersburg contains the ancient Pazyryk felt collection. The Historical Museum and Museum of Fine Arts, Bishkek, Kyrgyzstan hold ethnographic collections from the late 19th and 20th centuries including a permanent exhibition of felt carpets. Important examples of ancient felt objects are housed in the Mongolian National Museum, Ulaan Baatar, Mongolia. An extensive private collection of important historical and contemporary felt items is held by Mary Burkett (collated by Burkett since 1962). Some of this collection is held at the Horniman Museum, London.

unsurprising and can pose an uphill struggle for craft practitioners trying to create high end products and aspirations with couture related design.[28]

It is perhaps because of the perpetual reiteration of felt's primitive roots, that the stigma of felt as a low-status material has persisted and its simplicity has eluded scrutiny. Bunn reinforces this view by suggesting that 'among sedentary peoples on the periphery of nomadic societies, felt has often been seen as lacking in sophistication, rustic, or even 'rough'' (Bunn 2010, p.8). Within Western society the medium is certainly viewed as outside the mainstream of fashionable textiles yet remains a key staple of the craft repertoire. The revival of felt-making - and the reinterpretation of practices such as Central Asian felt-making traditions within contemporary felt craft - strengthens the perception of low craft status and associations with utility, an industrial aesthetic, green issues and the home made. Bunn (1998) points out that traditional Kyrgyz felts 'were always made as gifts and never to sell' (Bunn 1998, p.19), reinforcing the familial constant, associated with nomadic domestic life.

Felt craft and the vernacular

The level of activity has almost certainly exposed felt as a universal material that is accessible to all as a simple, easy technology that has satisfying outcomes and rewards for both novice and the experienced felt maker 'with both questionable and gratifying results' (Nagy & Vidák 2010, p.36). Indeed, felt's exposure in fine art practice[29] within the American Fiber Art movement[30] during the mid 20th century, awakened and fostered a curiosity with the medium amongst craft workers. Burkett's book and exhibition The Art of the Felt Maker (1979) established the initial re-awakening of the craft in the UK. The organic proliferation of the craft and the inclusive nature of the felt-making community, in offering something for everyone, can discourage a move towards a high value aesthetic, perpetuating nostalgic notions of felt's purpose and function as a low status craft. There are other aspects that contribute to this: the (incorrect) notion that it is easy, unskilled, acceptable if it is lumpy and disorderly. These assumptions 'play' with felt's transformative spell, further distancing felt from serious aesthetic and academic consideration. Felt-making can almost be understood as a form of alchemy, producing something from nothing with few if any tools.

In 1982 the newly set up European Textile Network, featured felt in the first publication of its journal Textile Forum.[31] The theme Faserstrukturen - Filz (Fibre Structures - Felt), was

28 The publications, Fashioning Felt (2009) and 500 Felt objects (2012) expose felt's potential as a creative medium within contemporary craft, reflecting a more discerning appreciation of felt's emerging status and vogue.

29 See section: Adding value - felt beyond the functional, for discussion on felt's use in fine art practice.

30 During the 1960s and 1970s American artists experimented and exploited the potential of fibre-based materials in their work, attracted by aesthetic and structural possibilities.

31 Textile Forum the journal of the European Textile Network (ETN) has extensive coverage of felt (Issues 1/1982, Issue 1/2010).

complemented with an accompanying feature on hand papermaking. Soon after, and through the auspices of the newly inaugurated International Feltmakers Association (IFA) in 1984, felt began to reach a wider audience internationally.[32]

Through its international network the IFA has supported and influenced other kindred membership associations from which a plethora of journals, magazines, newsletters and editorials on felt now exists.[33] The aim to foster interest with felt through education and making is sustained mainly through hobbyist activity.

Here, I would emphasise, it is with such activity and the notion of 'play' that felt-making becomes burdened through the physical engagement in making and the serendipity seemingly inherent in the results.

Two laudable IFA exhibition initiatives gave a degree of public prominence for international felt-making practice: New Directions (2000-2001) and On the Map (2004-2006). Seen as significant events within the felt-making community in the opportunity to engage current practice developments, albeit for a self-motivated and self-sustaining group. New Directions presented a celebration of contemporary felt-making underpinning the development as a craft since The Art of the Felt Maker exhibition in 1979. On the Map was primarily concerned with wool, the priority being to encourage use of local materials and bring awareness to felt makers of the different sheep breeds available on their doorsteps (Clay, 2005). On the Map toured extensively reaching no less than 17 national and international venues. The interest this exhibition generated perhaps reflected the ongoing concerns for sustainability and renewable resources. The majority of the exhibits selected[34] were from the UK, an indication of the selection panel's brief to consider 'the widest possible use of wool types the entries offered' (Clay, 2004). According to one review the exhibition 'produced an invaluable survey of how these fleeces could be used and manipulated' (Wynne 2004, p.10). An informal post-exhibition survey of exhibitors revealed that despite the initial willingness to try different wool types, felt makers were judicious in committing to continuing their use of local wools. One might infer from this, that the experience of using local wools, especially with difficulties encountered in supply and the physical effort required to prepare and felt, a return to using processed Merino or similar fine wools would be likely. Significantly, the non-British felt makers were unanimous in their openness to continued use of local wools.

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32 Since 1986 the IFA has published a quarterly membership journal, Echoes (now Felt Matters since Issue 89, 2007). Walker (1995) discusses the background and resurgence of interest in felt-making in the UK since 1979.

33 The following selected publications are representative of contemporary interest in felt-making: North American Felters' Network (NAFN) (1992-2009); Grima, The Danish Felt Association (since 1989); Felt/Filt Danish publication (1994-1996); verFiltz Und zugeNaht - FUN (since 2004); Filznetzwerk organisation in Germany (since 2005); Feltrosa, Italy (inaugurated 2006). Quarterly newsletters and magazines of regional groups in Australia include: Feltlines (Victorian Feltmakers Inc.) Feltmaker (Canberra Region Feltmakers Inc.) and Australian Felt (since 2009). The IFA holds felt related texts, exhibition catalogues, newsletters, journals and a slide collection, currently accessible as a member resource only. IFA journals: Echoes (1986-2007), Felt Matters (since 2007) are held at the British Library.

34 Submissions totalled 95 (including 5 collaborative regional applications). One third of the entries were selected, representing over 40 different sheep breeds from 12 countries (Clay, 2004).

The legacy of such initiatives rarely has impact other than to establish new audiences within a mainly hobbyist arena and from a craft perspective to offer an expression linked with strong eco-credentials (Hallett and Johnston, 2010). The value to the felt maker invariably is in supporting the close knit community that is representative within international felt-making. Whether this transcends globally to reach beyond felt-making's curiosity within textile hierarchies is less apparent.

Felt's ordinariness can lend it an endearing quality but such a quality is also readily absorbed by nostalgia and evokes attributes of the mundane. This traditionally perceived view can equally ascribe to other craft activities, such as knitting, described as thrifty, make do and mend pursuits, potentially rendering the material as 'tainted by poverty' (Turney 2009, p.217). This cultural baggage is both a virtue and a hindrance and requires intelligent understanding of tradition and knowledge if viable outcomes for new practices are to emerge and be managed. There are though overlaps, these paradoxical approaches are indicative of the dilemma in progressing felt practice in balance with a material understanding and resourcefulness wherein felt's highly inventive, experimental and fashion-led potential as a fine hand crafted material may be affirmed.

Whatever, the intention and platform aspired to, interest in felt is often projected through a material curiosity with process and technique and as such, examples of contemporary hand felted work have appeared in exhibitions with a material oriented focus.[35] Acquisitions of contemporary British hand crafted felt are visible in specialist textile collections and museums in the UK and worldwide.[36]

In order to develop a broad analysis of the literature of felt, a focus on the practical and useful elements of the fabric was investigated by exploring definitions of related sources in museum collections where material, process and manufacture could be identified from an historical perspective.[37]

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35 The exhibition Fabric of Fashion (2000/01) at The Crafts Council, London showed examples by designer Eley Kishimoto: felt coat with gold leaf print (a/w 1998/99) and milliner Jo Gordon: hand formed and cut wool felt hats "Felted Hairstyle". Images are available on Photostore (Crafts Council 2013)

36 Felt works by Appleton, Belcher, Brown, Clay, Cowern and Sherburne are held at the London Crafts Council; V&A, London; Nottingham City Museums and Galleries; Whitworth Art Gallery, Manchester; Kunstindustrimuseum, Trondheim, Norway and the Musée Des Modes at the Louvre, Paris, France.

37 The Museum of Rural Life (MERL) at Reading University holds a large collection of traditional artefacts used in farming supported by historical documentation, published texts and a photographic archive. Research material identifies British sheep breeds, wool classification, rural farm practice, cloth manufacture, industrial wool production and the felt industry. Archival resources held by Bradford Central library include information on Britain's wool trade and related industries. Bradford College Textile Archive holds approximately 10,000 fabric samples in its collection, including pattern reference books of regional and international manufacturers, student workbooks and pattern card collections. Wool is represented by an extensive collection of woollens and worsteds fabric samples and an extensive library of texts relating to the woollen industry and wool textile production. Of particular importance and specific to this enquiry is Bradford's collection of textbooks and trade journals such as Wool Record, Journal of the Textile Institute, Textile Month, Wool Science Review and Textile Horizon.

Industrial approach

Historically felt's appearance in popular fashion reflects an industrial aesthetic such as in hats and slipper manufacture. Traditional hat manufacture, which requires hand-processing skills, more than most felt industries, retains its handicraft characteristics.[38]

In the mid-twentieth century, industrial felt was plentiful and cheap. Attempts to glamorise the industry and market a potential "felt - elegance" were advertised in fashion magazines such as Vogue in the mid-1950s [Fig 3].

Image redacted in this digitized version due to potential copyright issues.

Fig 3 Industrial felt as a fashion fabric (Vogue, mid-1950's)

Felt was widely featured in magazines and advertising at this time in America with the poodle skirt, a wide swing felt skirt worn by Hollywood movie stars, becoming a must have fashion item and popular with teenage girls.

Felt's industrial applications have been used by practitioners to invigorate and rejuvenate design initiatives using traditional techniques for hand crafted fabric. The Crafts Council project Texstyles (1984) aimed to stimulate dialogue between makers and industry and to demonstrate the value of craft and thus the potential for quality and creativity in functional textile production. Felt was included amongst the ten development projects for Texstyles.

Hand manufacture offers unique outcomes that are not easily replicated for industrial scale production. A participant in Texstyles, felt maker Annie Sherburne addressed this problem through collaboration with pressed-felt manufacturer, Bury Cooper Whitehead Limited.[39] She developed a way to add decorative elements by hand part way through the industrial process[40]. This mode of practice was pioneering at that time but fraught with complexities in terms of sustained production. Operating industrial scale machinery within a factory environment and having to rely on technicians to operate machinery during creative interplay proved problematic.

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38 Hat Works Museum, Stockport exhibits working machinery and an extensive collection of tools associated with the hat making industry.

39 Bury Cooper Whitehead Limited closed in 1993

40 In an email on 11th July 2012 A. Sherburne stated: 'My innovation was to pattern felt using industrial processes.'

Even though the process is fundamental here and has been experimented with and developed,[41] the crux of Sherburne's work reflects the spirit of this thesis in its aim to produce innovative, short-run felted textiles of the highest quality using hand and machine led initiatives using undervalued and waste wools.

Sherburne resolved other inherent structural problems with the felt cloth by placing cotton scrim between the wool layers in order to strengthen the finished felt. This early use of the technique[42] has been much refined and used extensively by felt makers worldwide. Adding a woven substrate during the wet felt process enables the felt maker to create a lightweight fabric that drapes well for garment construction. Despite this achievement and the potential for fashion fabrics, capitalising these discoveries within an industrial environment remains elusive.

Other designers have employed industrial machine-led methods for creative purposes. Notably Ingrid Tait, whose company Tait and Style[43] customised needle punch technology in the late 1980s. Tait's first impression of felt fabric using this bonding process with wool fibres 'resembled crude handmade felt, which...looked dated and uninspired...and were not well adapted for fashion use' (Tait, 2004). However she saw the potential for innovative fashion-fabric manufacture that could be developed using traditional technology including wet felting techniques [Fig 4 and Fig 5].

Images redacted in this digitized version due to potential copyright issues.

Fig 4 Ikat (1990) Tait & Style *Fig 5 Pondveil (1997) Tait & Style*

The development and commercial success of needle punch technology by Tait and Style is important in the broader field of contemporary felt-making as it demonstrates the possibilities for

41 Sherburne's felt fabrics were commissioned by fashion designer Jean Muir (s/s collection 1984)

42 Now known as nuno felt, see p.38.

43 Tait and Style produce accessories, collaborative freelance designs and bespoke production fabric for designers and couture fashion houses. Clients include Paul Smith, Liberty, Kenzo, Dior and Shirin Guild.

new and inventive design for nonwoven fabrics that are sustainable and adaptable and highly sought after by leading fashion houses.[44]

Felt's use as a fabric of choice for fashion and specifically its application within high value craft and couture may be considered marginal in terms of sustained interest and visible exposure. Felt in high-end fashion is often associated with Japanese design collections.[45] The structural integrity and stability required of fashion fabrics further challenges the conservative view of wool and the expectations of felt fabric. Exposure for industrial felt as a couture fabric is utilised by French fashion designer Florence Bories whose experimental designs, although striking, depict a strong architectural geometry that is not unexpected when using such robust and thick materials[46] (Fig 6).

Image redacted in this digitized version due to potential copyright issues.

Fig 6 Sketchbook and industrial felt fashion designs (2001) Bories

Felt-making is labour intensive, making it costly to produce. Hand-made methods impose limitations on size and consistency of the fabric to be made, making production of continuous length fabric impossible. Designs are therefore limited to one off, bespoke creations. As previously mentioned, technical issues of stability and surface wear and tear contribute to felt's unsuitability as a fashion fabric but despite these problems there is a demand for industrial felt for interior design and its occasional use in high fashion.

Perhaps one of the first contemporary practitioners to rediscover industrial felt and expose the tactility and structural potential of the material in pioneering ways is Finnish artist Anne Kyyrö Quinn. Quinn's style of working is minimalist and architectural. The large-scale felt textile installations illustrate her signature three-dimensional technique (Fig 7) through which she

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44 Aviland Co. Ltd., Japan, specialise in commercial manufacturing of wet pressed felts and needle felt fabrics of wool and wool based products. Naish Felts Ltd., UK import wet pressed and needle felt fabrics from Europe and offer a custom service for bespoke batch production design applications.

45 See section: Fine craft approach, for discussion on influence of Japanese fashion aesthetic.

46 Le Musée du Feutre, Mouzon, France has a small collection of historical and contemporary felt objects and artefacts associated with hand and industrial felt production including industrial felt fashion garments and hand drawn designs by Bories, these were originally shown in an exhibition 'Entre Couture et Sculpture' (2001). Also in France, La Chapellerie Musée at Chazelles-sur-Lyon curates changing exhibitions of historical and contemporary felt work although the main focus of the museum is the display of working machinery, tools and samples relating to the hat industry.

explores and exploits the unique sound-absorbent properties of 100% wool felt. American artist and technologist Maggie Orth, whose company, International Fashion Machines, focuses on the development of electronic textiles, using industrial wool felt as a base fabric for interactive textile and light installations, in which the electrical and transmissive properties of felt are explored.

Image redacted in this digitized version due to potential copyright issues.

Fig 7 Felt Curtain System (2009) Quinn

Industrial wool felt waste has inspired a number of design innovations for fashion and interiors but without emphasis on wool type or indeed a regard for resource consumption. In developing the discussion relating to industrial and craft approaches within design, I examine definitions of waste wool in the practice of others whose use of felt is primarily functional and may indicate a conscious response to consumer trends that reflect environmental concerns.

The term 'industrial felt couture' could perhaps represent a paradigm to reflect environmentally aware fashion initiatives. The repurposing of waste wool materials including off cuts from industrial pressed felt manufacture has shown multiple uses as a fashionable material. There are numerous examples of industrial felt fabric used in contemporary design from fashion jewellery to large-scale interior fabrics. Fashion designer Paula Vidal from Chile transforms factory floor leftovers into cutting edge 'sustainable' fashion accessories. Converting waste wool into a lucrative resource is demonstrated by Mauro Bianucci's designer range, Carga Bags, which are hand assembled in Buenos Aires using recycled industrial felt sourced in Brazil.

Such design oriented uses for felt waste and industrially produced felt show felt's tactile appeal and versatility whilst the industrial precision remains evident. A collaborative project between Julia Lohmann and Liz Clay for innovative product design, investigated moulded concrete forms with decorative inclusions of hand felted waste wool from carpet manufacture (Fig 8). Craft knowledge and hand based skills, although less visible, facilitate the industrial outcome.[47]

47 Lohmann's award winning design concepts ('Designer of the Future' 2008, Design Miami Basel) project environmental concerns through working with unusual and undervalued natural and manmade materials such as concrete, waste wool, animal stomachs and seaweed.

Fig 8 Cracked Concrete (detail) (2008) Lohmann and Clay

Fig 9 Waseinmalwar – Winter, oder? (2010) Gudrun Knapp

On the periphery of what could be described as felt is the conceptual textile art of Austrian born, Gudrun Knapp, whose use of matted fibre waste from domestic tumble driers, fabricated as miniature felt garments, conveys a subliminal reference to environmental issues with material and the wasteful consumption of the earth's resources (Fig 9). In purposing a no less innovative outcome, the felt process was the inspiration for converting waste fabric particles from domestic clothes dryers and 'wasted woollen yarns that are usually thrown away' (Tidman, 2010) to create commercial fabrics shown as men's shirts and garment embellishments.[48]

These singular and somewhat unconventional applications and their material narratives nevertheless show extremes and versatility that is creatively possible when working with felt; identifying unmarked territory for fresh thinking and future research potential.

Craft techniques and innovations

The emergence of nuno[49] felt in the mid 1990's is an example of experimental methods embracing ancient techniques. By juxtaposing woven fabrics and loose wool fibres within the felting process, textured surfaces produce a new fabric identity that has been exploited by felt makers worldwide. This technique is not used in the research that was carried out, although the transparency the technique affords suggests a visual sympathy (Fig 10).

48 The Centre for Sustainable Fashion at the London College of Fashion MA course Fashion and the Environment encourages 'innovative and radical ways to approach sustainable fashion solutions' (Williams 2013) Available from: www.sustainable-fashion.com/challenging-what-we-learn/fashion-the-environment/

49 Felt makers Stirling and Kotaka are credited for introducing the descriptive term nuno felt in 1994. The publication, Nuno Felt (Clay, 2007) demonstrates evolving styles and applications exclusively referencing the nuno technique.

Image redacted in this digitized version due to potential copyright issues.

Fig 10 Boas (2003) Liz Clay

The requirement of a fabric substrate and subsequent research of such materials was considered too extensive within the time frame available. Nevertheless the notions of transparency have been investigated by working selectively with wool fibres and the construction of laminated structures. This way of working has inspired other felt makers in the search to create thin drape-able felt using only wool and wool rich blends. Cobweb felt, a thin, lacy, transparent felt fabric was developed by Danish felt maker Lene Nielsen in the 1990s. The technique is particularly suitable for all quick felting wool types such as Merino however; Nielsen's research into fine transparent felting techniques has explored the creative potential of different wools including some British native breeds.

The approach with materials in this investigation shares similar concerns with the creative process of the Dutch textile artist, Inge Evers. In 1979 Evers began developing a new aesthetic for felt fabric that led to a process she described as silk paper. The word nuno as a felt-making term was unknown at that time. Evers experimented with thin, laminated felt structures using silk chiffons, wool and her silk paper technique to make light felted fabrics.

Image redacted in this digitized version due to potential copyright issues.

Fig 11 Drijvend (2009) Inge Evers

Evers continues to use her silk paper technique along with materials such as coconut fibres and re-purposed waste packaging [Fig 11]. The commonalities triggered a sense that I might explore this path to realise a new identity in hand-made felt fabric using less valued wools.[50] The solidifying effects of additives, assisted by the felting properties of the wool, permit fragility and transparency and the illusion of strength.[51]

New directions for the material's aesthetic and developing the artistic potential and interpretation of traditional felt craft have been a source of inspiration to others. Artist and felt maker Jenny Cowern (1943-2005) realised the immense scope the medium of felt had to offer, the appeal for her was in the 'freedom, unfussiness, even crudeness, and the directness' of the technique (Cowern 1981, p.25). Cowern's craft is firmly situated within a fine art expression. In her work she explored the possibilities of lightly felted surfaces.

In a similar vein, the felt work of textile artist Janet Ledsham contests the conventions of traditional felt-making. Like Cowern, control of the technique is not the prime concern. Ledsham's work has engaged with the properties of the materials by incorporating natural materials and inclusions. Decomposing leaves, seeds and grasses and paper fragments conveying intimate messages are worked into thin translucent layers of wool and fine silk fabric. The lightness of touch and delicacy with sculptural form belie the techniques and materials that are used [Fig 12].

Fig 12 Veils of Courtship (1999) Janet Ledsham

The expressive use of materials and the transparency that is achieved provide visual dominance. The presence of wool is required merely to impart structure and strength yet is obscured and less significant visually.

The purpose in highlighting the work of these artists is not to form a comparative study but to outline and create links between hand-based processes and the potential for material

50 In seeking innovative surface potential of waste wools for felt fabric, the early stages of the research investigated parallel hand paper making processes using coarse fibre structures, specifically comparing tree bark products with coarse wool types such as Swaledale. Felt and bark objects were identified at collections held at the Horniman Museum, London; Pitt Rivers Museum, Oxford; the Ethnography Department at The British Museum, London; bibliographic information at the V & A, London.

51 Similar methods have been explored by American felt maker Beth Beede to exploit the sculptural potential of felt with ancillary agents to add rigidity, using paper pulp, wax and pig gut to achieve skin-like structures [Fig 12].

investment. In recognising the freedom the felt process can offer, my objective is to allow the materials to lead without masking their natural characteristics.

In contrast to the work of Ledsham and others, Brown (2009) describes felt's primal, entropic characteristics as positioning the existential qualities of the material within its current modern setting: 'felt feels like something that exists in nature ... felt has the gravitas of a raw material, such as wood or stone' (Brown 2009, p.51). The very ease with which certain wool fibres can be transformed into felt material contributes to a sense that the craft is an extension of the material's natural raison d'être. This affinity with nature reinforces the material's earthy and innocent characteristics, bolstering the satisfaction felt makers gain from working with natural fibres. Such satisfaction is further enhanced by the method of working by hand, which generates an emotional bond with the material through physical labour.

It is worth noting the comment by Janet Koplos concerning knowledge of material and technique; she argues 'when fiber [sic] work fails as art, the explanation is usually too much reliance on material or technique to carry the work, banal content or no content (decorativeness or formalism), or too personal a content' (Koplos, 1986). The field is indeed open to debate; felt's aesthetics are dependent on cultural issues and individual creative persuasion rather than strict canons of the professional. The work of British felt maker Heather Belcher conveys this well. She says 'I love the fact that felt is sometimes referred to as an 'anti-fabric' because it is not constructed from a linear thread as is the definition of a textile. I enjoy this sense of being on the edge, or in the borderlands between one thing and another' (Belcher 2012, p.4).

Felt has been described as 'an outcast from the system of textiles' (Hayes 2000, p.6) and ironically is somehow bound by its tradition. A sense of 'otherness' that felt portrays offers opportunity to move away from the expectation of felt and to manufacture tradition anew.

Adding value - beyond the functional

To counteract concepts of felt as either pre-industrial or pre-modern or as a practical filler, one has to move beyond common perception and use. If one considers the concept of value it is necessary to consider other fields and practices. The most obvious starting point is fine art, primarily because the conceptual fabric work of Joseph Beuys and Robert Morris played such a significant role in developing the discipline of Textile Art and the move away from a material dependency. Furthermore Morris' reputation and high regard within the art arena preceded him. (Auther 2010, p.60)

Beuys' use of industrial felt was symbolic, referencing the inherent physical properties of the material. For Morris the use of felt was conceptual; it was merely a material through which he presented his ideas. Morris' use of this ordinary material paradoxically freed it from its subordinate, low status, to create an object of high value and aesthetic appreciation. That is, fine art further elevated felt's status through its use by an established artist.

This exposure for felt was significant but although the works were fine art, did little to establish the material in terms of sophistication. Neither was it the intention of these artists to do so. The emphasis for them was on the literal properties of the material, whilst demonstrating an unmediated regard to the craft process. Acknowledging this is helpful but offers little scope beyond an esoteric understanding of the material. The approach that I wish to examine addresses an appreciation of the material characteristics and potential of waste wool and the fluidity of process to hone a fine crafted product.

There are textile-based artists who have used this industrial connection to their advantage such as established American artist Joan Livingstone whose use of felt was primarily for its materiality and functionality whilst resonating its rich history and cultural references. Livingstone stiffens felt's fabric to support the form she creates [Fig 13]. Livingstone has employed felt in her work since the early 1970s. Her work has been placed 'within a craft tradition' (Fernandes 1997, p.2) reflecting her concerns with process and great respect for materials. She investigates, tests their possibilities, examines their interrelation, to expand the visual interest, but for her the material is purely functional and a means of conveying her message although maintaining a vibrant discourse and intimacy with the material.[52]

Fig 13 Whorl (1990) Joan Livingstone

Within the framework of textile art, felt can play a significant role via its versatility as a material to transform and be manipulated as well as be anonymous, prioritising the concept and expression of ideas.[53] The material and technique are subordinate to the outcome intended and thus the labour of making the material becomes less significant.[54] In a similar vein, Belcher's work is concerned with the materiality of felt, using felt as a metaphor for skin or paper,

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52 British textile artist Reece Clements combines traditional techniques and new technologies to create large-scale textile installations of handmade felt. Clements uses Merino tops and British wool tops, incorporating suit fabric and a combination of mark-making techniques with silk-screen printing and laser etchings. He describes the hand processes as being 'crucial' within his artistic practice. (www.reececlemets.wordpress.com)

53 Felt maker artist Jeanette Appleton combines industrial needle punch technology and nuno techniques, using felt as a structure for developing concepts and ideas, distancing herself from technique and materials.

54 Livingstone (2002, p.13) no longer uses handmade felt but employs industrial felt in her sculptures commenting that for her purposes there was little difference between the two. She says: 'I realised I was making material pretty close to what one could buy'. Lopez R. (2001) Livingstone's body of work. Chicago Tribune News, 30th December 2001. Available from: http://articles.chicagotribune.com/2001-12-30/news/0112300314_1_resin-body-studio-visit

referencing the surface as membrane. Belcher often uses print techniques to convey imagery on the surface [Fig 14].

Image redacted in this digitized version due to potential copyright issues.

Fig 14 Arm in Arm (2007) Heather Belcher

The permanent collection of new work housed at The Fabric Workshop and Museum (FWM) Philadelphia, United States, includes significant works by leading contemporary artists such as Rachel Whiteread, Anish Kapoor, Marie Watt and others, including Robert Morris, whose collaborations with the FWM explored the possibilities of working with industrial and hand-made felt within a materials based research environment. Whiteread's work is a sculptural casting of a wooden floor in which resin impregnated three-inch thick blocks of industrial wool felt are heat cured to create subtle embossed impressions of a wooden floor (Fig 15). What is visually compelling about this work is the play of light on the subtle three-dimensional surface that creates an understated, ghostlike impression, far removed from its industrially conceived origin. Sadly, when distanced from a fine art aesthetic and associated critical and academic discourse, felt becomes mundane and ordinary once more.

Image redacted in this digitized version due to potential copyright issues.

Fig 15 Untitled (Felt Floor) and detail (1997) Rachel Whiteread

Perceptions and common narratives

Throughout my professional practice the ambiguity of felt is keenly understood through interactions with others. Since the 1980's felt-making has certainly flourished and I have witnessed this at first hand, both nationally and internationally. It is within this context, through working with makers, galleries, exhibiting and teaching that I began to work with people in the field of couture. As expected, this area offers a rich source of creativity within my practice. However, a self-consciousness persists, resting uneasily, felt's image may be construed as a problem in this regard. Such a view is corroborated by couture stylist for Balenciaga, Clare

Tough, who says: 'it (felt) is not so frequently found in couture as felt is usually seen as something very heavy and crafty'.[55] Thus, this comment and the infrequent associations with felt in high-end fashion, affirm the intent and scope of the research aim and objectives.

The tactile expectation of felt is often that it is stiff, rough and inflexible. These negative associations with felt fabric persist and detract from people's regard and willingness to engage with felt. Indeed such lack of enthusiasm for felt has been described as likening images of felt in textile art to 'badly illustrated Bible stories in Sunday Schools of long ago' (Highbeam, 1999). This and similar editorial comments plague and stigmatise felt as old-fashioned, utilitarian and insignificant. It is perhaps with some relief that in recent memory editorials and news comment have featured felt as having 'come out of the craft closet' (Meadows, 2002) and claiming 'the dismissed fabric makes a comeback' (ibid.) albeit in relation to design applications and technological advances involving synthetic fibre additions such as polyester in order to assist through chemical intervention felt's moulding capabilities using industrial applications.

Fig 16 Felt coat (2008) Stella McCartney - handmade felt Liz Clay

In 2008 softly draped hand-made felt, commissioned by Stella McCartney for her autumn winter collection [Fig 16], was appraised in an article entitled: 'Is felt sexy?' (Phelps, 2008). The same collection was reviewed in Vogue magazine:

> *'Stella McCartney opened her autumn/winter 2008/9 show with felt. But not just any felt; it was shaped into a sexy short kimono-style coat with the fabric resembling that of horse skin ... scored points for making* ***something so stiff*** *look so cool.'*
>
> *(Vogue, 2008)*

The expected qualities for luxury and exclusive materials are that it is soft, sensual to touch, often lightweight, delicate and expensive to produce. These attributes may be authenticated by

55 In an email on 10th July 2013 from C. Tough

high fashion and designer label status. It is interesting to note that fashion reviews, however enthusiastic, often regard the appearance of felt fabric in collections with the assumption it is stiff and rigid. This image persists and with it suggests an association of felt as the poor relative of fashion. Described as 'the dismissed fabric', 'primeval' and 'drab', these interpretations and similar can lead one to suppose there is no hope of elegance or glamour for this purely functional and common of fabrics, an outcast of fashion. However, by demonstrating material subtleties through exploitation of surface, form and finish in the felting process 'can bring sophisticated diversity to surface, texture, weight, opacity, handle and performance of a textile.'[56]

Communicating these aspirations for undervalued and waste wools is the gap this research aims to address. Examining the undeveloped opportunities of these wools and 'through working selectively and in harmony with material and process' (Geesin 1995, p.21) a new identity emerges.

In contextualising the enquiry I give an overview of contemporary felt practice and related materials research, examining diversity, creative potential and innovations in fibre, surface, technique and product placement. The ideas and concepts strengthen the experimental "non felt maker" approach that I seek. The literature review so far has shown that industrial felt is clearly visible within the ever-expanding field of fashionable technology albeit maintaining a functional need as facilitator and not for primary purpose. We now see that research with the hand made is ad hoc by practitioners developing specific techniques as shown by Sherburne and other well regarded figures in contemporary felt-making. Hobbyist development remains under the radar but is significant. Subject specific journals and publications provide evidence of experimental discoveries and practical tips and techniques, with occasional mention of wool type and use. What is less apparent is formal enquiry into material and process in fine craft felt-making and ways in which this can determine outcomes and make contribution from a practice-led research perspective.

New identities

Although felt has been used as a material in fine art there is little existing formal research into felt as an innovative practice[57] or that which defines a materials' led focus. An exception to this is demonstrated by Turkish born educator and felt practitioner, Selçuk Gürişik (2006) whose academic research investigates traditional Anatolian felt-making practice and its demise. Gürişik steers a creative path within his current practice that mediates between traditional and

56 T. Parry-Williams (2012) unpublished exhibition text for *Pushing Boundaries*, Bath School of Art & Design.

57 Practitioner based research is currently investigated at the University of Western Australia by felt maker Martien van Zuilen whose thesis is an ethnographic study into creative textile practices as cultural performances of gender in contemporary Australia.

contemporary felt product development, emphasising 'the rich traditions and cultural significance of wool felt in contemporary aesthetic and commercial life' (Padget 2004, p.4).

Within contemporary felt-making practice the response to materials has been influenced through the desire to achieve a specific outcome that is not necessarily wool driven. However, materials can be innovated by placing them in a previously unimagined context, revealing ways in which a fine art approach imbues a material with refinement and value. Such an example may be found in the work of Iranian born artist, Bita Ghezelayagh, whose exhibition *Felt Memories* (2009), featured stylised felt coats, depicting the traditional shepherd's cloak, hand made in Iran by Iranian felt makers. These works convey strong political messages but embody traditional values and skills currently in decline throughout Iran.[58]

Felt in all its guises is depicted as both an ancient and universal fabric. Design historian Dennis Doordan, describes materials as traversing back and forth across history 'from the so-called fine arts to the so-called applied arts, craft, art, industrial production' (Fricke 2004, p8).

Felt-making has long been associated with aspects of practice that focus on craft skills, time, process, material, value and intuitive methods of working. Makers address issues of consumerism and sustainability, acknowledging the very hands-on and labour intensive methods required. Attempts to speed up the felt-making process with washing machines, home made equipment and other 'pound shop inventions' present a somewhat chaotic landscape of creativity. A culture of improvisation persists, and with it a sense of amateurism. None of this detracts from the highly sophisticated felt-making of recognised professional practitioners and the accepted value of artisan felt-making in current practice but the wider understanding and appreciation of these is compromised by this perceived 'amateur' view.

The exhibition *Fashioning Felt* (2009) at Cooper-Hewitt, National Design Museum in New York City, set new standards in exposing felt's modernity and coming of age, revealing 'felt's paradoxical position as perhaps the most ancient man-made fabric, and yet the most exciting 'new material' in design today' (Brown 2010, p.24). The exhibition focused on traditional, craft and industrial design aspects of felt manufacture. The selected international designers exposed a wide range of cutting edge creativity, positioning materials at the forefront of investigation.[59] For some this involved collaborative experimentation in unfamiliar territory such as the fusion of felted wool fibres with traditional *urushi* lacquer technique[60] developed by Jorie Johnson (felt) and Clifton Monteith (urushi) [Fig 17]. For others the focus was on industrial design, sustainability and low environmental impact through technical innovation with material and

58 The V&A museum has acquired Ghezelayagh's work for its permanent collection.

59 Despite the importance of wool in this exhibition there was scant mention of the different wool types throughout the accompanying lavishly illustrated catalogue. Captions described materials as simply 'wool' or 'wool felt' with some mention of Merino. The one notable exception being the work of Danish felt maker Claudy Jongstra who works with wool produced from her flock of mostly rare European sheep breeds.

60 Protein in the wool fibres is used as a curing agent for the lacquer technique

process.[61] The sustainability of felt at this level of artistry remains to be seen. Further, it indicates how the placement of such work in its environment is critical in the appreciation and engagement it affords. Using a prestigious museum exhibition space is significant. Felt work is seldom projected in this way or curated with such attention and dedication.

Image redacted in this digitized version due to potential copyright issues.

Fig 17 Hairy Pottery (2004) Jorie Johnson & Clifton Monteith

Material diversity

The raw connection with materials that felt offers the maker is demonstrated by Russian felt maker, Alexander Pilin. According to Pilin, the perception of wool, incited feelings of 'disgust and contempt', the wool fibres were 'coarse ... prickly ... heavy stiff felt sheets'. Far from being discouraged, Pilin embarked on ways of reinventing felt, claiming 'In Russia felt was forgotten or neglected' (Pilin 2008, p.8). Pilin continues to build on tradition and a respect for materials. Pilin's materials are native Russian wool types and he has developed a felting technique he calls Feltlace, that transforms the appearance of coarse wools into lattice shaped surfaces suitable for accessories and garments [Fig 18]. The outcome is unexpectedly lightweight and modern - yet the fabrics possess an earthy organic quality. The simplicity and honesty conveyed by the neutral tones give Pilin's work fresh resonance and the material impact that strikes a chord of particular significance to the aspirations of this project.

Image redacted in this digitized version due to potential copyright issues.

Fig 18 The first shawl of first shaman's wife (2006) Alexander Pilin

61 'Striations' (2007) Kathryn Walter/FELT Studio, Toronto, Canada. A series of wall panels made of industrial felt using wool and recycled fibres.

The work of Dutch felt maker Claudy Jongstra is important in acknowledging a work ethic that promotes an entirely holistic approach to hand felt craft production, endorsing excellence in material diversity and subscribing value to raw materials [Fig. 19]. Jongstra describes being 'inspired by stewardship and the preservation of a natural and cultural heritage' (Jongstra, 2013). Her production includes large-scale textile art installations and architectural projects that involve entirely hand based production throughout all processes, reflecting a sense of freedom from the 'usual confines of industrial minimums, speed and waste' (Fletcher and Grose 2011, p.176). Jongstra shepherds her own flock of native rare breed sheep, Drenthe Heath, and cultivates dye plants on site to use in her work.

Image redacted in this digitized version due to potential copyright issues.

Fig 19 James' rug (2012) Claudy Jongstra

The fusion of traditional techniques and an awareness of renewable resources is present in the work of felt maker Anne Belgrave who, through her practice, has consistently encouraged the use of British wools. In her work, Belgrave exploits the natural colours of wools, striving to retain the authenticity of the raw material. Belgrave's book (1995) illustrates the different characteristics of certain wool types for felt-making projects, the emphasis is in revealing the different qualities of the wools and how they might best be employed in felt-making, she acknowledges the poor felting quality of certain wools. It is anticipated that this research will differ by not only extending the visual capacity of the wools' natural characteristics through hand processing but in rejecting the physical limitations of certain wool properties that she identifies by seeking alternative strategies within process and technique.

Creating a link between the land and the wool and the final textile outcome establishes a way of thinking and working that could describe a potential distinctiveness with materials. British rare breed wools are diverse in character and offer distinctive qualities for felt-making.

Is it therefore possible to imbue a sense of uniqueness and material value with such wools whilst honing a fine craft perspective with hand made felt?

Fine craft approach

It is through fashion and innovation that another form of adding value might be considered. Fabric has always been a key component in fashion and fibre research plays a critical part in contemporary design. Indeed a union of hand made craft with a factory made approach is subtlety shown in the textiles of Junichi Arai used in design collaborations with Issey Mikaye.

Dormer perceives that 'such fashionable connections secure a high profile and an acceptable provenance' (Dormer 1997, p.171) but more importantly it can create an energy and enthusiasm which transcends notions of the traditional and embraces an 'interconnectedness between craft and high technology' (ibid., p.170).

Others have explored this notion in the re-purposing or rescuing of waste and undervalued materials in order to bestow a new aesthetic language or meaning.

Images redacted in this digitized version due to potential copyright issues.

Fig 20 Felt Dress (1996) Yohji Yamamoto

Fig 21 Felt Dress (1983) Rei Kawakubo/Comme des Garçons

Fashion designer Yohji Yamamoto's unique signature reinterprets tradition through a synthesis of traditional Japanese clothing sensibility and conventional European tailoring. The emphasis of cut and subsequent parity accentuates felt's austerity [Fig. 20]. However, Yamamoto's design ethic, to eliminate excess, conveys a very different understanding of the material and it's potential message. A similar but different sentiment is skilfully crafted by Rei Kawakubo in her ingenious reinterpretation of a traditional garment, the travelling coat [Fig 21], reinforced by the notion of using affordable materials, in this case felt. Despite referencing traditional garments and nomadic lifestyles, the work makes an unexpectedly sensuous and seductive impression by the innovative cut of cloth and mastery of aesthetic sense. Kawakubo's 'Big and Fat' collection for Comme des Garçons (2012) features oversize shapes of two dimensional, felt fabric with strong colour and bold motifs depicting collaged cut outs, perhaps reminiscent of childhood fuzzy felt shapes and paper cut out dolls [Fig.22].

Image redacted in this digitized version due to potential copyright issues.

Fig 22 Big and Fat Collection (2012) Kawakubo/Comme des Garçons

The sensory qualities associated with felt-making are perhaps taken for granted by felt makers. The very nature of the process depends to some degree on intuition and instinct that develops over time. However, the mechanics of production can become simply an automated act in the artistic performance. This is true with all artistic endeavours. I would argue that a dependence and trust of the intimacy of sensual awareness and intuition is what might define quality in the making process and reaffirm values of tactility, authenticity, uniqueness and sustainability.

It is perhaps the sheer diversity of the medium and exhaustive range of felt's repertoire, which confuses perceptions of aesthetic value. For haute couture the subtleties of hand manufacture are attractive for the individuality and distinctiveness that is offered. Kane suggests the 'association with the hand made does not, by itself lead to a high perceived value. Sophistication in terms of design is also required' (Kane 2007, p.249). It is this necessity, in my view, that can isolate and diminish felt through poorly conceived process and use of material that forgoes potential beauty for the banal. There is of course a novelty factor that can make felt seem enticing, inviting an expression of modernity and perhaps elevated status.

Kane argues that in order for a fabric to achieve aesthetic value 'a designer/maker mode of practice' (Kane 2007, p.63) should be adopted; such modes of practice would typically involve hand-made not machine-made production methods. Therefore, in order to extract couture status from a purely industrial setting, qualities such as evidence of the touch of hand become key indicators of value. The distinction between hand craft and industrial manufacture of felt opens interesting areas for discussion and research potential.

In this thesis, the interaction between maker and material is measured through haptic sampling and the reflective process through which a qualitative analysis offers in ways 'to formulate new questions and levels of interpretation' (Coffey 1996, p.30).

By exploring the periphery of established processes and unpicking the processes within my practice, a deeper understanding develops. This personal and intimate 'contemplation of matter' (Harper, 2003) helps me to articulate and find my own voice within a landscape that is often thwarted by misunderstanding.

The techniques developed within my practice expose the material as light, delicate and transparent, arousing suspicion as to the usefulness and potential stability of the fabric and thus requiring explanation and assurance. The Boa design [Fig 23] is a clear example of the discrepancy between felt's reputation and its reality because of its strength as a material despite the fragile appearance. It is anticipated that this research will differ by developing the potential of more robust wools in fine craft felt-making and to show the capacity to become and extend the very light qualities that I seek to create. Using existing methods of practice so to create something new that is appropriate within a clearly defined context.

Image redacted in this digitized version due to potential copyright issues.

Fig 23 Boa (2001) Liz Clay

It is within an experimental framework that I seek the potential of undervalued materials and aim to bring an awareness of materials and techniques in new light.

Through the course of this chapter key issues have been identified within the field of felt-making. Felt's longevity and the fact that little has changed throughout time with both the process and the materials required is partly the impetus that directs these investigations. One could do very little indeed to challenge a rather rigid and negative perception. It is therefore fundamental to consider a different approach whereby materials and practice coerce and focus on diversity and appropriateness in response to vernacular and indigenous products. In this way a framework may be built in which a matrix of sustainable design innovations for waste wool and British rare breed wools may be examined and thus inform more propitiously the desire to seek novelty. Researcher and authority on sustainable fashion and textiles Kate Fletcher quantifies this by stating 'in searching for novelty we can sometimes disregard the familiar and lose sight of the major improvements being made to more conventional fibres' (Fletcher 2008, p. 37).

British wools

A revival of interest in the crafts and handwork, issues of ethics and consumption, industrial waste management, sustainability and a popular greening background are significant issues in framing this project within a wider context. In searching for originality within this context the interest and purpose of this investigation aims to demonstrate how my practice will expand the field of fine felt craft through innovative use of traditional techniques and processes using less established and less conventional materials. Attention to wool waste and heeding widespread concerns on the disposal of undervalued wool resources, the focus on specific wool types and

British rare breed varieties[62] as fine craft felt-making material became central to this investigation.[63]

British sheep breeds produce mostly coarser quality wool that traditionally is more suited for certain products such as carpets, industrial components and knitting yarns. The quality of these wools should not be regarded as inferior to fine wools but merely different and it is by exploring the characteristics and singular qualities of these wools that this material-oriented study seeks to open opportunities for niche felt fabric development. The focus on nonwoven textile production offers parallels to explore these notions, specifically in utilising wool that is regarded as waste; a by-product of industry or discarded at source.

The source of available literature, research and extent of knowledge in this field lies almost entirely within creative practice, subject related exhibitions and exposure in commercial products. Identifying the use of British wool in hand felting is predominantly found within the hobbyist arena albeit marginal due to the difficulties with making and the availability of processed fibre.

As a felt fabric, the inherent characteristics of British wool deem it potentially unsuitable as clothing fabric due to the rigidity of the felted surface and subsequent poor drape. However, I would argue that a lightweight felt for clothing could be investigated using waste wools by examining nonwoven methods of production and investing time and skill with a handcraft approach using finishing applications and treatments. Further, the demand for high-end craft and sustainable practice would suggest there is a market for such fabric. During the investigation I found no evidence of commercially produced British rare breed wools used for fine craft felt-making.

In the UK the British Wool Marketing Board (BWMB) continues to focus on the use of British wool for textiles, despite very considerable competition in the world marketplace both from the major woolgrowers and from replacement by synthetics. The low prices paid to wool producers by the BWMB have been such as to encourage the burning and destruction of fleeces rather than for use in commercial applications. The fleeces produced by the hill breeds present most problems for marketing, as they are relatively low quality for textiles. A number of novel alternative, industrial applications of coarse-grade wool have been identified including insulation, mulch for horticultural purposes and novel biopolymer design targeted at high value niche markets however, producers are largely unaware of these opportunities.

The Sheep Trust[64] at York University set up a wool investigation case study (Carson, 2009) aimed at interacting with hill farmers and working closely with the Breed Societies to address

62 An editorial in Wool Record (1995) identifies a decline in interest of rare breeds of British sheep, 'according to the Rare Breeds Survival Trust' (Wool Record 1995, p.31)

63 The National Sheep Association provides an extensive survey of sheep breeds and associated statistical data and contact addresses. The publication, British Sheep, provides a compendium of current breeds found in the UK with references characteristics and factual data concerning pure breeds of sheep and some traditional cross-breeds in the UK.

economic and environmental sustainability and to stimulate commercial opportunities for hill breeds such as Swaledale; the overall aim being to encourage the commercial development of the wool of hill breeds as a novel industrial fibre. In response to this strategy, the review explored information resources and assessed existing end-users of this product, which led to information gathering from relevant specialists and Breed Societies. Priority breeds at the time this research began included Dorset Horn, Shetland, Swaledale and Devon and Cornwall Longwool. These breeds were included for this research project.

Under current law wool producers must provide their fleeces for marketing by the BWMB who has a statutory monopoly over the purchase of all British wool from any flock exceeding four sheep.[65] Within legislation there is an opportunity for producers to 'opt out' under agreement by the BWMB. This entrepreneurial activity has been encouraged by the BWMB. The subsequent effect has been for some wool growers to obtain premium prices for their fleeces and this has initiated a demand for small scale production of artisan knitting yarns and associated products with an interest in the finer quality coloured wools such as Shetland, which are increasingly used for felt-making. The majority of British rare breed and classified heritage breed wools although used for weaving and knitting purposes remain underused in the production of hand made felt. Conversely the recent market interest for muted, natural tones, particularly greys in fashion textiles has elicited a favourable response to coloured wool types including production of specialist blends and bespoke dyed wool collections. Furthermore, consumer demand for fine quality, soft and machine washable wool products is not possible with the majority of British wool types. Imported Merino fibre dominates the raw wool wholesale supply.

British rare breed wools

As identified in the thesis Introduction the selection of British wools was made as a result of identifying wool waste in my locale and choosing where possible native breed wools currently listed on the Rare Breeds Survival Trust (RBST) watch list.[66] Divided into five main categories, the watch list indicates: critical; endangered; vulnerable; at risk and minority, plus a sixth category denoting other native breeds. The watch list is updated annually and current statistical information (2013) in relation to the rare breed wools selected for this research project is: North Ronaldsay (Category 2 endangered); Devon and Cornwall Longwool (Category 3 vulnerable); Dorset Horn (Category 5) Minority; Ryeland and Shetland have progressed out of the endangered list into Category 6 and Swaledale is listed as one of the wider population of breeds

64 The Sheep Trust research project at York University was founded from the Heritage GeneBank organisation in response to the Foot and Mouth epidemic in 2001. A science led organisation and independent academic authority working with breed societies and dedicated to protecting heritage sheep breeds (native breeds in significant numbers at risk from disease due to geographical concentration).

65 The Shetland Isles hold the only exemption to current legislation, having their own wool board. The Shetland Flock Book Trust was founded in 1926, known as The Shetland Flock Book Society.

66 A directory of priority and minority sheep breeds listed by the Rare Breeds Survival Trust (www.rbst.org.uk) is shown by category relating to endangered status and those not currently in popular demand.

native to the British Isles. The RSBT encourages specialised producers and marketing of products named from rare breeds.

Throughout Britain fleece is sold to the British Wool Marketing Board for the international market. Wool is over produced in the world and in recent years the demand for wool has shrunk due to the proliferation of man-made fibres and consumer demand for cheap products. A further detrimental effect has been a reduction in the choice of wool that is available further exacerbated by cheap imported wool. For British rare breed sheep the wool yield is low making it commercially unviable. The textile industry is concerned with speed, high volume and profit. As a result small-scale processors and manufacturers have struggled to stay in business and even the big manufacturers have been closing their doors at an alarming rate. Here in the UK, sustaining breed diversity by championing the distinctive qualities and characteristics of British rare breed sheep in products that are 100% produced in the UK will be dependent on strengthening the association with fine craft and creating niche markets. As fibre specialist, John Arbon (2010) suggests, using these wools will help sustain their survival.

The slow practice methods associated with hand made felt are ideally suited to this. It is naive to think the world population will be dressed in felt; however, there are ways to demonstrate the value of felting in more sophisticated ways. By exploring the periphery of established principles and emerging applications and using rare breed wools in more imaginative ways, this research will not only help sustain interest in their conservation but demonstrate new and original hand led applications for fine craft felt.

The literature review forms an integral part of material gathering that was conducted during extensive early field research of wool types and subsequent studio based sampling and analytical activities. Given the substantive nature of investigation and with over 60 breeds of British sheep and the focus on waste wool, the aim during the early stages of investigation was to provide a broad brush stoke in order to define general reference points to explore and consider whether a fine craft approach could be viable with the available supply and processing of these wools. As well as large flocks of commercial sheep breeds the enquiry identified examples of rare breeds within the studio locale including Ryeland, Dorset Horn, Greyface Dartmoor and Shetland, disclosing concerns and problems encountered with fleece disposal at source. The specific wool characteristics and qualities of the rare breeds presented the necessary focus for this material-led investigation.

Wool initiatives and ancillary research

The Campaign for Wool was launched in 2010 as a worldwide initiative to promote wool as ‘the superior natural and sustainable fibre for fashion, interiors and the built environment.’ The campaign is funded by the world’s leading wool grower organisations and their wool producers with the mutual aim to raise the profile and public awareness of wool as a natural, sustainable, multi-purpose fibre. One might be forgiven for thinking the focus is entirely about Merino sheep and its wool, albeit the most important type of wool for apparel production (Fletcher, 2008). This

focus serves to highlight the dependency on imported wool in the British textile industry. It is perhaps interesting to note that as far back as the 19th century concerns for the British wool industry, in this case from the influx of synthetic fibres, and subsequent threat to wool production, prompted wry comment that there was a time that 'English cloth was made from English wool' (Ponting 1961, p.140). History reflects a similar troubled wool industry. However, the campaign has brought attention to wool as a renewable fibre, raising public awareness and affirming wools' potential in a wide range of uses. Environmental credentials and sustainability issues, including animal welfare and over grazing concerns are perhaps where it fails in cultivating a more pluralistic approach that may be considered truly sustainable and long-lasting[67].

In the textile industry the properties and performance of textiles is continually being assessed. Presenting the performance potential of a felted material within a fashion arena and showing the unique versatility of British wools for highly original and sophisticated textile design can reposition British wools as a fabric that can be expressive for design purposes and offer an integrity for hand crafted felt through its unique qualities.

The desire for ever more fine quality wools and new and improved products has been researched by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Textile and Fibre Technology unit.[68] The Optim fibre treatment, a wool product innovation using Australian Merino wool was developed in the 1990s. This processing technology re-engineers wool fibres by stretching to make them softer, stronger and lighter than untreated wool to create a silk feel and lustre, described as a 'supreme luxury fibre'[69]which can be clearly seen and felt. The Optim process was originally designed for wool fibre less than 19 microns[70] and although opportunities for testing British wools with the technology had been discussed between the BWMB and the Woolmark company, due to cost and lack of potential market evidence for the resultant product, the idea was aborted.[71]

In recent years throughout Europe there have been a number of research funded projects concerning the benefits of wool and ways to exploit raw wool in product development,

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67 The Nordic Initiative Clean and Ethical (NICE), established in 2008, is a Nordic Fashion Association project with the purpose of raising awareness and promoting ethical initiatives in material processing, sustainable sourcing and production within the fashion industry. The remit is far reaching and supported by luminaries in the field such as Katharine Hamnett and Kate Fletcher. See also, Borrelli-Persson, Laird 'The Nordic Fashion Association Has A NICE Idea' (www.style.com/stylefile/2009/12/the-nordic-fashion-association-has-a-nice-idea/). In cooperation with NICE the project 'Valuing Norwegian Wool' was set up in 2010 to seek innovative approaches with wool and new ways to exploit the environmental and cultural benefits of wool as a traditional material and to meet the challenges of a consumer demand for imported fine and softer wool types, not produced in Norway (see: http://www.nicefashion.org/en/featured-projects/Wool/index.html)

68 Optim processing facts and information available from: http://www.csiro.au/files/files/p6py.pdf

69 Available from: www.woolnews.net/news/andar-optimistic-about-the-future/

70 In an email on 24th February 2004 from R. Poole

71 Discussion on development and commercialisation of Optim fibre available from: www.csiropedia.csiro.au/pages/viewpage.action?pageId=426494

specifically aimed at sustaining a cultural identity with the wool types.[72] The review examines existing processing methods and outcomes for waste wool and explored the potential for more refined processing methods for British rare breed wools. A willingness to invest in new ideas and schemes is evident across the manufacturing industries however the main driver for this interest is ultimately to sustain turnover and profit margins based on quantity and not necessarily a desire for small batch production. This is seen to be problematic and uneconomical. The seemingly insurmountable obstacle from a craft perspective is in addressing the still large fibre quantities required for minimum quantity processing.

There are successful initiatives addressing waste management of wool and developing products that add value to wool classified as waste or low grade materials such as Swaledale. Furthermore, the diversity of British wool[73] is ideally placed in addressing contemporary consumer trends that assert environmental concerns and sustainability issues.

The viability of industrial scale processing of speciality fibres and limited resources of rare breed wools rests with outcomes of research initiatives and the willingness of manufacturers to invest.

A modest number of specialist wool processing services exist in the UK producing breed specific products,[74] including single-breed yarns, carding and wool preparation for spinners and feltmakers: Diamond Fibres, Halifax Spinning Mill, Coldharbour Mill and The Natural Fibre Company.

A first source of reference examined wool processing and industrial perspectives both in the UK and beyond with assistance from the British Wool Marketing Board (BWMB).

According to industry experts at the BWMB, commercial scale blends for British wool and other fibres appear to be the way forward for apparel because British wool on its own is too strong and coarse.[75] Despite this view, in the UK, there has been 'an interest, albeit small, in fine wool production. This interest exists across all types of sheep farms' (Russell 1997, p.13). Through contact with the British Wool Marketing Board I spoke with Dr Margaret Merchant at the

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72 The Department of Textile and Clothing Design at The University of Lapland ongoing research projects: Healing Wool (2006-2007) and Woollen Innovations (WINNO) (2012-2013), investigate the utilisation of wool that is currently considered waste with the aim to explore the production, use and commercial prospects of Finnish Landrace wool and identify the ecological soundness of how wool is used and processed. Additionally the material-oriented study examines the natural felting properties of this wool as well as its aesthetic values and seeks opportunities to produce clean, usable raw material to generate new, healing wool products for commercial purposes. The European wool group - Atelier is a member based organisation supporting those working in the wool sector throughout Europe, aimed at adding more value to wool products and bringing awareness to different sheep breeds and the use of fibre as a sustainable material reflecting the bio-diversity of sheep breeds, the qualities and properties of wool and the manufacture of wool products. The Wools of Europe project and exhibition (2010) included a brief overview of ten British wools and related textile products felt was not represented.

73 Britain has more than 60 pure breeds of sheep and numerous cross and half bred varieties, a diversity unrivalled in the world (Robson and Ekarius, 2011 p.30)

74 The Somerset based company Woolcake promotes localism, sustainability and ethical trading of hand made products using local wool. The products are labelled identifying sheep, shepherd and farm.

75 In an email on 26th February 2004 R. Poole stated that 'our (British) wool suffers from the early scouring process here in the UK which knocks the stuffing out of the fibre to start with'.

Macaulay Land Use Research Institute who was at the time involved in researching the Bowmont breed, a variety of Merino sheep bred in Scotland. The study aimed to examine the potential to increase income from wool on hill and upland sheep flocks in the UK. Samples of this wool were provided to me for the early sampling investigation in order to test the fibre's performance capabilities as a felted fabric. Comparisons of processed fibre using greasy, scoured, scoured and carded fleece wool from different parts of the animal's body were inconclusive. Further sampling was compromised due to processing delays at the Bradford scouring plant and restrictions with scouring such small quantities (139kg). The Macaulay research project closed in 2006 however stock from the original flock is now owned by Devon Fine Fibres and the wool is successfully used to produce luxury goods for Finisterre, a surf-wear company in Cornwall.

The success of this initiative and that of other small businesses promoting a raw material that has regional identity and commercial prospects was an inspiration to the aims of this project. Following these entrepreneurial leads, the review examined existing processing facilities and research technologies in the UK, seeking potential interest and new opportunities for raw wool other than processing into yarn.

Sustainable ambitions

Coarse wool from hill sheep often goes to waste. As a consequence many farmers treat wool as a waste product and end up burning or burying it. Significant amounts of coarse wool produced in the UK go to waste because it has limited use in the modern textile industry where the demand is for lightweight, affordable products. Alternative products have been developed more recently using some poorer grades of British wool however these are mainly as house insulation and gardening products [Fig 24].

Fig 24 Felt-lined plant holders

Cumbrian hill farmer, Christine Armstrong, was the first to commercialise a product made from under-utilised Swaledale and Herdwick fleece. She led the way by developing a roof-insulation material (Thermafleece) with help from the Nonwovens Research Group at Leeds University. The company's promotional literature describes the material as 'a high density, wool rich insulation made from the wool of British hill sheep and contains 85% wool blended with 15% polyester binder. English Heritage and the National Trust use the product for conservation

projects. Thermafleece Edonbloc, launched in 2010, is an insulating material made largely from recycled wool.

Increasingly in response to the declining market value of the wool clip and the poor return from the BWMB, there are initiatives where wool products are bought direct from the farmer and so adding value at source. Dalefoot Farm in Cumbria initiated and developed Wool Compost, a product made from bracken and sheep's wool.

Although currently a niche market, wool used as sound insulation is gaining interest. Acoustic Clouds, an innovative interior design concept, is the brainchild of the Woolly Shepherd. The southwest based company manufactures small batch production of needle felts using local waste wool for their designs.

Industrial needle felt production in the UK uses composite fibre blends and recycled wool waste from the UK carpet industry for carpet underlay and other low-end products. Industry expert Simon Macaulay's (2004) paper given at the Ecotextile conference at Bolton, 2004 outlines and demonstrates the potential for developing innovative, 'niche' end-uses of low value waste materials. Efficient recycling techniques have been researched by Anglo Felt Industries Ltd., to produce WoolSpring, a range of bonded underlays made from 100% recycled fibres including reprocessing wool rich carpet edge trims. (Miraftab and Horrocks eds., 2007)

One particular initiative in seeking sustainable production methods and promoting enhanced value to a specific wool type has been brought to market by Axminster Carpets, claiming a carbon neutral range of carpets produced using wool from the Swaledale sheep. Its marketing strategy describes 'the finished plain carpet in a range of bright fashion colours, has a distinctively natural appearance, which is proving massively popular with a generation of 'green' consumers'.

The marketing material of Axminster Carpets asserts to being one of very few carpet manufacturers who can claim 'from fleece to floor', with more than 90% British wool in its carpet production. Fashion led carpet collections have resulted from collaboration with textile designer Sophie Conran.

Responding to the need for adding value to coarse quality hill breed wools, the company Wools of Cumbria Carpets Ltd. developed its yarn-spinning project with Herdwick wool to create a range of hardwearing and high-performance domestic and commercial floor products including underlay. The company promotes local Herdwick, Swaledale and Rough Fell breeds in its designer collection [Fig. 25] with a monetary donation made to the respective Sheep Breeders' Association for each square metre of carpet sold.

Image redacted in this digitized version due to potential copyright issues.

Fig 25 Union Jack (2013) Wools of Cumbria Carpets Ltd.

Wool is ideally suited for highlighting renewable resources and addressing the need for cultivating ideas of diversity for under-used natural resources. British based companies Abaca Organic and Devon Duvets use organic certified British wool in their bedding products. Abaca Organic supply a custom range of hand made mattresses with specific mention of Dorset Horn wool used as filler. Vi-Sprung bedding company promotes 100% wool mattresses using Shetland fleece and a range called Yorkshire blend. The versatility of wool in such products demonstrate sustainable, environmentally sound and perhaps socially responsible credentials but there remains a gap in the market for promoting these wools and the potential they offer within a fine craft perspective.

Other artisan and craft based industries specialising in products using only British rare breed wools are found mainly within yarn production for knitwear and some woven products, comparatively little felt is produced with these wools. However, there is an increasing interest amongst small business ventures to promote British fleece and some processed fibres of rare breed wools for felt-making.[76] Felt maker, Ellie Langley, shares a smallholding in the North Pennines, farming a variety of breeds including the rare breed Wensleydale. Langley concedes, 'Wensleydale wool isn't an obvious choice of wool for felting, but it gives very interesting results' (Langley, 2009 p.31). Langley is a member of the North Pennines Wool Project aimed at bringing together producers, processors and users of wool, to add value to local wool by raising awareness, developing skills and creating handmade products such as hats, bags and rugs.[77]

Evidence of more commercially viable end uses for felted products using British and some rare breed wools can be found in hand produced novelty items, felt projects, especially needle felt and knit-to-felt kits aimed at the hobbyist market. However, the market remains dominated by Merino wool products.

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76 The Wool Directory is an online database that connects UK wool producers, craft makers and wool product manufacturers.

77 Langley contributed a regular feature in Felt Matters (2009 - 2011) focusing on different breeds of sheep and their wool characteristics in order to bring attention to felt makers the potential of these wools for felt-making. The final article in the series Felt Matters (2011) Issue105 p.27 draws attention to ethical issues in fine wool production with reference to controversial farming practices with Merino sheep.

An exception to this has been demonstrated by the collaborative business partnership of British felt makers Anne Belgrave and Yuli Somme in the shroud project. Established from this initiative, Bellacouche was set up as a sustainable business practice to promote carefully sourced materials in the design of custom made felt burial shrouds [Fig 26]. A combination of industrial processing of wool into needle felts and hand made production methods using organic rare breed wool. The aim to exploit the wool's special qualities and 'promoting better use of this under-valued natural fibre' (Belgrave 2004, p.4) whilst encouraging its wider use, which in turn provides a market for local sheep farmers' fleece.

Image redacted in this digitized version due to potential copyright issues.

Fig 26 The Leafshroud (2012) Bellacouche

The implications of such a practice endeavour has potential on many levels, not least for developing meaningful networking interests and strengthening allied craft based activities within bespoke manufacturing. I aim to show how my approach with similar materials is different and thus my research is more formal, addressing felt at couture and establishing a luxury mode of practice.

The intent to encourage and promote native breeds and organic wool production is championed by an increasing number of specialist and diverse British textile companies such as Boreray, Finisterre, John Arbon Textiles, Izzy Lane, Garthenor Organic Pure Wool, Cornish Organic Wool and Ardalanish Organic Farm, whose shared concerns combine tradition, culture and local resources in pursuit of quality, ethical and environmentally sound products. Izzy Lane, Garthenor, Cornish and Ardalanish use wool from certified organic sheep including rare breeds. Fox Brothers based at Tonedale Mill in Somerset produce woollen cloth for Savile Row tailors and fashion designers, using wool from local rare breed Exmoor Horn. Annie Sherburne's award winning design, Soft Cobbles (2001), was one of the first commercially successful examples of hand-produced felt using organic British wool [Fig 27]. Under the label EcoAnnie (2006), Sherburne launched a yarn made from 50 per cent recycled London textiles and 50 per cent pure new wool from British farms.

Image redacted in this digitized version due to potential copyright issues.

Fig 27 Soft Cobbles (2006) Annie Sherburne

Considering the expansion of craft interest and investment of materials in high end products there remains within textile industries, little evidence of British wool used in felt. Interestingly, and perhaps more as a marketing tool and in selling the romance, British wool is featured in promotional material in the collections of Estonian felt maker, Eve Anders, whose garments are hand manufactured in Tallin. Despite the claim to eco fashion principles, only a generic description is given to materials, with no evidence of actual wool provenance or supply. However, the natural characteristics of the wools used are prominent features of the design concept, demonstrating something that is intrinsically 'animal' and raw but showing a contemporary edge [Fig 28]. Cultivating a no less distinctive purpose, the aim of this research seeks a more fine craft approach for British wools while acknowledging their material origins.

Image redacted in this digitized version due to potential copyright issues.

Fig 28 Eco Fashion (2012) Eve Anders

Understanding materials permits fluency in seeking challenges within the discipline. Awareness and appreciation of the intrinsic qualities of the wool fibres inspires this investigation into traditional techniques and finishes that may 'add value' and potentially elevate the status of a low grade material. More importantly the investigation offers an opportunity for detailed examination of material through the hand-made process, seeking both shifts in texture and

orientations over process. These combine to invest meaning and value beyond the wool fibres' materiality.

Technical innovation and niche product development

The review looks at technical and industrial research investment in textile related craft methodologies in order to identify potential crossovers with material processing that might be examined in new ways. Through examining materials in completely different contexts and through the eyes of others, a critical perspective enables a more coherent relationship with ones own ambitions and aims.

The review provides a reflection on the sources that have supported my studio research and the cultural geographers that have inspired me seeking to explore the different narratives in current textile design where hi-tech processes juxtapose with fine craftsmanship. Writer and curator Marie O'Mahony defines this 'as a pull between technology and earthiness' (as cited by Hoggard 2000, p.33). It is these distinctions and the versatility of key practitioners in the field that have opened up ideas to develop the properties of the materials I am concerned with in my practice.

The results of the survey of extant formal research in contemporary felt practice and related materials was found to be limited, focusing towards anthropological examination and reference to cultural values and perspectives in specific hand-crafted wool felted textiles. Although helpful in establishing cultural values of traditional felt within an historical context, current knowledge and research into material developments and innovation with wool felt relies on visibility within creative works and specialist publications. Most of my research has been based on practitioner accounts that reveal insights gleaned mostly through personal and specialist knowledge and subsequent accessibility.

In developing the discussion relating to craft approaches supported by industrial processing the review gave a brief examination of nonwoven research using patterning production methods and technologies. The technical distinction that exists between nonwoven materials and felt (also paper) is not relevant to the discussion. What is important is the connection between the fabrication and decorative potential of similar processes and what might emerge to make fresh work of established principles.

The review examines needle punch technology and applications using waste natural fibres. The waste trade uses needle punching to make products with mixed synthetic fibre waste including wool (Simpson and Crawshaw, eds., 2002). Discoveries pertinent to the research aims could be applied to the methodological sampling framework using composite blends and laminated hand processing methods of the research wools.

The Nonwovens Research Group, Centre for Technical Textiles at Leeds University is concerned with nonwoven fabric manufacture and nonwoven materials and technology. One of their major research themes is sustainable industrial materials leading to industrially relevant

outcomes. Approaches for the recycling, reuse and conversion of recovered fibres, including wool, has seen significant progress and success in development stages and product innovation for British wool waste products such as Thermafleece insulation material. The Centres research interests are diverse and extensive research has been undertaken into the engineering of nonwovens for apparel and their use as couture fashion fabrics.

Papers given at the Nonwovens Network first international conference, 2005 addressed a multiple range of applications in nonwovens' markets including fashion. The Woolmark Company speaker spoke of wool's 'old fashioned image' and the need to innovate and diversify. Fashion students from Leeds University School of Design, presented garments from their Nonwoven Project (2005) claiming 'various ground-breaking techniques'. There was little doubting the creative use of non traditional fabrics such as car interiors, cleaning cloths and mattress fillings, sponsored by the nonwovens industry and financial help and professional opportunities from an impressive industry line-up including Alexander McQueen, Paul Smith, Burberry and others.

The Nonwovens Research Group and Nonwovens Network at Leeds University were approached in order to gain knowledge and guidance of industrial processing methods that might be integrated with a 'craft knowledge' and provide a starting point for the practical investigation.[78] Laboratory facilities and technical advice enabled the functions of fibre blending, web formation and needle punch applications to be examined, evaluated and considered in light of the enquiry.

Access to appropriate technologies at Leeds University enabled me to explore industrial applications using sample laboratory scale equipment. Carding, web formation and needle punch technologies were investigated to consolidate the first stage of the practical investigation with British wools. The aim was to seek alternative processing methods in which the structural stability of a fine felt fabric could be made possible with coarse wool types.

The impact and creative potential of industrial nonwovens research has characterised a number of innovative design concepts[79] that have been significant in achieving fabrics with high strength. The textile practice and pioneering research work of Frances Geesin (1995) explores decorative and conceptual stiffening techniques using different methods including an electro deposition process. Her research with nonwovens also investigated patterning effects with simple folding and pleating that were heat set with steam. Geesin's work is a key influence in

78 Leeds University library holds textile specific literature, research papers and theses relating to industrial processing of nonwovens including fibre quality, product development and testing. Relevant to this study is a resource of research material relating to the wool industry, fibre performance and processing, engineering and manufacturing processes.

79 A research led collaboration between science and fashion resulted in Spray-on Fabric (1997), a patented technology developed by Fabrican, a unique, couture in a can concept - the brainchild of PhD student Manel Torres whilst studying at the Royal College of Art and working with Imperial College in London. This innovative spray on fashion technology used waste wool from the spinning process, combining polymer and nonwoven technology.

the direction I took to examine the structural potential of coarse wool types as translucent, paper-like felt fabrics.

The importance of finishing treatments in divesting a textile of its original state has created some of the most innovative and unconventional textiles in synthetics for fashion and interiors.[80] The parallel identities with Nonwovens research for fashion fabrics opened areas of discussion whereby the introduction of stiffeners and binders in the finishing process might offer novel surfaces as well as fabric stability for wool rich fabrics. The application of various shrink proofing processes during the felt process was speculative at this time.[81] Historically, developments within the area of manufacturing nonwovens have been limited due to increased production costs and fabric stiffness. Crawshaw and Russell (2002) suggest that the future of nonwoven fabrics 'will be partly dependent on advancements in patterning opportunities, as well as improved tensile and attritional properties in lighter-weight fabrics (<150g/m2)' (Crawshaw and Russell 2002, pp.308-309). The study of wool resistance to bonding agents such as Vinamul polymer has shown improvements with the stability and drape of very fine webs of wool fibre used in nonwoven technologies. Acknowledging the infancy of such technology at that time, the potential for patterning and surface featuring of felted fabrics to create fine lightweight felt fabrics was considered relevant to this research. The addition of chemical binders to effect changes to the performance quality of waste wool felt was in itself new and potentially pioneering from an industrial perspective. However, harnessing the natural properties of wool during the felt process by using non-chemical methods of resist was far more seductive from a hand craft perspective, imposing a discipline and code of behaviour demanded by a practice-led investigation.

It was by identifying and exploring similar perspectives and definitions in nonwoven research that an evaluation with existing needle punch applications was made. I revisited established technologies in wool-felt production, looking for ways to innovate processing of rare breed wools and discard fibres sourced locally. Traditional hand resist techniques and steam finishing gave the research a new and unexplored direction. Thus, traditional hands on finishing methods, essentially basic and simple technologies, became the focus to transform the fabrics into complex multi layered hand felted surfaces.

Summary

The contextual enquiry has identified methods of practice used by specialists in their field who acknowledge felt's diversity as a material. What is more significant is the lack of focus on the wool types; this highlights gaps in knowledge and approach that this thesis aims to fill. For some

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80 Examples of nonwoven technologies developed for fashion fabrics include: Bartlett and Van der Graaf in collaboration with Boudicca (1998); the couture collections of Miyake (1990s); Baurley (1997) in collaboration with Inoue Pleats Incorporation, Japan.

81 For discussion on polymer treatment read Simpson and Crawshaw eds. (2002 pp.222-224)

practitioners wool is simply the raw material of felt while for others the raw material is paramount; this thesis aims to fill the void between these two extremes with an awareness of British wools.

The literature review has identified current work by practitioners and industry that has shown possibilities of developing new felt materials within a range of visual and tactile qualities for bespoke design applications. The following questions have emerged from the investigations so far:

- What wool types are suitable for creative potential in the surface design of felt?
- What additional treatments may enhance the structural integrity of felt?
- What are the opportunities to manipulate the aesthetic qualities of felt using carding, needle punch, chemical bonding and heat transfer processes?
- How can further processing add aesthetic interest to the wool types?
- What are the properties and qualities of the fabrics produced using these processes in relation to specific end uses?
- What are the challenges and opportunities faced by the designer/maker working within the couture industry?

The literature review has established that, in examining a broad range of felt products and practitioner materials used in current felt production, British wool, although an abundant natural resource, is underused and considered difficult to work with. The enquiry revealed a lively response to British wools within allied craft production, specifically addressing British rare breeds.

The review highlighted the problems and challenges associated with supply, demand and processing of British wool. Initially the survey examined wool quality, including waste from processing of wool in the manufacture of carpets and other large-scale industry. Sheep breeds and wool types in relation to felting potential for high end products were investigated. What emerged from these investigations were issues concerning waste wool and the accumulation of fleeces discarded at source that became a central focus for the study. It was apparent that good quality ‘waste’ wool was difficult to place in an end product that reflected its potential value. The review examined methods and processes of felt production, confirming a growing interest amongst felt craft practitioners for developing new ideas and techniques. However from a material perspective, the review exposed negative aspects contributing to the isolated and marginal use of British wools in hand felt-making. The coarseness of British wools renders the material problematic for hand felt-making and as such use amongst felt makers is marginal. Moreover, the supply of clean, processed fibres of British rare breed wools is isolated and costly. Hand processing, while producing high-quality fibre, is time consuming and expensive. Further, the chief obstacle to a felt maker is in understanding the processing capabilities of these fibres so to produce a high quality felt product. This takes time and resources that are further challenged by the underlying perception of what are considered suitable wools for felt-making.

The review has however identified an increased awareness of British wools for felt-making as shown in hobbyist craft arenas but, despite growing interest with felt hand craft in this area, the use of British rare breed wool remains limited due to the reasons already examined. Inventive use of waste wools for design purposes using nonwoven industrial applications is apparent. The review has identified past and current research relating to hand and industrial methods of felt production, specifically looking at material used. In doing so the direction of the practical research and material-led investigation is brought into focus. There is currently limited interest in British rare breed wools in felt-making and lack of exposure of hand made felt in high end products, a gap in this market exists, which this research aims to fill. What I seek through this material-led investigation are ways to add value to a limited resource and show fine felt craft making in a new light. Slow practice methods are ideally suited to this.

On the one hand a functional outcome for waste wool may project an environmental and sustainable practice that is not necessarily high value but I would suggest focusing on labour intensive, creatively led methods can procure an alternative and equally valuable reality for British waste wools.

In developing and maintaining a viable practice with a sense of an alternative to popular felt practice, that has been and still is fed by the plentiful supply of commercially imported wools, the research seeks a creative and transformative approach with material. Fletcher (2008) suggests the need for 'alternative views of creativity necessary for sustainability' (Fletcher 2008, p.146). Perhaps in doing so a new identity for felt will emerge and help establish a shift towards quality and not quantity.

The review has identified a need and demand for this research in academic, industry and felt-making arenas by demonstrating the lack of interest in felt within the wider textile arena. It highlights elements of practice that marginalize the use of British wools in current felt-making practice. In order to clarify this the Formative Practice chapter focuses on the availability of such wools and gives an evaluation by comparing commercially processed wools with locally sourced fleece wools at various stages of felt production.

The review concludes that based on the survey of existing craft knowledge and current felt practice there is in general limited use of British rare breed wools in felt-making; this limited use points to a poor understanding of the creative potential of British wools for felt-making. This opened hitherto unexplored areas of investigation that could be applied to these wools to add value and in closely examining the research wool selection, ultimately lend these materials a new identity in fine craft felt-making. A new and innovative approach could be explored through rigorous sampling methods, applying traditional processes, techniques and finishes in different ways. The methodological approach to address is discussed in the next chapter.

Chapter 2 – Methodology

'touch precedes, informs and overwhelms language'
Classen C. (2005) p.13

Introduction

My approach is a process of researching through the practice of making felt, this is not just 'making' but a complex physical and intellectual space informed through both intuitive and practised modes of making as well as through objective and subjective processes. This demonstrates how modes and processes might direct the transformative potential of established principles of felt-making in fresh ways and thus address notions such as value, touch and feel associated with felt. Consequently this practice-based research is produced through a framework of active exploration or 'haptic sampling' that has shaped the investigative making. This gives structure and discipline to an iterative process: 'making is conceived to be the driving force behind the research and in certain modes of practice also the creator of ideas' (Sullivan, 2010 p.78). The methods I have adopted are sampling through practice. The motivation is to seek originality through refinement and nourishing tradition.

Perception of felt

This thesis has established that felt embodies an aesthetic of the tactile, low tech, hand made and, perhaps because of this, is viewed as workaday material. On the other hand it is reasonable to suppose that felt and felt-making offers an antidote to the hands off, digital aspects of making. As part of this antidote, felt's contemporary revival is driven by hobbyist craft makers and there is much reliance on technique. However, a craftsman's labour and toil are not measures by which a craft object may be valorised. Koplos (1986) states, 'time and effort are not equivalent to artistic worth; they have to do with labor, (sic) not aesthetics' (Koplos 1986). Therefore, notions of value underpin the purpose of this research. I express value in terms of originality and invention with material and technique. I do not imply a notion of monetary value but investigate ways that material and technique might imbue a new meaning that could enhance the perceived value of hand-made felt.

The focus on felt as a high-end fabric for research purposes offers a goal, driving me to resolve the technicalities that I find so disadvantageous and profoundly limiting within aspects of my professional practice experience with haute couture.[82] It is unrewarding to be unable to fully realise the technical challenges in production terms and translate material innovation, initiated

82 Since 2005 collaborations include Balenciaga, Givenchy and Stella McCartney for haute couture and prêt-à-porter collections.

by hand-led skills, ideas and concepts beyond the sampling and catwalk collection. The overall research methodologies therefore emerge through the need to create innovative solutions for diverse and challenging design briefs for couture collections.

It has occurred to me that using British wool types considered waste products and other wools less valued for felt-making might offer a positive way forward in bespoke design through my practice. The natural characteristics of these wools may enhance the visual perspective of a felt textile and create mood and aesthetic quality where the demand to be functional as well as pleasing to the senses could be established.

The challenge is the difficulty in creating a felt fabric with strength, durability, drape and aesthetic appeal within the economics of time and cost. Both industrial and hand-made concepts seem equally compromised in this way. Searching for suitable methods through which these complexities might be resolved provides a rationale for adopting a 'practitioner-researcher' approach (Robson 2002, p.219). This approach acknowledges the boundaries and creative freedom required to communicate knowledge and provides a conduit between practice and research investigation that is open and complementary. Above all it facilitates a structure and focus for the research process to evolve.

In 2004, a conversation with felt maker Inge Evers, where we discussed her response to paper making and subsequent development of techniques with silk papers to use in her felt work, gave me confidence to revisit the idea I had previously encountered between the interface shared with felt and paper.[83] Fine fabric overlays could be formed by the fusion of hand processed fibres and applying the hand felting technique to facilitate adhesion.

The objectives in realising the aim became evident through material, process and inventive manipulation of surface matter directed through my studio practice. Could the material be given a new identity? Could technique be developed and applied? Could a new visual language be found? To what end and purpose could this be realised? These questions encapsulate the character and aim of the research project.

I sustain the process of tradition through investigating established materials (wool), specifically native British wool types that are not typical felt-making wools because of their poor felting capacity and because they may be considered as waste or by-products of industry. These wools have been chosen in respect of their marginal position in terms of felt-making interest, their economic value in opposition to bespoke, high end use and their provenance in determining exclusivity, value and originality.

It is through investigating established materials and traditional techniques in hand-made felt production and using experimental methods that choices may be made to examine how these might produce value and originality to hand crafted fabric.

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83 See Appendix F

Practical objectives and sampling

In order to examine themes of value and originality using undervalued wool types it will be necessary to identify a number of objectives. This I will do through creating samples using wet and dry felting methods,[84] record and evaluate the samples in order to further select and develop. The results will be demonstrated within an exposition at the time of viva.

In all aspects of my work practice sampling is the necessary outcome through which I communicate my ideas. Sampling may perform a pragmatic starting point to understand new materials, techniques and methods. Sampling is the known language of the business that I work. I receive and give samples to and from clients, for commissions and project development. Without sampling there is no dialogue or progression. Production samples and research samples share a similar intent in that they are similarly motivated towards achieving a heightened visual aesthetic.

The methodological approaches derive from established practices in felt-making[85] but aim to investigate the nuances and parameters associated with the known physical properties of wool in the felting process (Hearle 2002, p.80), This is achieved through hand led methods by which haptic sampling[86] becomes articulated.

Throughout the sampling methodology visual and tactile observations will be recorded and articulated. The hands become the central tools for expression, manipulation and sensing; touch provides a balance for articulating the subjective with the objective.

'At the experiential level, touching provides concrete knowledge of the physical nature of things' (Driscoll 2006, p.1). An awareness of the multi sensory activity is particularly evident in the felt-making process.

The interaction between maker and material may be measured through haptic sampling and the reflective process through which a qualitative analysis offers in ways 'to formulate new questions and levels of interpretation' (Coffey 1996, p.30).

Therefore, this interest is in essence to work in excess of the material, seeking integrities offered by the raw fibres; finding ways in which unique qualities and characteristics of different wool types may emerge as original hand felted fabric.

Exploration will be expressed through a process of qualitative data analysis[87] gained through experience-based techniques, using methods of sampling, in order to identify a range of

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84 See Appendix D

85 Established felt-making practices are based on traditional wet felting and hand rubbing techniques.

86 haptic, hap'tik, adjective, relating to or based on the sense of touch. (haptics) the study of data obtained by means of touch. [Greek haptein, to fasten] (Chambers 2000). I use the term haptic to express tacit knowledge as defined in the process of hand making skills. It is a way in which tactile properties may be valued and articulated through the acquisition of knowledge that is honed by practical experience and intuitive responses.

87 Coffey & Atkinson (1996) present methods of evaluation and analysis for practice-led research.

sensory qualities and characteristics relating to felted wool types. This heuristic approach facilitates a way for me to observe, describe and reflect on the concepts of the physical and material aims of the research process through 'a regular and critical evaluation and analysis of thought and action' (Gray 2004, p.123).

Felt-making is an ambiguous process. By this I mean it is not possible to predict the outcome. Sampling is a way of anticipating the outcome but there is always a spontaneity and uncertainty within the process of making. However, this methodology is a way in which tacit knowledge and past experience may interact with creative thinking. I use it to generate new ideas and concepts, it is a way for me to engage with and make materials familiar.[88] Sampling offers me space to think and expand my thoughts creatively within an analytical framework. As a practitioner 'those processes of reflection are more important ultimately than the precise procedures and representations that are employed' (Coffey 1996, p.30). In relation to my sampling method, these moments of reflection, when gathering the samples together, are key to driving the process forward. The revelations push me towards the next stage of investigation.

Sampling is a way of building knowledge through physical investigation. It is 'the unconscious processing of information through the intimacy of touch' (Montgomery, 2011 p.29). This purposeful and intuitive approach not only defines the parameters of the research field within the practice environment but also provides a valuable body of information and material evidence, from which creative spontaneity and reflective responses may become harnessed, enriched and made accessible.

Before I begin to make a sample, I spend time considering and sensing the materials at their given values, separating out and feeling the dry fibres, recognising their distinctive qualities and the integrity of the materials because it is important to gain an understanding. By allowing connections to form between active and passive states of practice, decisions are formed through being still, through really looking and thinking.

The research methods encompass an evaluation study of six different wool types representing a cross section of British flocks.[89] Location, sustainability and the natural characteristics of each fibre were significant factors in the choices made.

Selection of materials

The choice of wools was determined by the availability of newly sheared wool that offered a good cross section between different breeds of local sheep. Sampling was carried out to explore the commonalities and contrasts of the haptic qualities and characteristics of these wools employed in hand felted and machine methods.

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88 Bang (2011) addresses the emotional value of textiles and their properties through tactile perception to develop a shared vocabulary and enhanced communication for participants in the design process.

89 See Appendix A

In order to identify the techniques and processes most relevant to this investigation, the different methods of producing felt and nonwoven include the following processes:

1. Traditional felting and pressed felts (wet felt): these processes involve the matting of fibres by combining water or steam and friction. The felting capacity is determined by the scale structure of the fibre. This is the most common method used in creating hand-made felt fabrics and also used in industrially produced felts.
2. Needle punched felts (dry felt): a process of entangling fibres mechanically with a needle punch machine. This process is sometimes applied to handmade felts but is more commonly used industrially for combining waste materials such as synthetics with wool in the production of carpet underlay.

Wool fibres may be rubbed together by hand to produce slight matting of the fibres aided by the moisture and natural grease of the hands' surface. This can be helpful when working with design concepts where stabilising the fibres for surface ornamentation prior to wet felting is used. For more refined purposes and the preparation of fibres in greater quantity, needle punch is the process used to describe the mechanical method of dry felting. I use this technology in the preparation of fibres before wet felting.

Needle punch technology offers consistency and speed in preparing the carded webs. The needles tack the webs and condense and compress, making them stable and easier to handle prior to wet felting. This technique is particularly efficient for stabilising fine webs of coarse wool types and laminated carded webs of contrasting wool types. At all stages of the process I am able to employ hand intervention where required, to adjust the material composition without compromising the design perspective of the materials and the outcome.

I use needle punch technology as a way to provide a temporary strength to the carded fibres. In essence this facilitates a scaffold effect and structural integrity to hold the fibres and add a degree of stability to the fragile web prior to fulling. In doing this I am able to explore the parameters of true felting whilst being receptive to the nuances of the fibre characteristic through touch. This method, and others that I explore in the research, ideally place handwork as the key facilitator in the creative process.

Evaluation

In the hand-made process of felt-making there is no certainty of the intended outcome, however experienced one might be. Materials respond differently according to their distinctive properties and the environment in which they are worked. An evaluation such as this is built on experience and tacit knowledge. The skill is in handling the spontaneity of performance through tacit knowledge and trust and is a way of 'thinking' with the eyes and hands in balance with each other.

The paper artist and sculptor, Winifred Lutz, developed innovative approaches with ancient methods of paper making that stemmed 'from the conviction that any material or process should

be used with close attention to its specific nature as this complements the user's thought' (Lutz 1981, p.38). Despite her skill and experience Lutz concedes the processes are unpredictable. The impromptu nature of working with materials and processes in felt-making is described by Anne Belgrave as having 'no foregone conclusion - and at some point the 'thing' almost makes itself' (Hoggard 1998, p.44).

Experimentation through sensual engagement with materials and process engenders unfamiliar results. The emotional response between the senses and materials is the unspoken dialogue or intuitive tool through which makers actively explore and seek information. This has been described as 'possessing an inner technique' (Needleman 1993, p.9). The physical response is both personal and thorough. It is motivated by curiosity and gestures that may be determined, sensitive, iterative, playful, unintentional or unconsciously articulated. The transfer of this information is predicated through an awareness and developed tacit knowledge.

Haptic interpretation - a personal research tool

As a research practitioner, my investigations begin in the studio. Sullivan (2010 p.238) describes the studio as a life-centred profound space for learning and making. In this space I engage with haptic exploration of my practice methods in order to discover and represent anew, concepts in hand felted fabric.

In the same way that Gibson (1996 pp.123-129) explores the notion of active perception using the haptic approach, I use the word haptic to describe an awareness of multi sensory activity that is particularly evident to the felt-making process. Felt is about the fibres and their characteristics and felt-making is a process where fibres are transformed, the outcome depending on their characteristics. The touch of hand is complicit in offering a heightened awareness of material and the potential this can offer. Johnson describes this connection as a path 'towards new forms and new visual vocabularies' (Johnson 1997, p.293). Touch disentangles and undoes the complexities of articulating a maker's intimate knowledge and understanding of materials through verbal explanation.

Sampling creates a tactile awareness of the materials. Haptic understanding provides a way to convey the physicality of process within a comprehensive and accessible framework. It is a way to evaluate sensory reflection, which can be complex and difficult to verbalise.

Sampling is also about the decisions made during the process of making. This cannot be scientific because it is a hand-made process but allows a certain level of scientific rigour to record the nuances of the different materials, through the process of making and evaluating.

Sensory analysis

I begin to work intuitively and yet, it is only when my hands work the fibres and I can feel (with all my senses) the transformations of the loose fibres becoming matted and felted that a rhythm

is established. Driscoll (n.d. p.3) describes this as a cumulative process in which the maker feels engaged and invested, acknowledging that 'touching takes time'. This rhythmic process offers reassurance and builds confidence. Without a sense of rhythm a felt maker is misplaced. Hungarian felt maker Zsofia Marx describes the essential repetitive movements of felt-making as 'a rich language having a thousand synonyms for one concept' (Marx 1998, p.14). Knowing and trusting these intuitive stimuli facilitates a highly significant function in determining the properties and characteristics of the materials used.

At this point I am not concerned as to the outcome, this early stage merely establishes the direction for the samples to come, because there may be several ways of purposing the explorations, thus decisions are made through intuition, tacit knowledge and importantly my clear understanding of the physical properties and characteristics of the materials.

Through working intimately with my materials I am acutely aware and responsive to surfaces and textures through touch, sight, sound and smell. Touch enables me to feel if the wool is greasy, clean, silky, crisp, damp, dry, raw or processed, soft, harsh. I can detect if the wool becomes stretchy, elastic, matted, smooth or is separating and not felting. It is an integral part of the process and valuable in asserting familiarity with the individual characteristics and nuances of the wools, and to make comparisons between the fibres: harsh, soft; smooth, hairy; dark, light and so on. Developing this familiarity with the wools will help distinguish the possibilities that juxtaposing contrasting and similar characteristics might offer.

Touch also helps me to understand the visual impact. Sight enhances this sense and offers a heightened awareness of material but is secondary during the making process. Although sight can arouse the senses, contradictorily sight can also de-sensitise the act of touching by distracting so I often close my eyes when I need to feel the wool under my hands and fingertips. These are the haptic attributes through which perceptual experience is transferred into the making. This sensory information is transparent, unspoken, unwritten, providing the essential connective tissue in the making process.[90]

Through sampling, critical reflective evaluation can be made in the action of making as well as from the finished piece. This programmed aspect to making is at the heart of my working practice, facilitating and enabling my research methods (Gray and Malins 2004, p.22).

Recording

Each stage of sampling is evaluated and recorded using a system of reference cards and tables through which observations are recorded. The haptic responses to material processes open ways to explore the potential of less established wool types for felting. The results tables provide a comprehensive analysis of the sampling process through haptic and sensory

90 See Evers (2001) for an investigation into haptic qualities of felt-making. In 2008, the conference Memory and Touch explored the importance of haptic engagement of the senses (UCA 2008)

reflection. This is important as the tables convey the tactile meaning and physicality of the processes used.

The characteristics and performance qualities of the individual wool types will be revealed when subjected to different methods of fibre preparation before wet felting, further exemplifying the intrinsic qualities and identity of each wool type.

The quality of the finished felt may vary considerably between processed and unprocessed wool fibres. This could be due to inconsistencies in thickness and retention of lanolin in the unprocessed fibres. Processed combed fibres could facilitate a more even and smoother felted surface.

The most significant observation was that the wool types known to be difficult to felt produced in general more interesting surface qualities. This observation is arguably subjective and unlikely to prove of great merit from a technical point of view. However, it addressed the notion that these more robust and resilient wool types deserved greater recognition for design potential.

Summary

The methods I adopt are research through making, working intuitively with an analytical approach. Robson (1993, p.456) describes this process as ongoing, a continual process, marked by stages, having no full stop.

I selected British wools for their distinctive characteristics and used two methods of felt-making: wet and dry. This practical making was combined with evaluative and detailed recording supported by complete photographic evidence presented on the thesis CD.

The collaborative potential of applying traditional techniques with unfamiliar materials highlights new perspectives for this research. Industrial intervention creates an interesting dialogue of equals between technician, machine and maker where authority and creative ownership become challenged. In the same manner, a diminished sense of intimacy and intuitive response with material and technique generated a visual aesthetic associated with the uniformity of machine manufacture. These connotations are engaging and will be discussed in the practice methods (Part 2) in which I juxtapose hand and machine led applications investigated in this research.

These practice methods were applied to the first two areas of research: Formative Practice and Established Practice. Using traditional skills and established notions of felt-making combined with a range of previously underused and undervalued British wools, a vocabulary of distinctive and unique felted surfaces became possible. Surprise outcomes excited further examination for potential inventive surface design and these are described in Developed Practice. Final samples and prototypes will be demonstrated within an exposition at the time of viva.

PART 2

Chapter 3 - Formative Practice

'It is easy to be seduced by a material which offers so many alternatives'

Geesin F. (2003) p.74

Introduction

This chapter describes the sequence of events that shaped the thoughts and ideas suggested through my professional practice and making of couture fabrics, that led to the Established Practice. Discussed here are primary questions, themes and areas for enquiry, as well as outcomes that fostered the possibilities for the material and aesthetic.

The diagram below [Fig 29] shows how one area of research inspired another. Certain areas of this early research were formal and the results are presented in this chapter. Other areas were more exploratory and less formal, driven by curiosity and a spirit of enquiry. For these no results are presented although some information is provided in the Appendices.

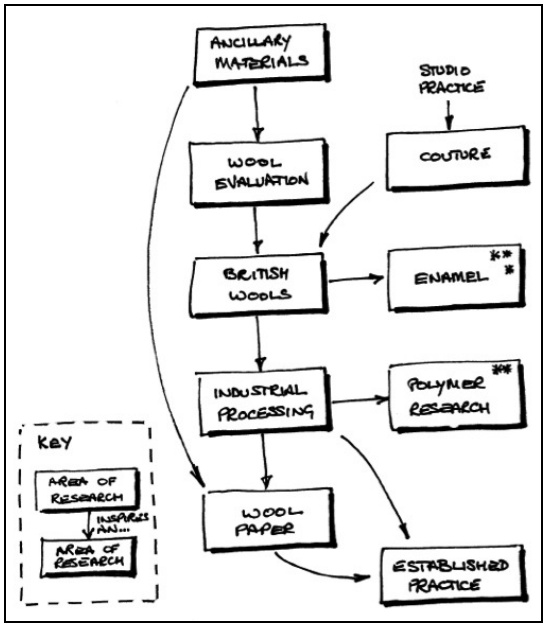

Fig 29 Formative Practice Timeline

** Further information available in Appendix G*

*** Taken no further and forms no part of this thesis*

Ancillary materials

The first area of research employed a broad approach, looking to evaluate the transformative potential of the felted surface through experimentation with familiar processes and techniques incorporating ancillary materials such as peat, flax and even fungi during the wet felting process. These exploratory sampling activities, although rewarding and with creative purpose, lacked a consistency and structure for developing the research aims but provided new ideas from which I could extract thoughts and suggestions for possible further course of action. The diversity and potential openings discovered was too labour intensive to include within the research time frame but merit recording as a basis for further research.[91] Furthermore the ancillary materials had a distracting effect, masking the distinctive characteristics that the different wool types could offer and demanding more attention than the wool itself. I made the decision to focus on the characteristics of wool fibres – without ancillary materials.

Wool evaluation

A sensitivity to the common perceptions of felt and a regard for the provenance of materials was a good starting point from which to explore the versatility of wool felt, testing the potential of the raw material for new creative directions.

The initial investigation began with imported Merino wool, as this is the most widely used wool for felt-making.[92] It seemed imperative that the characteristics of this popular wool were verified. The sampling was by no means exhaustive but gave a clear indication of the visual and textural qualities of this prolific and favoured wool type.

91 Appendix F (Ancillary Materials) contains information to areas examined but not included in the thesis.

92 In an email on 20th August 2012 R. Morsely confirmed that statistical evidence from Europa Wools Ltd. UK shows 70% of total annual sales are for Merino wools 3-4 tons a month. 20% is for British wools and 10% other fibres. Sale of Swaledale is poor approximately 20 kilos a month.

Imported Merino wools

Wet felted samples: using scoured fleece wools and machine carded scoured fleece wools.

Sample Ref. 63 - 68

Sample Ref. 63a - 68a

Aim

To compare the wet felting performance of scoured imported Merino fleece wools before and after machine carding. To seek comparisons of tactile and visual qualities of the felted fabrics and compare micron qualities within the same wool type.

Process

Two wet felted samples of each wool type were made using hand laid fleece wool and machine carded webs.

Observations and sensory reflection

Visual - all samples were similar in tonal quality. Uneven surface and crimp fibres showed in felts using hand laid fleece. Machine carding improved the consistency of fibre conformation, resulting in an even, smooth surface appearance.

Tactile - all samples had a soft, silky feel.

Summary

The performance of the wools varied in the wet felting process. In general the wools felted quickly producing a range of surface qualities from very soft and smooth to crisp. Samples 63 and 64 showed a crimp structure [Fig 30 and Fig 31]. Machine carding improved the texture and smoothness of the felted surface. The exception being the New Zealand lambs wool, Samples 67 and 67a [Fig 34] that was difficult to work due to the shortness of the fibres, which separated during the felt process both before and after machine carding.

Possible improvement might result from blending with finer wools however some fleece wools were difficult to process with machine carding. The different fibre thickness of the wool types (micron count) accounted for subtle differences to the surface qualities of the felted fabrics. However, an overall uniformity in the visual and tactile qualities was apparent throughout.

The purpose of sampling selected imported Merino wools [Fig 30 - Fig 35] was to create a control for comparison with the British wools.

Sample images

Full set of images on CD: Formative Practice – Images – Imported Merino

Fig 30 Sample 63

Fig 31 Sample 64

Fig 32 Sample 65

Fig 33 Sample 66

Fig 34 Sample 67

Fig 35 Sample 68

No.	Title	Materials	Source	Method	Observations	Outcome
63	Imported Merino Wool	Halfbred P3387 28.0 Micron Lambswool, New Zealand	Europa Wools Limited, UK	Hand laid fleece, wet felted	Crisp surface, crimp visible	Good carding and blending potential
63a	Imported Merino Wool	Halfbred P3387 28.0 Micron Lambswool, New Zealand	Europa Wools Limited, UK	Machine carded web, wet felted	Smooth surface	Good carding and blending potential
64	Imported Merino Wool	Merino P3336 20.2 Micron Lambswool, Australia	Europa Wools Limited, UK	Hand laid fleece, wet felted	Soft, uneven surface, crimp visible	Good carding and blending potential
64a	Imported Merino Wool	Merino P3336, 20.2 Micron Lambswool, Australia	Europa Wools Limited, UK	Machine carded web, wet felted	Smooth, soft, even surface	Good carding and blending potential
65	Imported Merino Wool	Merino P3316 21.6 Micron Fleece wool, Australia	Europa Wools Limited, UK	Hand laid fleece, wet felted	Soft, slightly uneven surface. No crimp	Good carding and blending potential
65a	Imported Merino Wool	Merino P3316 21.6 Micron Fleece wool, Australia	Europa Wools Limited, UK	Machine carded web, wet felted	Very soft, even surface	Good carding and blending potential
66	Imported Merino Wool	Merino P3402, 18.2 Micron Broken tops, South African (Cape)	Europa Wools Limited, UK	Hand laid fleece, wet felted	Easy and quick to felt	Excellent results Good felting wool. Carding improves performance for wet felting
66a	Imported Merino Wool	Merino P3402 18.2 Micron Broken tops, South African (Cape)	Europa Wools Limited, UK	Machine carded web, wet felted	Easy and quick to felt	Excellent results Good felting wool. Carding improves performance for wet felting
67	Imported Merino Wool	Quarterbred P3223 25.5 Micron Lambswool, New Zealand	Europa Wools Limited, UK	Hand laid fleece, wet felted	Fibres separate during felting. Patchy surface.	Poor quality felt, possible improvement with blending
67a	Imported Merino Wool	Quarterbred P3223 25.5 Micron Lambswool New Zealand	Europa Wools Limited, UK	Machine carded web, wet felted	Smooth surface but thin patches	Poor quality felt, possible improvement with blending
68	Imported Merino Wool	Native wool P3309 21.4 Micron, South African (Cape)	Europa Wools Limited, UK	Hand laid fleece, wet felted	Uneven surface texture. Visible vegetation contamination	Difficult to felt well. Carding improves performance for wet felting
68a	Imported Merino Wool	Native wool P3309 21.4 Micron, South African (Cape)	Europa Wools Limited, UK	Machine carded web, wet felted	Smooth but patchy surface quality	Difficult to felt well. Carding improves performance for wet felting

Table 1: Imported Merino Sample Results

Couture fabric development

During the formative research my studio practice continued with development and production work for international fashion houses. This involved experimentation of luxury fibres and sampling of hand felted fabric for haute couture collections. The directive was to use blends of silk, cashmere, mohair and Merino wool fibres and to create gossamer, light weight felt fabrics including feathered embellishments. A later haute couture collection included hand felted silk, cashmere, Merino and wool guipure [Fig 36]. The fine quality fibres in the hand-felted fabrics create a sophistication and elegance enhanced by the luxury fibres used.

Fig 36 Coat (detail) (2005) Liz Clay

Notions of quality and sophistication are well developed in hand felted fabrics that use fine Merino wool and other luxury fibres. Alpaca and cashmere fibres were included in the early research investigation as they represented luxury fibres in plentiful supply that could be felted. This is significant, as interest with luxury fibres in handcrafted products has developed during recent years.[93] However, in acknowledging the distinction that luxury fibres such as Merino wools attain in felt-making, the research aim is to achieve a similar sophistication and refinement using British waste wools and to reflect craftsmanship that has an individual, one-off quality that is not necessarily reliant on expensive raw materials.

British wools

In order to establish a comparative model and to consider the use of specific British wools, samples of imported Merino wool were compared against British wool tops, commercially

93 Hand crafted British products using luxury fibres such as cashmere; alpaca and mohair are retailed by John Arbon Textiles. The ethical knitwear brand Izzy Lane (2007) uses wool from rare breed sheep including Wensleydale and Shetland, their website marketing describes these fibres as 'soft as cashmere'. Fashion designer Anya Hindmarch has described this trend, saying 'Made in Britain has cachet again. It's shorthand for a certain kind of luxury' cited by Luu (2012)

scoured fleece wools and raw fleeces. I collected fleeces from local farms and received donations from people keen to find a use for their unwanted wool. My aim was to evaluate differences in hand-felted surfaces between hand-carded and machine processed wool tops.

Wet felted samples: commercially processed wool tops and locally available wool fibres in their raw and unprocessed state.

Sample Ref. 30 - 62

Aim

To compare the felting performance of hand processed wools with commercially processed wool tops for wet felting. To seek comparisons of tactile and visual qualities of the felted fabrics and determine if the natural characteristics of the wool fibres remain visible after wet felting. To compare the outcomes of these with wet felted samples of imported Merino wools.

Process

Tufts of processed wool tops were laid in two layers at ninety degrees before wet felting. The raw fibres were individually hand washed, dried and hand-carded into two layers before wet felting.

Sample images

Full set of images on CD: Formative Practice – Images – British Wools

Fig 37 Sample 54

Fig 38 Sample 56

Fig 39 Sample 61

Fig 40 Sample 47

Fig 41 Sample 36

Fig 42 Sample 33

Observations and sensory reflection

The wool types responded differently within the wet felting process, reflecting the individual physical properties and characteristics of the fibres.

Visual - the felted surfaces of the machine processed tops showed a consistency and regularity of fibre conformation. This was not apparent in the hand-carded samples, which showed

distinctive crimp characteristics and surface irregularities of fibre distribution. This was particularly noted in the Devon and Cornwall Longwool (Sample 54).

Tactile - the felted surfaces of the machine-processed tops were consistently smooth and even. The felted surfaces of the hand-carded fibres varied from soft to coarse and there was evidence of poor texture and uneven surfaces with the Southdown, Swaledale and Manx Loaghton wools (Samples 56, 61 and 47). The same wool types using machine-processed tops produced a robust and even textured felt as in the Swaledale (Sample 36) and Manx Loaghton (Sample 33).

Summary

As expected the wool types performed very differently demonstrating the variety of the individual characteristics of the raw fleece. However, these distinctions became even more contrasted when comparing machine processed and hand-carded samples. Machine processed fibres are smooth and aligned, facilitating an even layout for felting. The hand-carded fibres are less integrated and more difficult to layout evenly.

Comparisons of imported Merino and British wool types were noted between wet felted fleece wools and carded fibres in Samples FP 005 [Fig 43]). The imported Merino wools were consistently fine and soft however not all felted easily but the expectation of good quality felt-making was upheld. Comparisons of felt using British white wools and imported Merino wools demonstrated exceptional contrasts in visual and textural qualities Samples FP 002 [Fig 44] and FP 003 [Fig 45] compared with Samples 63 - 68a [Fig 30 - Fig 35].

The differences in the felted surfaces between the commercially processed and hand prepared wools led to a consideration of the ways that industrial (commercial) applications might be modified for studio-based practice using locally sourced wools.

Fig 43 FP005 - Shetland (SW) and Merino (MW)

Fig 44 FP002 – Comparing British Wools with Merino (last sample)

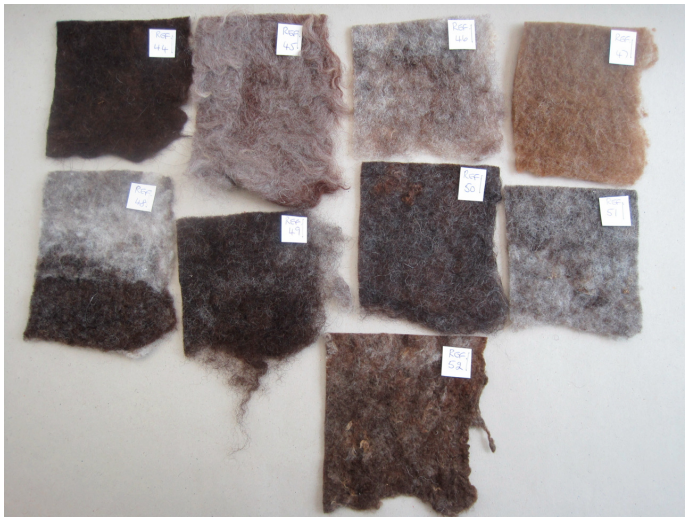

Fig 45 FP003 – British Wools

No.	Title	Materials	Source	Method	Observations	Outcome
30	British wool - processed tops	Massam mid-grey	Wingham Wool Work	Two layers of wool, hand felted with soap and water.	No crimp obvious.	Smooth, crisp felt
31	British wool - processed tops	Shropshire dark grey	Wingham Wool Work	Two layers of wool.Hand felted with soap and water.	Easy to felt.	Good even surface texture and appearance.
32	British wool - processed tops	Bluefaced Leicester grey	Wingham Wool Work	Two layers of wool.Hand felted with soap and water.	Easy to felt.	Smooth, even texture
33	British wool - processed tops	Manx Loaghton	Wingham Wool Work	Two layers of wool.Hand felted with soap and water.	Slow to felt	Retains springy quality.
34	British wool - processed tops	Jacob	Wingham Wool Work	Two layers of wool.Hand felted with soap and water.	Easy to felt.	Good firm texture
35	British wool - processed tops	Silver Swaledale	Wingham Wool Work	Two layers of wool.Hand felted with soap and water.	Hairy fibre.Flecks of dark fibres and white kemp fibres apparent.	Strong, robust textured felt
36	British wool - processed tops	Swaledale	Wingham Wool Work	Two layers of wool.Hand felted with soap and water.	Hairy fibre. Flecks of dark fibres and white kemp fibres apparent.	Strong, robust textured felt
37	British wool - processed tops	Blue Face Leicester white	Wingham Wool Work	Two layers of wool, hand felted with soap and water.	Easy to felt	Smooth, even texture
38	British wool - processed tops	Wensleydale	Wingham Wool Work	Two layers of wool, hand felted with soap and water.	Crimp visible	Smooth, silky felt
39	British wool - processed tops	Cotswold	Wingham Wool Work	Two layers of wool, hand felted with soap and water.	Crimp and long staple is maintained. Slight lustre	Silky, textured felt.
40	British wool - processed tops	Shetland white	Wingham Wool Work	Two layers of wool, hand felted with soap and water.	Easy to felt.	Smooth, soft felt
41	British wool - processed tops	Massam white	Wingham Wool Work	Two layers of wool, hand felted with soap and water.	Slight crimp visible	Smooth, crisp felt
42	British wool - processed tops	Texel	Wingham Wool Work	Two layers of wool, hand felted with soap and water.	Easy to felt.	Dense, even texture
43	Imported - processed tops (as a control fibre)	Merino (Australian)	Wingham Wool Work	Two layers of wool.Hand felted with soap and water.	Very easy to felt.	Soft, even surface
44	British wool - raw fibre	Icelandic (greasy)	Roger Dursdon, Cheddar	Hand carded. Two layers. Hand felted with soap and water.	Hairy fibre.	Firm textured cloth
45	British wool - raw fibre	Alpaca (greasy)	John Arbon, Lynton	Hand felted raw fibre with soap and water.	Fibre difficult to control in felting	Very soft. Lumpy texture.
46	British wool - raw fibre	Bluefaced Leicester(hand washed)	Raw Fibres, Robin Hood's Bay	Hand carded. Hand felted with soap and water.	Easy to felt. Crimp visible on surface.	Good even surface texture and appearance.
47	British wool - raw fibre	Manx Loaghton (hand washed)	Isle of Man Farm	Hand carded, two layers. Hand felted with soap and water.	Difficult to felt. Fibres were springy.	Soft, fragile felt.
48	British wool - raw fibre	Ryeland (greasy)	Kate Elliot, Rooksbridge	Hand washed. Two layers hand carded. Hand felted with soap and water.	Spongy texture.	Poor felting ability lacking density and close texture
49	British wool - raw fibre	Jacob (hand washed)	Donation: Rural Life Museum, Glastonbury	Hand carded. Two layers. Hand felted with soap and water.	Natural colour variations in fleece gave interesting patterns.	Slightly coarse texture.
50	British wool - raw fibre	Black Wensleydale (hand washed)	Raw Fibres, Robin Hood's Bay	Hand carded, two layers. Hand felted with soap and water.	Crimp visible on surface.	Soft, even surface
51	British wool - raw fibre	Shetland(greasy)	Inversnaid Lodge (2003 shearing)	Hand carded, two layers. Hand felted with soap and water.	Easy to felt. Crimp visible on surface.	Smooth, soft felt
52	British wool - raw fibre	Black Merino(greasy)	Falkland Island Shop, Wells	Hand carded. Hand felted with soap and water.	Easy to felt. Crimp visible on surface.	Smooth even felt
53	British wool - raw fibre	Merino(hand washed)	Donation (source unknown)	Hand carded, two layers. Hand felted with soap and water.	Dense texture with crimp visible	Firm smooth felt
54	British wool - raw fibre	Devon and Cornwall Longwool (hand washed)	Green Ore Farm, Mendip Hills	Hand carded, two layers. Hand felted with soap and water.	Crimp visible. Hairy fibre	Firm felt with open structure
55	British wool - raw fibre	Welsh Mule(greasy)	Rob Whitcombe, Shapwick	Hand washed. Two layers. Hand felted with soap and water.	Slow to felt	Thick, dense felt
56	British wool - raw fibre	Southdown(greasy)	Wincanton Farm	Hand carded, two layers. Hand felted with soap and water.	Difficult fibre to felt. Springy, uneven texture.	Poor quality felt
57	British wool - raw fibre	Bowmont (greasy)	Dr Margaret Merchant, The Macaulay Institute	Han washed. Two layers hand carded. Hand felted with soap and water.	Very difficult to felt, fibres separated. Texture similar to cotton wool.	Poor quality felt
58	British wool - raw fibre	White Wensleydale(scoured)	British Wool Marketing Board	Hand carded, two layers. Hand felted with soap and water.	Crimp visible on surface.	Soft, even surface
59	British wool - raw fibre	Blackface Light(scoured)	British Wool Marketing Board (732)	Hand carded, two layers. Hand felted with soap and water.	Coarse fibre	Coarse, even surface
60	British wool - raw fibre	Mule/Cross : Swaledale/Blueface Leicester (BFL)(scoured)	British Wool Marketing Board	Hand carded, two layers. Hand felted with soap and water.	Coarse fibres of Swaledale visble Crimp of BFL visible.	Good firm texture Good blending potential
61	British wool - raw fibre	Swaledale(scoured)	British Wool Marketing Board (709)	Hand carded, two layers. Hand felted with soap and water.	Hairy fibre.	Coarse, even surface
62	British wool - raw fibre	Swaledale (depigmented)	British Wool Marketing Board	Hand carded, two layers. Hand felted with soap and water.	Hairy fibre.	Unattractive marks from depigmenting process. Very coarse textured felt

Table 2: British Wools Sample Results

Industrial processing

Addressing the common perception of felt as a thick, dense fabric I looked to processing methods that could offer ways to re-purpose the materials to produce a fine transparent fabric. Technical support and laboratory testing, that included needle punch technology and carding equipment, at Leeds University, enabled me to investigate industrial sampling techniques as used by industry.

Nonwoven applications and needle punch technology became an area of focus;[94] the parallels with felt's industrial image became very apparent. Felt as an industrial material has sustained interest as a common material for design purposes.[95]

Wool preparation: machine carding and needle punch technology with locally sourced fleeces and scoured wools.

Sample Ref. 69 - 83

Aim

To determine the potential of industrial scale processing methods for custom wool blends. To investigate structural variations in web formation using machine carding and needle punch technology. To seek novel patterning with wool types that might enhance the surface quality of hand felted fabrics.

Process

The laboratory trials followed a prescribed format that was adhered to for each wool type and custom wool blend. The wools were weighed in 50gm amounts and used in single and double amounts for the experiments. The carding machine was set to produce webs at a distribution of 160gm per square metre. The needle punch machine was set at 75 punches per square cm using 40 gauge needles with 10mm penetration. The scoured wools were machine carded and then needle punched twice [Fig 46 – Fig 54].

94 The 5th Nonwovens Network Seminar (2005) 'Expanding the boundaries', organised by the Nonwovens Network at Leeds University highlighted new research developments in design-led nonwovens for niche markets. These included seminars on fashion, aimed at creating added value to nonwoven materials associated with an industrial aesthetic.

95 Research by Kane (2007) explores ways in which nonwoven materials could find a niche in the fashion market.

Sample images

Full set of images on CD: Formative Practice – Images – Industrial Processing

Fig 46 Sample 69

Fig 47 Sample 70

Fig 48 Sample 71

Fig 49 Sample 75

Fig 50 Sample 76

Fig 51 Sample 77

Fig 52 Sample 79

Fig 53 Sample 82

Fig 54 Sample 83

Observations and sensory reflection

Visual - in all samples the fibre distribution was very even and integrated. This was particularly noted in the coarse wool types where coloured and kemp fibres appeared less dominant (Samples 69, 71 and 79). The surfaces were consistently smooth and refined in both carded and needle punched samples. This was particularly noted with the Cheviot (Sample 75) and the Cheviot and Wensleydale blend (Sample 76) and with the Merino (Samples 82 and 83). The Wensleydale (Sample 77) showed a silky lustre. Hand washing failed to remove the vegetation impairing the visual quality.

Tactile - the surfaces of all samples were firm and even, ranging from coarse to very soft. The Swaledale wools were less scratchy than previously tested in Table 2 using the same fibre source. This was most likely due to the refined processing capabilities of the laboratory equipment. (Compare Samples 61 and 62 with Samples 69 and 70)

Summary

The laboratory environment and technical assistance provided rigorous specification and data control. I was able to trial commercially processed fibres and studio prepared fleeces with a degree of flexibility. This gave me an opportunity to consider further potential for customising wool blends and more importantly use established technology in ways that might enhance the handcrafted aesthetic.

The different stages of wool processing, both by hand and using industrial equipment provided key areas for discussion that could be developed within studio practice. Therefore the enquiry became focused on the appearance of selected wool types when subjected to the different stages of processing. Could the characteristics of the wools be altered or enhanced to offer unexpected and novel surface qualities in hand finished felt? These ideas were formative in developing notions of surface patterning in that I was seeking innovation by manipulation of the fibres using their physical and structural felting capacity.

What developed was an appreciation of the diverse qualities of the different wool types that could be available locally and the potential these could offer in added value as an integral process for design practice for hand felted fabrics. As an example of the way in which these ideas were articulated through practice, I collaborated with Edward Green and Company to develop bespoke hand-made slippers using hand felted British wools. These were exclusive designs made to order. Such products offer a sense of uniqueness enhanced by authenticity and provenance.

Networking and responding to research initiatives shown at the Nonwovens conference (Leeds 2005) led me to consider other nonwoven applications with natural materials and ways that wool fibres might be integrated successfully to achieve a fine felted structure. This new focus enabled me to move away from the expectation of a felt fabric as dense and heavy and re-negotiate traditional concepts of felt-making.

No.	Title	Materials	Source	Method	Observations	Outcome
69	Leeds University Laboratory Sampling	Swaledale(scoured) Carded Sample 5d	British Wool Marketing Board	50gm weighed wool. Machine carded (Web) 160gm per sq metre. Needlepunch (NP) 75 punches per sq cm 40 gauge needle(3"+3 barbs) 10 ml penetration. 9a : 2 x 50gm (2xcarded, 2xNP)	Good distribution of fibres	Firm, open fabric
70	Leeds University Laboratory Sampling	Swaledale(scoured) Carded Sample 5b	British Wool Marketing Board	50gm weighed wool. Machine carded (Web) 160gm per sq metre. Needlepunch (NP) 75 punches per sq cm 40 gauge needle(3"+3 barbs) 10 ml penetration. 10a : 2 x 50gm (2xcarded, 2xNP)	Good distribution of fibres with visible kemp	Coarse, even fabric
71	Leeds University Laboratory Sampling	Welsh Mule(scoured) Carded Sample 4a	British Wool Marketing Board	50gm weighed wool. Machine carded (Web) 160gm per sq metre. Needlepunch (NP) 75 punches per sq cm 40 gauge needle(3"+3 barbs) 10 ml penetration. 11a : 2 x 50gm (2xcarded, 2xNP)	Good distribution of fibres with visible kemp	Coarse, even fabric
72	Leeds University Laboratory Sampling	Charollais(hand washed) Carded Sample 3a	Peter Coombes, Chilcompton	50gm weighed wool. Machine carded (Web) 160gm per sq metre. Needlepunch (NP) 75 punches per sq cm 40 gauge needle(3"+3 barbs) 10 ml penetration. 12a : 2 x 50gm (2xcarded, 2xNP)	Dense, close texture with surface kemp fibres visible	Firm, even fabric
73	Leeds University Laboratory Sampling	Cheviot(scoured) Carded Sample 2e	British Wool Marketing Board	50gm weighed wool. Machine carded (Web) 160gm per sq metre. Needlepunch (NP) 75 punches per sq cm 40 gauge needle(3"+3 barbs) 10 ml penetration. 13a : 2 x 50gm (2xcarded, 2xNP)	Good distribution of fibres	Dense but springy cloth.
74	Leeds University Laboratory Sampling	Cheviot(scoured) Carded Sample 2c	British Wool Marketing Board	50gm weighed wool. Machine carded (Web) 160gm per sq metre. Needlepunch (NP) 75 punches per sq cm 40 gauge needle(3"+3 barbs) 10 ml penetration. 14a : 2 x 50gm (2xcarded, 2xNP)	Streaky web	Dense, even cloth
75	Leeds University Laboratory Sampling	Cheviot(scoured) Card Sample 2d	British Wool Marketing Board	50gm weighed wool. Machine carded (Web) 160gm per sq metre. Needlepunch (NP) 75 punches per sq cm 40 gauge needle(3"+3 barbs) 10 ml penetration. 15a : 2 x 50gm (2xcarded, 2xNP)	Good distribution of fibres	Very firm, dense, even fabric
76	Leeds University Laboratory Sampling	Cheviot(scoured) and Wensleydale(hand washed) Card Samples 2d and 1c	British Wool Marketing Board	50gm weighed wool. Machine carded (Web) 160gm per sq metre. Needlepunch (NP) 75 punches per sq cm 40 gauge needle(3"+3 barbs) 10 ml penetration. 16a : 2 x 50gm Cheviot(2d) needlepunched TWICE with 2 x 50gm Wensleydale(1c)	Good distribution of fibres	Laminated: dense, even fabric with silky, lustre to Wensleydale surface. Reversible cloth potential.
77	Leeds University Laboratory Sampling	Wensleydale(hand washed) Card Samples 1c and 1a	Butleigh Farm	50gm weighed wool. Machine carded (Web) 160gm per sq metre. Needlepunch (NP) 75 punches per sq cm 40 gauge needle(3"+3 barbs) 10 ml penetration. 17a : 2 x 50gm (2xNP) 17b : 1 x 50gm (2xNP)	Good distribution of fibres. Visible vegetable matter due to hand washing and processing	a) Smooth, even surface b) Silky,lustre transparent
78	Leeds University Laboratory Sampling	Swaledale/Charollais mix (scoured/hand washed) 25gm each Card Sample 6a	British Wool Marketing Board (Swaledale) Peter Coombes (Charollais)	50gm weighed wool. Machine carded (Web) 160gm per sq metre. Needlepunch (NP) 75 punches per sq cm 40 gauge needle(3"+3 barbs) 10 ml penetration. 18a : 1 x 50gm (2xNP)	Good distribution of fibres	Firm, springy cloth with dense quality
79	Leeds University Laboratory Sampling	Swaledale/Shetland mix (scoured/hand washed) 25gm each Card Sample 7a	British Wool Marketing Board (Swaledale) Rob Whitcombe (Shetland)	50gm weighed wool. Machine carded (Web) 160gm per sq metre. Needlepunch (NP) 75 punches per sq cm 40 gauge needle(3"+3 barbs) 10 ml penetration. 19a : 1 x 50gm(2xNP)	Good distribution of fibres and natural tonal blend	Firm, soft handle
80	Leeds University Laboratory Sampling	Swaledale/Shetland mix (scoured/hand washed) 25gm each and Shetland Card Samples 7b and 8	British Wool Marketing Board (Swaledale) Rob Whitcombe (Shetland)	50gm weighed wool. Machine carded (Web) 160gm per sq metre. Needlepunch (NP) 75 punches per sq cm 40 gauge needle(3"+3 barbs) 10 ml penetration. 20a : 1 x 50gm Swaledale/Shetland mix(7b) needlepunched TWICE with 1 x 50gm Shetland	Good distribution of fibres	Laminated: dense, even with soft handle. Reversible cloth potential.
81	Leeds University Laboratory Sampling	Shetland(hand washed) Carded Sample 8b	Rob Whitcombe, Shapwick	50gm weighed wool. Machine carded (Web) 160gm per sq metre. Needlepunch (NP) 75 punches per sq cm 40 gauge needle(3"+3 barbs) 10 ml penetration. 21a : 1 x 50gm (2xNP each side)	Good distribution of fibres	Soft handle and smooth surfaces.
82	Leeds University Laboratory Sampling	Merino Carded Samples 15/16/17	Leeds University NonWovens Dept.	70gm weighed wool. Machine carded(Web) 22a : Web divided in half 22b : Half web (NP) 22c : Half web (2 x NP each side)	Good distribution of fibres	a) Soft, thick web b) Soft, close texture c) Soft, dense texture with smooth matt surface
83	Leeds University Laboratory Sampling	Merino Carded Samples 18/19/20	Leeds University NonWovens Dept.	50gm weighed wool. Machine carded (Web) 160gm per sq metre. Needlepunch (NP) 75 punches per sq cm 40 gauge needle(3"+3 barbs) 10 ml penetration. 23a : Web divided in half 23b : Half web (NP) 23c : Half web (2 x NP each side)	Good distribution of fibres	a) soft web b) Soft and firm c) soft, fine texture with matt surface

Table 3: Industrial Processing Sample Results

Wool Paper

The similarity between hand-made felt and hand-made paper has been a subject of keen observation within my studio practice and formed the basis of the first area of informal research with ancillary materials. The reference to paper making is apt as the process shares similarities with felt-making in that the physical transformation of the fibres involves chemistry and not just the intervention of hand or mechanical tools as with say, weaving and knitting.

Experimental collaboration with professional hand paper makers Victoria Rabal and Maureen Richardson gave opportunities for informal exchange of ideas with materials and techniques.[96] The results were informative but inconclusive. The fusion of paper pulp and wool felt was initially problematic due to the physical properties of the materials and incompatibility of the materials within the process. What did emerge was the notion that if coarse plant fibres could produce fine quality papers what potential could there be for exploring a similar result with wool fibres alone to produce a felted paper.

I was keen to investigate possible similarities between paper and felt surfaces and probe the visual and tactile aspects of the waste wools to drive the research forward.

In order to expand opportunities for using the more difficult felt-making wools I developed the technique used for silk papermaking[97] but using a starch based solution as a stabilising agent prior to felting.[98] This enabled me to strengthen the pre-felted wool surface and if required, achieve a transparency associated with fine papers. The felts retained the distinctive characteristics of the wool types I was using. This technique I named *Wool Paper* [Fig 55].

96 Early research opened investigative opportunities with plant fibres and felt during the period 2004-2006. Professional hand paper makers Maureen Richardson (UK) and Victoria Rabal (Director of the Cappellades Museum, Capellades, Spain) generously shared their expertise and studio space to discuss and facilitate my research concepts and ideas. See Appendix F (Ancillary Materials)

97 The silk paper technique, developed by Evers, is used as a decorative technique in felt-making (Evers, 1986, 1993).

98 See Appendix D

Image redacted in this digitized version due to potential copyright issues.

Fig 55 Wool Paper (2008) showing fibre preparation and wet felting

I considered ways in which I could apply inventive ideas to the *Wool Paper* fabric by creating embossed effects with laminated wool fibres using carded webs, stiffened carded webs and unprocessed fleece wool prior to wet felting [Fig 56]. These methods became pivotal in establishing a transitional stage of the research and were instrumental in identifying alternative ways of improving the surface integrity and dimensional stability of the wools.

Fig 56 Wool Fold - Wool Paper (2008) Liz Clay

The *Wool Paper* technique contributed to creating a fine and light fabric that could give transparency, structure, architectural character and visual dimension with expectations of paper-like qualities. However, despite being visually appealing there was limited drape and fluidity of movement, the negative association of felt's stiffness and rigidity remained.

I looked for ways that the *Wool Paper* technique could offer strength and drape as a fashion textile.

Key to this thesis; a body of work, developed from the *Wool Paper* ideas, became the impetus to expand the potential of British wools in felted surfaces [Fig 57]. Exhibition opportunities enabled me to consider the potential of scale and subsequent strength of the fabric as transparent paper-like felt within the boundaries of the techniques employed and to elicit public response[99] [Fig 58]. The integrity of the wools and the potential for showing individual fibre characteristics through the techniques used became apparent in these works.

Image redacted in this digitized version due to potential copyright issues.

Fig 57 Wool Paper (2008) Liz Clay

Fig 58 Wool Paper (2011) Liz Clay

99 Selected solo and group exhibitions showing the Wool Papers included: Carpe Diem (2008) The Devon Guild of Craftsmen; Origin (2008) London; The Wool Paper Collection (2008) Lesley Craze Gallery, London; Designer Crafts (2009) Mall Galleries, London; 10 x 1 Series (2009) The Gallery, Bath School of Art & Design; Wool Fold - Wool Paper - The Climate is Changing (2010) Prato Textile Museum, Italy; Gallery SOU (2011) Sendai, Japan.

Issues of sustainability

The resurgence of interest in ecologically friendly materials and the popularity of emerging slow fashion principles[100] have encouraged a significant and sustained response to hand skills and traditional craft practice. Felt is a material that embodies this ethos entirely. At this time, a growing awareness with environmental concerns and the use of natural renewable resources presented the impetus to investigate new applications for waste wool.[101] This was wool that had no value to the farmer and was either burned or dug into the ground after shearing.[102]

There is an increasing awareness of British wools through initiatives creating networks and opportunities for promoting and selling British wools.[103] Issues of sustainability and the use of natural renewable resources are addressed through promoting British origin rather than relying on imported wools, thus encouraging a greater awareness of a raw material that is locally available and in the use of products made in the UK.

I visited farms locally and from the donations of fleeces produced samples of felt to examine the potential the distinctive characteristics of these wools could have for bespoke hand-made felt products. This opened up possibilities for blending unusual wool combinations, which would not be available commercially and so offer exclusivity.[104] Potentially, small batch production and developing a market for particular, niche, one-off, bespoke felt fabrics using supplies of wool from smaller flocks could become viable.

Technical aspects of using such wools became central to the investigation. What processes could be employed and developed from the early research sampling in order to exploit the fibre characteristics with greater creative purpose? I wanted to move away from established fine felted fabrics using Merino wool and other luxury fibres. The challenge for me was in identifying a similar aesthetic that could be achieved with wools insufficiently valued and recognised in hand crafted felt.

The *nuno* technique offered opportunities to develop these ideas but in these fabrics the woven substrate dominates the felted surface. I wanted the integrity of the wool fibres to be the

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100 The touring exhibition Taking Time: Craft and the Slow Revolution (2009-2011) and also Craftspace, a project involving nineteen contemporary makers curated by maker and academic Helen Carnac, focus on the philosophies and values of the Slow Movement.

101 Second Nature UK developed and brought to market a roof insulation product Thermafleece (2001) made from coarse wool waste, mainly Herdwick and Swaledale. Converting waste wool into a resource came as a response to imported wool insulation material and under-utilised British sheep's wool. The coarse British wools had limited use in modern textile industry and so often went to waste. www.thermafleece.com

102 Axe Valley Veterinary Practice, Wells supported my enquiries for fleece types, soliciting introductions with local farmers and shepherds.

103 UK based wool initiatives include Woolfest (2005), Wonderwool (2006), North Pennine Wool Group (2010) and internationally The Campaign for Wool (2010)

104 The Powys All Sheep Conference in Wales (2003) was an opportunity for me to meet producers, processors and users of wool and other sheep by-products. A platform for discussion with a broad set of objectives including questioning consumer perceptions and the potential for establishing a brand image that might add value to wool products.

commanding influence. Could the structure and felting capacity of more difficult British wools be compatible with this aim?

Investigations into novel patterning and finishes

During this period of research with British wools, opportunities arose for me to experience inter-disciplinary methods of craft production, inspired by the current climate of craft aspiration and thinking.[105] The intention being to seek ways in which through collaborative practice initiatives, experimental processes and potential new surfaces and finishing techniques might emerge and be utilised as decorative detail and embellishments for bespoke fabric design and couture fashion fabrics.

As shown in the formative practice timeline [Fig 29] two very different areas of investigation were opened and briefly explored: the studio-based (enamel) and industrial-led (polymer) opportunities were inconclusive at the time but some informal groundwork is presented for future investigation.[106]

Polymer: A spin-off from the investigation into industrial processing methods at Leeds University was suggested, to explore the potential of wool based surfaces with ongoing polymer research.[107] The aim being to seek novel patterning and surface featuring of felted fabrics by combining needle punch technology and curing processes with aqueous based compounds. This process was briefly considered but unsustainable alongside my studio practice and no results are presented.

Enamel: At the time of writing, the Enamel Research Centre at the University of the West of England (UWE) supports both a practical and theoretically oriented group of artists and makers whose diverse interests examine non-traditional approaches to vitreous enamel on metal.[108]

I was interested in combining the enamel process with wool felts, investigating the enamel process, its physicality and potential application with felt fabrics. The methods examined specifically looked for ways that different wool types might retain their individual characteristics within an enamelled surface. Despite being brutally radical as an approach with materials the intuitive encounter afforded an opportunity to challenge the status quo. Reward was measured through the collaborative experience and indirectly the unconscious concern and aesthetic consideration of the individual wool fibres within such a compact environment. This period of estrangement from the traditional felt-making process centred the direction I needed and finally

105 The Pairings Project initiated in 2009 at Manchester Metropolitan University involved 18 cross-disciplinary partnerships in craft, art and design backgrounds.

106 See Appendix G

107 Research of chemical processes for enhanced appearance and performance, including polymer treatments, is discussed in Chapter 1: Literature Review, see: Technical innovation and niche product development

108 Led by Elizabeth Turrell, Senior Research Fellow, Enamel Research Centre, UWE (now closed), whose pioneering work explores enamel's creative potential.

took with the choice of British wools for this project. This work, although formative, is not presented as part of this thesis.

Summary

Throughout this research period, experimental sampling and developed works have been made and emphasise the structure and backbone of this project. Some areas (such as enamel treatment of wool) were beyond the scope of this thesis but others became the focus through which a developed strategy emerged. The actual doing and hands on approach of studio based practice and the manifestation of practical discoveries drove this work forward. It was therefore crucial to sustain a studio practice environment through which the research questions could emerge and be developed.

The focus and comparative gathering of material offered a reprise and chance to recapture the definition and meaning of what felt meant. Juxtaposing notions of a paper aesthetic as new felt and a focus on wool characteristics essentially opened an entry point in developing the research project. The *Wool Paper* concept became a key area of focus in addressing notions of value and originality for hand crafted felt. It was clear that value, in terms of material provenance with British wools, could be sustained and employed within a niche product environment and strengthen the notion of authenticity and uniqueness associated with the hand made. The next chapter reveals how through haptic exploration the research methodology becomes firmly established and a mature process of qualitative data analysis emerges.

Chapter 4 - Established Practice

'The sampler her-self goes quietly about her business, testing out, experimenting, documenting, discovering, reflecting and doing.'[109]

Simonson C. (2005) p.33

Introduction

This chapter articulates the sampling methodology, its purpose and outcomes; the focus on materials (British wools) becomes closely associated with issues of material provenance through which pragmatic methods of practice could be sustained.

The aim is to create awareness for less prominent British wools in felt-making and to seek originality by adding value through creative technique to establish a handmade authenticity. The nature of this enquiry aims to present a sample collection of hand felted fabrics from overlooked sources, that could inspire niche felt products and couture fashion fabrics and create an appreciation of felt beyond its formal known qualities and understood industrial aesthetic as a means to inspire value and originality for hand crafted fabric.

Nancy (1998) opines felting is not an exact technique and as such there are no strict rules, the impetus of this research is to push the boundaries of established materials and techniques and look at ways the differing stages of the felting process with contrasting wools types might re-define the visual objective.

The Wool Paper fabrics made a significant contribution to the formative practice. The simplicity of the technique offered ways that could not only transform the expectation of felt but also capture the essence of the wool characteristic without compromising the structural identity. What followed in the established practice became an in depth exploration of the wool fibres' properties and characteristics by evaluating haptic qualities through production as a means to identify individual qualities so as to seek a new aesthetic in felt.

Developing the research aims and approach

Fundamental to my practice is working with materials using hand techniques to maintain a hand finished aesthetic, the very action of which embodies the skills of contemporary felt makers using traditional and contemporary ways with wool. Through harnessing these knowledges and processes I have been able to develop my own practice through experimentation and inventive

109 Simonson (2005 p.33) extract from 'The Sampler', one of 18 contributing essays published in the exhibition catalogue, "Revealed - Nottingham's contemporary textiles". Simonson writes about Heather Belcher's felt commission for the exhibition 'Reveal' and included in the museum collection.

strategies[110] and in this way the development of materials and innovating techniques for hand-made felt cloth becomes core. My aim is to challenge the use of conventional methods and materials, exploring possible new aesthetics, thus offering further worth to hand crafted felt fabric: therefore, investigating ways in which added value may be given to so called difficult and less popular wool fibres in order to pragmatically demonstrate opportunities for these to be considered in the future of hand felting.

The process of sampling and haptic evaluation of the samples considers the demand to be functional as well as pleasing to the senses, ultimately to show the potential of wool felt as a sophisticated textile.

The analytical approach documents the making process and the results achieved in five stages, shown as individual 'Sets' made up of a body of coherent samples. The observations and reflective analysis of each sample Set evaluates the techniques used; the limitations, the possibilities and a haptic exploration. The aim of each investigation has been to explore opportunities for exploiting fibre characteristics and quality to achieve enhanced tactile and visual aesthetics of hand felted fabrics. This has been conducted through preliminary carding processes, wet and dry felting methods, heat and pressure and applying post felted treatments of surface manipulation through stiffening, pleating and steaming. The objective has been to establish a work method and environment that could be sustained throughout the research and beyond.

In seeking the hand made aesthetic and in direct response to the importation of wool products, I considered the potential that British wool could offer the felt maker in terms of surface design which might add value and innovation for a by-product in some areas of wool production. Through the material evidence of my sampling methods I hoped to find ways in which felt fabric could be re-evaluated in terms of new aesthetics by re-defining the use of materials and integrating technology with the hand made process to seek newness and value.

Sampling methodology

In order to co-ordinate the progress and production of each hand felted sample, according to the research aims and objectives, an overview of the research materials and techniques has been developed through which the reader may be able to ascertain not just the processes through which the samples are made but also a haptic response to the samples in situ. A table of results that provides technical specifications, materials and processes used with a brief explanation to describe the sensory reflections for each sample, accompanies each sample set. A detailed account of these sensory responses is expanded in the main body of text. Physical samples with images support the text and are documented accordingly.

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110 At a midway stage of the research I developed a series of Wool Papers using British waste wools. These were exhibited in Carpe Diem (2008) The Devon Guild of Craftsmen and 10 x 1 Series (2009) Bath Spa University.

The themes of the research approach, method and anticipated priorities may be considered: processes, materials, techniques, treatments and finishes, however, such artificial categorisation of the first principles of felt-making denies the nuances and overlaps that inevitably occur. To assist in the categorisation and to allow the narrative to flow some definitions are required.

I use the term process to define the result of action from the material's perspective: much as one might require a process of sifting flour in a recipe without necessarily describing the best technique. It follows that technique defines the action from the human perspective and for this research explores both wet and dry felting methods.

Technique is used to process materials: the materials discussed are the principal materials in the studio practice - wool - and exclude ancillary materials in the felt-making process such as additional fibres blended with the wool and woven substrates, as used in the nuno technique. By adding hand techniques to established processes of textile production it is hoped to generate novel surface designs. For instance, by selective use of wool types in specific areas to create a characterful variation of surface texture. The choices and control of semi-mechanical processes give hand production its 'unique and special touch' (Robertson, 1961 p.112).

Treatments and finishes are applied both before and after the processing of wool into felt and include stiffening, heat pressing, pleating and steaming. The objective being to explore a combination of soft and hard surfaces in two and three-dimensional structures that might reveal distinctive and original surface qualities of the wool types. The practice methods used in this research are identified in the descriptive narrative which draws attention to closely related studies through the embedded literature review and in the sampling as discussed in Methodology. Through the various methods of making, the unconscious processing of information through the intimacy of touch emerges and thus nuances of the process are compared and evaluated.

The wool selection

To present an idea of how wool types could offer variations in a felted surface, a selection of wools was chosen for experimentation that ranged from fine to coarse types. I engaged with felt-making colleagues whilst considering these choices as from the research I had conducted thus far it was clear that wool from different flocks of the same sheep breed produced very different wool qualities. The common view was that 'It is not really possible to generalise about a breed. Every sheep is unique.'[111] Given that this research focuses on the hand made and the authenticity this might offer in value and originality it was indicative that the uniqueness of the sheep's wool could further establish a notion of exclusivity for the hand crafted fabric.

111 In an email on 19th June 2012 from E. Langley.

In order to limit the scope of the work to manageable proportions the following criteria for wool selection were set:

1. **contrasting fibre characteristics** - to include, fine, soft and harsh
2. **ease of supply** - as close as possible to the studio
3. **wool types not generally used for felting** - including non felting types
4. **natural colour range** - breeds offering both white and coloured fleeces
5. **British wools** - focus on native breeds to strengthen the association with 'home grown'
6. **low value status** - encourage use of wools considered waste or a by-product

The selected sheep breeds[112] for sampling are: North Ronaldsay, Zwartbles, Ryeland, Devon and Cornwall Longwool, Dorset Horn and Swaledale. Shetland and Merino are included as control wools to offer comparison. All are British native breeds except the Zwartbles and Merino.

A North Ronaldsay[113] fleece was donated at an early stage of the research. I chose to include it for the research sampling because of its distinctive dark grey colour and potential as a felted surface. The Zwartbles[114] breed was selected for the colour of its fleece, a rich, dark brown that provided a contrast with the other wool types. Additionally a Zwartbles grey fleece was selected for comparison, to demonstrate how two fleeces from the same flock could present such different visual and tactile qualities. The Ryeland[115] breed has both pure white and coloured fleeces of which each type was selected.

Devon and Cornwall Longwool[116] is classified as lustre wool and its fleece is heavy and cream in colour. The Dorset Horn[117] fleece is pure white. By way of a control I included two sheep breeds that are widely known and used for felt-making: Merino[118] and Shetland.[119] This enabled a comparison to be made against the main wool types selected and for practical purposes as an aid to the mechanics of hand felting.

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112 See Appendix A for sheep breeds, suppliers and for reference codes used in research

113 North Ronaldsay: farmed in scattered locations across the UK, listed rare breed. Not suitable as a commercial breed due to its small size and fibre yield. Its rarity status and attractive qualities will ensure continuity and sustainability for this breed. Fleece donation from Rita Peace (2003)

114 Zwartbles: farmed throughout the UK. Fleeces purchased from Peter Coombes, Chilcompton (2004)

115 Ryeland: farmed throughout the UK. One of the oldest breeds, dating back more than 800 years. Fleeces purchased from Simon Rogers, Shepton Mallet (2012)

116 Devon and Cornwall Longwool: farmed mainly in South West England. Fleeces purchased from Tom Rogers, Shepton Mallet (2012)

117 Dorset Horn: farmed mainly in South West England. Fleece donation from Richard Poole, The British Wool Marketing Board (2010)

118 Merino: sparse locations mainly in the south UK. White and coloured fleeces used for control purposes, having similar qualities to imported Merino wools. Fleeces purchased from Annabelle Spencer, Wells (2004 and 2010)

119 Shetland: farmed widely throughout the UK. This breed produces white and naturally coloured wool in a variety of different shades. White and Fawn were selected for the sampling process and used for control purposes. Fleeces purchased from Rob Whitcomb, Shapwick (2004) and Val Stevenson, Easton (2005)

The Shetland and Merino wools added an expectation of luxury, handle and drape reflecting a possible brand image for marketing purposes. For example, Swaledale, a carpet wool, has the perception of utility. If blended with Shetland or Merino might offer a newness of value or at least novelty value. The same could apply with the other wool blends, although Ryeland perhaps has a romance linked with its heritage. Couture work was considered as a good way to expose the potential of these wools within a luxury market.[120]The research samples integrated with ongoing projects in the studio and I was able to use ideas and concepts of the research with development work for couture collections. The purely exploratory nature of these experiments enabled me to investigate material and process freely whilst maintaining a degree of formality in collecting data and recording outcomes. In order to sustain the supply of wool for the studio sampling process and the exposition outcome two comparable sheep breeds were selected; Greyface Dartmoor[121] (for DLW) and Poll Dorset[122] (for DH).

Wool supply

Given there are over 60 native breeds of sheep in Britain and many breeds share similar characteristics, the final selection was made to represent wool types from each of the main categories according to wool properties.[123] In addition the selection criteria required accessibility to the studio, minority use from the felt-making perspective and the overarching aim was that the wools were of British origin; bred and farmed in Britain but not restricted to native British breeds. These encounters mostly relied on availability and accessibility dependent on word of mouth and local knowledge. And out of these visits transpired the generous donations of fleeces, allowing me to make studio samples in order to experience working with unprocessed fibres and to gain a greater understanding of working with the raw material in its virgin state.

Where possible, I collected wool from farms close to my studio. This was for ease of supply, allowing selective choice of particular fleeces from an individual flock; secondary to this was to survey how much suitable material could be sourced locally. The Swaledale[124] was the exception. This wool was chosen specifically because of its poor felting quality and also because it is in plentiful supply, and therefore a sustainable material.

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120 Ongoing professional practice offered two notable commissions for developing the research aims and use of British wools: bespoke hand felted fabrics for hand made slippers from Edward Green and Co., Northampton (2010); hand felted wool wrap, a commissioned gift from British Wool Marketing Board (2012)

121 Greyface Dartmoor: farmed mostly in South West England, listed rare breed. Similar fleece characteristics to the Devon and Cornwall Longwool. Fleeces purchased from Lou Kirk, Tiverton (2012)

122 Poll Dorset: farmed mainly in South West England. Closely related to the Dorset Horn. Poll refers to the sheep having no horns. Fleeces donated by Di and Mike Malcolm, Westbury-sub-Mendip (2012)

123 See Appendix B and C

124 Swaledale: farmed across Northern England. A mainstream, commercial breed and its wool is used for carpets, underlay, roof insulation and mattresses. The Swaledale used for this research is from known sources. Fleece donations from Richard Poole, British Wool Marketing Board (2004 and 2012)

For this practice research the provenance of the wool is important in order to establish an exclusivity that might add value and credibility to the raw material. Acknowledging the connection with the hand-made 'affirms a legitimacy for physical contact with the chosen materials which suggest and inspire' (Geesin 1995, p.25) providing a contextual link to the origins and history of felt craft and in seeking authenticity as a potential luxury product.

A personal aim is to employ ways in which an uninterrupted chain of personal involvement from fibre source to end product might perhaps highlight potential marketing opportunities to raise the profile of a breed in terms of its wool and product end use.

Processing difficulties

There are difficulties in maintaining the concept of locally produced. Ideally a fleece obtained locally may be washed and processed in the studio but this may not be sustainable for several reasons. Hand washing does not always thoroughly remove the lanolin content, which makes it difficult to process the fibres mechanically. The card cloth becomes sticky with lanolin, preventing the wool from being combed smoothly. In addition, some fleeces are difficult to process without the correct equipment configuration. This is especially significant when processing lustre wools and also fine Merino type wools due to the staple lengths and fibre characteristics.

Small-scale fleece processors are hard to find and not all will accept individual fleeces. Sometimes the fleeces are processed with other similar wool types, thus compromising the integrity of the materials (fleece). All fleeces for this research have been processed individually. Ultimately, the effort involved in hand processing was not inconsiderable and consequently I took fleeces to be processed at small independent mini mills, thus compromising the notion of 'local'. However, I have not compromised the integrity of the wool as all fleeces are washed and carded individually and with utmost care in the process. For final stages of the research sampling, the raw fleeces were processed in Yorkshire.[125] The carded wool is returned incomparable to any commercially retailed wool that might be available of the same type; this is very noticeable in the hand felting process. The wools have a vibrancy and softer quality whereas similar wool types that have undergone industrial scouring may be dry and harsh. This is because a combination of high water temperature to remove dirt and the de-pigmentation[126] process may damage the outer scale structure of the fibres. Damage to the fibre structure reduces the felting ability of the wool.[127]

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125 The small scale fleece processing facility that I used for the exhibition prototypes is in Yorkshire: The Halifax Spinning Company

126 De-pigmentation is the industrial process for removal of natural pigments of the fibres to obtain a lighter shade.

127 See Appendix B

The sample sets

A comparative framework of sampling was established to identify the characteristics of the selected wool types against established felt-making wools that included Merino and Shetland wools. The sample sets were conducted in separate stages that examined established wet and dry felting techniques. Two dimensional and three-dimensional surfaces were compared for each of the wool types using each technique. Further examination of soft and hard felted surfaces was compared by the addition of a stiffening treatment and by heat pressing.

Stage 1

- Set AA - Wet felted samples: hand scoured fleece wool
- Set AB - Wet felted samples: hand scoured and hand-carded wool

Stage 2

- Set D - Dry felted samples: needle punched
- Set DD - Dry felted samples: needle punched and heat pressed
- Set CC - Dry felted samples: laminated, heat pressed and stiffened
- Set AC - Wet felted samples: white wools machine scoured and heat pressed

Stage 3

- Set A - Wet felted samples: investigating three-dimensional surfaces with pleating
- Set B - Dry felted samples: investigating three-dimensional surfaces with pleating
- Set C - Dry felted samples: investigating three-dimensional needle punched, heat pressed and stiffened surfaces with pleating
- Set E - Wet felted samples: investigating three-dimensional needle punched, heat pressed and laminated surfaces with pleating

Stage 4 and Stage 5 sampling will be discussed in Chapter 5. Bespoke wool blends and finishing applications are developed into sample prototypes and the final fabric collection for exposition.

Stage 1

Set AA - Wet felted samples: hand scoured fleece wool

Sample Ref. 120 - 132

Aim

To test the wet felted performance of the wools in their raw and unprocessed state and seek tactile and visual qualities of the felted fabrics. To see if the natural characteristics of the wool fibres[128] remained visible after wet felting and to determine what dominant features might be apparent in the felted surface.

Process

All wools were individually hand washed [Fig 59] and wet felted [Fig 60]. The fleeces were teased open gently to ensure a good distribution of fibres across the surface area to be felted and to avoid disturbing the natural fibre characteristics by excessive separation. Extra care was required with both Devon and Cornwall Longwool and Greyface Dartmoor wools due to the thick, long wool staple, Samples 126 [Fig 61] and Sample 132 [Fig 62]. The wool types responded differently to wet felting, reflecting the individual physical properties and characteristics of the fibres.

Sample images

Full set of images on CD: Established Practice – Images – Set AA

Fig 59 Hand washed Devon & Cornwall Longwool

Fig 60 Wet felting Devon & Cornwall Longwool

128 See Appendix C

Fig 61 Sample 126 (DLW)

Fig 62 Sample 132 (GFD)

Observations and sensory reflection

Visual - perhaps the most striking impression from the samples was the variety of tonal qualities both in the white and coloured wool types. The white wools ranged from snowy white, white, white with grey flecks and kemp fibres to various shades of cream. The coloured wools ranged from light, medium, dark to very dark shades of greys and browns. The fibre structure of the two lustre wools was clearly defined in Samples 126 and 132 [Fig 61 and Fig 62]. The shorter staple wools showed a matt surface and evidence of crimp. This was particularly noted in the Shetland and Merino wools. (Samples 124, 125, 130 and 131) The North Ronaldsay was particularly striking with longer coarse fibres not fully integrated and loose, Sample 120 [Fig 63].

Fig 63 Sample 120 (NR)

Not all wools performed well in the felting process. The Ryeland, Dorset Horn and Swaledale fleeces were particularly problematic and difficult to felt well due to the poor elasticity of the fibres. The felted surfaces of the Ryeland wools were particularly uneven and fragile. (Samples 122 and 123)

Tactile - the weight, handle and feel varied, as did the consistency of the felted surface. The wools showed differences ranging from very soft to coarse. The textures of the Ryeland and Dorset Horn felts were crisp, uneven and very fragile. (Samples 128 and 129) The Swaledale was firm and scratchy. (Sample128)

Summary

As expected the wool types performed very differently demonstrating the variety of the individual characteristics of the raw fleece. All wool types were noted for their decorative potential due to the distinctive fibre characteristics evident in the felted surface. This decorative element could be lost during the carding process (See Set AB). The overall appearance of the felted samples gave a rustic look that captured the materials' individuality.

Sample Reference	Set	Wool	Scoured (Sc)	Blend/ Laminated	Carding	Wet felt (Wf)	Heat Press (Hp)			Needle Punch (Np)				Stiffen (Sf)	Pleating (Pl)				Sensory reflection of samples
		Type	Hand/ Machine	50/50 (Lm)	Form		Temp (degC)	Dwell (secs)	Presses	Needles Gauge	Needles Inch	Needles Barbs	Penetration		Temp (degC)	Steam (mins)	Pattern	Method	
120	AA	NR	Hand	-	Fleece	yes	-	-	-	-	-	-	-	-	-	-	-	-	Coarse, dense and hairy, dark grey and brown mix
121	AA	ZB	Hand	-	Fleece	yes	-	-	-	-	-	-	-	-	-	-	-	-	Smooth, firm texture, dark brown with caramel patches
122	AA	RB	Hand	-	Fleece	yes	-	-	-	-	-	-	-	-	-	-	-	-	Soft, spongy texture, dark to medium brown and grey
123	AA	RG	Hand	-	Fleece	yes	-	-	-	-	-	-	-	-	-	-	-	-	Crisp, spongy, stretchy, dark to light brown and grey
124	AA	SF	Hand	-	Fleece	yes	-	-	-	-	-	-	-	-	-	-	-	-	Soft, smooth, light brown
125	AA	SW	Hand	-	Fleece	yes	-	-	-	-	-	-	-	-	-	-	-	-	Soft, silky feel, crimp surface, white
126	AA	DLW	Hand	-	Fleece	yes	-	-	-	-	-	-	-	-	-	-	-	-	Soft, hairy, undulating very loose, open surface, visible locks, slight sheen, cream
127	AA	RW	Hand	-	Fleece	yes	-	-	-	-	-	-	-	-	-	-	-	-	Crisp, spongy and very unstable, white
128	AA	S	Hand	-	Fleece	yes	-	-	-	-	-	-	-	-	-	-	-	-	Coarse, white grey, flecked with dark and white kemp fibres
129	AA	DH	Hand	-	Fleece	yes	-	-	-	-	-	-	-	-	-	-	-	-	Very spongy, stretchy, patchy uneven surface, white
130	AA	MW	Hand	-	Fleece	yes	-	-	-	-	-	-	-	-	-	-	-	-	Very soft, smooth, dense surface, visible crimp, white
131	AA	MB	Hand	-	Fleece	yes	-	-	-	-	-	-	-	-	-	-	-	-	Very smooth, silky, compact surface, visible crimp, mixed browns
132	AA	GFD	Hand	-	Fleece	yes	-	-	-	-	-	-	-	-	-	-	-	-	Firm, smooth, undulating open surface, visible locks, creamy

Table 4: Sample results for Set AA

Set AB - Wet felted samples: hand scoured and hand-carded wool

Sample Ref. 133 - 146 (no heat press)

Sample Ref. 133a - 146a (heat pressed)

Aim

To test the wet felted performance of the wools after hand washing and hand carding [Fig 64 and Fig 65] and seek tactile and visual qualities of the felted fabrics. To seek comparison with Set AA. To see if the natural characteristics of the wool fibres remained visible after wet felting when undergoing a different processing method. To examine differences in surface qualities that might occur after heat pressing by preparing two sample sets for comparison.

Fig 64 Hand washed fleece – Ryeland (RW)

Fig 65 Hand carding RW

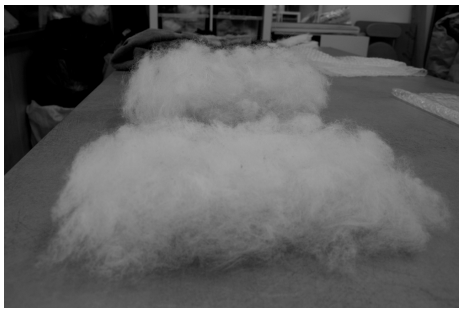

Fig 66 Carded batts of RW

Process

All wools were individually hand washed, hand-carded into batts and wet felted. The hand-carded batts were hand-layered 20cm deep before wet felting [Fig 66]. Hand carding gave an overall consistency to each wool type that facilitated the wet felting process. The white wools were heat pressed at a lower temperature and shorter dwell time to avoid scorching and potential discolouration of the fibres.

Sample images

Full set of images on CD: Established Practice – Images – Set AB

Observations and sensory reflection

Visual - the overall impression was of uniformity in colour and texture within each wool type, facilitated by the carding process that separates and disentangles the wool fibres. The coloured wools showed subtle tonal qualities indicating the distinctive characteristics of each fleece type. The white wools showed less colour variation and a variety of surface qualities ranging from matt to very textured. The Swaledale, Devon and Cornwall Longwool and Greyface Dartmoor felts were noted for their distinctive surface qualities, revealing the fibre characteristics in Samples 140, 142 and 146.

The heat pressed samples (Samples 133a - 146a) were noticeably smoother, appearing more sleek and refined.

Tactile - the weight, handle and feel of the felted fabric was consistent within the coloured wools and less so with the white wools. The white wools had distinctive qualities ranging from very soft to coarse emphasizing the inherent properties of the fibres more clearly than with the coloured wools.

Heat pressing enhanced the felted surface by giving a soft handle and sense of drape. This was more evident in the coloured wool samples. However the feel of all wool types was improved, imparting a smoothness and enhanced sense of refinement.

Summary

As a result of the carding process all coloured and white wools displayed uniformity in surface texture and tonal quality compared with Set AA. Overall the individual fibre characteristics are less visible.

The coloured samples showed uniformity of texture whereas the white wools retained their individuality. In particular the Devon and Cornwall Longwool and Greyface Dartmoor felts displayed irregular, undulating surface qualities and visible locks. (Samples 140 and 146) The Swaledale showed distinctive kemp fibres (Sample 142) and the Merino showed a compact rippled surface. (Sample 144)

The white wools showed a variety of distinctive visual and tactile characteristics that could be exploited through blending of different wools in the carding process.

Sample Reference	Set	Wool	Scoured (Sc)	Blend/ Laminated	Carding	Wet felt (Wf)	Heat Press (Hp)			Needle Punch (Np)				Stiffen (Sf)	Pleating (Pl)				Sensory reflection of samples
		Type	Hand/ Machine	50/50 (Lm)	Form		Temp (degC)	Dwell (secs)	Presses	Needles Gauge	Needles Inch	Barbs	Penetration		Temp (degC)	Steam (mins)	Pattern	Method	
133	AB	NR	Hand	-	Batt	yes	-	-	-	-	-	-	-	-	-	-	-	-	Coarse even surface, dark grey flecked
134	AB	ZB	Hand	-	Batt	yes	-	-	-	-	-	-	-	-	-	-	-	-	Smooth, firm, dark brown
135	AB	ZG	Hand	-	Batt	yes	-	-	-	-	-	-	-	-	-	-	-	-	Scratchy, springy, grey
136	AB	RB	Hand	-	Batt	yes	-	-	-	-	-	-	-	-	-	-	-	-	Soft, smooth, medium flecked brown
137	AB	RG	Hand	-	Batt	yes	-	-	-	-	-	-	-	-	-	-	-	-	Soft, firm, light grey
138	AB	SF	Hand	-	Batt	yes	-	-	-	-	-	-	-	-	-	-	-	-	Soft, smooth, light brown
139	AB	MB	Hand	-	Batt	yes	-	-	-	-	-	-	-	-	-	-	-	-	Very smooth, soft, compact surface, matt brown
140	AB	DLW	Hand	-	Batt	yes	-	-	-	-	-	-	-	-	-	-	-	-	Soft, hairy, open texture, undulating surface, visible locks, cream
141	AB	RW	Hand	-	Batt	yes	-	-	-	-	-	-	-	-	-	-	-	-	Crisp, spongy, white
142	AB	S	Hand	-	Batt	yes	-	-	-	-	-	-	-	-	-	-	-	-	Coarse, rough, white grey, flecked with dark and white kemp fibres
143	AB	DH	Hand	-	Batt	yes	-	-	-	-	-	-	-	-	-	-	-	-	Crisp, firm, white
144	AB	MW	Hand	-	Batt	yes	-	-	-	-	-	-	-	-	-	-	-	-	Soft, silky feel, compact, rippled surface, white
145	AB	SW	Hand	-	Batt	yes	-	-	-	-	-	-	-	-	-	-	-	-	Soft, silky feel, white
146	AB	GFD	Hand	-	Batt	yes	-	-	-	-	-	-	-	-	-	-	-	-	Firm, smooth, visible fibre web like structure, cream
133a	AB	NR	Hand	-	Batt	yes	200	20	2										Crisp, smooth surface, dark grey flecked
134a	AB	ZB	Hand	-	Batt	yes	200	20	2										Soft, smooth surface, dark brown
135a	AB	ZG	Hand	-	Batt	yes	200	20	2										Crisp, smooth surface, grey
136a	AB	RB	Hand	-	Batt	yes	200	20	2										Very soft, smooth, medium flecked brown
137a	AB	RG	Hand	-	Batt	yes	200	20	2										Soft and smooth, light grey
138a	AB	SF	Hand	-	Batt	yes	200	20	2										Very soft, smooth, light brown
139a	AB	MB	Hand	-	Batt	yes	200	20	2										Very smooth, soft and slightly silky, compact surface, matt brown
140a	AB	DLW	Hand	-	Batt	yes	150	10	1										Soft, hairy, firm texture, undulating surface, visible locks, cream
141a	AB	RW	Hand	-	Batt	yes	150	10	1										Crisp, smooth, white
142a	AB	S	Hand	-	Batt	yes	150	10	1										Coarse, firm, white grey, flecked with dark and white kemp fibres
143a	AB	DH	Hand	-	Batt	yes	150	10	1										Crisp, smooth, white
144a	AB	MW	Hand	-	Batt	yes	150	10	1										Soft, silky feel, compact, smooth slightly rippled surface, white
145a	AB	SW	Hand	-	Batt	yes	150	10	1										Soft, silky feel, white
146a	AB	GFD	Hand	-	Batt	yes	150	10	1										Firm, smooth, visible fibre web like structure, cream

Table 5: Sample results for Set AB

Stage 2

Set D - Dry felted samples: needle punched

Sample Ref. 316 - 343

Aim

To test the dry felting performance of the coloured wools after machine processing (carding) and to seek tactile and visual qualities of the felted fabrics as single wool types and as integrated surfaces by needle punching with other wool types. The wools were divided into individual groups for comparison. To seek a range of visual and tactile qualities that could become evident through laminating and needle punching the different wool types. To compare the dry needle process with the wet felted process used in sample Set AB.

Process

All wools were individually machine washed and carded into batts [Fig 67 and 68]. The batts of each wool type were separated into 10cm deep webs and needle punched to form a single felted layer (Samples 63 & 64). Two layers of different wool types were laminated by needle punching [Fig 69 and Fig 70]

Fig 67 Machine carded batts of British wools

Fig 68 Carding machine showing web formation

Fig 69 Needle punch machine with carded web of Zwartbles (ZB)

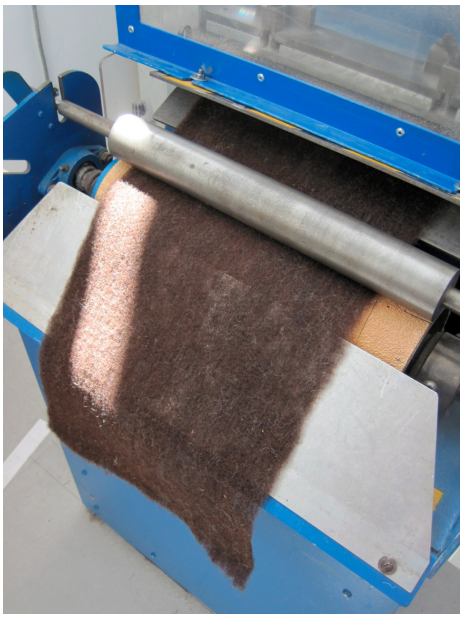

Fig 70 Needle punched web of Zwartbles (ZB)

Sample images

Full set of images on CD: Established Practice – Images – Set D

Fig 71 Sample 324

Fig 72 Sample 327

Fig 73 Sample 328

Fig 74 Sample 341

Observations and sensory reflection

Visual - all laminated samples showed a two-tone effect [Fig 71 – Fig 74]. The distinct fibre characteristics of each wool type were evident. No entanglement of fibres was apparent on either surface. However evidence of needle marks showed on the lighter coloured wool surfaces. (Samples 321, 322, 327, 328, 333, 336, 337, 339 and 340)

Tactile - the weight, handle and feel varied between the wool types and the laminated groups. The felt showed differences ranging from very soft to coarse, reflecting the individual properties of the fibres. There was a noticeably firm and compact quality to all the samples. The coarse wools were particularly scratchy but showed no apparent fragility in structure as with similar wool types in Set AA.

Summary

The felt samples showed an overall uniformity in surface quality and structural consistency that suggested a machine made aesthetic. However, the regularity and smoothness gave a sense of refinement compared with the unprocessed samples of Set AA. The machine carding process gave an improved consistency to the layout process before felting. This was noted in both needle felted and wet felted sampling.

This method was taken forward into the next stage of the sampling process in Set DD and included white wools.

Sample Reference	Set	Wool	Scoured (Sc)	Blend/ Laminated	Carding	Wet felt (Wf)	Heat Press (Hp)			Needle Punch (Np)				Stiffen (Sf)	Pleating (Pl)				Sensory reflection of samples
		Type	Hand/ Machine	50/50 (Lm)	Form		Temp (degC)	Dwell (secs)	Presses	Needles Gauge	Needles Inch	Needles Barbs	Penetration		Temp (degC)	Steam (mins)	Pattern	Method	
316	D	NR	Machine	-	Batt	-	-	-	-	40	3	3	10	-					Coarse; dark grey flecked; springy
317	D	NR ZB	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: coarse/crisp; dark grey flecked/dark brown; springy
318	D	NR ZG	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: coarse/scratchy; dark grey flecked/grey; springy and wiry
319	D	NR RB	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: coarse/soft; dark grey flecked/mid brown; firm and springy
320	D	NR RG	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: coarse/soft; dark grey flecked/light brown; firm and springy, Np marks
321	D	NR SF	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: coarse/soft; dark grey flecked/light brown; firm, Np marks
322	D	NR SW	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: coarse/very soft; dark grey flecked/cream; firm, Np marks
323	D	ZB	Machine	-	Batt	-	-	-	-	40	3	3	10	-					Medium soft; dark brown; firm
324	D	ZB ZG	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: medium soft/coarse; dark brown/grey; springy and wiry
325	D	ZB RB	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: medium soft/coarse; dark brown/medium brown; firm
326	D	ZB RG	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: medium soft/coarse; dark brown/light grey; springy
327	D	ZB SF	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: medium soft/soft; dark brown/light brown; firm and compact, Np marks
328	D	ZB SW	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: medium soft/very soft; dark brown/cream; firm and soft, Np marks
329	D	ZG	Machine	-	Batt	-	-	-	-	40	3	3	10	-					Scratchy, grey, springy
330	D	ZG RB	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: scratchy/soft; grey/medium brown; firm and springy
331	D	ZG RG	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: scratchy/soft; grey/light grey; firm and springy
332	D	ZG SF	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: scratchy/soft; grey/light brown; firm and compact, Np marks
333	D	ZG SW	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: scratchy/ very soft; grey/cream; firm and soft, Np marks
334	D	RB	Machine	-	Batt	-	-	-	-	40	3	3	10	-					Medium soft, medium brown, firm
335	D	RB RG	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: medium soft; medium brown/light grey; firm and compact
336	D	RB SF	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: medium soft; medium brown/light brown; firm and soft, Np marks
337	D	RB SW	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: medium soft/very soft; medium brown/cream; firm and soft, Np marks
338	D	RG	Machine	-	Batt	-	-	-	-	40	3	3	10	-					Medium soft, grey, stretchy
339	D	RG SF	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: medium soft/soft; grey/light brown; soft and compact, Np marks
340	D	RG SW	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: medium soft/very soft; grey/cream; firm and soft, Np marks
341	D	SF	Machine	-	Batt	-	-	-	-	40	3	3	10	-					Soft, light brown, firm and compact
342	D	SW	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Very soft, cream, firm and compact
343	D	SF SW	Machine	Lm	Batt	-	-	-	-	40	3	3	10	-					Double sided: soft; light brown/cream; soft and compact

Table 6: Sample results for Set D

Set DD - Dry felted samples: needle punched and heat pressed

Sample Ref. 344 - 399

Aim

To test the dry felting performance of both coloured and white wools after machine processing (carding) and to seek tactile and visual qualities of the felted fabrics as single wool types and as integrated surfaces by needle punching with other wool types in groups. The wools were divided into individual groups for comparison. Comparisons were made within each group to seek a range of visual and tactile qualities that could become evident through laminating and needle punching the different wool types. To compare the dry needle process with the wet felted process used in sample Set AB. To examine differences in surface qualities that might occur after heat pressing and to compare these with Sets AB and D.

Process

All wools were individually machine washed and carded into batts. The batts of each wool type were separated into 10cm deep webs and needle punched to form a single felted layer. Two layers of different wool types were then laminated by needle punching.

As in Set AB the white wool samples were heat pressed at a lower temperature and shorter dwell time to avoid scorch marks.

Sample images

Full set of images on CD: Established Practice – Images – Set DD

Observations and sensory reflection

Visual - all laminated samples showed a two-tone effect. The distinct fibre characteristic of each wool type was evident. No entanglement of fibres was apparent on either surface. However evidence of needle marks showed on the lighter coloured wool surfaces and especially where white wools were laminated with coloured wools.

Tactile - the weight, handle and feel varied between the wool types but smoothness was consistent across all samples. The wools showed differences ranging from very soft to coarse, reflecting the individual properties of the fibres. There was a noticeably firm but flexible quality to the samples. It was noted that the tactile quality of each sample was enhanced, feeling softer and more pliable than identical samples in Set D. This was most likely because of the polishing effect produced by the pressure and temperature of the heated plates of the heat press machine and subsequent consolidation and compression of the wool fibres.

Summary

The felt samples showed an overall uniformity and subtlety and a sense of quality and sophistication in the felted surface. This was also noted

The felt samples showed an overall uniformity in surface quality and structural consistency that suggested a machine made aesthetic. However, the regularity and smoothness gave a sense of refinement further enhanced by the heat press process. The machine carding process gave an improved consistency to the layout process before felting. This was noted in both dry felted and wet felted sampling. Compared with Set AB the dry felted samples of Set D and Set DD had a lightness and less stable quality although the laminated samples had improved structure as a result of fibre integration with the needle punch process.

This method was taken forward into the next stage of the sampling process in Set CC.

From this stage of the research onwards, it was decided that all further samples would be heat pressed. This process has consistently shown improvement to the felted surfaces of all the wool types, imparting smoothness and accordingly a sense of refinement. This is evident in both dry and wet felted samples. The success of the samples proved a way forward in demonstrating a fine craft approach with these materials was possible.

Sample Reference	Set	Wool	Scoured (Sc)	Blend/ Laminated	Carding	Wet felt (Wf)	Heat Press (Hp)			Needle Punch (Np)				Stiffen (Sf)	Pleating (Pl)				Sensory reflection of samples
							Temp	Dwell	Presses	Needles			Penetration		Temp	Steam	Pattern	Method	
		Type	Hand/ Machine	50/50 (Lm)	Form		(degC)	(secs)		Gauge	Inch	Barbs			(degC)	(mins)			
344	DD	NR	Machine	-	Batt	-	180	20	2	40	3	3	10	-					Crisp, dark grey flecked, smooth
345	DD	NR ZB	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp; dark grey flecked/dark brown; smooth
346	DD	NR ZG	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp/coarse; dark grey flecked/grey; smooth
347	DD	NR RB	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp/soft; dark grey flecked/medium brown; smooth
348	DD	NR RG	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp/soft; dark grey flecked/medium grey; smooth
349	DD	NR SF	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp/soft; dark grey flecked/light brown; firm and smooth, Np marks
350	DD	NR SW	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp/very soft; dark grey flecked/cream; firm and smooth, Np marks
351	DD	ZB	Machine	-	Batt	-	180	20	2	40	3	3	10	-					Crisp, dark brown, smooth
352	DD	ZB ZG	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp/scratchy; dark brown/grey; wiry
353	DD	ZB RB	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp/soft; dark brown/medium brown; smooth, Np marks
354	DD	ZB RG	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp/soft; dark brown/medium grey; smooth
355	DD	ZB SF	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp/soft; dark brown/light brown; smooth, Np marks
356	DD	ZB SW	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp/very soft; dark brown/cream; smooth, Np marks
357	DD	ZG	Machine	-	Batt	-	180	20	2	40	3	3	10	-					Scratchy, grey, springy
358	DD	ZG RB	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: scratchy/soft; grey/medium brown; smooth
359	DD	ZG RG	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: scratchy/soft; grey/medium grey; smooth
360	DD	ZG SF	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: scratchy/soft; grey/light brown; smooth, Np marks
361	DD	ZG SW	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: scratchy/very soft; grey/cream; smooth, Np marks
362	DD	RB	Machine	-	Batt	-	180	20	2	40	3	3	10	-					Soft, medium brown, smooth
363	DD	RB RG	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: soft/ crisp; medium brown/ medium grey; smooth, Np marks
364	DD	RB SF	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: soft; medium brown/light brown; smooth, Np marks
365	DD	RB SW	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: soft/very soft; medium brown/cream; smooth, Np marks
366	DD	RG	Machine	-	Batt	-	180	20	2	40	3	3	10	-					Soft, medium grey, smooth
367	DD	RG SF	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: soft; medium grey/light brown; smooth, Np marks
368	DD	RG SW	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: soft/very soft; medium grey/cream; smooth, Np marks
369	DD	SF	Machine	-	Batt	-	180	20	2	40	3	3	10	-					Soft, light brown, smooth and compact
370	DD	SW	Machine	-	Batt	-	180	20	2	40	3	3	10	-					Very soft, cream, smooth and compact
371	DD	SF SW	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: soft/very soft; light brown/cream; smooth and compact, Np marks
372	DD	RW	Machine	-	Batt	-	150	15	2	40	3	3	10	-					Soft, white, smooth
373	DD	RW NR	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp/scratchy; white/dark grey flecked; smooth and firm, Np marks
374	DD	RW ZB	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp/scratchy; white/dark brown; smooth and firm, Np marks
375	DD	RW ZG	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp/scratchy; white/grey; smooth and firm, Np marks
376	DD	RW RB	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp/soft; white/medium brown; smooth and firm, Np marks
377	DD	RW RG	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp/soft; white/medium grey; smooth and firm, Np marks
378	DD	RW SF	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp/soft; white/light brown; smooth and firm, Np marks
379	DD	RW SW	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp/very soft; white/cream; smooth and firm, Np marks
381	DD	DH	Machine	-	Batt	-	150	10	2	40	3	3	10	-					Crisp, white, smooth
382	DD	DH NR	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp/coarse; white/dark grey flecked; firm
383	DD	DH ZB	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp; white/dark brown; firm, Np marks
384	DD	DH ZG	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp/scratchy; white/grey; firm, Np marks
385	DD	DH RB	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp; white/medium brown; firm, Np marks
386	DD	DH RG	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp; white/grey; firm, Np marks
387	DD	DH SF	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: crisp; white/light brown; firm, Np marks
388	DD	DH SW	Machine	Lm	Batt	-	150	10	2	40	3	3	10	-					Double sided: crisp/soft; white/cream; firm, Np marks
389	DD	DH DLW	Machine	Lm	Batt	-	150	10	2	40	3	3	10	-					Double sided: crisp/smooth; white/cream; firm, Np marks
390	DD	DH RW	Machine	Lm	Batt	-	150	10	2	40	3	3	10	-					Double sided: crisp; white/white; firm, Np marks
391	DD	DLW	Machine	-	Batt	-	150	10	2	40	3	3	10	-					Coarse, creamy white, pliable
392	DD	DLW NR	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: coarse; cream/dark grey flecked; springy, Np marks
393	DD	DLW ZB	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: smooth/coarse; cream/dark brown; springy, Np marks
394	DD	DLW ZG	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: smooth/scratchy; cream/grey; springy, Np marks
395	DD	DLW RB	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: smooth/crisp; cream/medium brown; firm, Np marks
396	DD	DLW RG	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: smooth/crisp; cream/medium grey; firm, Np marks
397	DD	DLW SF	Machine	Lm	Batt	-	180	20	2	40	3	3	10	-					Double sided: smooth/soft; cream/light brown; smooth and compact
398	DD	DLW SW	Machine	Lm	Batt	-	150	10	2	40	3	3	10	-					Double sided: smooth/soft; cream/cream; smooth and compact
399	DD	DLW RW	Machine	Lm	Batt	-	150	10	2	40	3	3	10	-					Double sided: smooth/crisp; cream/cream; smooth and pliable

Table 7: Sample results for Set DD

Set CC - Dry felted samples: laminated, heat pressed and stiffened

Sample Ref. 430 - 470

Aim

To test the dry felting performance of the coloured and white wools at a pre-felted stage and seek tactile and visual qualities as hard surfaces through stiffening. To seek a range of visual and tactile qualities that could become evident through laminating and stiffening different wool types and to explore potential transparent surface qualities of the wool types with fine web distribution during layout.

Process

All wools were individually machine washed and carded into batts. The batts of each wool type were separated into 10cm deep webs and heat pressed. All wools were heat pressed at a low temperature and short dwell time to avoid scorch marks on the white wools. It was not necessary to increase the dwell time for the coloured wools as in the previous sampling with thicker layers: here, slight compression was adequate to stabilise the fibres and reduce surface disturbance of the wool fibres during the layout process with the fine webs. The wools were coated with the stiffening solution, by hand using a sponge and left to dry naturally.[129]

Sample images

Full set of images on CD: Established Practice – Images – Set CC

Observations and sensory reflection

Visual - all laminated samples showed a two-tone effect. The distinct fibre characteristics of each wool type were evident. There was evidence of slight starch residue on the Zwartbles sample group because of the smooth surface and dark brown wool colour (Samples 437 - 442) The white wools, particularly the Swaledale, showed subtle transparency and decorative potential, emphasized by the contrast in colour between the laminated surfaces. (Samples 467 - 470) The Devon and Cornwall Longwool was noted for its delicacy and open structure suggesting a lace or cobweb but also hairy surface. (Samples 455 - 458)

Tactile - the weight, handle and feel varied between the wool types but smoothness was consistent across all samples. The wools showed differences ranging from very soft to coarse, reflecting the individual properties of the fibres. There was a noticeably firm but flexible and pliable quality to the samples.

129 See Appendix D

Summary

The wool types showed an overall uniformity within the coloured wool samples, but an increased subtlety and a sense of delicacy and sophistication with the white wools. Stiffening the samples prior to wet and dry felting was seen as a useful method to exploit detail in surface designs where intricate patterns and definition is required. The stiffened fabric could be cut and positioned with precision. The wools could be prepared in very fine and transparent fabric layers, this would be especially helpful if using the more difficult and robust wool types such as Swaledale.

This method was taken forward into Stage 3 of the sampling process in Set C.

Sample Reference	Set	Wool	Scoured (Sc)	Blend/ Laminated	Carding	Wet felt (Wf)	Heat Press (Hp)			Needle Punch (Np)				Stiffen (Sf)	Pleating (Pl)				Sensory reflection of samples
		Type	Hand/ Machine	50/50 (Lm)	Form		Temp (degC)	Dwell (secs)	Presses	Needles Gauge	Needles Inch	Needles Barbs	Penetration		Temp (degC)	Steam (mins)	Pattern	Method	
430	CC	NR	Machine	-	Batt	-	150	10	1	-	-	-	-	yes					Crisp, dark grey flecked, pliable
431	CC	NR ZB	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: crisp/smooth; dark grey flecked/dark brown; firm
432	CC	NR ZG	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: crisp/coarse; dark grey flecked/grey; firm
433	CC	NR RB	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: crisp/smooth; dark grey flecked/medium brown; firm
434	CC	NR RG	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: crisp/smooth; dark grey flecked/medium grey; firm
435	CC	NR SF	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: crisp/soft; dark grey flecked/light brown; firm and pliable
436	CC	NR SW	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: crisp/soft; dark grey flecked/cream; firm and pliable
437	CC	ZB	Machine	-	Batt	-	150	10	1	-	-	-	-	yes					Crisp, dark brown, firm (starch residue on surface)
438	CC	ZB ZG	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: crisp/coarse; dark brown/grey; firm (starch residue ZB surface)
439	CC	ZB RB	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: crisp/smooth; dark brown/medium grey; firm (starch residue ZB surface)
440	CC	ZB RG	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: crisp/smooth; dark brown/medium grey; firm (starch residue ZB surface)
441	CC	ZB SF	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: crisp/soft; dark brown/light brown; firm and smooth (starch residue ZB surface)
442	CC	ZB SW	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: crisp/soft; dark brown/cream; firm and smooth
443	CC	ZG	Machine	-	Batt	-	150	10	1	-	-	-	-	yes					Coarse, grey, firm
444	CC	ZG RB	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: coarse/smooth; grey/medium brown; firm
445	CC	ZG RG	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: coarse/smooth; grey/medium grey; firm
446	CC	ZG SF	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: coarse/soft; grey/light brown; firm
447	CC	ZG SW	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: coarse/very soft; grey/cream; firm
448	CC	RB	Machine	-	Batt	-	150	10	1	-	-	-	-	yes					Smooth, medium brown, firm and smooth
449	CC	RB RG	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: soft/smooth; medium brown/medium grey; soft and pliable
450	CC	RB SF	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: soft/smooth; medium brown/light brown; soft and pliable
451	CC	RB SW	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: soft/smooth; medium brown/cream; soft and pliable
452	CC	RG	Machine	-	Batt	-	150	10	1	-	-	-	-	yes					Crisp, medium grey, soft and firm
453	CC	RG SF	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: crisp/smooth; medium grey/light brown; soft and pliable
454	CC	RG SW	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: crisp/smooth; medium grey/cream; soft and pliable
455	CC	DLW	Machine	-	Batt	-	150	10	1	-	-	-	-	yes					Crisp, cream, firm and hairy
456	CC	DLW NR	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: crisp/smooth; white/dark grey flecked; firm and hairy
457	CC	DLW ZB	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: crisp/smooth; white/dark brown; firm and hairy
458	CC	DLW RG	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: smooth; cream/medium grey; firm and hairy
459	CC	DH	Machine	-	Batt	-	150	10	1	-	-	-	-	yes					Soft, white, smooth
460	CC	DH NR	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: soft/crisp; cream/dark grey flecked; firm and smooth
461	CC	DH ZB	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: soft/crisp; cream/dark brown; firm and smooth
462	CC	DH RG	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: soft; cream/medium grey; firm and smooth
463	CC	RW	Machine	-	Batt	-	150	10	1	-	-	-	-	yes					Soft, white, smooth
464	CC	RW NR	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: soft/crisp; cream/dark grey flecked; firm and smooth
465	CC	RW ZB	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: soft/crisp; cream/dark brown; firm and smooth
466	CC	RW RG	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: soft; cream/medium grey; firm and smooth
467	CC	S	Machine	-	Batt	-	150	10	1	-	-	-	-	yes					Scratchy, cream, pliable
468	CC	S NR	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: scratchy both sides; cream/dark grey flecked; firm and pliable
469	CC	S ZB	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: scratchy/smooth; cream/dark brown; firm and pliable
470	CC	S RG	Machine	Lm	Batt	-	150	10	1	-	-	-	-	yes					Double sided: scratchy/smooth; cream/medium grey; firm and pliable

Table 8: Sample results for Set CC

Set AC - Wet felted samples: white wools machine scoured and heat pressed

Sample Ref. 306 - 315

Aim

To test the wet felting performance of laminated white wools and seek tactile and visual qualities of the felted fabrics. To see if the natural characteristics of the wool fibres remained visible after wet felting and compare the results with similar wool types in Set AB. To seek new fabric qualities and the potential for wool blending.

Process

All wools were individually hand washed, machine carded into batts and wet felted. The batts were separated into 10cm deep webs. Two layers of different wool types were then laminated by wet felting. Machine carding gave an overall consistency to each wool type that facilitated the wet felting process. The dry samples were heat pressed.

Sample images

Full set of images on CD: Established Practice – Images – Set AC

Observations and sensory reflection

Visual - the overall impression was a uniformity of colour within each wool type. This added a sense of sophistication to the fabrics as a collection. The subtle tonal qualities indicated the characteristics of the fleece type. Integrating the different wool types created a translucency and fragility, adding an unexpected dynamic. (Samples 310 and 312) The juxtaposition of coarse and soft wool types was complementary and gave a softening effect. (Samples 307 and 308) The combination of Swaledale and Devon and Cornwall Longwool produced a good quality surface. (Sample 306)

Tactile - the weight and handle of the felted fabric was consistent throughout. However subtle differences were evident in the laminated surfaces of each sample. The individual wool characteristics were mostly distinguishable despite integration of the wool fibres through the wet felting process. The combination of Devon and Cornwall Longwool and the white Ryeland produced a noticeably fine textured felt. (Sample 310) The laminated surfaces ranged from soft to firm and pliable.

Summary

The laminated surfaces were considered a success. As a result of the carding process the individual fibre characteristics were less visible and more integrated, producing overall consistency in texture noted across all samples as with Sample Set AB. A variety of distinctive

but subtle visual and tactile characteristics could be investigated using a combination of dry and wet felting techniques.

This could be developed further with white and coloured wool types and by introducing bespoke wool blends. (See Stage 4 Set F)

Sample Reference	Set	Wool	Scoured (Sc)	Blend/ Laminated	Carding	Wet felt (Wf)	Heat Press (Hp)			Needle Punch (Np)				Stiffen (Sf)	Pleating (Pl)				Sensory reflection of samples
		Type	Hand/ Machine	50/50 (Lm)	Form		Temp (degC)	Dwell (secs)	Presses	Needles Gauge	Needles Inch	Needles Barbs	Penetration		Temp (degC)	Steam (mins)	Pattern	Method	
306	AC	S DLW	Machine	Lm	Batt	yes	150	10	1	-	-	-	-	-					Very scratchy both sides; creamy white with dark flecks and white kemp fibres; slight stiffness
307	AC	S RW	Machine	Lm	Batt	yes	150	10	1	-	-	-	-	-					Scratchy/soft; creamy white with dark flecks and white kemp fibres; pliable
308	AC	S SW	Machine	Lm	Batt	yes	150	10	1	-	-	-	-	-					Scratchy/soft; creamy white with dark flecks and white kemp fibres; pliable
309	AC	S DH	Machine	Lm	Batt	yes	150	10	1	-	-	-	-	-					Scratchy/crisp; creamy white with dark flecks and white kemp fibres; pliable
310	AC	DLW RW	Machine	Lm	Batt	yes	150	10	1	-	-	-	-	-					Soft both sides; creamy with slight sheen; soft and pliable
311	AC	DLW DH	Machine	Lm	Batt	yes	150	10	1	-	-	-	-	-					Smooth/crisp; creamy with slight sheen; firm and pliable
312	AC	DLW SW	Machine	Lm	Batt	yes	150	10	1	-	-	-	-	-					Smooth/soft; creamy, translucent sheen; soft and pliable
313	AC	RW SW	Machine	Lm	Batt	yes	150	10	1	-	-	-	-	-					Soft both sides; creamy white; soft and pliable
314	AC	RW DH	Machine	Lm	Batt	yes	150	10	1	-	-	-	-	-					Soft crispness both sides; creamy white; firm and pliable
315	AC	SW DH	Machine	Lm	Batt	yes	150	10	1	-	-	-	-	-					Soft crispness both sides; creamy white; firm and pliable

Table 9: Sample results for Set AC

Stage 3

Set A - Wet felted samples: investigating three-dimensional surfaces with hand pleating

Sample Ref. 148 - 160

Aim

To test the wet felting performance of the single wool types as three-dimensional surfaces and seek new tactile and visual qualities of the felted fabrics. To see if the natural characteristics of the wool fibres could be enhanced by a three-dimensional surface.

Process

All wools were individually machine washed and carded into batts. The batts were separated into 10cm deep webs and wet felted. Machine carding gave an overall consistency to each wool type that facilitated the wet felting process. The samples were heat pressed and hand pleated using an accordion design template.

Sample images

Full set of images on CD: Established Practice – Images – Set A

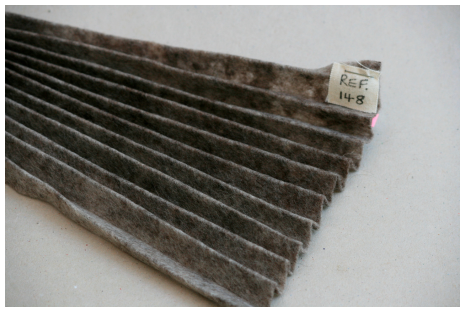

Fig 75 Sample 148

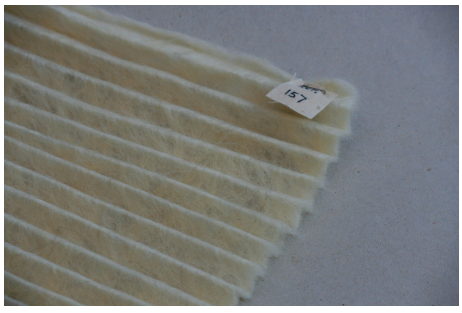

Fig 76 Sample 157

Fig 77 Sample 159

Observations and sensory reflection

Visual - the overall impression was a uniformity of colour within each wool type. This added a sense of sophistication that was further enhanced by the pleated surface. The contrast in colour range within each wool type was most noticeable in the coloured wools where subtle tonal qualities indicated the characteristics of the fleece type. The white wools showed less variation in colour but showed distinct variations in the surface qualities ranging from matt to very textured. The Swaledale and Devon and Cornwall Longwool were noted for their distinctive surface qualities in Samples 157 and 159 [Fig 76 and Fig 77].

Tactile - the weight, handle and feel of the felted fabrics was consistently firm but also pliable. The white wools showed distinctive qualities ranging from very soft to coarse, emphasising the inherent properties of the fibres. The coloured wools were less diverse in surface texture except the Merino, which was particularly fine and soft in Sample 148 [Fig 75].

Summary

Pleating added strength and structure to all the fabrics, creating an aesthetic appreciation beyond the formal expectations of the felted wool surface. The pleated surface gave movement and a lively quality to the felted surface that communicated a sense of fluidity and drape. Pleating offered a successful transformative effect to the hand felted fabric. Further sampling with laminated wools will be investigated in Set B.

Sample Reference	Set	Wool	Scoured (Sc)	Blend/ Laminated	Carding	Wet felt (Wf)	Heat Press (Hp)			Needle Punch (Np)				Stiffen (Sf)	Pleating (Pl)				Sensory reflection of samples
		Type	Hand/ Machine	50/50 (Lm)	Form		Temp (degC)	Dwell (secs)	Presses	Needles Gauge	Needles Inch	Needles Barbs	Penetration		Temp (degC)	Steam (mins)	Pattern	Method	
148	A	MB	Machine	-	Batt	yes	200	20	2	-	-	-	-	-	100	20	Accordion	Hand	Very soft, smooth, brown/grey mix, fine and pliable
149	A	MW	Machine	-	Batt	yes	150	10	1	-	-	-	-	-	100	20	Accordion	Hand	Very soft, smooth, creamy white, fine and pliable
150	A	NR	Machine	-	Batt	yes	200	20	2	-	-	-	-	-	100	20	Accordion	Hand	Crisp, dark grey flecked, smooth and firm
151	A	ZB	Machine	-	Batt	yes	200	20	2	-	-	-	-	-	100	20	Accordion	Hand	Smooth, dark brown, compact and firm
152	A	ZG	Machine	-	Batt	yes	200	20	2	-	-	-	-	-	100	20	Accordion	Hand	Coarse, grey flecked, firm
153	A	RB	Machine	-	Batt	yes	200	20	2	-	-	-	-	-	100	20	Accordion	Hand	Soft, medium brown, smooth and pliable
154	A	RG	Machine	-	Batt	yes	200	20	2	-	-	-	-	-	100	20	Accordion	Hand	Soft, medium grey, smooth and pliable
155	A	SF	Machine	-	Batt	yes	150	10	2	-	-	-	-	-	100	20	Accordion	Hand	Soft, light brown, smooth and pliable
156	A	SW	Machine	-	Batt	yes	150	10	1	-	-	-	-	-	100	20	Accordion	Hand	Soft, creamy, compact and firm
157	A	DLW	Machine	-	Batt	yes	150	10	1	-	-	-	-	-	100	20	Accordion	Hand	Soft, silky feel, compact, rippled surface, cream with sheen, firm
158	A	RW	Machine	-	Batt	yes	150	10	1	-	-	-	-	-	100	20	Accordion	Hand	Crisp, spongy, cream, firm
159	A	S	Machine	-	Batt	yes	150	10	1	-	-	-	-	-	100	20	Accordion	Hand	Coarse, rough, white grey, flecked with dark and white kemp fibres, firm
160	A	DH	Machine	-	Batt	yes	150	10	1	-	-	-	-	-	100	20	Accordion	Hand	Crisp, cream, firm

Table 10: Sample results for Set A

Set B - Dry felted samples: investigating three-dimensional surfaces with hand pleating

Sample Ref. 161 - 188

Aim

To test the dry felting performance of the coloured wools as three-dimensional surfaces and seek tactile and visual qualities of the felted fabrics. To seek a range of visual and tactile qualities that could become evident through laminating, needle punching and pleating different wool types and to see if the natural characteristics of the wool fibres could be enhanced by a three-dimensional surface.

Process

All wools were individually machine washed and carded into batts. The batts of each wool type were separated into 10cm deep webs that were needle punched to form a single felted layer. Two layers of different wool types were then laminated by needle punching. The samples were heat pressed and pleated using a 1/2" Flat design template.

Sample images

Full set of images on CD: Established Practice – Images – Set B

Observations and sensory reflection

Visual - all laminated samples showed a two-tone effect. The distinct fibre characteristics of each wool type were evident showing no obvious entanglement of the fibres on either surface. However there was evidence of needle marks on the lighter coloured wool surfaces (Samples 166, 167, 172, 173, 177, 178, 181, 182, 184 and 185). The overall impression was a uniformity of colour within each wool type, further enhanced by the pleated surface.

Tactile - the weight, handle and feel varied between the wool types but smoothness was consistent across all samples. Integrating the fibres through needle punching produced a softening effect to the coarse fibres. Compare Samples 163, 167 and 167a. The wools showed differences ranging from very soft to coarse, reflecting the individual properties of the fibres.

Summary

The wool types showed an overall uniformity and subtlety in surface quality. Pleating greatly enhanced the strength and performance of the dry felted fabrics compared with the two-dimensional samples of Set DD. Laminating the surfaces created stability. Pleating did not compromise the lightness and softness of the dry felted fabrics.

The pleated surface added movement and fluidity to the dry felted fabric. Further sampling with laminated wools and stiffening will be investigated in Set C.

Sample Reference	Set	Wool	Scoured (Sc)	Blend/ Laminated	Carding	Wet felt (Wf)	Heat Press (Hp)			Needle Punch (Np)				Stiffen (Sf)	Pleating (Pl)				Sensory reflection of samples
		Type	Hand/ Machine	50/50 (Lm)	Form		Temp (degC)	Dwell (secs)	Presses	Needles Gauge	Inch	Barbs	Penetration		Temp (degC)	Steam (mins)	Pattern	Method	
161	B	NR	Machine	-	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Crisp and springy, dark grey flecked, smooth and flexible
162	B	NR ZB	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: crisp/soft; dark grey flecked/dark brown; smooth and flexible
163	B	NR ZG	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: crisp/coarse; dark grey flecked/grey; smooth and flexible
164	B	NR RB	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: crisp/soft; dark grey flecked/medium brown; smooth and flexible
165	B	NR RG	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: crisp/soft; dark grey flecked/medium grey; smooth and flexible
166	B	NR SF	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: crisp/soft; dark grey flecked/light brown; smooth and flexible, Np marks on SF
167	B	NR SW	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: crisp/very soft; dark grey flecked/creamy white; smooth and flexible, Np marks on SW
168	B	ZB	Machine	-	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Soft, dark brown, smooth and flexible
169	B	ZB ZG	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: crisp/scratchy; dark brown/grey; smooth and flexible
170	B	ZB RB	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: crisp/soft; dark brown/medium brown; smooth and flexible
171	B	ZB RG	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: crisp/soft; dark brown/medium grey; smooth and flexible
172	B	ZB SF	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: medium soft/soft; dark brown/light brown; smooth and flexible, Np marks on SF
173	B	ZB SW	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: medium soft/very soft; dark brown/creamy white; smooth and flexible, Np marks on SW
174	B	ZG	Machine	-	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Scratchy, grey, springy
175	B	ZG RB	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: scratchy/crisp; grey/medium brown; smooth and flexible
176	B	ZG RG	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: scratchy/crisp; grey/medium grey; smooth and flexible
177	B	ZG SF	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: scratchy/crisp; grey/light brown; smooth and flexible, Np marks on SF
178	B	ZG SW	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: scratchy/soft; grey/creamy white; smooth and flexible, Np marks on SW
179	B	RB	Machine	-	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Soft, medium brown, smooth and pliable
180	B	RB RG	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: soft; medium brown/medium grey; smooth and flexible
181	B	RB SF	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: soft; medium brown/light brown; smooth and flexible, Np marks on SF
182	B	RB SW	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: soft/very soft; medium brown/creamy white; smooth and flexible, Np marks on SW
183	B	RG	Machine	-	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Soft, medium grey, smooth and pliable
184	B	RG SF	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: soft; medium grey/light brown; smooth and flexible, Np marks on SF
185	B	RG SW	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: soft/very soft; medium grey/creamy white; smooth and flexible, Np marks on SW
186	B	SF	Machine	-	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Soft, light brown, smooth and pliable
187	B	SW	Machine	Lm	Batt	-	150	10	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Soft, creamy white, smooth and pliable
188	B	SF SW	Machine	Lm	Batt	-	200	20	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Double sided: soft/very soft; light brown/creamy white; smooth and flexible

Table 11: Sample results for Set B

Set C - Dry felted samples: investigating three-dimensional needle punched, heat pressed and stiffened surfaces with hand pleating

Sample Ref. 189 - 216

Aim

To test the dry felting performance of the coloured wools as three-dimensional surfaces at a pre-felted stage and seek tactile and visual qualities of hard surfaces through needle punching and the stiffening treatment. To seek a range of visual and tactile qualities that could become evident through laminating different wool types.

Process

All wools were individually machine washed and carded into batts. The batts of each wool type were separated into 10cm deep webs and needle punched to form a single felted layer. Two layers of different wool types were then laminated by needle punching, to integrate the fibres and stabilise the web. The wools were coated with the stiffening solution and left to dry naturally.

The samples were heat pressed. Samples 189, 196 - 216 pleated with the 1/2” Flat design template. Samples 190 - 195 pleated with the Accordion design template.

Sample images

Full set of images on CD: Established Practice – Images – Set C

Fig 78 Sample 210

Fig 79 Sample 210 (reverse)

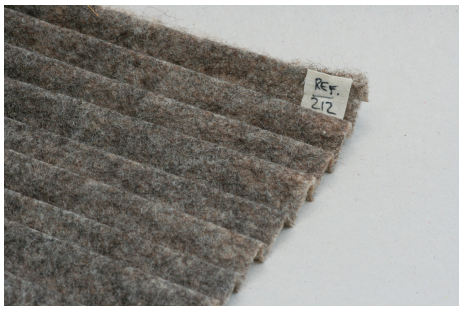

Fig 80 Sample 212

Fig 81 Sample 212 (reverse)

Fig 82 Sample 215

Fig 83 Sample 216

Observations and sensory reflection

Visual - all laminated samples showed a two-tone effect. The distinct fibre characteristics of each wool type were evident showing no obvious entanglement of the fibres on either surface. However there was evidence of needle marks on the lighter coloured wool surfaces [Fig 78 - Fig 81]. (Samples 194, 195, 200, 201, 205, 206, 209, 210, 212, 213 and 216) It was noted that no evidence of starch residue was apparent on the dark brown Zwartbles samples (samples 196 - 201 as there had been in Set CC. This was most likely because steaming during the pleating process had removed traces of the starch. The overall impression was a uniformity of colour within each wool type [Fig 82 & Fig 83].

Tactile - the weight, handle and feel varied between the wool types but a smoothness and rigidity was consistent across all samples due to the stiffening process. Despite the altered

surface quality through stiffening, the wools showed differences ranging from very soft to coarse, reflecting the individual properties of the fibres.

There was a noticeably firm but smooth and pliable quality to the samples despite the rigidity and sharpness of the folded edge.

Summary

The combination of stiffening and pleating the felted surface created an overall rigidity that suggested a manufactured aesthetic. This was thought to diminish an appreciation of the handcrafted fabric. The hard surface was accentuated by the stiffness of the fold. Stiffening was considered unnecessary unless employed to stabilise the surface of very fine translucent felted webs before laminating. Strengthening the surface by stiffening would lend support to delicate structures especially when handling larger surface areas.

Wet felting prior to pleating could produce equally satisfactory results for translucent and delicate surfaces. These surfaces will be investigated in Set E.

Sample Reference	Set	Wool	Scoured (Sc)	Blend/ Laminated	Carding	Wet felt (Wf)	Heat Press (Hp)			Needle Punch (Np)				Stiffen (Sf)	Pleating (Pl)				Sensory reflection of samples
		Type	Hand/ Machine	50/50 (Lm)	Form		Temp (degC)	Dwell (secs)	Presses	Needles Gauge	Needles Inch	Needles Barbs	Penetration		Temp (degC)	Steam (mins)	Pattern	Method	
189	C	NR	Machine	-	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Crisp, dark grey flecked, smooth and rigid
190	C	NR ZB	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	Accordion	Hand	Double sided: crisp/soft; dark grey flecked/dark brown; smooth and rigid
191	C	NR ZG	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	Accordion	Hand	Double sided: crisp/coarse; dark grey flecked/grey; smooth and rigid
192	C	NR RB	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	Accordion	Hand	Double sided: crisp/soft; dark grey flecked/medium brown; smooth and rigid
193	C	NR RG	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	Accordion	Hand	Double sided: crisp; dark grey flecked/medium grey; smooth and rigid
194	C	NR SF	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	Accordion	Hand	Double sided: crisp/soft; dark grey flecked/light brown; smooth and rigid, Np marks on SF
195	C	NR SW	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	Accordion	Hand	Double sided: crisp/soft; dark grey flecked/creamy white; smooth and rigid, Np marks on SW
196	C	ZB	Machine	-	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Crisp, dark brown, smooth and rigid
197	C	ZB ZG	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Double sided: crisp/scratchy; dark brown/grey; smooth and rigid
198	C	ZB RB	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Double sided: crisp; dark brown/medium brown; smooth and rigid
199	C	ZB RG	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Double sided: crisp; dark brown/medium grey; smooth and rigid
200	C	ZB SF	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Double sided: medium soft/soft; dark brown/light brown; smooth and rigid, Np marks on SF
201	C	ZB SW	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Double sided: medium soft/soft; dark brown/creamy white; smooth and rigid, Np marks on SW
202	C	ZG	Machine	-	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Scratchy, grey, springy and rigid
203	C	ZG RB	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Double sided: scratchy/crisp; grey/medium brown; smooth and rigid
204	C	ZG RG	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Double sided: scratchy/crisp; grey/medium grey; smooth and rigid
205	C	ZG SF	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Double sided: scratchy/crisp; grey/light brown; smooth and rigid, Np marks on SF
206	C	ZG SW	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Double sided: scratchy/soft; grey/creamy white; smooth and rigid, Np marks on SW
207	C	RB	Machine	-	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Soft, medium brown, smooth and rigid
208	C	RB RG	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Double sided: soft; medium brown/medium grey; smooth and rigid
209	C	RB SF	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Double sided: soft; medium brown/light brown; smooth and rigid, Np marks on SF
210	C	RB SW	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Double sided: soft/very soft; medium brown/creamy white; smooth and rigid, Np marks on SW
211	C	RG	Machine	-	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Soft, medium grey, smooth and rigid
212	C	RG SF	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Double sided: soft; medium grey/light brown; smooth and rigid, Np marks on SF
213	C	RG SW	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Double sided: soft/very soft; medium grey/creamy white; smooth and rigid, Np marks on SW
214	C	SF	Machine	-	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Crisp, light brown, smooth and rigid
215	C	SW	Machine	-	Batt	-	150	10	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Soft, creamy white, smooth and pliable
216	C	SF SW	Machine	Lm	Batt	-	200	20	1	40	3	3	10	yes	100	20	1/2" Flat	Hand	Double sided: soft; light brown/creamy white; smooth and rigid, Np marks on SW

Table 12: Sample results for Set C

Set E - Wet felted samples: investigating three-dimensional needle punched, heat pressed and laminated surfaces with hand pleating

Sample Ref. 220 - 246

Aim

To test the wet felting performance of wet felted coloured and white wools as three-dimensional surfaces and seek tactile and visual qualities of the felted fabrics. To seek a range of visual and tactile qualities that could become evident through laminating, needle punching and pleating of different wool types and to see if the natural characteristics of the wool fibres could be enhanced by the three-dimensional surface.

Process

All wools were individually hand washed and machine carded into batts. The batts were separated into 10cm deep webs and wet felted to the pre-felt stage to form a single felted layer. Two pre-felted layers of different wool types were then laminated by needle punching, to integrate the fibres. The laminates were fully wet felted. The samples were heat pressed and hand pleated using the Accordion design template.

Sample images

Full set of images on CD: Established Practice – Images – Set E

Fig 84 Sample 224

Fig 85 Sample 232

Fig 86 Sample 233

Fig 87 Sample 235

Fig 88 Sample 237

Fig 89 Sample 237 (reverse)

Observations and sensory reflection

Visual - all laminated samples showed a two-tone effect. The distinct fibre characteristics of each wool type were evident showing no obvious entanglement of the fibres on either surface. The wet felting process removed evidence of the needle marks, however there was some evidence of needle marks on the lighter coloured wool surfaces.

The white wools offered a subtle transparency and decorative element, emphasised by the contrast in colour of the laminated surface. The Devon and Cornwall Longwool was noted for its delicacy but also hairy surface in Samples 224 – 226 [Fig 84]. The Swaledale gave the most variation in surface structure especially when laminated with the coloured wools in Samples 235 - 237 [Fig 87 - Fig 89]. The distinctive kemp fibres added a unique authenticity to the fabric

(Samples 235a - 237a). The Swaledale and Dorset Horn combination was particularly noted for the consistency of surface quality Sample 233 [Fig 86].

The overall impression was of uniformity in quality and a sense of sophistication that was further enhanced by the pleated surface. Wet felting reduced the effect of needle punch marks dramatically. Where there was evidence of needle marks, these were subtle, Samples 230 and 232 [Fig 85].

Tactile - the weight, handle and feel varied between the wool types but an improved softness was noted overall. The wools showed differences ranging from soft to crisp, reflecting a changed perception in the expectation of the individual properties of the fibres as felted surfaces. There was a noticeably firm but flexible and pliable quality to the samples.

Summary

Pleating added strength and structure to all the fabrics. This was enhanced by the wet felting technique. An aesthetic appreciation beyond the formal expectations of the felted wool surface was shown by the performance quality of the felt. The pleated surface gave movement and fluidity to the felted surface. Pleating offered a successful transformative effect to the hand felted fabric. The contrasting wools worked well together and produced good quality felted surfaces.

Further sampling with laminated wools and wool blends is investigated in Stage 4: Set F and Set G.

The methods used in Set E are taken forward into Stage 4 of the sampling process and developed as sample prototypes for fabric development.

Sample Reference	Set	Wool	Scoured (Sc)	Blend/ Laminated	Carding	Wet felt (Wf)	Heat Press (Hp)			Needle Punch (Np)				Stiffen (Sf)	Pleating (Pl)				Sensory reflection of samples
		Type	Hand/ Machine	50/50 (Lm)	Form		Temp (degC)	Dwell (secs)	Presses	Needles Gauge	Needles Inch	Needles Barbs	Penetration		Temp (degC)	Steam (mins)	Pattern	Method	
220	E	DLW DH	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: soft, hairy/matt smooth; creamy white, firm and flexible
221	E	DLW RW	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: soft and translucent; creamy white; delicate and flexible
222	E	DLW S	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: medium soft/crisp; creamy/flecked with kemp fibres; firm and flexible
223	E	DLW SW	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: soft, sheen/soft matt; cream; firm and flexible
224	E	DLW NR	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: soft, hairy both sides; creamy white/ dark grey lacy effect; firm and flexible
225	E	DLW ZG	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: crisp, hairy/crisp, matt; cream lacy effect/grey; firm and flexible
226	E	DLW RB	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: soft, hairy both sides; cream lacy effect/ medium brown, firm and flexible
227	E	RW DH	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: soft/matt; creamy white; firm and flexible
228	E	RW S	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: soft, matt/crisp; creamy white/flecked with kemp fibres; firm and flexible
229	E	RW SW	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: soft, matt both sides; creamy white; firm and flexible
230	E	RW NR	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: soft, matt both sides; white/dark grey flecked; firm, flexible, Np marks on NR
231	E	RW ZG	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: crisp, matt both sides; white/grey; firm and flexible
232	E	RW RB	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: soft, matt both sides; white/medium brown; firm, flexible, Np marks on RB
233	E	S DH	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: coarse/crisp; cream flecked, kemp fibres/matt; firm and flexible
234	E	S SW	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: crisp/soft; cream flecked, kemp fibres; firm and flexible
235	E	S NR	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: crisp, hairy; cream/dark grey, kemp fibres; firm, flexible, Np on NR
236	E	S ZG	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: coarse/crisp; cream/grey, kemp fibres; firm, flexible, Np on ZG
237	E	S RB	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: crisp, hairy; cream/medium brown, kemp fibres; firm, flexible, Np on RB
238	E	DH SW	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: crisp/soft; creamy white, firm and flexible
239	E	DH NR	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: soft, matt; white/dark grey flecked; firm and flexible
240	E	DH ZG	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: soft/crisp; white/grey; firm and flexible
241	E	DH RB	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: soft, smooth; white/medium brown; firm and flexible
242	E	SF NR	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: soft, matt; light brown/dark grey flecked; firm and flexible
243	E	SF ZB	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: soft, matt; light brown/dark brown; firm and flexible
244	E	SF ZG	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: soft/crisp; light brown/grey; firm and flexible
245	E	SF RB	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: soft, silky both sides; light brown/medium brown; firm and flexible
246	E	SF RG	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Accordion	Hand	Wf individually before Np: soft, silky both sides; light brown/medium grey; firm and flexible

Table 13: Sample results for Set E

Reflective analysis

The experiments so far concluded that traditional felt-making techniques performed well when fine wool types were used. Due to the structure of the fibre, the more robust wools were more resistant to the traditional wet felting process. Dry felting these fibres did not produce similar results because the fibres are entangled mechanically to produce a matted surface and are not interlocked as in the wet felting technique. What did emerge from these experiments was the potential for blending coarse and fine fibres to produce unexpected surfaces for transparent and fine quality felts.

Fibres in the wet felt process become entangled and matted into an almost self-selected arrangement, without distortion of their natural twists and bends. Sheep's wool possesses this ability to become entangled to a higher degree than any other fibres, natural or synthetic. This interlocking or self-tightening action is possible by hand or mechanical means.[130]

The sampling methods investigated and compared the felting characteristics of different wool types and identified blends of fibres that would provide just enough tensile strength to permit the fulling process. The sampling demonstrated considerable potential for applications using various wool types that are normally considered unsuitable for creating fine felt cloth. In so doing the research aims to challenge established notions of felt fabric and explore aesthetic qualities that will contribute to a new visual language and offer innovative surface qualities for hand finished felt fabric.

Carded batts of blended wool and laminated layers of separate carded wool types in the layout process prior to wet felting produced instant results and flexibility to exploit tonal qualities and surface patterning. Interesting surface qualities showed during the wet felted process as the wool fibres entangled at different rates according to their structure. Subtle nuances with texture and the individual characteristics of the wool types became evident. What more could be achieved in the preparation of the dry fibres that might offer ways to exploit coarse wool types in the production of a fine felted fabric?

Key moment when ideas developed revealing emergent new concept

The reflective approach with the studio practice achieved thus far allowed me time and space to consider the practicalities of pushing the boundaries of what could be considered a true felt. The Wool Paper concept imbued a new meaning of felt as a textile. The focus of the research had changed and with the choice of finishes and surface treatments the emphasis of the new fabric was entirely on how the different wool types performed. Hand pleating was key to the patterning potential of the wools. The pleating technique offered ways to strengthen fragile surfaces and create structure with fluidity, adding softness and supple feel to the felt fabrics.

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130 See Appendix D

Transformative potential of materials and emergent applications

Having established that undervalued wool types offered potential for surface design in hand felted fabric, re-defining the process and techniques of established principles within the making process became the next challenge.

So, what is a true felt?

Given that the felt process is interlocking of fibres, I questioned ways in which this process could be applied and re-evaluated. Initial research developed from an earlier investigation into hand-made papers made from plant fibres[131] concluded that the matting of fibres using water and pressure produced a fine-quality self-supporting and durable structure, which bore similarities that could be exploited within the hand-felting process.

From this point I looked at how processing and preparation of the wool fibres could affect the felting process and offer newness in the finished surface. An exploration into the physical boundaries of the materials demonstrated potential for exploiting the visual aesthetics of the individual wool types.

Emergent ideas

Whilst acknowledging the advancements in fibre technology and the opportunities arising for future wool processing using innovative large scale manufacturing processes, the research enquiry had established a clear potential for originality using hand made processes within the confines of studio practice. It enabled me to address the significance of exploiting techniques of the hand-made and hand-finished whilst embracing methods of machine intervention within my personal practice. The intention was to open such potential for the development of inventive surface design for niche-felt products.

The raw material is plentiful and renewable. There is great variety in the characteristics of wool when considering texture, appearance and performance however, not all wools may be used successfully to make felt but there is still great potential to exploit this.

In this research I have used traditional techniques and methods of felt-making and investigated these by juxtaposing materials and processes to open a wider discourse within nonwoven textiles. In many ways it has been easy to exercise simple, direct methods of hand construction with available materials. What has not been easy is to question the accepted rules of fibre entanglement with wool and sustain a narrative of new ideas and concepts that break these rules and withstand scrutiny. I hope at the very least to have suggested new ways of thinking that may contribute in the making of contemporary felt textiles and seek further investigation.

131 See Appendix F

Re-defining felt

The research and sampling so far identified wool types that (depending on the source of supply and the methods used in processing the fibre) could demonstrate significant flexibility in surface design in hand felted fabric thus providing a framework from which further experimentation with different wool fibres could be suggested.

The established practice provoked and challenged the perception of what is a true felt. 'To know the rules but don't apply them'[132] exemplifies the potential to re-define and re-negotiate the concepts of what hand-made felt could be.

Summary

The versatility of felt defies classification. It can be processed to almost any consistency from its pure and virgin wool state or be combined with natural substances and synthetic materials. It is both exclusive and inclusive and has characteristics offered by no other fabricated product. Fulling (hardening) is peculiar to wool felt manufacture and is the essential feature of the entire process. It is precisely this characteristic that I wish to re-define, challenging the perception of what a felt fabric could be.

132 In a presentation on 24th March 2012 spoken by L. Kindersley at the Heritage Crafts Association Spring Conference, V&A, London (Evolving Craft Communities: From the Stone Age to the Digital Age)

Chapter 5 - Developed Practice

'Only when an idea takes physical form can we recognise its real nature and potential.'

Bristow, M. (1998) p.118

Introduction

In order to bring together the threads of my research I looked at various ways that the felt process could achieve a unique hand-made signature through traditional finishing techniques. The Stage 3 sampling methods had established that simple pleating designs and custom wool blends could offer improved performance characteristics and new perspectives for hand felted surfaces. The creative potential for using waste wools in new ways became exciting.

Pleating by hand presents substantial variety in relief surfaces and form, introducing movement and structure that offers spatial freedom, investing the felted surface with a new identity. By exploiting the three-dimensional surface through pleating, the sense of familiarity with the felted surface could be transformed without compromising the physical understanding and integrity of the wool's characteristics. Further, by manipulation of the two dimensional fabric, the sculptural geometry and contoured surfaces creatively subvert the felting technique, adding fluidity to counteract the perception of lumpiness and stiffness of the coarse fibres. The wool's pleated surface evoked a sensual appeal through the flexible three-dimensional surface. It was hoped this new surface and structural interest would invite curiosity and an urge to seek explanation through touch. Pleating enabled me to discover new ways to develop the coarse wool types as fine translucent felted fabric whilst creating softness and fluidity to give the fabric a unique identity and the material a new meaning.

Various methods of hand pleating, including hand stitch resist and hand operated machine pleating for smocking, are familiar to me and have been developed for my felt accessory collections. The traditional technique of using folding card templates and steam offered ways for introducing experimental hand finishing and irregular surface patterning in the design process through post pleated applications. This could be enhanced through the different felting capacity of the wools and with custom wool blends. I was interested to see how I could develop this specific hand pleating method further.

In order to pursue an holistic approach to the findings thus far I was keen to design my own pleated template. I investigated hand folded design templates to use with felt fabrics that could be tested in the studio. The intention was to design my own pleat templates for the sample prototypes.

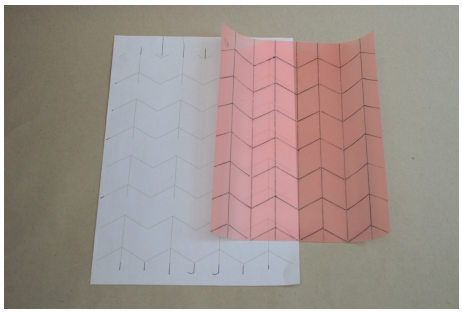

Fig 90 Hand-drawn folding pattern: chevron

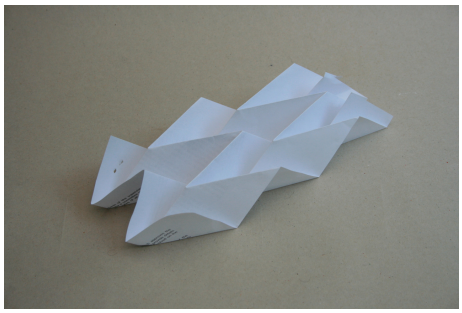

Fig 91 Hand-folded paper template: chevron

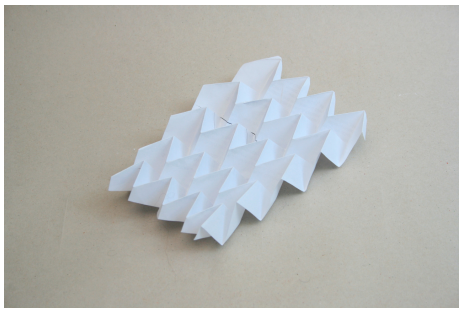

Fig 92 Hand-folded paper template: chevron

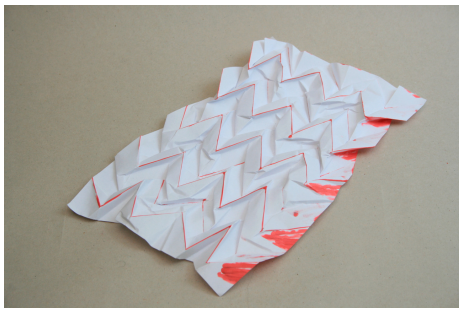

Fig 93 Pressed template [Fig 92]. Red marks identify the chevron pattern in a two-dimensional plane.

Finding suitable pleating card was problematic and so I discussed my ideas with established hand pleating specialists.[133] This proved advantageous as the expertise and knowledge of the skilled technicians suggested an area for dialogue and expansion of ideas that hitherto I had not considered or had been available to me within the studio environment. By integrating machine led applications with hand-finished elements a new creative dialogue emerged.

Large and small-scale versions of a chevron pleat design that I had previously constructed in my studio were used [Fig 90 - Fig 93]. This gave me the opportunity to see if the fabric structure would be compromised by the increased volume and weight of wool and thereby gauge the visual effect of patterning with drape and movement.

133 Hand pleating specialists Ciment (pleating) Ltd., Potters Bar.

Fig 94 Scoring new pattern template at Ciment (pleating) Ltd.

Fig 95 Trial chevron pleat with Wool Paper fabric (DLW)

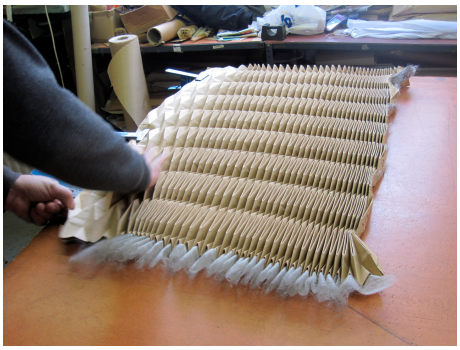

Fig 96 Folding the pleated template

Fig 97 Pleated felt: chevron design

A variety of design templates were used to consider the potential for experimental patterning and customisation of the design process [Fig 94]. A range of wool blends and laminated surfaces were created from the research wool types but particular emphasis on the design potential of the Swaledale wool was investigated [Fig 95 – Fig 97]. Here was an opportunity to enhance the performance quality of hitherto undervalued wool and to redefine its materiality and value.

The aim was to maintain the transparency and lightness achieved by the Wool Paper technique but without the stiffening process. It was hoped this could be achieved through mechanical folding (pleating) rather than chemical treatment (stiffening).

Stage 4

Set F - Wet felted samples: white wool blends (composite 50/50) investigating hand pleating. Selected needle punch and stiffening.

Sample Ref. 247 - 249 and 300 - 305

Aim

To test the felting performance of selected wet felted wool blend. To seek what potential blending might achieve to improve performance and stability in the surface structure. To seek tactile and visual qualities of the felted fabrics and see if the natural characteristics of the wool fibres could enhance the three-dimensional surface.

Process

All wools were individually hand washed. The dry fibres were weighed separately into 50gm amounts. Each sample blend consisted of two wool types of 10gm of each fibre and hand-carded to integrate the different fibres and prepare as batts. A sample with fleece wool was made to compare the surface qualities of processed and unprocessed blending methods (Sample 304). The hand-carded batts were hand-layered 20cm deep before wet felting. Hand carding gave an overall consistency to each wool type that facilitated the wet felting process. However, Samples 248 and 249 were needle punched to provide extra entanglement of the fibres as poor quality wool and re-cycled industrial waste fibres were added (Sample 249). The fleece wools were hand blended without carding equipment, taking care not to disturb the natural crimp in the lay out process before wet felting. A stiffening treatment was added to Sample 304 to stabilise the felted surface. All samples were heat pressed and hand pleated. Two design templates were used: accordion and 1/2" flat design [Fig 98 – Fig 100].

Observations and sensory reflection

Visual - blending achieved noticeable contrasts between the samples. This was not unexpected even within the limitations of the selection sampled. However, on close examination the individual characteristics of the wool types produced subtle effects that would otherwise not have been achieved without blending. The coarse wools appeared 'tamed' by the integration with softer wool types and the characteristics of lustre and crimp added a new surface quality to the felt adding a sense of sophistication that was further enhanced by the pleated surface.

Tactile - the weight, handle and feel of the felted fabrics were varied and revealed distinctive qualities ranging from very soft to scratchy, emphasising the inherent properties of the fibres.

Sample images

Full set of images on CD: Established Practice – Images – Set F

Fig 98 Sample 248

Fig 99 Sample 249

Fig 100 Sample 303

Summary

Pleating added strength and structure to all the fabrics. This was particularly evident with the Swaledale wool blends, Samples 248 and 249 [Fig 98 & Fig 99]. Pleating added movement and vitality to the felted surface offering a successful transformative effect to the flat hand felted fabric. Although a limited selection of wool blends had been sampled, the results were encouraging and informative. Further hand blending in Set G with Swaledale wool was investigated to identify a creative potential for this low-grade wool.

Sample Reference	Set	Wool	Scoured (Sc)	Blend/ Laminated	Carding	Wet felt (Wf)	Heat Press (Hp)			Needle Punch (Np)				Stiffen (Sf)	Pleating (Pl)				Sensory reflection of samples
		Type	Hand/ Machine	50/50 (Lm)	Form		Temp (degC)	Dwell (secs)	Presses	Needles Gauge	Needles Inch	Needles Barbs	Penetration		Temp (degC)	Steam (mins)	Pattern	Method	
247	F	S DLW	Hand	50-50	Hand	yes	150	10	1	40	3	3	10	-	100	20	3cm Chevron	Hand	Crisp, smooth surface, creamy with kemp fibres, slightly hairy, pliable
248	F	S SW	Hand	50-50	Hand	yes	150	10	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Scratchy, matt, flecked cream with white and black kemp fibres, pliable
249	F	S DH	Hand	50-50	Hand	yes	150	10	1	40	3	3	10	-	100	20	1/2" Flat	Hand	Scratchy, crisp, flecked re-cycled industrial waste fibres, cream, kemp fibres, pliable
300	F	DH SW	Hand	50-50	Hand	yes	150	10	1	-	-	-	-	-	100	20	Accordion	Hand	Soft and smooth, matt cream, firm and flexible
301	F	DLW SW	Hand	50-50	Hand	yes	150	10	1	-	-	-	-	-	100	20	Accordion	Hand	Smooth and hairy, cream with slight sheen, firm and flexible
302	F	RW SF	Hand	50-50	Hand	yes	150	10	1	-	-	-	-	-	100	20	Accordion	Hand	Soft and smooth, matt light brown and cream, firm and flexible
303	F	DH RW	Hand	50-50	Hand	yes	150	10	1	-	-	-	-	-	100	20	Accordion	Hand	Soft, matt and smooth, cream, dense, firm and flexible
304	F	DLW RW	Hand	50-50	Fleece	yes	150	10	1	-	-	-	-	yes	100	20	1/2" Flat	Hand	Soft, creamy, rigid but pliable. Poor felted surface, very fragile due to thick staple of DLW
305	F	DLW RW	Hand	50-50	Fleece	yes	150	10	1	-	-	-	-	-	100	20	3cm Chevron	Hand	Soft, silky feel, slight sheen, creamy open texture

Table 14: Sample Results for Set F

Set G - Wet felted samples: investigating three-dimensional surface structures with various hand pleated designs, bespoke wool blends, single wool types and laminated carded webs. Selected needle punch and stiffening.

Sample Ref. 400 - 429

Aim

To produce a sample collection of three-dimensional felted fabrics that could be evaluated and considered for potential development as exposition prototype fabrics. The intention is to show how bespoke wool blends and laminated surfaces perform as three-dimensional structures after wet felting. The objective is to seek new and original surface characteristics in the felted structure that could be enhanced by different pleated design templates. To examine the potential for increased surface area and scale of design with the wool blends as felted fabrics; testing for weight and drape and performance of the fabric using hand and machine pleated designs: 2cm and 3cm chevron; accordion; 1/2" flat; crushed chevron, cracker, basket weave and coral zig-zag.

Process

Wools were individually hand or machine washed according to the quantities required. The wool blends (Samples 423, 424, 426) were prepared using the same methods as in Set F. All laminated samples used machine-carded batts. The batts were separated into 10cm deep webs and wet felted individually before laminating and needle punching. Machine carding gave an overall consistency to each wool type that facilitated the wet felting process.

Stiffening treatments were given to selected blended wool type samples (Samples 404, 423, 424) and one laminated felt sample (Sample 426) This was to compare differences in surface structures between the coarse and fine pleated wools and consider three-dimensional effects of soft and hard wet felted surfaces. All samples were heat pressed and hand pleated using a variety of hand and machine pleated techniques.

Sample images

Full set of images on CD: Established Practice – Images – Set G

Fig 101 Sample 402

Fig 102 Sample 402 (reverse)

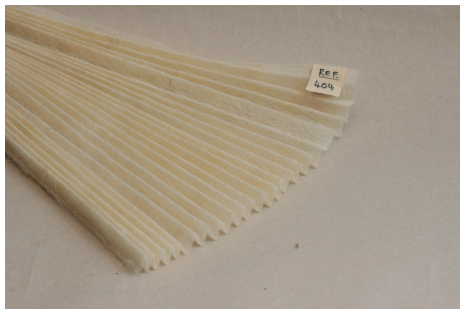

Fig 103 Sample 404

Fig 104 Sample 410

Fig 105 Sample 410 (reverse)

Fig 106 Sample 413

Fig 107 Sample 413 (reverse)

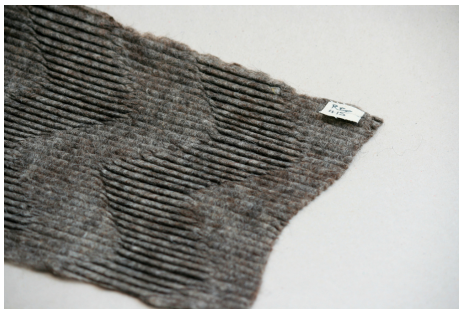

Fig 108 Sample 415

Fig 109 Sample 416

Fig 110 Sample 422

Fig 111 Sample 423

Fig 112 Sample 429

Observations and sensory reflection

Visual - as with sample Set F the individuality of the different wool characteristics was distinct and varied, enhanced by the juxtaposition of contrasting wools both in bespoke wool blends and laminated samples. Distinctive mark making effects were further produced by contrasting thickness of web layering within the laminated wools. Thin webs of white wool produced a lacy, cobweb effect (sample 402b). The felted surfaces were enhanced by the two-tone effects of the laminated coloured wools (Samples 400 and 403) and those of the white and coloured laminated wool surfaces (Samples 401 and 402).

The tonal effects were further enhanced by the pleated surface [Fig 112]. Pleating imparted strength and structure to the delicacy of the transparent wet felted webs of single white wool types. These subtleties were less evident in the laminated white and coloured wool samples but this was more than compensated by the subtle mark making enhanced by needle punch marks on the lighter felted surfaces (Samples 402, 417, 418). Further wet felting after needle punching

was shown to reduce and in some cases remove the evidence of needle marks (Samples 400 and 403). The additional friction applied to the surfaces during wet felting furthered fibre migration within the felted structure. This was very apparent in the laminated surfaces with soft and coarse wools where the longer hairy fibres protruded to reveal subtle surface qualities (Sample 403b).

The white wools showed subtle variations in colour and distinctive variations in surface qualities ranging from matt to very textured. (Samples 404, 406) The Devon and Cornwall Longwool and Greyface Dartmoor were noted for their distinctive surface qualities (Samples 407 and 408)

The decorative hand pleated designs Samples 410, 413, 415, 416 [Fig 104- Fig 109] produced surprising and exceptional results. Due to the thickness and wool character of the hand felted fabrics it had been doubtful if the complexities of folding the fabric in the templates would be possible. If the pattern definition could be achieved it was uncertain how long this could be retained with excessive handling and more importantly sustained as a larger fabric piece. The success of the initial samples showed potential for developing distinctive wool blends and introducing modified hand felting techniques during the production process. Subtle irregularities could be produced within the rhythm of repetition through hand pleating. Manipulation of the surface by heat pressing, wet felting, needle punch and secondary hand pleating methods could develop the process further to create original and unique surfaces.

The machine-pleated design (coral zig-zag) perhaps gave the most unexpected surprises. Because of the intricate mechanism by which the pleats are produced the process was initially considered unsuitable. This was because the weight and thickness of the wool was crucial in allowing sufficient space for the pleat construction. Hand preparation of the carded webs made this technique possible. Selected hand felted fabric samples were tested (Samples 409, 415 - 422). The most successful results visually were the fabrics with less tonal variation (Samples 415, 416 and 422) these clearly showed the subtle zig-zag design [Fig 108 - Fig 110].

Tactile - the weight, handle and feel of the felted fabrics were consistently firm but pliable. The white wools showed more distinctive variations in surface qualities ranging from very soft to crisp emphasising the inherent differences of the properties of the fibres and showing evidence of the long staple characteristic of the lustre wools. The different pleated surfaces added a luxurious quality to the felted surface. The stiffened fabric samples gave an impression of a manufactured finish compared with the untreated samples [Fig 111]. The chevron pleat design enhanced this industrial aesthetic due to the sharpness and depth of the folds, further accentuated by the crisp touch and feel of the stiffened fabric surface. However, there was movement and a surprising flexibility in the felted structure.

Fig 113 Coral zig-zag pleating machine

Fig 114 Unfolding the felted samples [Fig 113]

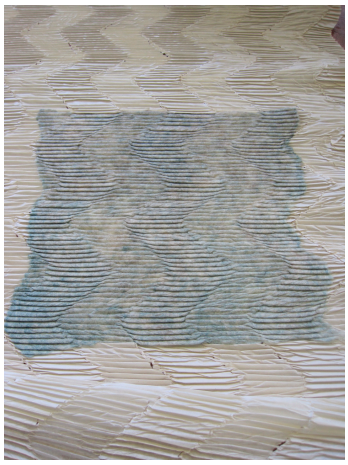

Fig 115 Sample 420 showing coral zig-zag pleat

Fig 116 Sample 415 showing coral zig-zag pleat

The machine-pleated samples (coral zig-zag) showed exceptional handling qualities and potential as a sophisticated fashion fabric. This was noted with all wool blends and laminated surfaces using this process. The coral effect is caused by small 5cm blades (unique to this machine) being lifted at different times to create pleats in opposite directions. The machine moves the blades from side to side to create a zig-zag effect. The combination of the mechanical action with the irregularities of the hand felted surface creates a uniquely hand crafted aesthetic [Fig 113 – Fig 116].

Sample Reference	Set	Wool	Scoured (Sc)	Blend/ Laminated	Carding	Wet felt (Wf)	Heat Press (Hp)			Needle Punch (Np)				Stiffen (Sf)	Pleating (Pl)				Sensory reflection of samples
		Type	Hand/ Machine	50/50 (Lm)	Form		Temp (degC)	Dwell (secs)	Presses	Needles			Penetration		Temp (degC)	Steam (mins)	Pattern	Method	
										Gauge	Inch	Barbs							
400	G	RG SF	Machine	Lm	Batt	yes	200	20	1	40	3	3	10	-	100	20	3cm Chevron	hand	Wf individually before Np: soft; medium grey/light brown; smooth and flexible
401	G	RG DH	Machine	Lm	Batt	yes	200	20	1	40	3	3	10	-	100	20	3cm Chevron	hand	Wf individually before Np: soft, matt; medium grey/white, smooth and flexible
402	G	ZB SW	Machine	Lm	Batt	yes	200	20	1	40	3	3	10	-	100	20	3cm Chevron	Hand	Wf individually before Np: crisp/soft; dark brown/white lacy effect; smooth, flexible, Np marks on ZB
403	G	ZG SF	Machine	Lm	Batt	yes	200	20	1	40	3	3	10	-	100	20	3cm Chevron	hand	Smooth, soft; grey/light brown; firm and flexible
404	G	DH DLW	Machine	Lm	Batt	yes	150	10	1	-	-	-	-	yes	100	20	Accordion	hand	End section cut from development prototype 404b before pleating: soft, hairy/matt; cream; rigid and flexible
404b	G/P	DH DLW	Machine	Lm	Batt	yes	150	10	1	-	-	-	-	yes	100	20	2cm Chevron	hand	Double sided: Crisp, soft and hairy, cream , very springy, subtle two tone effect.
405	G	SW	Machine	-	Batt	yes	150	10	1	-	-	-	-	-	100	20	3cm Chevron	hand	Very soft; cream; delicate cobweb effect; pliable structure
406	G	DH	Machine	-	Batt	yes	150	10	1	-	-	-	-	-	100	20	3cm Chevron	hand	Soft and crisp; white; delicate cobweb effect, firm structure
407	G	DLW	Hand	-	Batt	yes	150	10	1	-	-	-	-	-	100	20	Accordion	hand	Soft, hairy, undulating surface, visible locks; slight sheen, cream; firm and flexible
408	G	GFD	Hand	-	Batt	yes	150	10	1	-	-	-	-	-	100	20	Accordion	hand	Soft, hairy, undulating surface, visible locks, matt; cream; firm and flexible
409	G	ZB SW	Machine	Lm	Batt	yes	200	20	1	40	3	3	10	-	100	10	Coral Zig Zag	machine	Wf individually before Np: soft, matt, smooth; dark brown lacy effect/creamy white, firm and flexible
410	G	MB MW	Machine	Lm	Batt	yes	200	20	1	-	-	-	-	-	100	20	Cracker	hand	Double sided: soft/very soft; medium brown/white; smooth and flexible
411	G/P	DLW	Machine	-	Batt	yes	150	10	1	-	-	-	-	yes	100	20	2cm Chevron	hand	Transparent fine carded web, stiffened to test structure performance with increased surface area.
412	G/P	DLW	Machine	-	Batt	yes	150	10	1	-	-	-	-	yes	100	20	3cm Chevron	hand	Transparent fine carded web, stiffened to test structure performance with deeper pleat fold.
413	G	NR SF	Machine	Lm	Batt	yes	200	20	1	40	3	3	10	-	100	20	4cm Basket Weave	hand	Double sided: soft; dark grey/light brown; smooth and flexible
414	G	RB MB	Machine	Lm	Batt	yes	200	20	1	40	3	3	10	-	100	20	Flat Chevron	hand	Double sided: very soft; medium brown both sides; smooth and flexible
415	G	RG MB	Machine	Lm	Batt	yes	200	20	1	40	3	3	10	-	100	10	Coral Zig Zag	machine	Wf individually before Np: double sided; soft; medium grey/medium brown; smooth and flexible
416	G	RB MB	Machine	Lm	Batt	yes	200	20	1	40	3	3	10	-	100	10	Coral Zig Zag	machine	Wf individually before Np: double sided; soft; medium brown/medium brown; smooth and flexible
417	G	ZB SF	Machine	Lm	Batt	yes	200	20	1	40	3	3	10	-	100	10	Coral Zig Zag	machine	Wf individually before Np: double sided; medium soft; dark brown/light brown; firm and flexible
418	G	ZB ZB/SF	Machine	Lm/Blend	Hand	yes	200	20	1	40	3	3	10	-	100	10	Coral Zig Zag	machine	Wf individually before Np: double sided; medium soft; dark brown/light brown; firm and flexible
419	G	ZB DH	Machine	Lm	Hand	yes	200	20	1	40	3	3	10	-	100	10	Coral Zig Zag	machine	Wf individually before Np: soft, both sides; dark brown/hand dyed; firm, flexible, Np marks on RB
420	G	SF DH	Machine	Lm	Hand	yes	200	20	1	40	3	3	10	-	100	10	Coral Zig Zag	machine	Wf individually before Np: soft, smooth; creamy light brown/ hand dyed, firm and flexible
421	G	RB RW/GFD	Machine	Lm/Blend	Hand	yes	150	10	1	-	-	-	-	-	100	10	Coral Zig Zag	machine	Double sided: soft/slightly hairy and smooth; medium brown/creamy white; flexible
422	G	RW DH	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	10	Coral Zig Zag	machine	Wf individually before Np: double sided; soft; slight sheen/matt; creamy; firm and flexible
423	G	S DH	Hand	50-50	Batt	yes	150	10	1	-	-	-	-	yes	100	20	2cm Chevron	hand	Crisp, smooth hairy surface, creamy flecked surface, firm and flexible
423b	G/P	S DH	Machine	50-50	Batt	yes	150	10	1	-	-	-	-	yes	100	20	2cm Chevron	hand	Crisp, smooth hairy surface, creamy flecked surface, firm and flexible
424	G	S GFD	Hand	50-50	Batt	yes	200	20	1	-	-	-	-	yes	100	20	2cm Chevron	hand	Crisp, hairy surface, creamy flecked surface, firm and flexible
425	G/P	S RW/RG	Hand	Lm/Blend	Batt	yes	200	20	1	-	-	-	-	-	100	20	2cm Chevron	hand	Crisp, smooth hairy surface. Varied tonal effects produced by integrating hand laying of carded web RW/RG blend onto carded web S surface. Thicker web formation sections produced softer Chevron pleated effect in the wet felted surface. Heavy, stretchy fabric overall.
426	G	MB RB	Hand	50-50	Batt	yes	200	20	1	-	-	-	-	yes	100	20	2cm Chevron	hand	Soft, matt surface, light brown mix, springy, flexible structure
427	G	MB RG	Machine	Lm	Batt	yes	200	20	1	40	3	3	10	-	100	20	1/2" Flat	hand	Double sided: very soft/soft; medium brown/medium grey both sides; smooth and pliable
428	G	MB RB	Machine	Lm	Batt	yes	200	20	1	40	3	3	10	-	100	20	1/2" Flat	hand	Double sided: very soft/soft; medium brown both sides; smooth and pliable
429	G	RB RW	Machine	Lm	Batt	yes	200	20	1	40	3	3	10	-	100	20	3cm Chevron	hand	Double sided: medium soft; medium brown/creamy brown; firm and soft, Np marks RB side

Table 15: Sample Results for Set G (including G/P)

Reflective analysis

Pleating added strength and structure to all the fabrics, creating an aesthetic appreciation beyond the formal expectations of the felted wool surface. The pleated surface added movement and a lively quality to the felted surface. Pleating offered a successful transformative effect to the hand felted fabric. This was demonstrated in each of the pleated design templates and was not compromised by either hand or machine method employed. What became significant was acknowledging the requirement for careful preparation of the wool fibres and the felting method to enable the pleating to be successful. The traditional wet felting technique is ideally suited in producing the required specifications for hand and machine pleating methods.

The degree of fineness created by web formation suggested that blending of different wools could be considered unnecessary in order to create a translucent effect. Comparing sample Set F with sample Set AC confirmed this from a purely visual perspective however, handling of these samples revealed subtle nuances in the surfaces that might be exploited further and offer creative diversity and uniqueness for less valued wools. The traditional felting technique offered rich potential to investigate a new path and direction.

Sample prototypes

Set G/P - Wet felted samples: developing scale and modified three-dimensional surface structures using bespoke wool blends, single wool type and selected laminated carded webs. Selected stiffening.

Sample Ref. 404b, 411, 412, 423b and 425

Aim

To examine strength, movement and structure with increased scale and weight of fabric in three-dimensional surfaces. To seek the potential of altered surfaces that might be created through laminating and wool blending.

Process

All wools were machine washed and carded individually. The wool blend and laminated hand layering (sample 425) was strengthened with needle punching before wet felting. The batts were separated into 10cm deep web formation and each piece wet felted. Machine carding gave an overall consistency to each wool type that facilitated the wet felting process. This was particularly helpful in the layout process of a greater surface area where the intention was to exploit a fine and transparent felt structure.

Stiffening treatments were given to selected samples after wet felting (Samples 404b, 411, 412, 423b) in order to strengthen the surface structure and add support to the increased weight of wool [Fig 118 - Fig 120].

The chevron design was used for all samples; this was to facilitate the comparisons to be made. Making the larger samples and with so many wool blends and options possible would have been difficult to sustain in the time available, therefore a composite selection of two wool types were selected (DLW and S) with additional available wools prepared in the studio. Two different size chevron designs were made in the Devon and Cornwall Longwool (Samples 411 and 412) so to compare possible changes in surface qualities that might be emphasized with 2cm and 3cm folds. One prototype was made using the maximum lengthwise dimension of the card template (200cm) in order to test the movement and weight of the fabric and the impact these might have on patterning stability with an increase in surface area, Sample 404b [Fig 117]. All samples were heat pressed before hand pleating.

Sample images

Full set of images on CD: Established Practice – Images – Set GP

Fig 117 Sample prototype 404b

Fig 118 Sample prototype 411

Fig 119 Sample prototype 423b

Fig 120 Sample prototype 425

Fig 121 Sample 404b (detail 4)

Fig 122 Sample 412 (detail 5)

Fig 123 Sample 423b (detail 1)

Fig 124 Sample 425 (detail 1)

Observations and sensory reflection

Visual - the increased scale had great impact. The chevron design had an architectural quality that imparted strength and rigidity to the fabrics. The translucency of the white wools was less obvious as a three-dimensional surface. Tonal variations were evident in the coloured wool surfaces. These variations were enhanced according to the linear direction of the pleat pattern that made further impact with light falling on the surface, creating shadow effects. The natural colours of the wool types added subtle tonal qualities responsive to light [Fig 122 & Fig 123]. Additional surface changes became evident with the play of light by exposing the contrasting wool types Sample 404b [Fig 121] and Sample 425 [Fig 124]. Where thicker webs of wool fibres had been integrated into the surface layout before wet felting and no stiffening treatment applied the pleated edges were softer and more rounded (Sample 425). The deeper folded pleats gave more distinctive shadow effects and a sense of solidity to the white wool surfaces [Fig 121].

Tactile - the pleated design gave an overall hardness and strength to the fabric surfaces further distinguished by the stiffening treatment. Where no stiffening treatment had been used (Sample 425) the pleated surface was softer and the edges more pliant. This was considered an advantage despite the increased mobility and inclination for the fabric to stretch [Fig 121].

Summary

The combination of pleating and stiffened surfaces produced hard and defined edges that perhaps invited an industrial aesthetic. However this was less evident with the Swaledale blends where the weight of fabric caused greater elasticity and movement [Fig 120].

The combination of coarse and fine wool types in bespoke wool blends opened new possibilities for niche hand felted fabric development. From a design perspective the possibilities were endless. The potential investment for waste wools could be realised and in doing so affirms the aim of this research.

Sample results

Results for Set G/P are included in Table 15

Stage 5

Set H - Wet felted samples: selected needle punch, investigating three-dimensional surface structures using bespoke wool blends (composite 50/50), single wool types and laminated carded webs.

Sample Ref. 471 - 500b

The following samples show experimental post-pleating treatments using secondary heat press and wet felting processes.

Sample Ref. 492b and 492c; 493a; 494b and 494c; 495b and 495c; 497; 490a; 499a and 499b; 500a and 500b

Aim

The priority here is for comparison of performance qualities of wet felted fabrics using different pleated design templates and to consider the potential for post pleating surface manipulation. Selected stiffening was also re-introduced in order to examine the potential for post-felting ornamentation. This could consider patterning potential of pre-felted surfaces using needle punch and further wet felting methods. Additionally, tonal variation and fabric density will be investigated. The design, scale and weight of the fabrics will be considered in relation to fibre characteristic, fibre distribution and felting performance. The sampling will specifically seek ways in which customisation may become integral during production to produce unique hand finished effects. It is intended that the investigations in this stage will inform the final exposition fabrics.

Process

All wools were machine washed and carded individually. Machine carding gave an overall consistency to each wool type that facilitated the wet felting process. The laminated samples (Samples 471 - 483; 492 - 495c; 499 and 500b) were made using batts separated into 10cm deep web formation. Each batt was needle punched before wet felting to integrate the fibres. The single white wools and composite white wool blends (Samples 484 - 490 and 500a) were wet felted only. The Devon and Cornwall Longwool (Samples 498 - 499b) were stiffened. A variety of pleat designs were used: 4cm and 7cm basket weave [Fig 129 - Fig 140]; flat chevron and 2cm and 3cm chevron.

Sample images

Full set of images on CD: Established Practice – Images – Set H

Dorset Horn & Swaledale 50/50 composite blend

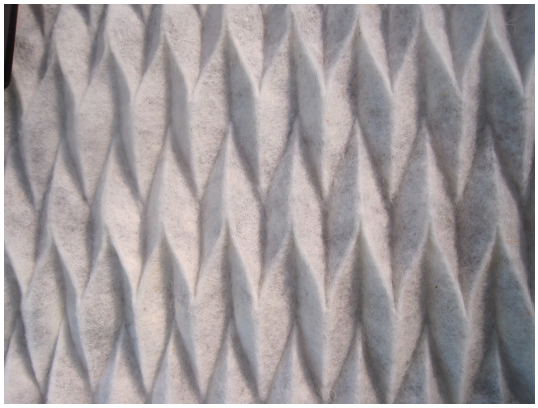

Fig 125 DP024 – chevron pleat before heat pressing

Fig 126 DP024a – chevron pleat after heat pressing

Fig 127 DP024e – detail [Fig 126] showing embossed effect

Fig 128 DP024f – detail [Fig 127] showing embossed effect

Fig 129 Sample 471

Fig 130 Sample 471 (reverse)

Fig 131 Sample 472

Fig 132 Sample 472 (reverse)

Fig 133 Sample 475

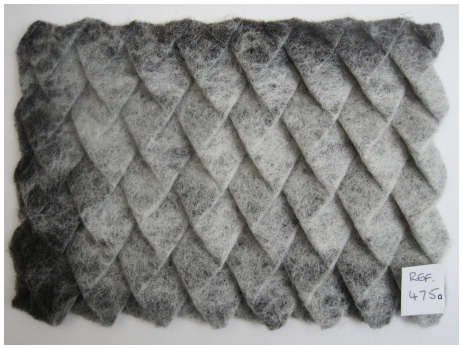

Fig 134 Sample 475 (reverse)

Fig 135 Sample 478

Fig 136 Sample 478 (reverse)

Fig 137 Sample 482

Fig 138 Sample 484

Fig 139 Sample 488

Fig 140 Sample 488 (reverse)

Fig 141 Sample 491

Fig 142 Sample 491 (crushed)

Fig 143 Sample 492

Fig 144 Sample 492 (crushed reverse)

Fig 145 Sample 493

Fig 146 Sample 493 (crushed reverse)

Fig 147 Sample 494

Fig 148 Sample 494 (crushed)

Fig 149 Sample 494a (reverse)

Fig 150 Sample 494a (crushed reverse)

Fig 151 DP023 – before and after heat pressing

Fig 152 DP025– before and after heat pressing

Fig 153 DP018a – felted, pleated and crushed

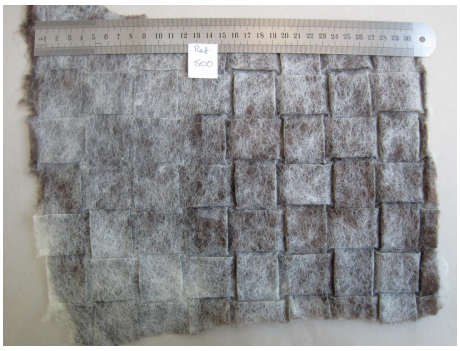

Fig 154 Sample 500

Fig 155 Sample 500 (reverse)

Fig 156 Sample 500a

Fig 157 Sample 500a (reverse)

Observations and sensory reflection

Visual - all wool types performed well with each of the pleated designs. The laminated felts imparted a robust character, emphasised by the clean, defined folds and edges of the pleats. This was also noted with the white wool blends. As with similar samples in Set G the chevron pleat gave an architectural quality that imparted strength and rigidity to the fabrics [Fig 125]. The flat chevron pleat gave a much softer look to the surface area. Tonal variations were evident in the coloured wool surfaces. These variations were enhanced according to the linear direction of the pleat pattern, creating subtle shadow effects depending on the fall of light. The felted basket weave pleat performed well in 4cm and 7cm size folds, however surface stability was compromised with large-scale fabric pieces using the 7cm pleat (Sample 471). The folds opened easily with handling, drooping slightly, distorting the patterned effect. This was also noticeable on the reverse side of all 7cm size folds (Samples 471, 472, 473) but less significantly with 4cm size folds. Thicker felts were considered unsuitable for the 4cm template as the volume of surface density restricted folding. The 7cm basket weave pattern could have great potential for innovative surface patterning where pre-felted sections and needle punched surfaces could be integrated in specific areas during the felting process. The chevron designs had potential for post-pleated surface manipulation using heat pressed surfaces, lamination and further wet felting.

Tactile - all pleated designs gave strength and firmness to the fabric surfaces. This was advantageous to the fine and translucent white wool felts. The feel and drape of the coarser wool surfaces was greatly enhanced, pleating added flexibility and a pliable quality to the fabric. Post-pleating manipulation with the heat press created unique embossed effects further enhancing the drape and feel of the fabrics [Fig 126 - Fig 128].

Summary

The wool types and composite blends selected were not definitive but the selection enabled a good range of surface qualities to be investigated and considered for experimental customising and thereby an investment in which to broaden the original intent. This was demonstrated with the Swaledale felts Samples 491 - 495c [Fig 141 - Fig 150]. The 3cm chevron pleat was used throughout in order to compare the surface structures between the different laminated wools. As expected the results were varied, producing consistently good felted surfaces.

The Wool Paper fabrics were light and transparent but became transformed as a pleated structure, imparting strength and rigidity to the delicate felt surface. The pleated folds maintained their transparency, enhanced by subtle shadow effects revealing two-tone surfaces that amplified the visual aesthetic. There was a flexibility and movement to the felt that gave the fabric a suppleness and textile quality. The wool types responded differently to surface manipulation but all imbued newness and elegance.

The pleated fabrics were heat pressed to create a crushed effect. The introduction of secondary heat pressing and wet felting as post-pleating treatments opened fresh approaches for further manipulation and complex surface design. The rhythmic repetition of the pleated design

became broken and less defined, fusing the hard edged geometric structures into the soft fabric folds [Fig 146]. A new dynamic was evident, offering greater expansion of the techniques used and ways to integrate subtle irregularities into the surface structures of the felt. The crushed surface applications created an unexpected embossed effect (Samples 494b and 494c) shown with great subtlety in the laminated surfaces, Samples 500 and 500a [Fig 154 and Fig 157]. Embossed qualities where secondary wet felting was possible using pre-felted designs signified potential for new methods of felt surface development of the wool types [Fig 151 and Fig 152].

Fig 158 DPE 001 – Dorset Horn & Shetland (SF) chevron pleat

Fig 159 DPE 004 – detail of Fig 158

Fig 160 DPE 005 – Dorset Horn & Shetland (SW) chevron pleat

Fig 161 DPE 006 – Devon & Cornwall Longwool accordion pleat

Sample Reference	Set	Wool	Scoured (Sc)	Blend/ Laminated	Carding	Wet felt (Wf)	Heat Press (Hp)			Needle Punch (Np)				Stiffen (Sf)	Pleating (Pl)				Sensory reflection of samples
							Temp	Dwell	Presses	Needles			Penetration		Temp	Steam	Pattern	Method	
		Type	Hand/ Machine	50/50 (Lm)	Form		(degC)	(secs)		Gauge	Inch	Barbs			(degC)	(mins)			
471	H	RB SF	Machine	Lm	Batt	yes	200	20	2	40	3	3	10	-	100	20	7cm Basket Weave	Hand	Double sided: soft; light brown mottled surface/medium brown; smooth and flexible, pliable
472	H	DH ZG	Machine	Lm	Batt	yes	200	20	2	40	3	3	10	-	100	20	7cm Basket Weave	Hand	Double sided: crisp/scratchy; creamy brown/mottled brown; smooth and firm
473	H	DLW NR	Machine	Lm	Batt	yes	200	20	2	40	3	3	10	-	100	20	7cm Basket Weave	Hand	Double sided: smooth/crisp; cream/medium grey; hairy surface both sides, DLW lacy effect, firm
474	H	NR RW	Machine	Lm	Batt	yes	200	20	2	40	3	3	10	-	100	20	Flat Chevron	Hand	Double sided: crisp/soft; dark grey flecked/creamy grey flecked; smooth and flexible; slight Np marks on NR
475	H	NR DH	Machine	Lm	Batt	yes	200	20	2	40	3	3	10	-	100	20	Flat Chevron	Hand	Double sided: crisp/soft; dark grey flecked/creamy grey flecked; smooth and flexible; No Np marks
476	H	NR DH	Machine	Lm	Batt	yes	200	20	2	40	3	3	10	-	100	20	3cm Chevron	Hand	Double sided: crisp/soft; dark grey flecked/creamy white lacy in parts; smooth and flexible, Np marks on NR
477	H	ZG RW	Machine	Lm	Batt	yes	200	20	2	40	3	3	10	-	100	20	Flat Chevron	Hand	Double sided: crisp; grey flecked/creamy ; smooth, even; pliable; Np marks on ZG
478	H	ZG RW	Machine	Lm	Batt	yes	200	20	2	40	3	3	10	-	100	20	4cm Basket Weave	Hand	Double sided: crisp/soft; grey flecked/creamy; smooth and flexible; very slight Np marks on ZG
479	H	RB RW	Machine	Lm	Batt	yes	200	20	2	40	3	3	10	-	100	20	4cm Basket Weave	Hand	Double sided: crisp/soft; medium brown/ creamy cobweb effect; smooth and flexible; Np marks on RB
480	H	RB RW	Machine	Lm	Batt	yes	200	20	2	40	3	3	10	-	100	20	Flat Chevron	Hand	Double sided: soft; medium brown/creamy brown lacy effect; smooth and flexible; Np marks on RB
481	H	RB DH	Machine	Lm	Batt	yes	200	20	2	40	3	3	10	-	100	20	3cm Chevron	Hand	Double sided: crisp; medium brown/creamy; smooth and flexible; Np marks on RB
482	H	S RW	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	Flat Chevron	Hand	Double sided: crisp/soft; creamy; smooth, even and flexible
483	H	S DLW	Machine	Lm	Batt	yes	150	10	1	40	3	3	10	-	100	20	3cm Chevron	Hand	Double sided: crisp both sides; creamy white; slightly hairy and very flexible
484	H	DH	Machine	-	Batt	yes	150	10	1	-	-	-	-	-	100	20	Flat Chevron	Hand	Soft, smooth; creamy white; even surface, pliable
485	H	DH SW	Machine	50-50	Batt	yes	150	10	1	-	-	-	-	-	100	20	Flat Chevron	Hand	Soft, smooth; creamy white; compact and firm
486	H	DH SF	Machine	50-50	Batt	yes	150	10	1	-	-	-	-	-	100	20	Flat Chevron	Hand	Soft, smooth; creamy light brown; even surface, pliable
487	H	DH DLW	Machine	50-50	Batt	yes	150	10	1	-	-	-	-	-	100	20	3cm Chevron	Hand	Soft, smooth; creamy white; slightly hairy but even surface, pliable
488	H	DH	Machine	-	Batt	yes	150	10	1	-	-	-	-	-	100	20	4cm Basket Weave	Hand	Soft, smooth; creamy white; even surface, pliable
489	H	DH RW	Machine	50-50	Batt	yes	150	10	1	-	-	-	-	-	100	20	4cm Basket Weave	Hand	Soft, smooth; creamy white; even surface, pliable
490	H	RW SW	Machine	50-50	Batt	yes	150	10	1	-	-	-	-	-	100	20	3cm Chevron	Hand	Soft, smooth; creamy white; even surface, pliable
491	H	S	Machine	-	Batt	yes				40	3	3	10	-	100	20	3cm Chevron	Hand	Delicate, cobweb effect; coarse, white/grey flecked, kemp fibres; very springy pleated surface, stretchy
492	H	S ZG	Machine	Lm	Batt	yes	-	-	-	40	3	3	10	-	100	20	3cm Chevron	Hand	Coarse, firm pleated surface; mottled grey; slight Np marks; pliable
493	H	ZB S ZB	Machine	Lm	Batt	yes	-	-	-	40	3	3	10	-	100	20	3cm Chevron	Hand	Lm x 3 web layers (S centre); crisp/coarse; dark brown/creamy patches; Np marks both sides; firm, stretchy
494	H	S NR	Machine	Lm	Batt	yes	-	-	-	40	3	3	10	-	100	20	3cm Chevron	Hand	Double sided: crisp/coarse; dark grey flecked/white kemp fibres; firm, rigid and flexible; Np marks on NR
495	H	S RB	Machine	Lm	Batt	yes	-	-	-	40	3	3	10	-	100	20	3cm Chevron	Hand	Double sided: crisp/scratchy; mottled brown/white flecked kemp fibres; firm and rigid; Np marks on RB
496	H	DH	Machine	-	Batt	yes	-	-	-	-	-	-	-	-	100	20	3cm Chevron	Hand	Pre-felted before pleating; Crisp, soft; creamy white; firm well defined pleat; slightly springy surface
497	H	DH	Machine	-	Batt	yes	150	10	1	-	-	-	-	-	100	20	3cm Chevron	Hand	Prepared as 496; Hp post-pleating creates a firm , supple fabric; crushed pleats give layered Em effect
498	H	DLW	Machine	-	Batt	yes	150	10	1	-	-	-	-	yes	100	20	3cm Chevron	Hand	Transparent fine carded web, stiffened. Stretchy, rigid structure
499	H	DLW	Machine	-	Batt	yes	150	10	1	-	-	-	-	yes	100	20	2cm Chevron	Hand	Transparent fine carded web, stiffened. Stretchy, rigid structure (Cut from Sample 411)
500	H	RB RW	Machine	Lm	Batt	yes	150	10	1	sample 479 used				-	100	20	4cm Basket Weave	Hand	Hp post-pleating. Improved stability. Firm soft fabric with good drape potential
491a	H	S	Machine	-	Batt	yes	150	10	1	40	3	3	10	-	100	20	3cm Chevron	Hand	Crisp, firm surface, white/grey flecked, kemp fibres, Hp post-pleating; embossed (Em) effect
492a	H	S ZG	Machine	Lm	Batt	yes	-	-	-	40	3	3	10	-	100	20	3cm Chevron	Hand	Coarse, firm pleated surface, white/grey flecked, dark/white kemp fibres; pliable
492b	H	S ZG	Machine	Lm	Batt	yes	150	15	1	40	3	3	10	-	100	20	3cm Chevron	Hand	Prepared as 492; Hp post-pleating creates a firm, supple fabric; crushed pleats give Em effect
492c	H	S ZG	Machine	Lm	Batt	yes	150	15	1	40	3	3	10	-	100	20	3cm Chevron	Hand	Prepared as 492a; Hp post-pleating creates a firm, supple fabric; crushed pleats give Em effect
493a	H	ZB S ZB	Machine	Lm	Batt	yes	150	15	1	40	3	3	10	-	100	20	3cm Chevron	Hand	Prepared as 493; Hp post-pleating creates a firm, supple fabric; crushed pleats give Em effect
494a	H	S NR	Machine	Lm	Batt	yes	-	-	-	40	3	3	10	-	100	20	3cm Chevron	Hand	Double sided: coarse/crisp; white flecked kemp fibres; firm, rigid and flexible
494b	H	S NR	Machine	Lm	Batt	yes	150	15	1	40	3	3	10	-	100	20	3cm Chevron	Hand	Prepared as 494; Hp post-pleating creates a firm, supple fabric; crushed pleats give Em effect
494c	H	S NR	Machine	Lm	Batt	yes	150	15	1	40	3	3	10	-	100	20	3cm Chevron	Hand	Prepared as 494a ; Hp post-pleating creates a firm, supple fabric; crushed pleats give Em effect
495a	H	S RB	Machine	Lm	Batt	yes	-	-	-	40	3	3	10	-	100	20	3cm Chevron	Hand	Double sided: crisp/scratchy; white flecked kemp fibres/mottled brown; firm and rigid
495b	H	S RB	Machine	Lm	Batt	yes	150	15	1	40	3	3	10	-	100	20	3cm Chevron	Hand	Prepared as 495; Hp post-pleating creates a firm, supple fabric; crushed pleats give subtle Em effect
495c	H	S RB	Machine	Lm	Batt	yes	150	15	1	40	3	3	10	-	100	20	3cm Chevron	Hand	Prepared as 495a; Hp post-pleating creates a firm, supple fabric; crushed pleats give subtle Em effect
498a	H	DLW	Machine	-	Batt	yes	150	10	1	-	-	-	-	yes	100	20	3cm Chevron	Hand	Prepared as 498; Hp post-pleating creates firm, crushed, layered effect; consistency in repeat pattern folds
498b	H	DLW	Machine	-	Batt	yes	150	10	1	-	-	-	-	yes	100	20	3cm Chevron	Hand	Prepared as 498; Fabric extended before Hp. Post-pleating Hp creates firm, crushed, layered effect; irregular pattern folds
499a	H	DLW	Machine	-	Batt	yes	150	10	1	-	-	-	-	yes	100	20	2cm Chevron	Hand	Prepared as 499; Hp post-pleating creates firm, crushed, layered effect; consistency in repeat pattern folds
499b	H	DLW	Machine	-	Batt	yes	150	10	1	-	-	-	-	yes	100	20	2cm Chevron	Hand	Prepared as 499; Fabric extended before Hp. Post-pleating Hp creates firm, crushed, layered effect; irregular pattern folds
500a	H	DH RW	Machine	50-50	Batt	yes	150	10	1	-	-	-	-	-	100	20	4cm Basket Weave	Hand	Section of Sample 489 used. Hp post-pleating. Improved stability. Firm soft fabric with good drape potential
500b	H	S RW	Machine	Lm	Batt	yes	150	10	1	sample 482 used				-	100	20	Flat Chevron	Hand	Hp post-pleating. Improved stability. Firm soft fabric with good drape potential

Table 16: Sample Results for Set H

Fig 162 DPE 008 – Dorset Horn & Ryeland (RW) 50/50 composite blend with Devon & Cornwall Longwool chevron pleat

Summary

Throughout the final development stages described the research methods and concepts were integrated with ongoing projects in the studio, offering evaluative reward and reflection. The purely exploratory nature of these studio-based experiments enabled me to investigate material and process freely whilst maintaining continuity, rigour and formality in collecting data and recording outcomes. This creative investigation was key to the success or failure of the sampling methodology. The labour-intensive and time-consuming research methods generated

layers of complex and dynamic sensory information through which to navigate, understand and move forward.

The decision-making in controlling the semi-mechanical processes was paramount in managing the material aesthetic. The sampling methods, ongoing data collection and qualitative analysis required constant re-thinking, grouping and organising. Data reduction played a significant element in the focus and inspiration for the expansion of each new idea.

The sample prototypes demonstrate a logical move forward to investigate scale and structure to establish the quality and usefulness of the fabrics as bespoke fashion and interior design textiles. The fabric weight, feel and look became critical indicators of value and character. The basic principles of manufacture remained constant but often surprising results became evident through multiple intervention and manipulation of the felt process shown in the fabric prototypes [Fig 158 – Fig 162].

The culmination of the developed practice in Stage 5 released a new spirit of adventure. Inventiveness stimulated a new direction and authority, culminating in a clear visual definition of reinvented surfaces capable of retaining the artistry and unique spontaneity recognised with the hand made.

These expressions of a new material understanding and refinement for undervalued wools and exposure of key moments that shaped the research thinking are brought together in the concluding exposition.

Conclusion

> *'If in this competitive age fabrics are made which cannot be imitated, then something is achieved.'*
>
> *Haigh H. and Newton B.A. (1952) p.47*

This thesis has established that felt presents a diverse and eclectic material, deeply embedded within the textile history of many cultures and within the broader system of textile hierarchies. Its visibility and opaqueness reveal identities that are contemporary, yet profoundly traditional. On the one hand, and contemporaneously, felt may be seen as having a new visibility and yet there appears to be a state of isolation amongst felt makers with regards to the creative potential and opportunities of using British wools. The thesis identifies that the materiality of felt is infrequently defined in terms of wool type used and exposes two extremes in this particular regard. Firstly, that much of the work shown by contemporary felt makers for craft objects and fashion is centred on Merino wool and secondly, that design outcomes for felt, considered functional, often utilise low-grade wools and recycled wool based materials. The territory between these two viewpoints appears wide and until now not fully explored, and this establishes the territory for this project.

My particular interest, for this project, has been to closely examine the responsive nature of the different wool types to variations in the felt-making process. The ability of felt's plasticity to engineer potential subtle mark making and bold manipulations of the fibres fostered imaginative and fertile investigation into unfamiliar surface textures. Embracing this vision for undervalued and waste wools gave the impetus to underpin the rationale and so develop this area for research.

Driven by acknowledging the poor response to using British wools in current felt-making practice, alternative practice methods were sought; the aim being to cultivate in an inquiring manner the materials' technical and aesthetic boundaries and potential, and to apply and document the materials in order to establish a broader understanding of design possibilities. Why use British waste wools? How could this be potentially sustainable within a high-end craft practice? What meaning and significance emerged that could be made relevant within a wider context? How did the research affect my working method and have I changed as a result? The answers to these questions will be made clear throughout this chapter.

From the start of this investigation a non-linear process informed the research direction. Thus, in pursuing the role of researcher as craft practitioner the following criteria emerged: firstly, applying knowledge within felt-making, regarding material and process and secondly, identifying the boundaries of felt-making, involving suppliers and consumers.

Personal contact with makers and observation of contemporary practice has established that wool provenance is neither well documented nor considered especially relevant in the creative outcome intended. Furthermore the use of British wools is neither commonplace nor has been developed in regards to fine craft felt-making practice.

In this thesis, a survey was made on contemporary felt-making practice and the use of waste and rare breed wools. Firstly, to establish amongst felt makers the interest with British wool types and processing and secondly to consider interdisciplinary craft methods that could be integrated in the pursuit of new knowledge. Although my studio practice methods and outcomes are personal and experimental, the interactions with makers of felt and other allied disciplines were influential in stimulating the practice methods and tone of the project.

At an early stage, exchange of ideas and resources in relation to the project was for the most part provided through verbal communication and experimental interplay between colleagues and practitioners. Such discussions invariably confirmed that felt is undoubtedly a marginalised craft, despite current popularity, and within felt-making practice there exists a lack of awareness in the different material properties and the potential they offer.

The informal and often spontaneous outcomes emerging from these oral narratives provided a much-needed filler in the absence of formal documentation and research material. As a result and for this thesis, a framework of practice methods was sought and has enriched the discussion.

My aim was to reconcile a haptic-based view against established felt-making principles in order to overturn convention and expose a new identity for material and end product and identify what could be made meaningful to practitioners and offer future research potential beyond the periphery of current felt practice. Collecting materials and sampling data is embedded in my professional practice and thus became the balancing act in divesting the research opportunities and ways to make relevant the evidence generated by the research sampling.

This was demonstrated in the early research investigation with plant and wool fibres in the felt-making process. The failures and difficulties of the technique, although at the time inconclusive, became a natural progression that led to the development of the Wool Paper fabrics.

Although embedded firmly in my practice and artistic aspirations, the Wool Paper innovation affirmed the research intent and gave me the opportunity to maintain individuality as a felt maker whilst testing the materials' structural and tangible boundaries. The investigation into the characteristics and properties of British wool fibres as fine-structured felt fabric challenged how felt is perceived. From this notion transpired an opportunity to expand the research enquiry and so offer an area for further research investigation.

Through contact with industry experts, introductions enabled me to experience at first hand industrial processes, equipment and nonwoven materials research at Leeds University allowing me to explore unfamiliar and unexplored practice methods. The nonwoven process presented a new way of articulating the aims of the project. The parallel design concepts of web formation and dry-laid methods were developed and adapted to achieve a new dimension in lightness and tonal qualities for hand-felted fabrics. In this way a contribution to understanding and new knowledge of unique design possibilities for hand crafted felt has been recognised.

To further explore and extend the boundaries within these contexts and practices, the thesis enquiry pursued the following research questions:

- What materials knowledge is evident within current felt craft practice?
- What use is there of British rare breed and waste wools in current felt-making practice?
- What new materials knowledge may be identified through tacit understanding?
- What aspects of conventional craft knowledge and industrial technologies could be integrated and sustained using hand-based felt processes?
- What evidence is shown by the sample collection of production viability for the craft maker, specifically within couture and high-end markets?
- What opportunities and limitations exist in the processing of waste wool for small-scale production within the context of fine craft felt-making?

In seeking answers to these questions, a material-led investigation was carried out and a reflection on the selected outcomes and the research aims and objectives was identified and summarised. In doing so, attention is drawn to the aspects of work that contribute to new knowledge and the future potential avenues for further research and development in fine craft felt fabric. The sampling methodology was key and fundamental to the research approach.

The selected texts brought together historical, technical and contextual information not previously developed in terms of a practice-based investigation, thus this focused survey of contemporary felt makers and artists highlighted a curiosity with materials and techniques in the felt-making process and a quest for innovation, in some examples using felt as a metaphor to express meaning.

The interaction of machine and hand as creators of production opened avenues of enquiry for post-pleating surface manipulations. The pleating methods and hand techniques transformed the fabric identity and were key factors in overcoming the structural limitations and stability of fine felted fabrics. The development of webs and adaptations of wool blends resulted in unique surface effects that led to further unexpected design possibilities. The different fibre characteristics were central in regard to determining the value and aesthetic perspective of the felted surface.

Sheep's wool is a unique fibre and every breed of sheep has its own unique character. This offered great scope for developing the methodological approaches and presented a true focus of creative expression in the final stages of this research project.

The sampling framework was a key investment in driving the research forward. However, this approach presented challenges in recording and giving meaning to the samples within the text. Such challenges were overcome to a greater extent by practice documentation of the physical samples on disc, which provided evidence of the making process in its broadest reflexive sense.

The technical boundaries of traditional and contemporary felt-making practice were explored and opened through the methodological approaches and further investigative modification of these approaches at each stage. Hand made methods were central to the research enquiry but mechanical expediency was invited and recognised in offering diversity that could be harnessed through the trace of hand. In this way the hands became the key research tools.

The research project reflects on established felt-making practice, material properties and techniques and their potential applications. This gave me the impetus to sustain the hands-on investigations and develop new design concepts that contribute to new knowledge and thus broaden the boundaries of traditional production. The sampling methodology - alongside haptic guidance elicited from the very wools and subsequent research findings - sets a unique guide for others to follow and for those making similar comparisons in this field. Thus, the principal aim to identify newness with established materials and techniques has been demonstrated through using local materials revealing a cultural identity through celebrating the characteristics and beauty of British wools as hand crafted felt fabric.

There were other significant factors, from a practitioner point of view, that drove the research enquiry. Not least to investigate solutions for local wool processing and ways to give value to waste and discarded wools and seek their potential in high-end markets. The obstacle here was to move beyond solely hand production methods and to integrate machine technologies that could be mastered with hand intervention with unique outcomes. Thus discovering that creating a method of continuous production could become possible using industrial web formation and needle felt technology linked with studio-based wet felting processes and provide the necessary impetus to expand this technology at a more commercially viable level.

It was at this stage of the sampling process that a truly unique development emerged. Three-dimensional surface manipulation using traditional hand pleating methods had given the delicate felt surfaces a new dynamic and stability. There is nothing new in this technique and the decorative potential it offers, however, I quickly discovered the simplicity of transforming unremarkable surfaces into three dimensional fabrics that presented new ways to exploit the felt-making process with controllable results. As the sampling progressed and the exploration of materials developed, the versatility of the pleating technique had become the prime area of interest in seeking originality in terms of process and material outcome. This was further enhanced with post-pleated felt applications that realised a very different and unexpected character. The method ensured controlled application of fine web structures, previously difficult to handle, transforming the way waste wools and British rare breeds wools can be used in fine craft felt-making. It is in this regard that new ground has been broken. This claim has been acknowledged as unique and original by the hand pleating manufacturers who collaborated in the research sampling trials and fabric prototypes.

The original aims of this thesis were to create new surface identities and innovations in pursuit of fine craft felt-making. However, in establishing the creative potential of the undervalued and underused British wools as sample felt fabrics, it is necessary that economic considerations have to be taken into account. The production of a range of prototypes has been achieved and at the time of writing there is a substantial interest from the market. It is my belief that with this endorsement of the research outcome there will be investment for future development and production in couture collections from significant manufacturers. The cost of producing felt using the techniques and methods described is marginal in terms of economic viability. The alternative strategy in supporting a viable market for fine craft felt products is to sell the

romance as part of the package in order to drive up the value and price. Craft makers can use the technique described therein to reflect provenance and the rare breed status, limited wool availability and distinctive processing criteria that make this product uniquely viable in terms of fine craft production.

The research has identified that the waste factor is significant in addressing volume and quantity. Mass production is associated with low-end markets such as carpet underlay and manufacturing components. However, there is proof of commercial viability for low value wools (Swaledale) as prestige interior products such as heritage ranges of wool carpets and bedding products. There remain problems in creating fine quality felt in large quantities. To the craft maker, the physical limitations are significant. This has been identified in development projects I have been involved with for couture houses. Translating the sample fabrics into economically viable production ranges is compromised by the technical limitations in achieving relatively short runs imposed by the craft process. Even if these problems could be overcome with small scale manufacturing potential, the factory set up, supply of suitable fibre and consistency of outlay is challenged in regard to material costs compared to actual fabric output. Neither would the outcome be viable in order to attain acceptable qualities as couture fabrics. Probably the mechanics for felt-making are not possible at the moment and certainly not currently economically viable or sustainable with regards using British waste and rare breed wool types.

In acknowledging the limitations that currently exist with wool supply and wool processing, the research has opened new ways of thinking in terms of sustainability and in expanding the market for local sheep growers' wool. The new skills and expertise gained in understanding these areas point to future developments and positive impact of practice. These could be profitable in building a more sophisticated understanding of the materials in terms of organic production and processing methods involving small batch production. The field is indeed open for further investigation. Nevertheless, the thesis has demonstrated its principal aim, which was to examine the creative potential of waste wools for fine craft felt-making and thus gain expertise in handling the fabrics in which to seek new levels of integrity in felt production.

As a felt maker, I intended the practice to be the primary basis of my research project. The perspectives and methods of enquiry have informed the development of my creative practice. It is through this journey and the location of the research strategy employed that the impetus and momentum of studio practice has been sustained and a critical synthesis emerged.

The methodological framework presented a matrix of wool types that were selected from waste wool supplies but also representing the diversity of British wool characteristics typified by the rare breed sheep selected.

At the outset of this investigation I was inspired to discover qualities in materials beyond the expectation of their physical properties. Materials that are familiar yet possess the capacity to surprise and to be re-valued. The concept of felt as a material of regard and esteem, specifically within the fashionable textile arena, drove the investigation forward, which through my sampling process the anticipation of expanding the newfound identities is affirmed. So, by focusing on the

technical parameters within the material choices I developed a framework that could be flexible and allow further discussion.

Felt-making techniques and processes were documented as individual sets with each wool type, procuring a system of value judgements relating to touch and visual sensory reflections in relation to wool, process and product potential. Through this critical discourse a material understanding became developed and rationalised in seeking a fine felt craft perspective.

The haptic exploration of the different wools uncovered subtleties and new identities, arousing curiosity and stimuli for innovation with materials and processes. This could only be realised through being intimately connected to the whole process of making. For felt-making, the analysis provides new levels of material understanding. The production of the research prototypes has stimulated a greater awareness and recognition for the potential of waste wools and British wool products as shown by the selected exhibition exposures, reflecting environmental concerns and the impact of sustainable practice. My practice-based research has raised these issues and the resulting evidence commands a greater respect and prestige for these wools in current felt-making practice.

Economic contribution is recognised through craft skills and tacit knowledge that are evident in the fabric outcomes and in creating accessible design opportunities for these craft skills to develop with unconventional use of materials and finishing applications. My aim has been to show the unique characteristics, distinctiveness and exceptional potential of British waste wools and to dispel assumptions that these are unfit for fine craft felt-making. The thesis has only touched upon the notions of ethical practice and sustainable values but nevertheless points to unashamedly high end markets and one-off exhibition works, where the importance of craftsmanship in processing these materials is not to be wasted.

In order to legitimise and articulate the craft values of the felt fabrics for high-end markets and applicable production methods, I chose valuation measurement criteria based on the complete process of production from fibre cleaning through to product placement and consumption. The sampling considerations are noted in terms of the suitability for couture fashion and interior product potential and thereby affirm the field and sophisticated consumer demand in which the research investigation is situated. Additionally to this, the value judgements expanded to consider if the processes used could facilitate and ensure production viability beyond the studio environment and still maintain hands on control over process at all stages. Further indicating potential uses and practical applications.

The thesis samples and fabric prototypes demonstrate a highly evolved and sophisticated knowledge of felt-making. The materials, processes and application methodologies show a deep awareness of fibre and a complex understanding of surface manipulation exploiting multiple approaches. As such and from an economic perspective the fabric collection clearly focuses on luxury handcraft, couture and high-end market potential, where each studio crafted piece is unique and highly valued. Focusing on and working with the fibre, often intuitively, in order to find a response within the hand made process, specifically facilitating the development

of hands-on knowledge, have distinguished this. This has been an important exercise in evaluating the research samples and affirming their credibility through a value system of touch. Hemmings (2012) emphasises this by implying that without touch, certain conditions and qualities, 'often unique to the textile can be misunderstood' (Hemmings, 2012, p.3). In felt-making language, failure to notice felt's tacit properties becomes fundamentally a failure to understand the material. It is through the research sampling that a contribution to new knowledge has been established.

There is no doubting the distinctive qualities and diversity of British wools as identified in the felt sample collection. These samples and the prototypes prove a radical move away and transformation from the perceived view of rare breed wools for felt-making, giving a new identity to material and technique. Whether this creates an opportunity to make a more broadly sustainable impact through couture fashion placement, remains to be seen. Such an approach is argued by Hethorn and Ulasewicz (2008) whose conversations explore the wider issues and potential of sustainable principles within fashion. The research methodology clearly defines routes that suggest more ecologically sustainable practice methods as part of my future design process. Particularly with regards organic wool processing and custom fibre development and from a purely felt-making perspective this would indeed be a future worth speculating about.

The practical investigation has demonstrated a significant awareness of the design potential for undervalued British wools and as such has been instrumental in opening a new direction for my practice. Studio-based initiatives for small-scale industrial production of niche fabrics are an area to be developed from this research. Further research and analysis of wool types could offer a wider perspective and dialogue for collaborative materials based research and technological development. Research on wool textiles and finding innovative, environmental approaches for product development has unexploited potential.

The established practice methods focused on local wools, those selected by me, concerned with my practice aspirations. The wider perspective would be to extend the materials based investigation to include wools and wool blends not examined and to develop a narrative or dialogue for originality through localism with a strong sense of cultural identity. This exciting field is now open for further investigation.

Furthermore this indicates a starting point for developing a design blueprint with commercial potential and viability for small run production. Although the individuality of the handcrafted fabrics could theoretically be sustained in terms of increased small-scale production, the viability in terms of larger scale production would most likely be unsustainable due to manufacturing parameters and production constraints. These would be further compromised and less relevant from a fine craft perspective due to loss of intimacy with process and materials and subsequent aesthetic adaptations that could be perceived as less authentic or potentially appear contrived. However, the filtering criteria, that I applied to my processes, may be relaxed to allow production within a mini-mill or small scale manufacturing environment therefore making it possible to expand the production techniques and product target market. Thus indicating ways

in which to reconcile the limitations in hand fabric production that have currently proved testing and complex to resolve.

The results of the sampling investigations in response to the research questions have only touched upon the potential of the felted wool fabrics produced. The primary aim of this thesis focused on local waste wools, selected by me, highlighting, through a robust investigation, their potential for fine craft felt-making and ways to interpret this in future fabric development. The investigation has unpacked and exposed a new identity for material and product. The relevance of the findings will be known in time. This is a beginning that has to be fully explored with so many exciting questions still to ask and hints of more potential. The scale and presence of the prototypes have much to say in a whole new way, beyond their 'cloth' status.

The research has informed the basis of a new felt fabric collection with manufacturing potential whilst sustaining its craft based roots. The capacity for ancillary materials to enable more sophisticated surface patterning would further extend the aims of the practice-based research, addressing both functional and aesthetic content.

Experimental investigations, sampling and developed works formed the background of the thesis enquiry. It was only through the discoveries and searching curiosity with rigorous studio practice that the project moved forward. Refining early experiments offered freedom to work outside the mainstream and re-define a new spirit and aesthetic language for hand crafted fabric. This research therefore is significant in addressing ways to make this viable.

A respect for tradition and heritage and the importance of craftsmanship define my role as artisan and custodian of the craft. The research achievement confirms this position of privilege and the contributions made. The focus as creator of fine craft felt-making - and being intimately connected to the whole process of making - changes nothing for me as a maker. However, the fabric prototypes demonstrate a self-confidence and assurance that have opened potential avenues for further research in fabric development and collaboration with others. The hand pleating technique offers huge scope for diversity, enabling hands on knowledge to be developed using different wools and wool blends. The potential for customising pleated designs and creating bespoke patterns and a personal design library with commercial potential are notions that I wish to develop. Adding other materials and fabric finishes offers yet further rich rewards within the hand felt process and is an area for continued investigation.

The research practice methods did not include dyeing or printing techniques. These were not considered appropriate in addressing the research aims. The selection of British wools provided sufficient variation in natural colour without dyeing and indeed this was fundamentally the characteristic and quality I wished to expose. An obvious progression from this research would be to develop a range of dyed wool and wool blends and integrate colour innovation through fibre separation and novel finishing technologies. This could further be enhanced with printing methods and introducing intricate surface control using carefully considered and appropriate hand-felting applications. I hope to develop these concepts into commercially viable solutions for couture and interior markets.

The research sampling has proved that the British wools used offer unique surfaces, which can be further developed with high technology applications (such as laser cutting and electroplating). Although these were investigated briefly at the early stages, the difficulty of accessing equipment and finding ways to overcome the limitation of available equipment was problematic in sustaining the practice progress. With this research complete I aim to develop such concepts in the future and seek collaborative funding and development initiatives with industry. Another area of research interest would be to investigate emerging technologies, specifically in seeking environmentally low impact methods for textile finishing.

More research is needed into potential production of longer length fabrics, specifically pleated felt designs, which remains for now a traditional hand operated entity. Useful lengths for bespoke fabric development involving short runs of 10 - 20 metres could potentially be viable.

In conclusion, British wool remains underused by felt makers because it is not easy to work with, however fibre blending does have potential to create a desirable product and is an area for expansion through further materials based investigation opportunities and networking initiatives with small business enterprises.

The research addresses the potential of renewable materials and undervalued wools for felt-making, securing a luxury label and design concept for waste wools - taking ancient hand craft techniques to a new level by challenging conventional persuasion with established materials.

From my own perspective, making informed choices has been endorsed throughout this research. The ability to sustain a working practice with environmentally conscious credentials is both challenging and often through economic factors becomes compromised for the craft maker and markets. It would be a good beginning if as a positive outcome from this thesis the potential of British waste wools could be embraced by more felt makers and this material awareness endorsed amongst the wider felt-making arena and to progress notions of fine craft felt-making.

In this chapter I have outlined the main areas of work presented in this thesis and the key findings in relation to the central research questions. In doing so, the contributions to knowledge made through the research have been drawn out and areas of further work have been identified.

The key tenets of haute couture demand originality through ‘quality of materials, the skill of manufacture and hand finishing’ (Bancroft 2012, p72). The validation of these criteria as presented through the research process demonstrates originality with materials, showing unique style and substance as hand crafted felt fabric. More importantly this research contributes a new understanding and sincerity for disregarded wools, as a source of inventiveness to enrich and expand the felt-making vocabulary.

The results of this practice-based research are not intended to present scientific evidence but intended as a source of information to be made accessible to felt makers, researchers and to those with creative and imaginative design purposes with a strong material identity. Although the material selection preferences are entirely personal to me and therefore subjective, the chosen sampling methodology and reference system of results tables provides transferable

data and practice methodologies that may be used and adapted by others. The processes, techniques and finishes applied are exchangeable and pave the way for further research and development with other wool types, opening new opportunities for design and research that may be extended to other practice skills and technologies, such as nuno felt, allied materials and finishing processes.

The knowledge gained presents a material investment for contemporary felt practice, a valuable teaching and research tool, and from an academic perspective, the first of its kind. The sampling methodology is a substantial investment from a practitioner perspective, offering a flexible but robust framework for further research development of different wools, fibre blends and technologies. Thus a transferable skills base may be developed from the sample tables for further adaptation, discussions and potential beyond the project boundaries. As a physical resource the thesis samples affirms the scope such wools offer in terms of potential uses and practical applications, demonstrating resourcefulness and originality not previously accessible or made aware. The archive of sample materials and database shows a new identity for material and product. This is a beginning, signalling a new perspective for waste wools within high-end markets. In so doing the thesis hints at the placement of fine craft felt in the public conscience. This research therefore is significant in the contribution to make this viable.

This thesis has demonstrated its principal aim, which was to examine the creative potential of waste wools for fine craft felt-making and as such has indicated ways in which to utilise and interpret the findings within future fabric development. Through being responsive to existing hand crafted and industrial based technologies the main concept has been realised in design strategies and unique outcomes for undervalued materials. The research has enabled an original response to choices of materials and processes. The focus on post felting applications and finishes has successfully evoked a more refined approach in three dimensional patterning and surface integrity for hand made felt fabrics, establishing newness and freshness from a craft perspective.

The research has questioned the idea of a felt fabric and how it is perceived and may be judged both visually and by touch. It has also challenged the exemplar of tradition from the felt-making perspective, recognising the historical integrity and value while yet being attentive and sensitive to the need to look forward and nurture felt-making as a dynamic process that must move forward and thus be renewed.

This raises the question of the persistence of felt craft as a distinctive category within the textile hierarchy. I questioned felt's image and its security in concurrent craft terms as being more hobbyist than fine craft oriented, firmly rooted in its ancient beginnings. In this practical enquiry material evidence has been assuaged by a material culture that is neither resolved nor tested in terms of sophisticated acceptance. The claim I make for originality is based purely on tacit knowledge and the production of a comprehensive learning process showing a haptic-based view that is not anthropological or scientific.

The research conducted has defined a niche market for waste wools in hand production, pointing to industrially applicable solutions that could enable more creative freedom and exposure for British waste wool in more commercially driven high end markets, clearly foregrounding and commending with confidence the undeveloped potential of such wools and the future legacy for fine craft felt-making.

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Special thanks must go to Professor John Miles who presented the opportunity in the first instance and nurtured my enthusiasm during the early research investigation. Also my grateful thanks to Professor Paul Davies for his timely responses and guidance during moments of doubt and despair.

Professionals in their field are many who gave unfailing support and generosity with their time and sharing expertise. I am particularly indebted to Richard Poole at the British Wool Marketing Board for his kindness and willingness to help and advise on any wool related matter however small, to Gary Mitchell whose immense skill and expertise in handling my fabrics gave me confidence to push beyond creative boundaries and to Professor Stephen Russell and the Nonwovens Research Group at Leeds University for access to production equipment and technical support during the early research stages.

Instrumental in shaping the character and qualities of the research enquiry were the sheep and their shepherds without whom this thesis would not exist in the way that it does. The diversity of materials generously donated and the knowledge and skills so freely shared were both a joy and delight.

There are others who gave me time and conversation, not least my felt-making friends and colleagues worldwide. Heartfelt thanks go to Mary Burkett OBE who listened and shared her great knowledge and passion of felt, inspiring me to keep going. My warmest thanks go to Dr. Michele Whiting and Dr. David Gee who offered courage and fortitude in the spirit of friendship. To these friends and so many others who have extended cheer and understanding, thank you.

Finally, I thank my family for their tireless devotion and love at all times: my mother Mary and “mum” Alice, who have been part of the journey; especially my daughter, Alice, whose unselfish acts of kindness, candid reading of drafts and constant demands for perfection set the goal high; my sons, Henry and Saul who breathed humour and life during dark days and low spirits; and last but not least my husband, Ben, who at moments of panic and crisis was simply heroic.

Thank you.

Appendices

Appendix A – Sheep Breeds & Wool Suppliers[134]

Devon & Cornwall Longwool

Tom Rogers, Shepton Mallet

Photo: Liz Clay

Dorset Horn

Richard Poole, Bradford
British Wool Marketing Board
Di & Mike Malcolm, Westbury-sub-Mendip

Greyface Dartmoor

Lou Kirk, Tiverton

Merino (white and coloured)

Private Flock, Easton

Photo: C Goodwin (1998)

North Ronaldsay

Rita Peace, Hertfordshire

134 Unless otherwise noted, all photos of sheep are courtesy of British Wool Marketing Board

Ryeland (coloured)

Simon Rogers, Shepton Mallet

Photo: Liz Clay
Sheep photo © Richard Webb licensed for reuse under the Creative Commons License

Ryeland (white)

Adrian Goldsack, Wincanton

Shetland (white)

Rob Whitcomb, Shapwick

Shetland (coloured)

Rob Whitcomb, Shapwick
Val Stephenson, Easton

Photo: Liz Clay

Swaledale

Richard Poole, Bradford
British Wool Marketing Board

Zwartbles

Peter Coombes, Chilcompton

Codes

The following codes are used to identify the sheep breeds

Code	Breed	Colour Variation
DH	Dorset Horn	White
DLW	Devon & Cornwall Longwool	Creamy/White
GFD	Greyface Dartmoor	Creamy/White
MB	Merino	Brown
MW	Merino	White
NR	North Ronaldsay	Grey/Black
RB	Ryeland	Brown
RG	Ryeland	Grey
RW	Ryeland	White
S	Swaledale	White
SF	Shetland	Fawn
SW	Shetland	White
ZB	Zwartbles	Brown
ZG	Zwartbles	Grey

Appendix B – Wool Properties

Wool is an animal protein fibre. Keratin is the main protein in wool and hair fibres. Each fibre is covered with a protective membrane of overlapping scales, the structure of which will vary depending on the type of fleece or breed of sheep. The diversity of these imbricated surfaces within each breed of sheep directly influences the physical properties of the fibres when subjected to the conditions required for felt-making. Felts are compacted, entanglements of fibres and in the case of wool and keratin fibres, the process is spontaneous and irreversible. Individual fibres range in size from fine to coarse described according to the number of scales and their diameter, the length or staple and crimp of each fibre. Fineness of fibre, crimp and elasticity are essential factors of felting capacity. These factors explain why certain wools will not felt as easily as others. The scale structures of coarse wool types are thin and without significant overlap thereby offering more resistance to this natural phenomenon and consequently the fibres will felt less readily.

Wool fibres do not have manmade alternatives. Where wool is concerned, 'the mechanics of most of the properties is understood qualitatively, and there are some quantitive theories' Simpson and Crawshaw (2002 p.106) however, the unique morphological structure of the fibre and diversity of these structural forms has not so far been replicated by modern science. *Wool: Science and Technology* (Simpson and Crawshaw, 2002) provides substantial information on the chemical and physical properties, processing and manufacture of wool.

Breed	Code	Type	Colour	Handle	Staple Length	Micron Range	Main Uses	Category	Breed Society	Comments
North Ronaldsay	**NR**	Naturally Coloured	Grey/Black	Soft/Harsh	4 - 8 cm	32 - 35	Hand spinning	Native Rare	1997	
Zwartbles	**ZB** **ZG**	Naturally Coloured	Black/Brown	Soft/Medium	7 - 15 cm	31 - 34	Finer for blends - knitwear/cloth Rest - carpets		1995	Established in UK 20th century
Ryeland	**RB** **RG** **RW**	Fine	White and Coloured	Soft	5 - 8 cm	30 - 32	Knitwear Fabrics Blends with other white wools	Native	1903	
Shetland	**SW** **SF**	Hill	Eleven main colours	Very soft and silky	6 - 12 cm	30 - 31.5	Knitwear Woven fabrics	Native	1927	11 main colours
Merino	**MW** **MB**	Very fine	White and Coloured	Very soft	5 - 12.5cm	20 - 25 (Average) 11.5 - 26 (Widest range)	Luxury fabrics			Introduced to the UK from Spain in the 18th century. Very few flocks in UK. Merino is mostly imported
Devon and Cornwall Longwool	**DLW**	Lustre	Creamy/White	Medium/Demi-Lustre	20 - 25 cm	40 - 42	Carpets	Native Rare	1977	
Dorset Horn	**DH**	Fine	White	Crisp/Soft	8 - 10 cm	33 - 34	Top class bedding products	Native Rare	1891	
Swaledale	**S**	Mountain	White	Medium/Harsh	10 - 20 cm	35+	Carpets	Native	1920	
Greyface Dartmoor	**GFD**	Lustre	Creamy/White	Medium/Demi-Lustre	15 - 20 cm	40 - 42	Carpet blends	Native Rare	1909	

Wool Characteristics

Appendix C – Wool Staples

Fig 163 A - Devon & Cornwall Longwool (DLW)
B - Greyface Dartmoor (GFD)
C - Dorset Horn (DH)
D - Ryeland (white) (RW)

Fig 164 A - North Ronaldsay (NR)
B - Zwartbles (coloured) (ZB)
C - Ryeland (coloured) (RB)

Fig 165 A - Merino (coloured) (MB)
B - Merino (white) (MW)
C - Shetland (fawn) (SF)
D - Shetland (white) (SW)

Appendix D – Practice Methods and Descriptions

Wet felting

A wet or pressed felt is formed by the interlocking structure of animal fibres such as wool or animal hairs when subjected to certain conditions. At a microscopic level animal fibres and particularly wool fibres appear scaly. Depending on the scale structure of each type of fibre the degree of felting and surface appearance will vary.

Fig 166 Electron microscope image showing overlapping exterior scales

When subjected to moisture, heat and agitation, the movement of the fibres causes the scales to catch and interlock. This unique phenomenon is called the 'differential friction effect' and this performative action is what makes felt possible. Without these conditions very little felting will occur. The fibre properties and process conditions will determine the fabric quality and visual aesthetic of the felt fabric.

There are two stages in the wet felting process:

- The pre-felt stage where fibres begin to interlock and form a loose, unstable material.
- The hardening stage (fulling or milling) where fibres have interlocked to form a dense, cohesive material.

The method of agitation used for all the research samples is by the hand rubbing method. The first stage of wet felting uses only the fingertips, applying gentle pressure. Add increased pressure by rubbing with the palm of the hands. To harden and compress the felt surface kneading and squeezing the fabric with hot soapy water will cause the wool fibres to migrate and compact.

Dry (needle) felting

Needle felting is a mechanical bonding method by which dry fibres, usually carded, are fed through a bed of barbed needles to produce a continuous web structure. The needles move up

and down to interlock the fibres. Speed and depth of needle penetration, needle gauge and barb configuration as well as fibre properties will determine the fabric quality and visual aesthetic of the felt fabric.

Needle felted fibres that are entirely wool or have a high percentage of wool content may be wet felted. Wet felting transforms the surface by reducing and in most cases eliminating the needle marks associated with needle felted surfaces.

Stiffening formula

A preparation of maize starch and water.

15gm maize starch powder mixed to a smooth paste with a small quantity of cold water.

Add 850ml of boiling water and whisk vigorously until solution is a uniform consistency.

Dilute with 1 litre of cold water.

Appendix E - Equipment List

Carding machine

Fig 167 Sample Carding Machine

Working width	12 in (30m)
Manufacturer	John Haigh, Huddersfield (ceased trading)
Supplied by	D J McCarthy Associates, Huddersfield

Needle punch machine

Fig 168 Needle Punch Machine

Model	KN Laboratory Needle Punch Machine
Manufacturer	William Bywater, Leeds (ceased trading)
Supplied by	D J McCarthy Associates, Huddersfield
Working width	15 ins (38cm)
Top	1/8 ins
Bottom	3.2

Heat press

Image redacted in this digitized version due to potential copyright issues.

Fig 169 Adkins Beta Maxi Heat Press

Work Area	15 x 20 ins (38 x 50 cm)
Power Consumption	2500 Watts
Power Supply	230 - 240 Volts
Working Temperature	70 - 230 degC
Timer Range	0 - 9:59 mins
Weight	45 kg
Manufacturer	A Adkins & Sons Limited

Pleating machine

Fig 170 Coral Zig-Zag Pleating Machine

Manufacturer	Ezbelent, France (1873-1926)
'Programmable'	Capable of being 'programmed' to produce different repeating patterns
Individual blades	50mm
Overall working width	1200 mm
Operating temperature	150 degC

Appendix F – Ancillary Materials

Results

No	Date	Title	Aim	Materials	Source	Method	Observations	Outcome
6	Sep-03	Felt with Peat	To test the stability of surface with peat inclusion	Merino tops and Estonian peat	Wingham Wool Work Peat Moors Visitor Centre	Double layer of merino for base layer. Peat fibre broken loosely over surface of wool then covered with a fine layer of merino. Hand felted with soap and water.	Peat very crumbly during felting process. White wool became very discoloured with peat fibres.	Firm texture when dry. Possibly use less peat next time and break it up more before using. Finished cloth rather dusty and prone to shedding of peat fibres. Limited applications unless sealed with a laminate or glue.
7	Sep-03	Felt with Peat	To test the stability of surface with peat inclusion	Merino tops and Somerset peat	Wingham Wool Work Peat Moors Visitor Centre	Double layer of merino for base layer. Peat fibre broken loosely over surface of wool then covered with a fine layer of merino. Hand felted with soap and water.	Peat is quite thick and muddy but remained stable and did not break up. The wool remained fairly white during felting.	Very firm cloth with patterned effect from peat. Definitely try this again.
8	Oct-03	Felt with Hemp	Test appearance of hemp inclusion for decorative potential	Merino tops and hemp 50/50 composite blend	Wingham Wool Work	Hand card wool and kemp fibres. Layout fibres in one layer. Hand felted with soap and water.	Easy to felt.	A stable cloth with firm texture
9	Oct-03	Felt with Hemp	Test appearance of hemp inclusion for decorative potential	Merino tops and hemp 50/50 composite blend	Wingham Wool Work	Single layer of merino keeping fibres in one direction. Hemp fibres laid loosely on wool. Hand felted with soap and water.	Fragile and all stages of the felting process. Used towel to remove most of the water.	Very unstable surface. Possible improvement if stiffening agent applied.
10	Jul-03	Paper:Corn Husks	Determine structure of paper for possible decorative potential	Corn Husks	Field in Somerset.	Dry husks thoroughly (3 months). Cut into short 1" pieces. Boil for approximately 1 hour in water with 2tbsps. soda crystals added. Beat fibres until soft. Add the pulp to 1 gallon of water and make paper sheets.	Pulp does not easily disperse in vat. Sheets of paper very lumpy.	Fairly brittle surface
11	Jul-03	Paper:Iris Leaves	Determine structure of paper for possible decorative potential	Iris Leaves	Unknown source	Dry iris leaves then cut into 1" strips. Boil for approximately 1 hour. Beat fibres until soft. Mix pulp with 1tsp. PVA and water. Make sheets of paper.	Fibres quite fine and dense.	Patchy sheets of paper. Probably more beating and reduction of fibres required.
12	Nov-03	Hand felted Merino tops and Iris Paper	Test suitability of paper with felting process	Merino tops and Paper made from Iris Leaves	Wingham Wool Work Iris Leaves-unknown source	Single layer of merino wool covered with a sheet of iris paper and then another single layer of iris paper. Hand felted with soap and water.	Fine, lace-like sheet of felt. Good combination of fibres.	Felted well and produced a surprisingly stable cloth. Transparent and soft handle.
13	Nov-03	Hand felted Merino tops and Iris Paper	Test suitability of paper with felting process	Merino tops dyed black. Paper made from Iris Leaves	Wingham Wool Work Iris Leaves-unknown source	Double layer of merino wool covered with a sheet of iris paper. Hand felted with soap and water.	Felted surprisingly well. Paper kept its shape and bonded easily with the wool fibres during the felting process.	Smooth surface texture. Try again with other applications.
14	Nov-03	Hand felted Merino tops with Corn Husks	Test suitability of fibre with felting process	Merino tops dyed black. Corn Husk paper.	Wingham Wool Work Corn Husks-local field.	Double layer of merino wool covered with a sheet of corn husk paper. Hand felted with soap and water.	Difficult to felt together. Corn husks kept separating from wool.	Very unsatisfactory. The paper was too brittle to felt well
17	Jul-04	Laminated Korean Mulberry Paper : Hansi (pron. Hanchi)	To obtain a laminated paper from three sheets	Mulberry Papers x 3 (White/ Orange/Black)	Korea-Maureen Richardson	Laminate the paper sheets by layering and wetting together with water using a sponge.Crumple sheets between hands and beat lightly using a dropping and lifting method of the hands. Unfold crumpled paper laminate and dry flat.	Mulberry paper is strong when wet and handles easily. Laminating technique is similar to felting process without the shrinkage.	A strong paper surface. Dyes remain strong after felting.
18	Jul-04	Laminated Korean Mulberry Paper : Hansi (pron. Hanchi) with oil.	To obtain a laminated paper from three sheets and seek possible changes to surface with application of oil	Mulberry Papers x 3 (White/ Orange/Black) Vegetable cooking oil	Korea-Maureen Richardson	Laminated sheets of Mulberry Paper as Sample 17. When dry apply a thin coat of vegetable oil with a brush or sponge, making sure the oil penetrates the paper's layers. Apply oil to both sides.	Creates a slightly leathery but pliable surface. Oil affects the colour of the lighter paper by darkening and revealing deeper coloured layers beneath.	Strong texture. Folds and creases well
19	Jul-04	Korean Mulberry Paper with felted Zwartbles wool	Testing the strength of paper with wet felting process	Mulberry Paper and Zwartbles wool	Paper:Korea-Maureen Richardson Wool:Peter Coombes	Hand felt a thin layer of wool onto the Mulberry paper using soap and water.	Paper tears and wool felts unevenly.	Textured surface but lacks strength. Possibly try with other wool types.
20	Jul-04	Laminated recycled plant papers with oil	To obtain a laminated paper from three sheets and seek possible changes to surface with application of oil	Pulp from old papers:nettle/straw/ tomato. Vegetable cooking oil.	Maureen Richardson	Using pulp from old papers make new sheets. Arrange fragments of old papers onto surface of new wet sheet and cover with a final new sheet of recycled papers.Dry. Apply a thin layer of vegetable oil.	Clear defined patterns of added paper fragments. Leathery, pliable surface as in Sample 18.	Good decorative potential.
21	Jul-04	Recycled plant papers and wool	Combine plant paper with wool by laminating	Pulp from old papers:nettle/straw/ tomato. Kozo pulp. Wool: Blackface and Ryeland	Paper: Maureen Richardson. Blackface wool: British Wool Marketing Board Ryeland wool: Kate Elliott.	Sample 1 Sheet from recycled paper pulp. Sample 2 as Sample 1 with grey/black Ryeland (cut and ground in blender) sprinkled over wet paper sheet. Sample 3 as Sample 2 with Kozo sheet covering wool. Sample 4 as sample 3 but using white wool:Blackface (W.B.Grade 723)	Sample 1 : Good even texture. Sample 2 : Wool adheres well. Sample 3 : Kozo paper provides a transparent layer over wool. Sample 4 : As sample 3 but with more even distribution of wool. Has a cushioned feel to the surface (Kozo side).	Samples 2 and 3 have decorative possibilities. Sample 4 good textural qualities.
22	Jul-04	Kozo paper and wool	Combine plant paper with wool by laminating	Kozo pulp. Wool: Blackface and Ryeland	Paper: Maureen Richardson. Blackface wool: British Wool Marketing Board Ryeland wool: Kate Elliott.	Sample 1 Sheet from Kozo pulp. Sample 2 as Sample 1 with grey/black Ryeland (cut and ground in blender) sprinkled over wet paper sheet. Sample 3 as Sample 2 with Kozo sheet covering wool. Sample 4 as sample 3 but using white wool:Blackface (W.B.Grade 723)	Sample 1 : Fine, transparent sheet. Good even texture. Sample 2 : Wool does not adhere well. Sample 3 : Kozo paper provides a transparent layer over wool. Sample 4 : As sample 3 but with more even distribution of wool.	Sample 1 satisfactory. Samples 2-4 have poor quality surfaces. Not successful with wool.
23	Jul-04	Recyled plant papers and wool	Combine plant paper with wool by laminating	Pulp from old papers:nettles/straw/ tomato. Wool:Jacob(fleece) Leicester Longwool(tops)	Pulp: Maureen Richardson Jacob fleece Clare Laverick Leicester longwool tops: Wingham Wool Work	Jacob fleece and Leicester Longwool tops carded together(50/50) and hand felted using soap and water. Sample 1 Felt was dropped into pulp, removed and left to dry. Sample 2 Pulp was poured over felt.	Sample 1 Pulp covered felt unevenly. Sample 2 Pulp covered unevenly remaining thick in areas.	Very little difference between samples. Maybe try again with different pulp and wool.
24	Jul-04	Recycled plant papers and wool	Combine plant paper with wool by laminating	Pulp from old papers:nettles/straw/ tomato. Wool:Jacob(fleece) Leicester Longwool(tops)	Pulp: Maureen Richardson Jacob fleece Clare Laverick Leicester longwool tops: Wingham Wool Work	Jacob fleece and Leicester Longwool tops carded together(50/50) and hand felted using soap and water. Laminate a sheet of paper onto felt. Another smaller sheet of paper laminated onto the exposed felt.	Paper and wool laminated well with this technique. Clear definition of edges. Clean cut edges.	Good outcome with interesting patterning possibilities. Try again with other pulp and wool.
25	Jul-04	Bracket mushroom pulp and wool.	Laminate felt surface with plant pulp	Bracket mushrooms. Wool: Jacob(fleece) Leicester Longwool(tops)	Pulp: Maureen Richardson Jacob fleece Clare Laverick Leicester longwool tops: Wingham Wool Work	Jacob fleece and Leicester Longwool tops carded together(50/50) and hand felted using soap and water. Pour the bracket mushroom pulp directly onto the felt using a cup. Cover one side completely and leave to dry.	The surfaces laminate well with no seepage of pulp, creating two contrasting surfaces. Cuts well. Surface is pliable. A very pungent smell which completely disappears once the fibres are completely dry.	Excellent results. The pulp surface has a rich sheen. The two surfaces bonded well. Great possibilities when back lit from wool side: lighting applications for lamp shades etc.

Table 17: Ancillary Materials

Images – Ancillary materials

Fig 171 6 - Felt with peat

Fig 172 7 - Felt with peat

Fig 173 8 - Felt with hemp

Fig 174 9 - Felt with hemp

Fig 175 10 - Paper: Corn Husks

Fig 176 11 - Paper: Iris Leaves

Fig 177 12 - Hand felted Merino tops and Iris Paper

Fig 178 13 - Hand felted Merino tops and Iris Paper

Fig 179 14 - Hand felted Merino tops with Corn Husks

Fig 180 17 - Laminated Korean Mulberry Paper: Hansi (pron. Hanchi)

Fig 181 18 - Laminated Korean Mulberry Paper: Hansi (pron. Hanchi) with oil.

Fig 182 19 - Korean Mulberry Paper with felted Zwartbles wool

Fig 183 20 - Laminated recycled plant papers with oil

Fig 184 21 - Recycled plant papers and wool

Fig 185 22 - Kozo paper and wool

Fig 186 23 - Recycled plant papers and wool

Fig 187 24 - Recycled plant papers and wool

Fig 188 25 - Bracket mushroom pulp and wool.

Appendix G – Enamelling

In 2010, a research grant from Bath Spa University enabled me to work under Elizabeth Turrell, Senior Research Fellow: Enamel at the Centre for Fine Print Research, University of the West of England.

This research of enamelled surfaces opened new and unexpected ways in which to explore the distinctive characteristics of the different felted wool types as hard surfaces.

The intention was to seek ways in which a collaborative practice initiative might create a process that could be utilised for decorative detail and embellishments in bespoke design and couture fashion fabrics.

The methods used specifically looked for ways that the different wool types might retain their individual characteristics within the fired surface.

Methods:

Copper discs were used as bases.

Industrial porcelain enamel (wet process) and sifting enamels (dry process) were applied to felted wool surfaces and wool staples.

The samples were fired individually at 800 degrees Celsius for 2 minutes. After firing and cooling the surfaces were sanded to create a matt surface and remove surface debris.

Discussion

Although suitable for small surface areas the project concluded it was not viable to produce reliable and consistent results without further technical understanding of the enamel process. The high temperatures required in the firing process, the kiln size and complexities of chemical reaction during the firing process presented obvious limitations. However, the residual effect of the carbonised wool shell showed that it could be possible to incorporate these processes as three-dimensional surface effects where negative space could be explored.

Conclusion

The results concluded that the process was unsustainable within the research time frame but that the results merit recording as a basis for further research.

Results - Sample UWE025

Materials

Copper discs – counter enamel – sifting enamels and clear flux. Grey wet process (industrial enamel-porcelain enamel)

English wools:

- Cotswold
- Devon Longwool
- Gotland
- Herdwick
- Shetland

Process

- Copper discs – counter enamel – sifting enamels and clear flux. Grey wet process (industrial enamel-porcelain enamel)
- Counter enamel copper discs
- Wool motif soaked in wet enamel and dried
- Baked at 800 degrees Celsius for 2 minutes

Observations

- Cotswold – exposed copper surface in parts after firing. Carbon and ash from the wool as a result of chemical reaction of acid burn of the counter enamel.
- Devon Longwool – Very smooth unbroken surface revealing fibre structure.
- Gotland – definition of fibre crimp in carbonised relief.
- Herdwick – impression of fibre but less defined.
- Shetland – subtle marks exposed with sanding.

Outcome/Result

- Enamel surfaces are varied but mostly have remained firm enough to pumice the surface smooth. Good results.
- Fine wools show uniform, even surfaces.
- Thicker crimp fibres have formed a fragile shell. Exposing pitted marks through to copper base. Distinctive carbonised relief marks of fibres.
- Try with other wool types and base metals.

Images – UWE025

Fig 189 Gotland after firing

Fig 190 Devon Long Wool after firing

Fig 191 Herdwick after firing

Fig 192 Shetland after firing

Fig 193 Shetland after pumice

Results - Sample UWE026

Materials

Copper discs – counter enamel – sifting enamels and clear flux. Grey wet process (industrial enamel-porcelain enamel)

English wools:

- Blue Face Leicester
- Alpaca
- Bowmont
- Wensleydale
- Wool Nepps
- Silk Nepps

Process

- Copper discs – counter enamel – sifting enamels and clear flux. Grey wet process (industrial enamel-porcelain enamel)
- Counter enamel copper discs
- Wool motif soaked in wet enamel and dried
- Baked at 800 degrees Celsius for 2 minutes

Observations

- Blue Face Leicester – shows a clear impression of the wool crimp in the enamel surface.
- Alpaca – less clear but definition of fibre evident. Copper base exposed.
- Bowmont – little impression of fibre evident
- Wensleydale – dark carbonised area where wool is dense (thick crimp)
- Wool Nepps – interesting residue of circular shapes of wool
- Silk Nepps – little evidence of fibre used. Copper base exposed.

Outcome/Result

- Enamel surfaces are varied but mostly have remained firm enough to pumice the surfaces smooth. Generally good results.
- Fine wools show uniform, even surfaces
- Thicker crimp fibres have formed a fragile shell. Exposing pitted marks through to copper base. Distinctive carbonised relief marks of fibres.
- Try with other wool types and base metals.

Images – UWE026

Fig 194 Blue Face Leicester after firing

Fig 195 Blue Face Leicester after pumice

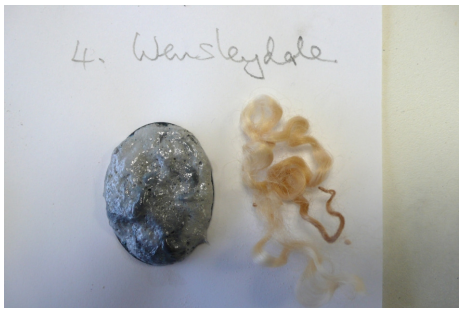

Fig 196 Wensleydale after firing

Fig 197 Wensleydale after pumice

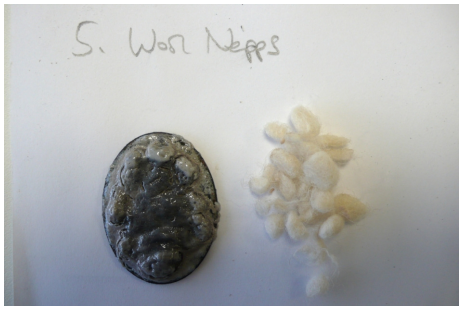

Fig 198 Wool Nepps after firing

Fig 199 Wool Nepps after pumice

Appendix H – Research & Presentations

The following lists specific research activities attended and presentations of the research material.

Conferences

Selected conferences and seminars attended during the research period:

- **Expanding the Boundaries**, Nonwovens Network 1st International Conference, Leeds 25th-26th May 2005
- **Cutting Edge: Lasers and Creativity**, Loughborough University School of Art and Design, 4th November 2009
- **Textiles-UK, Wool - the cloth of kings**, Society of Dyers and Colourists, Clothworkers' Hall, London, 5th October 2010
- **Textile Research in Practice**, School of the Arts, Loughborough University, 16th-17th November 2011
- **Evolving Craft Communities: From Stone Age to the Digital Age**, Heritage Crafts Association Spring Conference, V&A Museum, London, 24th March 2012
- **Pairings**, Symposium, Stroud International Textiles, 5th May 2012

Presentations

The results of the research presented in this thesis have been presented at the following:

- **Material Evidence**, Symposium, Corsham Court Centre, 29th September 2010
- **Doctoring Practice**, Symposium, Bath School of Art and Design, 27th April 2012

Exhibitions

The material outcomes of the research presented in this thesis have been presented through inclusion in the following exhibitions:

- **Material Evidence**, Corsham Court Centre, 29th September 2010
- **Doctoring Practice**, Bath School of Art and Design, UK touring exhibition (2012)
- **...In Bewegung**, Filz-Netzwerk, international touring exhibition (2013)

Glossary of terms

Batt	A formation of carded webs of fibres into a multi-layer structure
Blending	Combining different wool types into carded batts
Carding	Disentangling wool fibres using hand tools (carders) or carding machine by opening the fibres to maximise the amount of air between the fibres and produce thin even layers of fibres
Clip	Shearing or clipping the wool from a sheep
Combing	Straightening and parallel alignment of long fibres with removal of short fibres after the carding process
Crimp	The natural waviness or curliness along the length of individual wool fibres
De-pigmentation	Industrial bleaching process to remove natural colour (pigmentation) of wool fibres
Dwell time	The length of time that felt is exposed to heat and compression during the heat pressing process
Felt	The generic term given to a fabric of matted, compressed animal fibres, usually sheep's wool. Heat, moisture and pressure are required in the process.
Fibre	The individual hair of a fleece
Fleece	The shorn wool from a sheep, also unprocessed wool fibres
Fulling	The final stage of the wet felt process to further harden the felt and increase density. (also known as milling)
Gauge	Measurement used to denote thickness of a barbed felting needle
Half felt	See *Pre-felt*
Hand rolled felt	The traditional Central Asian and Middle Eastern technique of rolling the wetted wool fibres in a reed mat or cloth until felted
Hand rubbing technique	Method of wet felting using only the hands to create friction by rubbing directly onto the wool fibres
Haptic	A term referring to communication through the senses, specifically touch
Kemp	Hollow, dead fibres that are brittle and coarse
Laminating	Fusing two or more layers of carded webs or pre-felted wool by wet or dry felting methods. (Term sometimes used by felt makers to describe *nuno* felt)
Lanolin	The natural oily or waxy secretion from the sebaceous glands of sheep forming a residue in unwashed, greasy fleece

Lock	A cluster or tuft of fibres
Lustre	The shiny, light reflecting quality of certain wool fibres (usually longwools) due to their scale structure
Micron count	The thickness of an individual wool fibre in microns (0.001mm)
Milling	Another term for *fulling*
Needle punch	A dry method of making a nonwoven felt structure formed by mechanical process. Barbed needles entangle the fibres at high speed. Hardening the felted surface is possible by repeating the process
Nep or nepp	A small knot of broken, entangled fibres removed after combing
Nonwoven	A non felted fabric formed by needle punch technology that is not a wet milled structure
Nuno	The Japanese word meaning functional textile. A term used in contemporary felt-making to describe wet felting wool fibres into a woven substrate to produce a lightweight fabric with a highly textured surface. The term *nuno* is accredited to felt maker Polly Stirling and her assistant Sachiko Kotaka (1994).
Pre-felt (also half-felt)	The first stage of wet felting to produce a loose but coherent fabric. It is possible to add fibres at this stage or to cut and reshape the pre-felt for design purposes
Raw wool	Unprocessed wool, direct from the sheep, containing grease and dirt
Scale structure	The overlapping cells of the cuticle responsible for entangling and felting properties of wool
Scouring	Washing wool to remove dirt and grease
Scrim	A light weight woven fabric, usually cotton
Sliver	Continuous soft rope lengths of carded wool containing short and long fibres
Staple	The varying length of a fibre
Teasing	Loosening fleece wool to separate the fibres
Tops	Machine combed wool fibres in continuous alignment to form soft ropes.
Traditional Wet felting	The process of making a wool fabric, using water, heat and friction
Urushi	A traditional Japanese handcraft using natural lacquer created from the sap of the Urushi tree
Web	A thin layer of an homogenous mass of individual fibres
Yurt	A felt tent that is the traditional nomadic dwelling in Central Asia

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