ZERO-WASTE FASHION DESIGN:

a study at the intersection of

cloth, fashion design and pattern cutting

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Certificate of Authorship/Originality

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of Timo Rissanen

13th of May, 2013
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I dedicate this project to my mum and dad. Kiitos.

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PREAMBLE  OCT 5, 2012

At the start of this project in 2004 or 2005 I wrote a note to make a t-shirt that had all of its waste appliquéd on it.

I did this in August 2012.

Completing to-do-lists feels great.

Let's do this.

Tim
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Abstract

This thesis examines zero-waste fashion design: design activity that results in zero-waste garments. Conventional design approaches waste approximately 15 per cent of the fabric used in the design and make of a cut and sew garment. The responsibility for this wastage belongs with manufacture, which is constrained by what has already been designed and pattern cut. The economic systems that underpin fashion design and manufacture are such that there is little economic incentive to be concerned with this wastage. An examination of the material and social investments embodied in fabrics alongside their environmental impacts, reveals that these investments are wasted in the wasted fabric.

The context of this study is contemporary fashion design within the ready-to-wear industry: fashion design that leads to the manufacturing of multiples of one design. The contextual review of this study examines different methods of fashion creation. Design ideation tools and the relationship between fashion design and pattern cutting in current industry provide the frame for design practice in this study, together with an analysis of historical and contemporary zero-waste and less-waste garments. Findings from the contextual review frame a series of briefs for design experiments. This study asks: What are the opportunities for creating zero-waste garments within contemporary menswear fashion design practice using cut and sew methods?

Fashion design practice is the primary research tool in this study. Design processes and their outcomes are documented in a journal, and the journals are transcribed and analysed. Successful strategies for zero-waste fashion design, emerging from the data, are presented. Pattern cutting emerges as integral to zero-waste fashion design. Zero-waste fashion design is examined in relation to fashion manufacture, as particular manufacturing issues such as fabric as material, and the grading of garment patterns to achieve size ranges of garments, create new kinds of opportunities for zero-waste fashion design. This study also asks: To what extent is a zero-waste approach feasible and desirable within contemporary fashion industry? This study demonstrates that zero-waste fashion design generates new opportunities for fashion design to engage with fashion manufacture that may not currently exist.

This study calls for fashion design to consider pattern cutting an integral part of the fashion design process. Such an approach to fashion design creates new opportunities for the fashion industry and fashion design education. Zero-waste fashion design is part of a larger picture of beauty for everyone, that fashion is capable of being the source of.
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INTRODUCTION TO
ZERO-WASTE FASHION DESIGN

“I shall cut my cote after my cloth.”
English proverb in Proverbs in the English Tongue (John Heywood, 1546),
quoted by Burnham (1973: 2)

“Fashion’s most glaring aspect is waste. ... waste is not only regarded as perfectly legitimate but assumes the significance of patriotic duty.”
Bernard Rudofsky (1947: 227)

“Immaterial aspects of fashion will become more celebrated as raw materials become scarcer. The material components of fashion will be treated with greater reverence and respect for the same reason.”
Kate Fletcher and Lynda Grose (2012: 181)
Almost all clothes are made from fabric, or cloth; they do not exist without it. The predominant method of making clothes involves cutting fabric and assembling the pieces through sewing, fusing, welding and other techniques into garments. A considerable amount of fabric is often wasted in the process. Through researching the French couturier Madeleine Vionnet for an undergraduate dissertation in 1999, I became aware that throughout history, various cultures had produced clothes in a way that wasted little or no fabric. Thanks to two decades of research by Betty Kirke (1998), I was able to examine Vionnet’s work in detail. I was particularly interested in the relationships between three-dimensional garments and their two-dimensional patterns. I began to realise that zero-waste fashion design might be possible in a contemporary industry context. Through my subsequent practice as a fashion designer and pattern cutter this hunch became stronger. But how would a designer go about creating zero-waste garments?

The focus of this thesis is zero-waste fashion design. A zero-waste garment in this thesis refers to a garment that has been designed and pattern cut in such a way that when the garment is cut, all of the fabric is in the garment, and none is left behind as off-cut waste. Zero-waste fashion design in this thesis refers to the activities and design processes that lead to such garments. Zero-waste fashion, however, is a broader term, with potentially multiple interpretations. In my view, our common goal as an industry and as a global community should be zero-waste fashion. This would be a community of fashion producers and users who eliminate waste – material and immaterial waste – at every instance of fibre generation, yarn spinning and processing, fabric design manufacture, garment design and manufacture, storage and transport, sales, garment use, and the cycling back of resources at the end of the first use life of the garment. Zero-waste fashion design as it is presented in this thesis, is one significant stage of that cycle.

A brief consideration of the possible reasons for the fabric waste produced during making fashion garments reveals that where fabric waste is a consideration in the fashion manufacturing process – at the marker planning and making, and cutting stages – the designed garment is already inviolable; it cannot be changed. This suggests that to eliminate fabric waste, fabric waste needs to become a concern earlier in the process: a consideration for fashion design and pattern cutting. Manufacture is governed by what has been designed and pattern cut.

At this point in time, fabric waste is mainly regarded an economic issue (Cooklin 1997: 9-10). This study responds to calls by Fletcher (2008) and Allwood et al (2006) that fabric waste should also become an environmental and ethical consideration for the fashion industry. I, the researcher, am an experienced practitioner with thorough knowledge of the craft of fashion design and pattern cutting. The project is structured around the design of a menswear
collection, an area of practice with which I am very familiar. In the course of developing the collection I systematically identified a range of approaches that could be adopted when designing and making zero-waste garments. The application of these approaches to the menswear collection has been documented and analysed. Successful and unsuccessful strategies are reported. The implications for manufacturing and fashion design education are explored.

1.1 Fabric waste: an emerging problem for fashion design and manufacture

How does waste come to exist? The focus here is on material waste. Waste comes into being through sorting and categorising. When someone deems a material entity undesirable or unnecessary, it becomes waste (Strasser 1999: 5). Textile waste is created in two broad categories (Caulfield 2009). Pre-consumer textile waste is created during manufacture of fibre, yarn, fabric and garments. Post-consumer textile waste is created by consumers and comprises garments and household textiles. This research is concerned with pre-consumer fabric waste and more specifically, fabric off-cuts created during the cutting phase of clothing manufacture.

The way in which the fashion industry uses fabric to create garments is arguably wasteful and inefficient. For the garment manufacturer¹, a garment costs money to make and this cost is a sum of several parts. Generally the two most significant sources of garment cost are fabric and labour for construction (usually sewing). Fabric makes up approximately 50 percent of the cost price of a garment and labour 20 percent (Cooklin 1997: 9). It is therefore in the manufacturer’s economic interest to be able to make each garment from as little fabric as possible without compromising the fashion designer’s intent regarding garment appearance or fit. To reduce fabric usage and cost prior to cutting the fabric, the pattern pieces are laid out on the fabric width as closely together as possible. A person may do this manually on paper, but increasingly appropriate computer software, such as OptiTex, Gerber or Lectra, is used to determine the most efficient cutting layout. The resulting pattern layout, the lay plan for cutting, is called a marker and the person responsible for the planning is the marker-maker. As long as the production yield for each garment (the amount of fabric that a garment will require in mass production to cut) is at or below the costed yield (this was calculated when the original sample garment was made, based on how much fabric was required to make the sample garment), the profit margin will be satisfactory as far as fabric consumption is concerned.

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¹ Manufacturer here refers to an entity that takes orders from retailers for a particular garment and then produces multiples of that garment, either by manufacturing them or by subcontracting the manufacturing to someone else. Regardless of which way the garments are produced, the manufacturer bears the costs discussed.
While the overall fabric usage may be satisfactory to the manufacturer in an economic sense, after garments have been cut there are usually fabric off-cuts left – the fabric waste with which this study is concerned. Even with up-to-date software or the most experienced and skilled manual marker-makers, in adult outerwear this fabric wastage varies from 10 to 20 percent (Feyerabend 2004: 4). Cooklin (1997: 9) estimates the average waste to be 15 percent of total fabric used, while Abernathy, Dunlop et al. (1999: 136) give an estimate of 10 percent for trousers and jeans and higher for blouses, jackets and underwear. Manufacturers and much of the literature on fashion manufacture do not regard this as a problem as long as the total amount of fabric is at or below the costed yield. From a strictly economic viewpoint it appears to make sense to waste 15 percent of the total fabric used. The established industry models are such that there seems to be no economic imperative to be concerned about this level of waste.

Why doesn’t extensive marker-making expertise or the most sophisticated software result in patterns that reach 100 percent fabric usage? The answer lies in the nature of the pattern pieces, the pieces of fabric from which the garment is made. In order to use all of the fabric, they would need to interlock perfectly, not unlike the pieces of a completed jigsaw puzzle. Why do the pattern pieces not do this? They are not designed to do so. In most fashion industry practice, a pattern is cut for a garment based on a sketched idea. When a fashion designer is sketching a
garment, the shapes of pattern pieces and how they may interact on a fabric width are not considerations in conventional fashion design. It seems that the primary aim of conventional pattern cutting is to assist in realising a sketched idea in three-dimensional form; most pattern cutting manuals reinforce this view.

Variation in the amount of waste (10-20%+ percent) stems from a number of variables. These include: a) the garment style (number, size and shapes of pattern pieces) in relation to fabric width; b) the number of garment sizes marked together in one marker\(^2\) and c) the expertise of the marker-maker (whether manual or computer-aided). In conventional industry practice, the marker-maker is severely limited by what has already been designed and pattern cut. This problem lies at the heart of this research.

Conventional attempts at improving the efficiency of fabric use focus on the manufacturing stage. Pattern engineering refers to the practice of modifying a garment pattern in order to achieve a better yield on fabric and thus reduced fabric cost for a garment (Fasanella 1998: 36). This usually entails shifting, adding or eliminating a seam, and it occurs during manufacture (after design), usually based on a suggestion by the marker maker or sample cutter. Depending on the size of the company, these roles may be performed by the same person. According to Fasanella (1998: 36) sample cutters “are usually the first to notice the over-all efficiency of fabric use. If too much fabric is wasted, their suggestions guide the pattern maker to cut a more efficient pattern to reduce waste.” The sample cutter is the person cutting the sample garment from fabric; depending on the size of the company, this may not be a separate role and maybe performed by the pattern cutter. The fashion designer and pattern cutter typically do not see the amount of waste created because the waste mostly occurs after the garment has been designed – while it is being manufactured – often in a separate physical location. This study investigates the relationship between fashion design practice and how fabric is used to design and make garments. This research proposes that fashion design and pattern cutting are capable of producing considerable improvements in the efficiency of fabric use; and that it is possible to create fashion without creating fabric waste in a contemporary fashion design context. Key to this development would be to include pattern cutting within the practice of fashion design; currently the two crafts tend to be practiced separately.

\(^2\) Creating a single marker that contains more than one garment style is rare, but tailors often mark a jacket and trousers (and sometimes a waistcoat) on one marker, resulting in better efficiency (Cabrera & Flaherty Meyers 1983: 57). In 1992 Yeohlee Teng marked three dresses together to ensure the restricted length of fabric was sufficient for the three garments (Teng & Major 2003: 82-83). Holly McQuillan has designed multiple garments within one marker, resulting in no fabric waste (McQuillan & Rissanen, 2011: 54)
1.1.1 Fabric waste and the waste management hierarchy

Fashion fabric is fabric that is specifically designed and manufactured for use in the process of designing and making clothes. This fabric arrives at the fashion designer containing its “raw” materials as well as the embodied energy and other resources consumed to generate raw fibre and transform it into yarn and then fabric. The primary function of the fabric used by the fashion industry is for use in the garments produced by it. Any fabric not in the finished garment has been “wasted” by the fashion industry; its primary function has been lost. Nevertheless, a “fabric waste industry” of rag traders exists to trade in the off-cuts produced by the fashion industry. This raises the question: Is the fabric waste really waste if it is a resource to be traded and used? In this study, the scraps left over when the garment has been cut will be referred to as waste because of the loss of original function.

There is a high degree of consensus amongst researchers working in the field of waste management that there is a clear hierarchy amongst the approaches that might be adopted to the management of waste within the fashion industry (Sakai et al 1996; White, Franke & Hindle 1999). Prevention is better than cure: it is better to avoid creating waste than to manage it (Gertsakis and Lewis 2003: 7). Figure 1.2 sums the options from most through to least favoured. The clarity of this hierarchy provided the initial impetus for the study. This study is situated at the top within waste prevention, and in the contextual phase (Chapter 2) waste minimisation, because there are significant problems with approaches that sit within the lower levels of the hierarchy. I will briefly review some of the difficulties that arise when working with these lower level approaches.

Figure 1.2: Waste management hierarchy, adapted from White, Franke & Hindle (1999: 20)
Reuse in the hierarchy refers to using fabric waste as fabric; the function as well as the material (fibre) of fabric is retained. Cutting garments from fabric appears somewhat like cutting cookies from rolled out dough. Unlike cookie dough, however, the fabric scraps left behind cannot be combined and “kneaded” into new fabric of the same quality as the original fabric. Fabric waste can nevertheless be reused in a number of ways, for example by weaving rag rugs or making small items such as wallets.

The Riedizioni collection by Luisa Cevese uses fabric waste from the fashion industry as decorative elements in polyurethane bags (Braddock and O’Mahony, 2005: 31). Gale and Kaur (2002: 117) question whether Cevese’s approach is “green”; “what is gained in terms of issues of disposal may be lost in terms of issues of manufacture”. In the 1997 Prism collection Issey Miyake seemingly uses fabric scraps as decoration on garments; pieces of different fabrics are placed on a base fabric, which is needle-punched to intertwine the fibres of the different fabrics (McCarty & McQuaid 1998: 28-29). Whether actual fabric waste is used or new fabric cut for these pieces is unclear, but as examples Miyake’s and Cevese’s approach are perhaps an ideal way of treating fabric waste if waste must be created: as fabric. Two companies in the USA point towards the possibility of turning fabric waste into a source of profit. Alabama Chanin in Florence, Alabama (Chanin 2010: 5–6; McQuillan & Rissanen 2011: 66) and Dosa in Los Angeles, California (Fletcher 2008: 71), re-use all of their fabric waste within their product ranges, turning waste into embellishment, yarn and stuffing for furniture, to name a few examples. Both companies have incorporated a holistic zero-waste
philosophy into their business models, thus ensuring waste elimination on one hand and profitability on the other. Moreover, fabric waste becomes a source of employment for communities locally and overseas (Alabama, USA and India, respectively).

If a separate small product such as a wallet is to be made from the waste, a problem arises: it is difficult to handle and store fabric waste while maintaining ease of cutting using conventional mass-production methods. Ideally the item should be cut concurrently with the garment, requiring that it is also designed and pattern cut before cutting the garment. In mass-production cutting, dozens or hundreds of layers of fabric may be laid on the cutting table; moving and storing multiple layers of off-cuts for later cutting without shifting the layers is difficult. For economic reasons alone it would make more sense to produce the product concurrently with the garment. Further, some fabrics suit only a limited number of useful items.

Materialbyproduct, an Australian fashion company, routinely produces accessories from fabric waste, that coordinate with the garments that created the waste. The company calls each of these items “an anti”. Materialbyproduct states that the demand for antis matches the demand for the garments (Dimasi, 2009). Given that Materialbyproduct cater to a niche market, it is likely that this situation would not be sustainable across the industry as a whole. While in some instances an additional product may be the ideal way to address off-cut waste, overall avoiding waste is better than making things from it.

Recycling paper and glass, and more recently plastic, is familiar to most people at home and at work. It is therefore perhaps the most easily understood mode of waste management. Where reuse of fabric waste is not possible, recycling is the next option to investigate. Fabric, however, creates its particular challenges for recycling. Fletcher (2008: 103-105) notes that there are two methods for fibre recycling: mechanical, which has not changed for 200 years, and chemical, an approach which is technically possible with some synthetic fibres. Perhaps the largest problem posed for either method is the sheer diversity of fabrics: synthetic and natural fibres are often blended into one fabric, and sorting fabric waste by fibre type and colour (necessary for mechanical recycling unless a lesser-quality end product of mixed fibre is deemed acceptable) can be problematic. When different coloured fabrics or fibres are recycled together, the end colour can rarely be predetermined, and re-bleaching and dyeing may be necessary; this can be resource intensive. Furthermore, recycling can impact negatively on the environment
through transportation (fuel, emissions) and reprocessing (in particular, water, energy and chemical consumption). Mechanical recycling also shortens fibres, resulting in lower quality yarns and fabric. This degradation in material quality, or more specifically, the decrease in value during recycling is referred to as “downcycling” (McDonough & Braungart 2002: 56-59).

The problem of recycling a blend of natural and synthetic fibres might make one question the rationale for blending these in the first place, yet in terms of sustainability some benefits may arise from such blends. Braddock and O’Mahony (2005: 14-6) discuss the benefits of mixing polyester microfibre with cotton for better durability and colour-fastness; this could potentially extend product life considerably. In such instances, McDonough and Braungart (2002: 116) propose for the cotton to be composted to allow the collection of the polyester for reuse, while more recently chemical processes have been developed for separating cellulosic and synthetic fibres (Jeihanipour et al, 2010).

Palmer (2001: 205) calls most recycling “a fraudulent program thrust forward by the Garbage Industry.” Palmer’s alternative, “Universal Recycling,” is concerned with what a waste article does as well as what it is made of. Palmer’s ideal of recycling “consists of reusing both materials and function” (222). Certain forms of fabric waste recycling are not ideal as fabric’s original function (in case of fashion fabrics, to provide material for clothes) is often lost. This could be argued in particular when denim waste is used for housing insulation (Chong, 2006). Whilst using the waste in this way is better than sending it to landfill, it is nevertheless a high-impact way of producing insulation with a loss of the denim’s original function.

Increasingly high quality products made from mechanically or chemically recycled fabric waste are becoming available (Fletcher 2008: 103-105) but many are of a lesser quality than the fabrics they were originally made from. An example is the blanketing fabric from which the Shoddy coat and vest (Figure 1.4) were made as part of this project. The fabric is made from recycled fabric waste: scrap fabric that has been torn apart through carding and then spun into a thick, coarse yarn, comprising the weft (the horizontal filling yarn of the blanket). As a testament to the blanket’s origins, on the surface it is easy to identify small, unbroken fragments of cotton jersey and a few places strands of fine elastic poke out. The fabric is rather unstable to work with and after cutting releases large quantities of dust, posing possible health risks.
A coarse blanket with possibly a long, low-impact use-life is better than losing the raw materials to landfill. Such blankets can have further value added through use in humanitarian and environmental crises. However, a consideration of the global volumes of clothes manufactured annually, with attention to the 10-20 percent of fabric wastage, the loss in quality, and the undesirable aspects of the processes involved in recycling, undermines the case for recycling as the ideal.

Energy recovery refers to the incineration of fabric waste for energy production. The function of fabric and its material are lost but some energy investments are recovered. To the researcher’s knowledge no research has set out to find out whether energy recovered from incinerating fabric waste equals the energy consumed during fibre generation, fabric manufacture and transport. Fabric waste can also be incinerated without energy recovery; the aim is to reduce the volume of waste going to landfill.
Disposal refers to storing the waste in landfill. Through sending fabric waste to landfill its raw material and function are lost, whilst decomposing fabric may leach toxic chemicals and produce methane and ammonia (Fletcher 2008: 98).

1.1.2 From embodied economic investments to embodied environmental investments

Fabric is a precious, sophisticated and designed product, due to fibre extraction, spinning, design, weaving or knitting, and finishing processes. When fabric is wasted during conventional manufacture, one could argue that the embodied economic investment of the wasted fabric is also lost.

As we have seen, current costing models are such that fabric waste does not show up as an economic concern. If a garment uses 150cm of fabric and wastes 15 percent of it, the whole 150cm is costed into the making cost of the garment. As long as the production yield for each garment is at or below the costed yield the profit margin is considered satisfactory. Under current economic models there are some savings to be made by eliminating fabric waste. The company would benefit economically if the same garment could be cut from 140cm of fabric. Further, in some cases indirect savings could be possible through reduced waste management costs. This would vary depending on the size and kind of company and in particular, depending on whether cutting occurs in-house or is subcontracted out. The location of the company would also impact on waste management costs and taxes relating to waste. For most companies these economic considerations are not currently considered to be significant.

The principal motivation for eliminating fabric waste emerges from environmental considerations. These concerns emerge from an examination of the environmental impacts of the fabrics used by the fashion industry. These impacts can be partly revealed by life-cycle assessment, a tool that can measure the material and energy inputs of fibre, fabric and garment (Fletcher and Grose 2012: 55–56).

Fletcher (2008) discusses the environmental and social impacts of fibre production. It is clear that no ideal fibre exists as everything has an impact; rather, the impacts of different fibres vary greatly in type and intensity. Cotton and polyester account for more than 80 percent of global fibre use (Fletcher 2008: 4), and thus their impacts are magnified. If we take the example of cotton, a brief examination of the environmental impacts reveals cause for concern.

Cotton growing is characterised by high consumption of pesticides, synthetic fertilizers and water (Fletcher 2008: 9). Cotton growing accounts for approximately 2.4 percent of the world’s arable land but 24 percent insecticide use and 11 percent of other pesticides (Chapagain
et al 2005: 19); cotton growing and processing also accounts for 2.6 percent of global water use (31). Grose (2009) provides a thorough overview of the complexity of the global cotton industry that further reinforces the idea that fibres embody investments. In the case of cotton, these investments arguably include research and development of pest- or herbicide resistant strains of genetically modified cotton, for example (whether or not one’s personal ethics align with genetic modification), where such strains are grown.

Formerly the fourth largest lake in the world, the Aral Sea is situated in Kazakhstan and Uzbekistan. In the 1960s, the Soviet Union diverted the two main rivers feeding into the Sea primarily for cotton irrigation. By 1989, the Sea had split into two and had lost more than 60% of its area since the 1960s. Whilst some restorative work has occurred in the Northern half (Aladin et al., 2005: 378), most of Aral’s fish species have been locally extinct for more than two decades, rendering a formerly thriving fishing industry obsolete with significant social consequences (Williams & Aladin, 1991). The Australian cotton industry may be contributing towards a similar environmental and social catastrophe. In Australia, increasing diversion of water from the Murray-Darling River for agricultural irrigation and cotton in particular, coincided with one of the worst droughts in the country’s history during the 2000s. As a result the unique ecosystem of the Coorong, the mouth of the Murray River in South Australia, was in 2008 facing ecological collapse (Wilkinson, 2008). While the more recent flooding has remedied the situation (Wright, 2011), one must question the sustainability of such a water-reliant crop on the most arid continent, particularly in the face of climate change and increasingly erratic weather patterns.

In the United Kingdom, the annual consumption of clothing is estimated at one million tonnes (Allwood, et al 2006: 16). Even with a conservative estimate of fabric wastage (five percent), it is reasonable to assume that to produce the annual clothing consumption of the UK, approximately 50,000 tonnes of fabric is wasted during manufacture. Roughly 40 percent, or 20,000 tonnes, of the clothing is likely to be cotton (Fletcher 2008: 6). If 8000 litres of water is required to produce 1kg of cotton (Fletcher 2008: 7), the cotton fabric waste alone amounts to 160 million tonnes of embodied water – wasted. Other similar figures could be calculated.

Fletcher (2008: 100) discusses the energy is embodied in fabric. The embodied energy of fabric is higher than the embodied energy of fibre. This energy is the aggregate of raw material, labour, energy and water consumed from fibre generation and extraction, to spinning, weaving or knitting. Fabric can be therefore said to embody investments of raw material, labour, energy and water. Building on Sherburne’s concept of “embedded energy” (2009: 19), “embodied energy” might be extended to include fibre and fabric research, development and design.
All fabrics embody the time and efforts of various people from fibre extraction to spinning to textile design and weaving and knitting the fabric; wasting a portion of fabric is also a waste of the embodied contribution of those people. As Tarrant (1994: 10) notes, fabric is “expensive to make in time and in raw materials”. Zandra Rhodes is a fashion designer who designs the textile prints first. It is therefore easy to see why she states: “I always consider what is left and try to make it into another part of the dress. I can’t tolerate waste and use every inch.” (Rhodes and Knight 1984: 56). It may be easy for a fashion designer to forget that someone, whether a textile designer or a textile engineer, designs every fabric; wasting any is wasting part of the embodied time and effort of textile design.

Social injustices associated with fibre extraction exist; these are investments embodied in fabrics that humanity would best do without. Arguably anyone working with fabrics – including fashion designers – needs to be aware of such issues and work with the appropriate stakeholders to have the issues rectified. Recent reports speak of severe human rights abuses associated with cotton cultivation in Uzbekistan (Environmental Justice Foundation, 2007). The much-publicised Dirty Laundry report (Greenpeace, 2011) documents the presence of toxic chemicals in two river systems in China, a direct contribution made by the fashion and textile industry. This is as much a social as an environmental problem, as the pollution impacts directly the people living alongside the rivers.

A consideration of the full range of embedded investments and energy must surely raise the question: Why waste part of the fabric required in making a garment, when there is such an enormous investment of resources embodied in the fabric? And if producing fabric from any fibre has environmental and/or social impacts, does not designing fashion from fabric wastefully add to those impacts?

1.2 On the possibility of fabric waste elimination by design: existing literature and documentation of zero-waste fashion design

1.2.1 An emerging interest in zero-waste fashion design
The term zero-waste in a fashion context has emerged during this study, primarily from 2008 onwards. This has led many to think that zero-waste fashion design is a new phenomenon. By drawing on a range of sources including illustrated texts on historical dress, monographs on fashion designers, texts on manufacture (clothing and other products) and exhibition

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3 Ironically, in the 18 years since, the actual prices of fabrics and clothes have decreased (Allwood, et al, 2006: 11-12).
catalogues, it can be shown that while the term may be new, the practice is as old as making clothes from cloth.

Working outside the domain of fashion, Paul Palmer established Zero Waste Systems Inc. in 1972 (Palmer 2001: 227). Palmer later founded the not-for-profit Zero Waste Institute and has published critiques of the modern waste industry, and recycling in particular. This study acknowledges Palmer as the first to use the term zero waste; due in part to his pioneering work, the term was perhaps more easily adapted to fashion later. It needs noting that Palmer’s zero waste calls for closed loops of material use and reuse, not unlike the later Cradle to Cradle (McDonough & Braungart 2002), while zero-waste fashion design in this thesis refers to fashion design that wastes no fabric. It is acknowledged that a broader and more holistic definition of zero-waste fashion design would include delay of garment disposal as a design criterion. Given the recent popularisation of the term zero-waste fashion design in the same context that it is presented in this study, and the necessity of this study to remain focused, zero-waste fashion design in this study refers to fashion design that creates no fabric waste in the design and making of a garment.

Bernard Rudofsky (1947: 137-54) was among the first to formulate a critique of contemporary fashion design and manufacture in contrast to historical methods. In the 1944 exhibition “Are Clothes Modern?”, and the 1947 catalogue that followed (Figure 1.5), he criticised the wasteful Western way of cutting fabric, comparing it with examples of efficient cut in traditional forms of dress from around the world. Rudofsky noted that in many cultures fabric “was clothing itself,” “free of the curse of dress-making” (143).

Figure 1.5: Pages from “Are Clothes Modern?” by Rudofsky (1947), highlighting waste
Perhaps the most significant documentation of the construction processes involved in zero and minimal waste traditional dress to date is that provided by Deborah K. Burnham (1911-2005) of the Royal Ontario Museum and her seminal 1973 exhibition and text, “Cut My Cote.” Whilst Rudofsky and others had noted the efficient use of fabric in some garments prior to Burnham’s work, Burnham was among the first to place the efficiency of cut at the forefront of her study, uncovering the link between the loom type used for weaving by a particular culture at a particular time, the resulting fabric width, and most significantly, the relationship between fabric width and garment cut, and the resulting waste. Burnham includes diagrams of garment cut indicating the amount of fabric waste produced during the making of the garment, demonstrating the efficiency of the garments in relation to wastage. Palmer (2008: 44) acknowledges the impact of “Cut My Cote” on later exhibitions of traditional and historical dress in terms of combining rigorous scholarship with exhibiting visually powerful objects.

Burnham’s (1973: 3) thesis about waste is clear: “With today’s ease of manufacture we take textiles for granted and the wasting of cloth does not worry us. But for those closer to the processes of production the attitude changes, and an extreme economy of material was practised in the cutting of traditional garments. This does not necessarily mean that very little material was used. Extra and unnecessary length could be employed for purposes of opulence, but full benefit was obtained from it and nothing was left over.” In 1976, three years after the exhibition “Cut My Cote” had been shown at the Royal Ontario Museum, graduating students at Ryerson Polytechnic Institute (now Ryerson University) in Toronto designed garments based on the exhibition and its catalogue. In writing about the student work, Burnham (1976: 34) called the student work “an intelligent use of
available design sources," despite the fact that – according to Burnham herself– the concern for waste evident in “Cut My Cote” did not emerge in the students’ work. In looking at the photographs and through reading the article, it would seem that within the project the students focused on garment appearance (shape) and principles of cutting, insofar as a satisfying garment appearance was achieved.

1.2.2 Changing the culture of pattern cutting: on the need to integrate zero-waste pattern cutting techniques into design practice

Drawing in part on Burnham’s work, Tarrant (1994: 10) explains how pre-industrial societies treated fabric as a precious resource. Through the history of dress she highlights several instances of cutting in which waste minimisation is inherent although this is not the primary focus of her study. In a study of indigenous textiles and dress in Mexico, Fernandez (2006: 87) notes that in making traditional Mexican dress little or no fabric waste is created, because “the story told by a piece of cloth remains incomplete if it is fragmented”. Both Rudofsky and Fernandez have applied their research to the practice of designing and making garments (see section 2.2.2, and Figure 1.7).

Chow (1978: 396-402) provides an elegant introduction into the efficient utilisation of materials that come in sheets and plates, albeit outside of fashion design. Chow draws parallels between placing components on the material and M. C. Escher’s art (397). The primary distinction between Chow’s research and this study is that the aesthetics of what the components create when assembled is not a concern in the former, whereas they are in fashion design: the shapes of cut pieces of fabric directly impact on the appearance of a garment.

Holly McQuillan’s (2005) Master of Design thesis, whilst not primarily about zero-waste fashion design, contains an integral and substantial element of it, which to date has not been acknowl-
edged to an extent that it warrants. Late during this study, McQuillan (2011a) published an account of some zero-waste strategies she has adopted, providing a significant contribution to a fledgling field.

Fletcher (2008: 153) includes a photograph of a shirt by Andrew Hague (Figure 1.9), referring to “efficient pattern cutting” but the pattern for the shirt is not shown nor is the garment discussed in the text.
My own work in this area commenced during my final year of undergraduate study in 1999. In a written dissertation on Madeleine Vionnet I speculated that designing garments without wasting fabric might be possible. Equally significantly, while designing the final collection for graduation, I would sketch garment patterns alongside sketches of garments. My aim at the time was to understand the relationship between two-dimensional patterns and three-dimensional garment form, not zero-waste, but reflecting on those sketches now I see how the foundation for this study was laid then. In late 2004 I wrote the formal proposal for this study, and sketches of garment patterns returned into my sketch book soon after. In the early stages of the research I investigated the work of a range of designers including Yeohlee Teng and Zandra Rhodes while also investigating the cuts of historical garments from around the world. In 2005 I presented this research at a conference in Denmark (Rissanen 2005); that paper formed the basis of a later book chapter (Rissanen 2008a) and the book was received favourably (Bye 2009). In 2006 I extracted speculative approaches to fashion design that could result in zero waste; I developed these into experimental design briefs that led to the first garments in this project. From 2006 I regularly shared garments and patterns from this study on a blog (initially zerofabricwastefashion.blogspot.com, from September 2011 timorissanen.com); this led to a blog post on Fashion Incubator (Fasanella 2007b). In 2010 I developed findings from this study into an elective course at Parsons The New School for Design, which received considerable publicity (starting with Rosenbloom 2010).

Figure 1.10: Garments designed by the author from 2008 to 2011
Julia Lumsden’s Master of Design thesis (Lumsden 2010) focuses on zero-waste fashion design and specifically designing through pattern cutting. In her research Lumsden acknowledges my work, documented in this thesis, which I had published in a number of venues listed above (Lumsden 2010: 96).

Figure 1.11 Garments designed by Julia Lumsden

1.3 Towards an approach to fabric waste elimination that can be integrated into contemporary fashion design and manufacturing processes.

As discussed in Section 1.1.1, pre-consumer fabric waste created during fashion manufacture is significant in quantity (approximately 15 percent of total fabric used in cut and sew manufacture), and waste reduction and elimination are preferable to waste reuse and recycling. If the fashion industry is to adopt the highest and most effective level of waste management, then waste must be eliminated at the design stage. This implies that the designer must understand the processes involved in the construction of the garments that they are designing. This also implies changes to the way in which production practices (manufacturing processes) are currently organised. The existing literature does not address either of these issues in sufficient depth.

1.3.1 Fabric waste elimination from a fashion design perspective

In the outline of the existing literature on zero-waste garments above (section 1.2) we have seen that many of these sources do not place a lot of emphasis on the processes involved in the construction of the garments. Those that do, approach this material from the point of view of historical documentation. A contemporary designer would have to work extremely hard to translate the lessons that might be learned from these historical examples into practice. Indi-
Individual fashion designers have explored waste reduction and elimination through their design practices but only the recent work by myself, Holly McQuillan and Julia Lumsden, documents approaches to zero-waste garments from a design practice perspective.

One of the serious limitations in fashion design expertise and the related literature that my own research points to is the need to integrate pattern cutting into fashion design and zero-waste approaches into pattern cutting. Fashion design manuals aimed at undergraduate fashion design students provide some information about the practices of fashion design and manufacturing. Many of these texts seem to base their claims about practice on the authors’ own assumptions and opinions about practice, and the rich and diverse ways in which designers practice is not always evident or acknowledged. The numerous monographs on fashion designers can also be problematic. The widespread myth-building (Breward 2003: 21) about fashion designers and their practices (for example, an uncritical framing of the fashion designer as artist or genius) in these texts is not only a problem for fashion design studies but it could pose a challenge for various future strategies for sustainability, such as co-design, design where the designer facilitates participation from wearers (Fletcher & Grose 2012: 162). Pattern cutting manuals with a fashion design focus, notably those by Winifred Aldrich (1990, 1996, 2002), are helpful, but others present pattern cutting merely as a subsequent step to design (for example, Joseph Armstrong, 1995). At the time of writing (2012) there is no manual on fashion design or pattern cutting that describes approaches that would result in the total elimination of fabric waste.

1.3.2 Rationale for the approach taken to the investigation of fabric waste elimination from the fashion designer’s perspective.

From the inception of this project I was interested in investigating the issue of zero-waste fashion design in a way that could be translated into practice. The primary audience for this component of the research is the fashion design practitioner. The aim was to identify, document and present the research in a way that would allow other designers to incorporate zero-waste approaches into their practice. The aim is to produce a body of research that will benefit fashion designers and pattern cutters by providing new knowledge about how existing fashion design and pattern cutting practices may be modified to create zero-waste garments. An associated aim is to benefit fashion design education by presenting new knowledge that may assist in reas-

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4 For example, see Colin McDowell’s book on the fashion designer John Galliano. In Galliano, McDowell (1997: 119, 194) uses “genius” repeatedly, and is generally unrestrained in his praise of Galliano. It would seem strange not to examine Galliano’s work in a more critical light, particularly in terms of its appropriating cultural heritage as discussed by Shand (2002), or from a postcolonial viewpoint as expressed by Said (1978).
In working towards this outcome I draw heavily on my own background as both a fashion designer and a pattern cutter. I was educated as a fashion designer in Australia, in a program that has been over time adapted from the UK system of fashion design education to meet the needs of Australia’s fashion industry. Between graduation in 1999 and becoming a full-time academic in January 2009, I worked in the fashion industry for nine years, as a fashion designer in my own business, and as a pattern cutter for over 30 businesses. At the outset of the project, this background informed my ability to “read” and synthesise a range of disparate sources including images of garments, images of garment patterns, as well as various types of texts, to identify a range of approaches that have been used to design and make zero-waste garments. A practice orientation is a holistic, integrated orientation. Many of the texts that this thesis draws from concentrate on one area of fashion design, such as manufacture and technology of fashion (Carr & Latham 1988; Cooklin 1997), fashion as visual culture (Stern 2004) or craft of fashion (Shaeffer 2001). This thesis aims for a holistic treatment of these sometimes disparate sources, reflecting the diverse ways in which all of these areas interlink and interact. The range of approaches to zero-waste garment design identified through documentation of contemporary and historical sources are discussed in Chapter 2.

There are, however, specific limitations to studying zero-waste fashion design through literary and photographic sources alone. Illustrated literature is a relatively fast way of uncovering zero-waste garments from different eras and cultures. The technicalities of a garment, however, are often not explicitly explained, whether in text or through visuals. Yet, for this research to progress, I needed to understand how the zero-waste garments worked. As an experienced practitioner with thorough knowledge of the fashion crafts, I was keen and curious to attempt designing garments without creating fabric waste in the process. Intuitively it seemed that the key to meeting one of the project’s primary objectives – to generate and disseminate new knowledge about fashion creation without fabric waste creation to other practitioners – was in the practice itself. The research problem can be “brought to life” in a designerly sense through practice. I had prior, albeit limited, experience of this through completing an undergraduate dissertation on Madeleine Vionnet in 1999. I experimented with draping some of Vionnet’s designs on a half-scale mannequin as she had 80 years earlier (Kirke 1991: 28, 233–4). Engaging in practice provided a deeper understanding of Vionnet’s approach to fashion design than reading about her approach had. In this study, however, for a researcher relatively new to
the craft of rigorous research, designing a practice-led method for generating primary data was a challenge early in the project.

Pedgley (2007: 463) claims practice-led research to have “significance because it empowers academically competent designers to utilise their design expertise and assert ownership on design research.” This is not to say that only practitioners should research practice, but that practice-led approaches are complimentary to approaches by non-practitioner design researchers. Over time a richness of approaches is likely to yield a rich knowledge of practice. Mäkelä & Routarinne (2006: 13) claim that a practitioner engaging in research is in a double position: “s/he can access the process of making while s/he is meeting the need for explicitness that is characteristic of academic research.” They state that inquiry can arise from practice or research intent. In this project the inquiry arose from research intent, but the researcher’s practice in preceding years had sensitised him to the research problem considerably. As a practitioner (fashion designer and pattern cutter) with a practice-oriented research problem at hand, practice provided a meaningful approach to examine that problem.

I explored the range of approaches identified through the contextual investigation, through practice. I aimed to situate the practice within a realistic context. Therefore I designed and made a small collection of men’s ready-to-wear zero-waste garments. Men’s fashion is the area of design in which I have the most experience. This component of the research, then, was guided by the question: What are the opportunities for creating zero-waste garments within contemporary menswear fashion design practice using cut and sew methods? Cut and sew is the dominant method of designing and making garments; in this method fabric is cut and sewn to create garments and approximately 15 percent of the fabric is wasted. Design activity was used to generate data on strategies for zero-waste fashion design. Details of the practice investigation will be discussed in Chapter 3. As a fashion design educator with significant networks of peers with a background in fashion design and education, I was able to draw on these networks of students and educators to interrogate emerging insights and themes arising from the research. A particularly significant event, early findings from this study were developed into an undergraduate course on zero-waste fashion design (Rosenbloom 2010), and feedback from students in that course over several semesters and my own reflections on classroom learning have led to further refining of the insights of this study.

1.3.3 Fabric waste elimination from a manufacturing perspective

As we have seen, the amount of pre-consumer fabric waste created during fashion manufacture
is significant. Historical and contemporary examples of such designing show that it is possible to design without creating fabric waste, but the relative rarity of the contemporary examples suggests that barriers exist in fashion industry practices to the adoption of a zero-fabric waste approach. An important source of many of these barriers are the current systems used to manufacture multiple garments. An investigation of the possibility of zero waste fashion must therefore take into consideration industry conventions that come into play after the design and manufacture of one-off sample garments. While there is literature that may be drawn on to understand these industry processes as they are currently practiced there is at present no literature that investigates these processes from a zero-waste perspective.

A key impediment to zero-waste fashion design is the separation of roles of fashion design and pattern cutting. The separation of fashion design from the making of garments, both of sample garments as well as manufacturing multiples, further distances fashion design from issues it could address, such as fabric waste. At present none of the literature on fashion design and manufacturing investigates this arrangement, including the small body of literature on zero-waste fashion design. If the key to eliminating fabric waste lies in reconfiguration of these roles then the feasibility of overcoming potential impediments to this reconfiguration must be considered.

1.3.4 Rationale for the approach taken to the investigation of fabric waste elimination from a manufacturing perspective.

A key aim of this study is to provide the industry with findings that can be applied to the design of garments, which can also manufactured; during the course of the investigation manufacturability emerged as an important consideration for this research, and led to the second question: To what extent is a zero-waste approach feasible and desirable within contemporary fashion industry? The garments designed in this study were not manufactured in multiples in collaboration with manufacturers. I did not deem this necessary to meet the objective of the study. Rather, I have drawn on my own experience of working as a designer and pattern cutter in companies producing ready to wear garments at a range of price points. For the manufacturing aspect of this study, I have used literature on fashion manufacture, I have conducted visual experiments to quickly test issues such as grading patterns (Chapter 4), and I have had countless conversations with peers about the potential of manufacturing zero-waste garments. Chapter 4 will address particular issues for fashion manufacture that arise from fabric waste elimination through design.

It is my hope that this study contributes towards further conversations about fashion design and fashion manufacture working together in new, more productive ways in the future.
Among other things, such conversations have the potential of enabling fashion manufacture to not be a source of pre-consumer fabric waste. As noted in section 1.2, the responsibility for fabric wastage is currently with manufacture, but manufacture is always constrained by what has already been designed and pattern cut. New conversations, of which this study is a significant part, can break through such constraints.

1.4 Overview of thesis and structure of the investigation

This research then responds to two questions: What are the opportunities for creating zero-waste garments within contemporary menswear fashion design practice using cut and sew methods? To what extent is such an approach feasible and desirable within contemporary fashion industry? The research is an investigation into the opportunities and barriers for designing and making fashion garments without wasting any of the fabric used to create them. This first chapter has outlined the rationale for the study.

The study is contextualised in Chapter 2. Fashion creation methods from a fabric waste perspective are described, followed by a discussion of the design ideation tools used by the vast majority of fashion designers and how these relate to pattern cutting. Practice of zero-waste fashion design to date is then examined, including examples of historical and traditional dress, followed by examples of contemporary zero-waste fashion design. The focus is on what fashion design practice can learn from these. The chapter closes with an overview of how these lessons can be harnessed into design briefs, to allow design practice to examine the research questions in this study.

Chapter 3 discusses the key findings of this study in a fashion design context. The coding and category-building processes are discussed in detail. Fabric waste as a design criterion is examined in relation to other criteria in design. I then present successful strategies for zero-waste fashion design and pattern cutting as they emerge from the data. Chapter 3 closes with sustainability issues that design practice in this study did not directly address, but I deemed important discussing, partly as these were issues that emerged on reflection on practice.

Chapter 4 provides an account of the implications for manufacturing zero-waste fashion garments. Literature on fashion manufacture and my own experiences of working with fashion manufacturers ground the discussion. There are manufacturing issues relating to fabric itself that open the discussion, followed by opportunities for grading zero-waste garment patterns. In

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5 Cut and sew is explained in Section 2.1.
closing this chapter I propose that the fashion industry would benefit from closer collaboration
between fashion design and fashion manufacture than is currently the case.

Chapter 5 concludes this thesis with a look at some possible futures for fashion and
humanity. Drawing from the findings of this study, I make recommendations for the fashion
industry as well as fashion design education. I also present opportunities for further research,
followed by a reflection on the use of fashion design practice in research. I conclude this study,
thesis and a significant chapter in my life by pointing towards a shift in beauty in fashion.

1.4.1 Definitions of terms
In order to maintain the momentum of this thesis on one hand, and to provide the reader with
the necessary tools on the other, the key terms are introduced briefly here. These are elaborated
on in more detail in Appendix A, Glossary of terms.

**Fashion**
Fashion in this thesis refers to physical garments: fashion garments designed and made – fash-
doned – by individuals within the fashion system. In Appendix A, the propositional term of
“designerly fashion” is fleshed out. It is acknowledged that in other contexts and within other
fields of study fashion refers to symbolic production, as well as the system at large.

**Zero-waste fashion**
Zero-waste fashion in this thesis refers to a fashion system that creates no waste. The system
would be a community of fashion producers and users who eliminate waste – material and
immaterial waste – at every instance of fibre generation, yarn spinning and processing, fabric
design manufacture, garment design and manufacture, storage and transport, sales, garment use,
and the cycling back of resources at the end of the first use life of the garment. While currently
individual companies operate according to zero-waste principles, adoption across the entire
system would require agreement from the prevailing economic system.

**Zero-waste fashion design**
Zero-waste fashion design in this thesis refers to the activities and processes that lead to zero-waste
garments. In zero-waste fashion design pre-consumer fabric waste is eliminated through design
that integrates pattern cutting. Zero-waste fashion design in this thesis does not address the vast
quantities of wasted garments created by the capitalist pursuit for economic growth; zero-waste
garments as defined in this thesis could easily contribute towards this larger issue of post-consumer waste, if created within the dominant economic and fashion systems focused on growth.

**Zero-waste garment**
Zero-waste garment in this thesis refers to the outcome of a zero-waste fashion design process. It contains all of the fabric that was used to create it, with pre-consumer fabric waste having been eliminated through design.

**Fashion designer**
Fashion designer in this thesis refers to the person primarily responsible for the ideation and problem solving phases of a garment. These responsibilities include aesthetic decisions, fabrication as well as the responsibility for various sustainability-related impacts of a garment, even if the designer may be unaware of these. As elaborated in Appendix A, the responsibilities of fashion designers vary depending on the market level and size of a company, personality of the designer and other factors.

**Pattern cutter**
In this thesis pattern cutter refers to the person responsible for creating the patterns for a garment design. The use of this UK-centric term is a deliberate choice, despite the fact that in Australia (and the US) patternmaker is the most commonly used term. In my opinion, the inclusion of the word “cutter” implies a closer relationship with cloth. In reading this thesis, pattern cutter could be replaced with patternmaker.

Both fashion designer and pattern cutter are discussed in the context of the fashion hierarchy in Section 2.1.2. This study will make a strong argument for fashion designer also being the pattern cutter, despite treating them separately in this instance, because creating zero-waste garments is only possible if pattern cutting is an integral, active part of the fashion design process. It is nonetheless acknowledged that within the predominant industry situation two separate individuals perform these roles, and this thesis is thus written with that situation in mind. I the researcher performed both these roles during this study. I will note this was a seamless performance in the sense that I did not make the separation in my mind. I encourage anyone wanting to try zero-waste fashion design to equally put that separation aside.
2.

TOWARDS A ZERO-WASTE FASHION DESIGN PRACTICE
This chapter builds on the investigation into opportunities for fashion creation without fabric waste creation in a contemporary fashion design context. Garments created without wasting fabric are not new, as this chapter will demonstrate. Neither is the concern about fabric wastage new; procedures exist in fashion manufacture to reduce fabric waste – and cost – to a minimum. The initial proposition in this study, however, that fabric waste can be an environmental and perhaps an ethical and aesthetic issue situated in fashion design, as well as an economic issue situated in fashion manufacture, differs somewhat from conventional thinking in the fashion industry. The claim of newness in this project extends primarily to formalised research on fashion creation without fabric waste creation, of which there has been a limited amount to date although this has improved during the duration of this study (Section 1.2). As this chapter will demonstrate, some contemporary fashion designers’ practice is informed by a concern for minimum fabric wastage; the practice of fashion creation without fabric waste creation is not new. From a fashion designer’s perspective a discord often exists between the visual examples of those designers’ works and the texts discussing them. For example, aspects of design practice may be suggested in visual form but not discussed verbally. Fashion studies (as different from fashion design studies) do not always concern themselves with the minutiae of practice or garment details (Taylor 2002), yet this thesis aims to show that such discussions could benefit the fashion industry by revealing opportunities for amplified resourcefulness.

2.1 Fashion creation methods and fabric waste

2.1.1 Fashion creation methods from a fabric waste perspective

With fabric waste creation as the distinguishing factor, I have identified three methods of fashion creation: Fully-fashioned, Cut & Sew and A-POC (with subsets and some overlaps); these are illustrated in Figure 2.1. I have simplified the methods into “formulae” of materials and actions, demonstrating the process from yarn or fabric to garment. Each is described. I acknowledge that experimental methods exist. For example, Tissue + Culture in Western Australia (artists Oron Catts and Oinat Zurr) are experimenting with growing clothes out of living animal and human tissue (Braddock & O’Mahony 2005: 146-7; Hemmings & Simonson 2008). Such approaches should be lauded and encouraged; this research, however, only examines methods of designing and making clothes that are possible through technologies widely available in current fashion industry through cutting and sewing fabric.
The two most common methods of fashion creation in industry are Cut & Sew and Fully-fashioned. These are also the dominant methods in fashion design education. A brief introduction into fabric construction is necessary to understand the differences between these methods, as different fabric types have implications for the different fashion creation methods. Three broad categories exist for fabric construction: wovens, knits and non-wovens. In woven fabrics weaving results in yarns interlacing in two directions (warp and weft), knits are knitted rows of looped yarns, while non-woven fabrics are made directly from fibre without spinning it into yarn first, or may not consist of fibre (leather, for example). Sorger and Udale (2006: 70-77) use four categories: woven, knitted, non-woven (felt, rubber sheeting, leather, fur) and other (macramé, lace, crochet). Jenkyn Jones (2002: 96) lists three categories: wovens, knits and non-wovens, the latter including “felt, net, lace and bonded fabrics”.

Figure 2.1: Fashion creation methods from a fabric waste creation perspective

**Fully-fashioned/Knitted fabrics: Yarn + Knitting + Sewing = Garment**

Fully-fashioned is commonly used in manufacturing knitted garments: the garment pieces are
knitted individually and then sewed or linked together (Black 2002: 178). In its truest form, the making of a fully-fashioned garment involves no cutting, and therefore creates little or no yarn or fabric waste. Domestic hand knitting is a familiar example; a front, back and sleeves are knitted individually and then sewed together to make a jumper. BTTG (1999) report two percent yarn wastage in the knitting of a nylon blouse. Setting up a knitting machine for each new style can be costly, and a lot of knitwear is a combination of Fully-fashioned and Cut & Sew. For example, rectangular panels may be knitted from which the garment pieces are cut (Cut & Sew), but the panel may have a finished hem knitted into it. For the Perfect T-Shirt project (Figure 2.2), Better Thinking Ltd chose fully-fashioned knitting as the most appropriate method of garment creation (Gwilt & Rissanen 2011: 79).

![Figure 2.2: The Perfect t-shirt by Better Thinking, manufactured through fully fashioned knitting.](image)

**Seamless Knitting: Yarn + Knitting = Garment**

Seamless Knitting is a technologically advanced version of Fully-fashioned; a machine knits a finished garment to its three-dimensional shape, thereby eliminating sewing from the garment making process (Black 2002: 118; Choi & Powell 2005: 1). While this has been technologically
available for more complex garments since the mid-1990s, socks and knitted gloves are examples of Seamless Knitting that have been manufactured industrially for several decades. Because of the method’s elimination of waste, Allwood, et al. (2006: 30-31) call for more garments to be created through Seamless Knitting: cutting and sewing are eliminated as the knitting machine creates finished garments from yarn, and thus wastage is potentially reduced.

Figure 2.3: Dress created through seamless knitting by Wolford, 2000 (Black, 2002: 128)

**Fully-fashioned/Non-woven fabrics: Fibre + Fabric Construction + Sewing = Garment**

Non-woven sails made of carbon and aramid fibre by North Sails Nevada demonstrate that non-woven fabrics can be adapted for an industrial Fully-fashioned approach. The sails are made into the exact required shape by specialised fibre-laying machinery (Brown 2005: 53, 55). To adapt this technology for the fashion industry seems plausible, even likely, as increasingly diverse non-woven fabrics become available. To date, shaped non-wovens have been limited to a few isolated examples, such as the moulded plastic bodice by Issey Miyake from 1980 (Fukai & Suoh 2002: 609). Fabrican Ltd., a company established to commercialise Manel Torres’ PhD research, manufactures fibre that can be sprayed directly on the body to form a garment (Gundry 2008; Figure 2.4), representing a Fully-fashioned approach in non-woven fabric. From a zero-waste perspective further research into the potential of these technologies seems warranted.
Fully-fashioned/Woven fabrics: Yarn + Weaving + Sewing = Garment

Looms are generally used to weave rectangular lengths of fabrics. As Burnham (1973: 9) demonstrates, through hand-weaving shaped woven pieces can be created. According to Tarrant (1994: 10), the Roman toga was woven rather than cut into the half-oval shape.

Technologies for weaving shapes other than the rectilinear form of fabric exist. Using hand-weaving on a purpose-built loom, jewellery designer George Plionis wove a fully-fashioned t-shirt sleeve for my company Usvsu in 2003 (Figure 2.5). Using industrial machinery, Shape 3, a German company, produces what Fully-fashioned, three-dimensional woven products for the medical industry (see http://shape3.com for further information). In a fashion context, the Indian company August (see http://august.synthasite.com/) has developed Fully-fashioned weaving for creating garments; the company calls this method direct panel on loom or DPOL. Each garment component is woven individually (Figure 2.5). A jacket by August was featured in the Trash Fashion: Designing Out Waste exhibition at The Science Museum in London in 2010. It is unclear from the August website how much it costs to set the machinery to weave each new style, but for garment styles that are manufactured over several seasons the technology is certainly promising. The company website remained largely unchanged from 2009 to 2011 so it is unclear how widely
the technology has been adopted. Whilst it might seem that the technology could make the focus of this study obsolete, it is safe to assume that the fashion industry will continue to manufacture garments from lengths of fabric in the foreseeable future, hence the necessity for this study. Technological solutions such as that offered by August are nevertheless welcomed.

![Figure 2.5: Jacket by August using DPOL technology; fully-fashioned woven sleeve by George Plionis for Usvsu (2003).](image)

**A-POC: Yarn + Knitting or Weaving = Fabric, followed by Fabric + Cutting = Garment + Fabric Waste**

In the late 1990s Japanese fashion designer Issey Miyake and his colleague Dai Fujiwara launched A-POC (A Piece Of Cloth). A flat tube of fabric is knitted or woven with the two sides of the tube joined in areas to create cavities within the tube (Figure 2.6). Black (2002: 118) distinguishes knitted A-POC from seamless knitting in that the former uses warp knitting while seamless uses weft knitting; both rely on computers to guide the knitting machine. The consumer buys a tube and following the lines of the joins cuts out finished garments (Kries & von Vegesack 2001). How the consumer cuts out the pieces determines partly how much waste is created. Some woven A-POC garments have been developed; for example, Caravan and Pain de Mie from 2000. The latter can be cut out as finished garments like the knits, while Caravan requires some sewing after cutting (Kries & von Vegesack 2001: 63). Extending A-POC to non-woven fabrics would seem possible: it is, for example, possible to create a double-layered felt with cavities within the two layers (Fisher 1997: 36). Issey Miyake claims A-POC to recycle thread (Kries & von Vegesack 2001: 68), but how it achieves this is not clear. While the inventiveness of A-POC is not in doubt, the methods of making A-POC are technologically unattainable to most manufacturers (Scanlon 2004). Additionally, the responsibility for fabric waste creation and
management is passed from the designer and manufacturer to the consumer (Sato 1999: 125).

Cut & Sew: Fabric + Cutting + Sewing = Garment + Fabric Waste

Through a Cut & Sew method garment pieces are cut from fabric and these are sewed or otherwise joined to make garments. Fabrics from any of the three categories (wovens, knits, non-wovens) may be used. It is the predominant way of designing and making clothes, and arguably the fashion industry is most familiar with this method; the textile industry that produces vast quantities of lengths of fabrics caters purely for this method. Cut & Sew can waste fabric considerably. In adult outerwear this fabric wastage can vary from 10 to 20 percent (Feyerabend 2004: 4). Cooklin (1997: 9) estimates the average waste to be 15 percent of total fabric used, while Abernathy, Dunlop et al. (1999: 136) give an estimate of 10 percent for pants and jeans and higher for blouses, jackets and underwear.
Zero-Waste: Fabric + Cutting + Sewing = Garment

Zero-Waste in this thesis refers to Cut & Sew that wastes no fabric; the method of construction is the same. The pattern pieces interlock on a length of fabric; no waste is therefore created. Unlike Fully-fashioned and A-POC, Cut & Sew and Zero-Waste require practically no reprogramming of machinery to create new garment styles. This suggests that the methods will remain feasible alternatives alongside emerging technologies for some time to come. Notably, most research and development on efficiency of fabric use has occurred with Cut & Sew but this is generally framed as belonging to manufacture rather than design. Figure 2.8 shows a zero-waste dress created by Mark Liu as part of his Masters degree in 2007. I included the dress in a book chapter (Rissanen 2008a), in which I called zero-waste fashion design “Jigsaw Puzzle”. I later chose to abandon the term, for it potentially trivialises the issue, and could unintentionally reduce zero-waste fashion design to a technique. As this study will demonstrate, zero-waste is best described as a philosophy of making and being that utilises a palette of techniques.

Figure 2.8: Zero-waste dress by Mark Liu (2007).

2.1.2 Hierarchies of roles in current industry

Between the initial conception by the fashion designer and a retail store, a mass-produced garment passes through several steps. The pattern cutter makes a pattern (on paper or computer) based on the designer’s sketch; the pattern guides the cutter in cutting fabric. Before the cutting of multiple garments in production, the marker-maker creates a marker (on paper or computer),
which contains all the pieces of all the sizes to be cut – the marker is a cutting map for production. Most often responsibility for fabric waste creation at the cutting stage is placed on the marker-maker, and the primary objective is to reduce fabric cost (Abernathy et al. 1999: 136).

![Hierarchies of roles in the fashion industry](image)

This hierarchy has its roots in industrial organisation, and particularly ideas put forth by Henry Ford and Frederick Winslow Taylor at the turn of the nineteenth and twentieth centuries (Forty 1986: 122-123). Taylor (1913), through “scientific management”, studied the potential to increase industrial efficiency through a critical look at workflows. During the Second World War, a number of countries regulated industrial production, including that of clothing, to maximise the use of scarce resources and labour. In the UK, this effort became known as the Utility Scheme and the scheme had a permanent positive impact on how the garment industry was organised in the UK (Sladen 1995). Sinha (2000, 2001) has studied the role of the fashion designer in its larger hierarchical context within the UK, revealing the separation of fashion design and pattern cutting in the UK industry.

These hierarchies have advantages, of which having a clear and defined role is perhaps the most obvious; it allows each worker to concentrate on improving and becoming an expert in the role and skills they are responsible for. In contrast, however, the worker may have a limited understanding of the overall process. In the case of fabric waste, this can mean that the waste is largely invisible to the fashion designer and pattern cutter, and in the current organisation of the hierarchy, fabric waste is beyond the control of the fashion designer. Fletcher & Grose (2012: 155) refer to Buckminster Fuller: “As you get more and more over-specialized, you in-breed specialization (and) breeding in specialization also breeds out adaptability.”
2.1.3 Design tools in fashion design ideation

Different approaches to designing fashion exist; these have implications for fabric waste elimination. Because the aim of this study is to uncover practical information about fashion creation without fabric waste creation, an understanding of different ways of creating fashion is important; fabric waste elimination may need to be investigated through several types of design practice. Fashion design at haute couture level may differ from fashion design at ready-to-wear and mass-market levels. Although it is possible that fabric waste elimination through design is possible at all levels of the fashion system, the focus is on ready-to-wear fashion.

Despite the numerous histories of fashion design and designers, few studies have investigated how fashion designers design although such research is plentiful among industrial and engineering design. Anecdotal evidence and increasingly critical designer monographs suggest that diverse approaches to fashion design exist. For example, this study draws from Kirke (1998), Major & Teng (2003), Koskennurmi-Sivonen (1998), Sudjic (1990), Wilcox (2004) and Bolton (2011). The thoroughness and criticality of the texts somewhat contrast with an increasing number of fashion design manuals aimed at undergraduate fashion design students; these arguably present fashion design as a standardised and formulaic practice. These manuals are generally written by fashion design academics, and they are rarely grounded in formalised, critical research into design practice but rather, they draw from the authors’ own assumptions about fashion design practice. In short, such books could be described as attempts to summarise three- or four-year degrees into textbooks. This study reviewed Faerm (2010), Sorger & Udale (2006) and Jenkyn Jones (2002). Many more were available but I deemed further review of the genre unnecessary.

The types of fashion design practice presented are simplified to the core stages that the fashion designer is influential in. Each begins with the initial design ideation tool and ends with the final sample garment. Only stages with direct impact on waste elimination are included; some, such as market research conducted by the designer, are thus omitted. In practice some stages such as making a toile or pattern alteration may be repeated more than once. I acknowledge that a designer may use more than one tool; fashion design is a flexible, dynamic and personal practice.

1. Sketch – Pattern – Toile – (Design alteration) – Pattern alteration – Sample garment

This may be the most common approach to designing in industry and fashion design education. The designer produces a sketch (Figure 2.10), which the pattern cutter uses to create a pattern. The fashion designer may also be responsible for the pattern. Sketching is a fast way of communicating an idea to others, and the role of sketching in the conceptualisation phase of the design process has been
widely researched. Menezes and Lawson (2006) review much of the research to date across design disciplines, and note that sketching is particularly important during early design activity (572). Jonson (2005) concludes that while the verbalisation of ideas may be the most used conceptual tool in design, designers nevertheless perceive sketching as an important skill (623). Jenkyn Jones (2002: 118-119) suggests that in fashion, the pattern is generally preceded and guided by a sketch. Nance (2008) reviews eight models of fashion design process; remarkably, all assume fashion design to occur through sketching, and sketching to precede pattern cutting. Given the widespread use of sketching in the fashion industry, sketching may pose particular problems for fabric waste elimination; the research addresses these through particular design experiments.

Figure 2.10: Fashion sketches by Jonathan Kyle Farmer

2. Pattern – Toile – (Design alteration) – Pattern Alteration – Sample garment
A fashion designer may skip sketching and use pattern cutting as the primary design ideation tool. Julian Roberts, an English designer, sometimes begins the design process of a dress with a large rectangular tube (3-18 metres long, Roberts 2008) that has a number of circular holes and the top of the bodice cut into it. The top bodice anchors the garment onto the body. The drape of the large fabric rectangles depends on the position of the bodice in the overall tube, and the number and position of the circular holes, and the order in which these join to each other (Figure 2.11). There seems to be a great deal of uncertainty in this kind of designing; the final form of the garment is not revealed until it is made up and tried on. Quinn’s (2002: 87-92) account of Roberts’s design process refers to “complicated” and “elaborate” processes (89), with Roberts discussing the significance of pattern cutting in the fashion design process and the uncertain nature of the final outcome (91). Roberts’s approach shows that serendipitous pattern cutting can be a design tool, a view supported by Aldrich (1996: 5): “…the tension between precision and the speculative cut of new fabrics can generate new garment forms”.
For Yeohlee Teng, a contemporary designer in New York, fabric waste reduction is integral to her work. Like Roberts, Teng’s design process may begin with the flat pattern (Major and Teng 2003:140-1). Some garments by Teng create very little or no fabric waste. To achieve the interlocking of the patterns Teng would need to consider the garment patterns in relation to the fabric width from the outset. The cape from 1982 is engineered to the width of the fabric it is cut from (Figure 2.12)

Figure 2.11: Dress and pattern by Julian Roberts (2011).

Figure 2.12: Cape and pattern by Yeohlee Teng (1982).
During the 1980s, Yoshiki Hishinuma in Japan created a series of garments made entirely of equilateral triangles, presented in Clothes by Hishinuma (Hishinuma 1986: 162-72; Figure 2.13). No account of the design process is included, but it is likely that the process begins with a pattern rather than a sketch. The book includes with each garment a diagram of its composition, hinting that Hishinuma places great importance on how the garments are designed, pattern cut and made. It seems that the three designers, while allowing a degree of uncertainty into their designing, decide on the type of garment (dress, jacket, trousers) before the pattern is made.

Figure 2.13: Garments created from triangles by Yoshiki Hishinuma (Hishinuma, 1986)


Through draping fabric can be manipulated on a mannequin according to a sketch. The resulting fabric pieces are then developed into a garment pattern from which a toile can be made. Jaffe & Relis (1993) provide one of many manuals for this approach.

4. Draping – Pattern –Toile – (Design alteration) – Pattern alteration - Sample garment

Draping can also be a way of exploring the potential of a fabric on the body, and therefore it can initiate the design idea. This is similar in many ways to beginning with pattern, except that a pattern is created flat in two dimensions, while draping investigates three-dimensional form with two-dimensional fabric. Ericson (1992: 7) defines draping as “fashioning a garment with-
out the aid of a pattern”. Madeleine Vionnet (Figure 2.14), an early twentieth century French designer, developed her ideas exclusively through draping on a half-scale mannequin (Kirke 1998: 28, 233-4). Vivienne Westwood designs through drape, “in the round”, rather than through sketching (Wilcox 2004: 33). Alexander McQueen also used drape extensively as a design ideation tool (Bolton 2011: 229). Research on the practice of draping in fashion design, other than draping manuals for fashion designers, is scarce. Virtual or simulated draping using various types of software, on the other hand, has been widely researched (Townsend 2003: 4-22-26). While the primary use of simulated draping may seem to be dressing virtual humans in computer games and animated films, some recent research is directed specifically at the fashion designer: simulated draping as a design tool (for example, Volino et al. 2005). Such investigations are welcome but I would like to call for more research on the practice of draping with real, material fabric and the role of draping in fashion design practice.

![Figure 2.14: Madeleine Vionnet draping on a doll, 1923 (Kirke 1998).](image)

5. Conceptual idea – Pattern – Toile – (Design alteration) – Pattern alteration – Sample garment

Sudjic (1990: 30-4) provides a detailed account of how Rei Kawakubo of Comme des Garçons works with her pattern cutters. Often the sketch given by Kawakubo lacks detail, and sometimes there is no sketch. For example, she may give the pattern cutter a piece of crumpled paper and ask for an interpretation. The level of aesthetic and creative responsibility the pattern cutters have may
be higher than what is usual for pattern cutters in the industry. Kawakubo credits her pattern cutters with helping her to design. Not unlike Kawakubo, Halston, an American designer, would fold pieces of paper to communicate his ideas to his pattern cutters, or the design team would search for flowers to communally understand the shape of a skirt (Gross & Rottman, 1999: 145); these were supplemented with verbal descriptions. Figure 2.15 shows a top by Halston that could be engineered to use the full width of a fabric (fabric width is not communicated), creating little waste.

A contemporary designer of textiles and fashion, Zandra Rhodes often allows the printed fabric to determine the pattern shapes of a garment. She explains: “The [printed] patterns lead me along and influence the way I use them [in garments]…I always consider what is left and try to make it into another part of the dress. I can’t tolerate waste and use every inch.” (Rhodes and Knight 1984: 56). Rhodes pins the printed paper on herself in front of a mirror to determine the impact of the print on the body. Notably for someone lacking formal fashion design
training (Rhodes trained as a textile designer), for Rhodes pattern cutting is an integral aspect of the fashion design process. Townsend (2003: 3-21) calls this textile-led fashion design: the printed pattern on the fabric determines or guides the garment cut.

7. Existing garment – Sketch – Pattern – Toile – (Design alteration) - Pattern alteration – Sample garment
It is common practice in Australia and elsewhere for the fashion designer to purchase a garment and develop a slightly modified sketch based on it. In a more economic variation, the sketch can be based on a photograph of the garment. The pattern cutter then creates a pattern based on both the garment (or photograph) and the sketch. Depending on the level of modification from garment to sketch, whether this constitutes fashion design is open for discussion.

8. Existing garment – Pattern – Toile – (Design alteration) – Pattern alteration - Sample garment
Sometimes the existing garment is given directly to the pattern cutter to create a pattern from, sometimes referred to as “rubbing off”. This in effect is copying and in my opinion does not constitute fashion design. Two pattern cutting manuals (Hollen & Kundel 1999: 270-276; Joseph-Armstrong 2006: 531-542) provide detailed instructions on such an approach; the introductory section in each is surprisingly uncritical. One might expect this to be more common in “lower” levels of the fashion system (mass-market), but I witnessed such practices somewhat regularly within the Australian designer ready-to-wear industry. In some instances this practice may have merit. Vivienne Westwood states: “By trying to copy technique, you build your own technique.” (Wilcox 2004: 9) Westwood began her career as a self-taught fashion designer in the early 1970s by copying Teddy boy suits. Arguably she ventured beyond copying; she analyzed the garments’ structure and construction, and later applied this knowledge into ideas of her own.

9. Photograph of garment – Pattern – Toile – (Design alteration) – Pattern alteration – Sample garment
McQuillan (2011a: 84) discusses a fashion designer developing a garment design from a photograph of an existing garment. This approach is more economic than purchasing a garment for copying, and somewhat common within the industry in Australia. In this study, the various ways of copying (7, 8 and 9) do not inform the experiment briefs. The assumption is that most existing garments waste fabric as stated earlier; copying them would create the same amount of waste.
Every fashion designer may work somewhat differently and therefore various combinations of the above may exist, or there may be other types of designing that the list does not cover. For example, Jaffe and Relis (1993: 2) note that combining draping with pattern cutting has certain benefits when variations of a silhouette are sought; pattern cutting may be faster than draping in such an instance. Jenkyn Jones concurs (2002: 124): “Most pattern development is a mixture of [pattern cutting] and draping.” Even if not exhaustive, the nine types arguably cover the vast majority of fashion design practice in the industry.

2.1.4 Communication between the fashion designer and pattern cutter

From the types of fashion design practice, different types of pattern cutting practice become evident. The focus here is on the type of communication from the fashion designer that initiates the pattern cutting process, despite that in this study the fashion designer and pattern cutter are the same person. Because the amount of fabric waste produced depends on how well the pattern pieces are able to interlock on a length of fabric, pattern cutting has great significance for fabric waste elimination. Consequently, how a pattern cutter approaches the design and make of a set of garment patterns has implications for fabric waste elimination. Relationships between designers and pattern cutters are diverse; whilst the communication is simplified here into four types, combinations of the four probably take place. In some instances the designer may make the pattern, but may use sketches, draping or existing garments as conceptual tools preceding the pattern cutting process. The importance of other forms of communication between the designer and pattern cutter should not be underestimated. Regardless of the type of pattern cutting practice, verbal conversations probably play a significant role in assisting the pattern cutter to interpret the designer’s idea.

1. The pattern cutter may make a pattern from a sketch, notes and measurements produced by the designer. Often these take the form of a specification sheet. This is perhaps the most common type in the industry, and the predominant type in cases where the designer and pattern cutter are in two different locations, a somewhat common occurrence with clothing production having shifted to countries with low labour costs.

2. The pattern cutter may make a pattern from draped pieces of fabric (or paper, as with Zandra Rhodes). If a sketch precedes draping, the pattern cutter is likely to be responsible for draping, but if the idea were first conceived through drape, the designer would probably do this, as Vionnet and McQueen did. The draped fabric pieces often do not match to each other exactly and some pieces
such as facings and linings are usually not draped. Geneviève Dufy, a Vionnet employee, noted how difficult it was at times to translate Vionnet’s scaled down drapes to full scale (Kirke 1998: 118). The pattern cutter ensures that a complete set of patterns is produced, which can be made into a toile.

3. The pattern cutter may make a pattern from an existing garment. It is possible to trace a pattern from a garment without taking it apart, using a tracing wheel and taking measurements. Kirke (1998: 233–4) developed the patterns in her book on Madeleine Vionnet by laying the garments flat and analysing the fabric grain (direction of yarns) and taking measurements, preserving the often fragile museum specimens. With some shapes, such as trouser crotches and jacket sleeves, it would be more accurate to carefully unpick the garment first, lay the pieces flat and then trace them.

4. The pattern cutter may make a pattern from an idea communicated verbally and/or non-verbally by the designer. This approach is evident in Halston and Kawakubo’s approaches to working with their pattern cutters.

### 2.2 Zero-waste fashion design: past and present

This section discusses examples of zero-waste and “less-waste” garments throughout history in a chronological manner. Whilst it is difficult to tease out a consistent temporal narrative, some connections nevertheless emerges. In particular, it is evident that some fashion designers in the twentieth and twenty-first centuries have been influenced by cuts of historical zero-waste or less-waste garments. Due to space limitations this section is not an exhaustive list of every zero-waste garment discovered during this study; rather, the aim is to provide a snapshot of the rich diversity of zero-waste garments through time, and to create a fertile foundation from which to draw from in this study. The heading of this section may seem erroneous in that it is not possible to name the designer for the examples of earlier garments. Fry (2009) regards all human beings as designers; this study seconds the view and argues that someone (and more accurately, someone building on designs by several generations of people) designed each garment discussed here, even if it is not possible for us to know who that was. These garments are referred to as “zero-waste fashion design without fashion designers”, after Rudofsky’s (1977) “architecture without architects”.

Evidence shows that the developments in cutting into fabric have been influenced by developments in fabric weaving technology (Burnham 1973; Tarrant 1994). Burnham (1973:
2) discusses the various factors affecting garment cut – the body, climate, geographic terrain, social status and (culturally variable) modesty, stating that they “are all important, but the material from which a garment is made is the factor that has the most influence on the particular shaping of it.” Burnham asserts that there existed two separate developments in the cutting of garments: those based on the shape of animal skins, and those “dependent on the rectilinear form of loom-woven cloth”. Eventually these merged into one. When fibre was scarce and spinning and weaving were slow, fabric was precious. It was cut as little as possible and waste creation was avoided during the cutting process. Before the Classical period in Europe, two types of loom were used for weaving (Tarrant, 1994: 8). The ground and warp-weighted looms were not ideal for weaving long lengths of fabric and both looms were relatively slow. Around 1000 AD the horizontal loom was introduced to Europe from China; the weaving of longer lengths of fabric became much faster than before. Regular changes in dress in Europe appeared from the fourteenth century onwards (Tarrant 1994: 48). In the eighteenth century a dressmaker was judged by the skill she fitted the customer with, the way she cut without waste and the way she matched patterned fabrics (Ginsburg, 1984: 28). During the Industrial Revolution the weaving industry was mechanised approximately a century before the fashion industry, allowing plentiful “raw” material for the industry sped up by the sewing machine from 1850s onwards (Forty 1986: 73, 94). In an anthropological look at cloth, Schneider (1987: 433) notes that technological and organisational innovations lowered the cost of fabric, thereby permitting “the wastage of tailoring”; given the extensive bibliography, it seems odd that Schneider does not cite Burnham.

2.2.1 Zero-waste fashion design without fashion designers

Many examples of traditional dress are zero-waste garments. The himation, chiton and peplos of ancient Greece, and the main piece of the sari of India are lengths of fabric with no cutting, draped on the body. The sari can be draped in a variety of ways (Lynton 1995: 14-6), as can examples of ancient Greek dress (Rudofsky 1947: 137). The garment pieces of a Japanese kimono are engineered to the fabric width and length. No fabric waste is created in the cutting process, as Van Assche (2005: 7), Tarrant (1994: 36; Figure 2.16), Kennedy (1990: 6) and Liddell (1989: 223) demonstrate. Surplus fabric in front neck is pleated inside the collar for structure rather than cut (Dobson 2004: 54). Similarly, the curved sleeve hem present in some kimono is achieved by easing the excess seam allowance inside the sleeve rather than by cutting it away.
Tilke (1956) presents several garments from around the world that could be zero-waste. It is, however, impossible to ascertain this from the pattern diagrams without knowing the pattern configuration on the fabric width. The men's breeches from Turkey (Plate 19: Garment 1; Figure 2.17) are a basic example. The crotch is made from four gores that could interlock on a particular width of fabric. The legs are two large rectangles with some fabric cut away at inside ankle. Plate 89 includes two examples of Chinese trousers (Garments 6 & 7, 9 & 10; Figure 2.17) demonstrating the displacement of two rectangular shapes against each other. This results in the fabric hanging off-grain in an asymmetrical garment.
A woman’s blouse from Denmark (Plate 38: Garments 1, 2, 9 & 10; Figure 2.18) is cut from one piece. The bodice wraps to the centre back and attaches to a yoke seam from which the sleeves jut out. Burnham (1973: 20) states that the shape of animal skins influenced this cut; Hungrywolf (2003: 47–48) explains the making of a Native American dress from two skins that bears a similarity to the European examples. This is not to say that the European garments in question were influenced by those from America; Europe has its own history of garments made from animal skins. A baby blouse that belonged to my grandmother (born in Finland in 1923) is based on the same cut (Figure 2.18), as are garments by Balenciaga (Figure 2.7), Teng (Figure 2.25) and Telfer (Figure 2.30).

Figure 2.18: Blouses from Denmark and Finland (circa 1923), demonstrating similarity in cut

Shirts that seem similar in their t-shape but are in fact cut differently are common in texts on European historical dress. The difference to the previous examples is that the sleeves are cut separately from the body. A t-shaped blouse worn by the seamen and fishermen of Bornholm, Denmark, (Tilke 1956: Plate 38: Garment 24) seems to be cut for maximum efficiency. Shep and Cariou (1999: xxiv) reproduce the cutting diagram for a men’s shirt from 1837, which echoes the shape of the Danish blouse described above. The entire shirt is cut from rectangles that form an interlocking grid on a particular length of fabric, thus producing no waste. However, from the diagrams shown it is very difficult to determine how the pieces correspond to a finished shirt. The authors also include two square-cut shirts from the “Keystone Shirt
“System” from 1895 (121, 123). By the late nineteenth century many men’s shirts were already similar to contemporary men’s shirts in cut, utilising curves around armholes and neck, but these examples were work wear and frugality would have influenced the cut. An eighteenth century men’s shirt illustrated by Hart (1987: 153) is a simpler version of the principle. Burnham (1973) illustrates several shirts cut using the same principles, making a note of the fabric width in relation to the cut. A man’s linen shirt from England or America featured by Baumgarten et al (1999: 105–108) from 1775–1790 is also cut from a series of rectangles. Further examples, from Estonia and Finland respectively, can be found in Kaarma & Voolma (1981: 28-30, 45) and Lehtinen & Sihvo (1984: 155-162). Figure 2.19 illustrates three examples of these shirts. Vivienne Westwood mentions the use of a 500-year-old shirt pattern as the basis for the Pirate collection of 1981 (Wilcox 2004: 9); the visual connection between the shirts shown here and Westwood’s work from the early 1980s is clear.

Figure 2.19: Cut of shirt from 1837 (Shep & Cariou 1999), square-cut shirt from 1930 (Burnham 1973), square-cut shirt from 1775-1790 (Baumgarten et al 1999)

1 Breward (1995: 172) notes how throughout the nineteenth century men’s clothes became more refined in fit.
Arnold (1977(1966): 3) discusses fourteenth century dresses from Greenland, which use interlocking gores on a full width of fabric to create fullness in the skirt with minimal waste. She also details ways in which off-cut waste was often used as part of the interlining of a garment, similar in principle to the kimono collar described earlier. Ginsburg (1984: 17) describes a seventeenth century knitted jacket made of rectangles. Like the curve of the kimono sleeve, curved neck and underarm shaping are achieved by turning under sections of fabric.

2.2.2 Modern zero-waste fashion design

From early twentieth century onwards it is possible to identify the creators of garments that demonstrate a relationship between fabric width and garment cut, the foundation of zero-waste garments. It is likely that others were involved through collaboration with the named designer; this is, however, difficult to ascertain from the available literature. The Italian futurist artist Thayaht (Ernesto Michahelles) launched the tuta, or overalls in 1919 (Stern 2004: 43). The entire body is cut in one piece, with the cutout wedge between the legs used for front facings. Gussets under the arms and at the crotch allow better movement. Figure 2.20 illustrates several versions of the tuta, including a two-piece for men, and a dress version for women. English (Chenoune 1993: 142) and Italian (Stern 2004: 43) versions of the original tuta cut are known; the English version, slightly cropped, is included here.

Figure 2.20: The cut of Thayaht’s tuta, Thayaht wearing the tuta, sketches for men’s one- and two-piece tuta and women’s tuta dress.

Thayaht worked for Parisian couturier Madeleine Vionnet in the early twenties. Kirke (1998) demonstrates several garments by Vionnet that exhibit an affinity with fabric width. A Vionnet dress from 1919-20 is essentially four squares of fabric, with minimal shaping (Kirke 1998: 54-5). Twisting the front shoulder against the back before joining eliminates
armhole and neck gape (Figure 2.21). Thayaht’s tuta and Vionnet’s square dress date from the same year, 1919. To accommodate the expansive garment cuts, Vionnet worked closely with the textile mill Bianchini & Ferier to have wider than usual fabrics woven for her (Kamitsis 1996: 12; Kirke 1998: 80).

Bernard Rudofsky (1947: 137-48) was critical of the European tradition of cutting fabric to make clothes, and applied his knowledge of traditional dress into the Bernardo Separates range in 1950 (Bocco Guarneri 2003: 294; Figure 2.23). The clothes were adjustable and one-size-fits-all, made from rectangular pieces of fabric. Rudofsky aimed to minimise waste as well as sewing (LIFE, 1951), to keep the clothes financially accessible to most. In 1944 Rudofsky included garments by Claire McCardell as examples of zero-waste fashion design in the exhibition *Are Clothes Modern?* (Rudofsky 1947: 201). The pattern diagrams for the McCardell garments (Figure 2.22) have been simplified, and do not include all the pieces. Notably, Rudofsky (1947: 204) included Max Tilke’s pattern diagrams (see section 2.2.1) in the exhibition catalogue.
An English designer, Zandra Rhodes, often allows the printed fabric determine the pattern shapes of a garment (see Section 2.1.3). Rhodes was trained as a textile rather than fashion designer and yet for Rhodes pattern cutting is an integral aspect of the fashion design process. On her time at the Royal College of Art, Rhodes says: “I enjoyed the discipline of the prints, that they had to be cut and used economically, that I had to consider measurements and repeats,
that it was both technical and artistic at the same time, and directed towards an end product outside the pattern itself.” (11) The cut of a blouse from 1979 (Zandra Rhodes 2005: 34-5), while not entirely eliminating waste, demonstrates this approach clearly. The sleeve and peplum pieces interlock fully, while the bodice length is determined by the space left over by the aforementioned pieces. A dress from the same collection (Figure 2.24) demonstrates a variation of the same textile print-drive approach to designing a garment (McQuillan & Rissanen 2011: 8).

Interestingly Tilke’s (1956) “Costume patterns and designs” was an early influence on Rhodes (Rhodes & Knight 1984: 37). Rhodes’s contemporary, Vivienne Westwood, also discusses her dislike of wasting fabric (Wilcox 2004: 9), but there are no concrete examples given.

Yeohlee Teng, an American designer, has adopted fabric waste minimisation as a key element of her design practice since 1981 (Major & Teng 2003: 14). The pattern of a cape (155) described as cut “with no waste” (18) shows that roughly ten per cent of the fabric is wasted. However, the patterns of two complex sarongs from 2001 demonstrate full utilisation of the fabric, as does that of a coat from 1997 (171; Figure 2.25). In its cut the coat is similar to the Danish blouse in Figure 2.18: folds replace side and shoulder seams to create the body, and sleeves jut out of one piece of fabric. The illustrated coat pattern (like all the pattern diagrams in the book by Major and Teng) does not include facings, interlinings or linings, which a rigorous approach to eliminating waste would demand.
In the first decade of the twenty-first century, zero-waste fashion design has become more widely adopted worldwide. During this study (2004-2012) in particular, new examples have come to my attention. While I am aware that Materialbyproduct (an Australian company designed by Susan Dimasi and Chantal Kirby), Andrew Hague (an American designer) and Friederike von Wedel-Parlow (a German designer) have created zero- or less-waste garments, patterns for these are not publicly available so they are not included here; to grasp the zero-waste nature of a garment one needs to see its pattern. The same applies to Kyotap, an Australian brand owned and designed by Fiona Buckingham. Nevertheless, these designers’ work warrants commendation. Mark Liu (Figure 2.8) received considerable attention in 2007-8 for his zero-waste garments (for example, Liu 2010; Fasanella 2007a; Menkes 2008), which in part facilitated conversation I was able to have about zero-waste fashion design with the media.

Undoubtedly Holly McQuillan (Figure 2.26) has conducted the most significant work on zero-waste fashion design outside of this study in Wellington, New Zealand. Notably the work has been largely concurrent to this study, yet until 2008 we were unaware of each other’s work. McQuillan completed a Masters in 2005; in her thesis zero-waste fashion design was not the main focus yet it was an integral part of the study, and laid the foundations for McQuillan’s now extensive zero-waste practice and research.
In 2011 McQuillan and I curated and exhibited in Yield, a survey exhibition of zero-waste fashion design. Included in Yield were Rhodes, Teng, Alabama Chanin (Section 1.1.1), Roberts (Section 2.1.3), Fernandez, Lumsden, Whitty and Telfer, alongside work by McQuillan and my work from this study (McQuillan & Rissanen 2011). The remaining Yield designers are Tara St James of Study NY, Caroline Priebe of Uluru and Samuel Formo; these designers’ work from Yield is shown in Figure 2.27. St James presented her first collection for Study NY in September 2009. The collection was based on squares: look 1 in the show was made from one square, look 2 from two, and so forth. St James has included zero-waste garments in each collection since. Priebe’s Westlake dress and its pattern were also exhibited in “Ethics + Aesthetics = Sustainable Fashion” in 2009-10 exhibition (Scaturro & Granata 2010). In Spring 2011, Priebe taught the zero-waste course (Chapter 5) at Parsons. Sam Formo created a zero-waste jacket during his studies at California College of the Arts (CCA). It must be noted that Andrew Hague, Caroline Priebe and Samuel Formo are all former students of Lynda Grose, professor at CCA and a fashion industry sustainability pioneer (McLaren 2008; WRI 1992).
Carla Fernandez (Figure 2.28) is a Mexican designer whose design practice for her company Flora 2 draws from her research into indigenous textiles and dress (Fernandez, 2006). She collaborates with indigenous artisans, who weave the fabrics for Flora 2. The cuts of Flora 2 garments draw from those of indigenous garments; there seems to be an intellectual connection between the approaches by Fernandez and Rudofsky.

McQuillan’s influence on colleagues and students is evident at Massey University. Jennifer Whitty is an Irish designer and a colleague of McQuillan at Massey. Julia Lumsden completed her Master of Design at Massey University in 2010 with McQuillan as an advisor; Lumsden’s collection included several zero-waste men’s shirts (Lumsden, 2010). Zero-waste garments by Whitty and Lumsden were featured in Yield (Figure 2.29).
David Telfer, a British designer, has explored zero-waste fashion design alongside other concerns for efficiency, such as minimal fabric utilisation and minimal seaming. The cut of the duffel coat he exhibited in Yield (McQuillan & Rissanen, 2011: 24) bears a resemblance to the blouses in Figure 2.18; the body, sleeves and hood are not separated from the original piece as slashes are used.

During the last two years of this study, there has been a considerable increase in the number of young designers exploring zero-waste fashion design, as evidenced by the many emails I receive from them. While they are too many to mention, Simone Austen’s undergraduate collection, all zero-waste, demands acknowledgment, as does a collection by Yitzhak Abecassis, who created a collection entirely through cutting slashes into single pieces of fabric.
With the presence of zero-waste fashion design in the fashion media, books on fashion and sustainability and online, it seems likely that both established companies and designers and new designers entering the industry, as well as institutions teaching fashion design, will increasingly adopt zero-waste fashion design.

2.3 Method of enquiry adopted in this project

2.3.1 From design briefs to frames for practice

From the contextual review (Section 2.2) emerging concepts were developed into a series of design briefs to direct the design practice. I regarded this early phase as a series of experiments. It can be seen as a sensitising phase: the practitioner feeling his way around unfamiliar territory. The design briefs are included in Appendix B; this section includes an overview of the issues that were drawn from the contextual review for design exploration. Section 2.2.2, on modern zero-waste fashion design, has expanded considerably since late 2006 when the practice phase commenced. Some of the designers uncovered later during the study have explored some of the issues that I had incorporated into the design briefs; these will be discussed where relevant.

Prior to the practice phase, I had conceived the experiments and the designing of a collection as two discreet phases. During practice, however, the experiment phase did not end and collection design began. Post-practice it is also not possible to point out when the experiment phase finished and the collection design commenced. On reflection, it is more useful to look at the practice phase as one whole. The practice phase is presented in the larger context of the entire study in Figure 2.32.

Relatively early during the practice phase I wrote the following in the journal: “I’m feeling more and more, that rather than stick to rigid briefs and follow them to a tee, I should respond to what I’m finding out and tailor future practice so that it inquires into issues arising from practice as I go. That’s not to say the briefs to date are worthless; I think it’s important to keep checking that the practice doesn’t become ‘stuck’ around one issue or group of issues, but that it is covering all the issues raised from both the literature and practice, and later on, from peers.” (Appendix C, transcription of journal page 52, dated March 18, 2007.) This comment demonstrates how practice-based research can dynamically react to issues arising from the practice itself. This is called theoretical sampling: “Data gathering driven by concepts derived
### Research activity (inward facing) vs. Dissemination (outward facing)

<table>
<thead>
<tr>
<th>Research activity (inward facing)</th>
<th>Dissemination (outward facing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 2004: application for PhD</td>
<td>September 2005: Creativity conference presentation in Copenhagen, Denmark</td>
</tr>
<tr>
<td>December 2006: First experiments in studio (undocumented)</td>
<td>March 2006: Doctoral Assessment, UTS, Sydney, Australia</td>
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<tr>
<td>March 2007: Intensive practice phase begins</td>
<td>August 2006: InForm symposium presentation, Sydney, Australia</td>
</tr>
<tr>
<td>August 2008: intensive practice phase ends</td>
<td>May 2007: Dressing Rooms conference presentation in Oslo, Norway</td>
</tr>
<tr>
<td>October 2009: Course on zero-waste fashion design written for Parsons</td>
<td>August 2008: Bad Dogs exhibition</td>
</tr>
<tr>
<td>December 2010: Analysis of journals complete</td>
<td>August 2009: Fashioning Now exhibition</td>
</tr>
<tr>
<td></td>
<td>August 2010: first Zero-Waste Garment course at Parsons begins</td>
</tr>
<tr>
<td></td>
<td>February 2011: student work from Zero-Waste Garment course exhibited in New York, USA</td>
</tr>
<tr>
<td></td>
<td>July 2011: The Cutting Circle at Massey University, Wellington, New Zealand</td>
</tr>
<tr>
<td></td>
<td>October 2012: submission of thesis</td>
</tr>
</tbody>
</table>
from the evolving theory and based on the concept of ‘making comparisons’, whose purpose is to go to places, people, or events that will maximize opportunities to discover variations among concepts and to densify categories in terms of their properties and dimensions” (Strauss & Corbin 1998: 201). Early practice in this project was also used to inform further practice.

The model of identifying alternative frames for practice and using these frames to structure the practice component of the research was developed with the specific aim of countering the tendency of practitioners to rely on their own particular “habits” of practice. Prior readings and professional experience as both a fashion designer and a pattern cutter had suggested that approaches to fashion design and pattern cutting practices varied from one practitioner to another. In order to avoid limiting the scope of the project to the researcher’s own approach, alternative frames for practice were identified through literature. This literature ranged from monographs on fashion designers to fashion magazine articles and pattern cutting manuals. Nine approaches to fashion design were identified; these are discussed in 2.1.3. The approaches were varying sequences of different activities: sketching, draping, pattern cutting and acquiring an existing garment for copying. Three approaches were rejected because they were copying rather than designing, and one because it was primarily relevant to a combination of fashion and textile print design practice, which was not the focus of this project. The remaining five approaches were used to develop design briefs to guide practice. The aim was to ensure that the diversity of practice in industry was reflected in the practice within the project. Notably, three of the five approaches were significantly different from the researcher’s own previous approaches to practice.

The following design guides under three categories were developed from the garments covered in section 2.2 and were used to develop the design briefs for the experiments. The aim was to find common elements in the garments rather than articulate the differences in cultural or historical contexts, for example. The aim was to acquire a sense of “what has been done before” – even the contemporary examples (e.g. Mark Liu) were historical in the context of this research. The garments, despite their differing cultural and historical contexts, can arguably lead to valid questions about zero-waste fashion design.

**Fabric in zero-waste fashion design**

Fabric is inherently central to this project and the intrinsic qualities of fabric lead to specific questions for design practice. Fabric width must be a design criterion from the outset because it defines one of the spatial dimensions from which the garment is cut. It is common in industry to produce a successful seller in different fabrics of different widths. In zero-waste fashion design
this may not be possible because the configuration of pattern pieces will be different on two different fabric widths. This may, however, be an opportunity for bringing depth into a collection through design variations: for example, a shirt initially conceived on 140cm-wide fabric may be adapted to fabric that is 110cm wide. A new design is created but common elements with the initial design are retained, a useful tool for creating depth in collection development. It must be considered that many fabrics are prone to variation in width and small faults during weaving or knitting. Allowances for slight variation may therefore be necessary in individual garments of one style. For example, selvedge, the finished fabric edge, may be shorter or longer than the main body of the fabric; either variation could have implications for zero-waste fashion design.

**Pattern design**

Some questions arising from the garments in section 2.2 are best described as relating to the design of the garment patterns. Two broad categories emerge: square-cut and tailored. Square-cut refers to garments that are cut from primarily rectangular or triangular pattern shapes; straight pattern piece edges dominate. Tailored refers to patterns that make use of curved pattern edges. Rectangular pattern shapes seem to be more common in the reviewed zero-waste garments, in particular among “zero-waste fashion design without fashion designers”. This might suggest that zero-waste design leads to basic box and t-shaped garments. However, the offsetting of two identical rectangular pattern pieces against each other creates shapes beyond the basic box and t-shapes. Tilke (1956: Plate 89: Garments 6 & 7, 9 & 10) demonstrates this in a pair of trousers from China. A Japanese designer, Yoshiki Hishinuma explored the same principle extensively in the 1980s (Hishinuma 1986: 162-172). Vivienne Westwood refers to geometric fabric having a “terrific dynamic” (Wilcox 2004: 31); some of her early work could be described as explorations of geometric pattern shapes. In Thayaht’s tuta a traditionally curved crotch seam is replaced with a triangular gusset inserted into front and back slashes. Eliminating curved pattern edges may in some circumstances facilitate fabric waste elimination.

Interlocking gores can create graduated fullness in a garment while possibly making fabric waste elimination easier. Arnold (1977(1966): 3) discusses gore use in fourteenth century gowns from Greenland, while Baumgarten, Watson and Carr (1999: 43-46, 57-60) show advanced examples of the same principle from eighteenth century Europe. Cutting slashes into a pattern piece combined with the use of gussets may sometimes replace shaped seams in creating three-dimensional shapes. Yitzhak Abecassis has explored the use of slashes extensively.

Straight seams may be eliminated by combining pattern pieces into larger ones. The
kimono (Tarrant 1994: 36) has no shoulder seams, with left front becoming left back at shoulder and vice versa. In Thayat’s tuta the entire body is cut in one without side seams. At times even curved edges or seams maybe converted into folds. Ginsburg (1984: 17) describes how the underarm and neckline curves were achieved through folding in a seventeenth century knitted jacket. The hem of a circular skirt in haute couture is often a fold, with the excess internal fullness controlled with darts, tucks or gathers (Shaeffer 2001: 65). Adapting this to ready-to-wear warrants experimentation.

Seam and hem allowances may vary in width, allowing more fabric to be incorporated into a garment internally. This “excess” can have functional properties, in enabling repair or alteration (wider seam allowance is common on the centre back seam of men’s trousers, to allow for possible growth in the wearer), or through added weight helping with the hang of a garment part (curved kimono sleeves; Dobson 2004: 53). “Excessive” seam allowances are sometimes regarded as “waste” by manufacture. Cooklin (1997: 10) states that 5.5 percent of the total fabric in a garment is in the seam and hem allowances, and that the pattern cutter is responsible for ensuring “that all these allowances are the practical minimum possible”. This does not, however, account for the enabling of future transformative practices that can result from larger allowances.

Small fabric pieces can be potentially useful as internal or external structural components. For example, selvedge strips can be used to stabilize armholes or necklines (internal; Shaeffer 2001: 49-50), while often high-end garments may be sold with a small piece of the garment fabric (external). The consumer can use this piece to test laundering or for garment repair. An eighteenth century shift (Baumgarten, Watson & Carr 1999: 57-60) has fabric rectangles appliquéd internally to reinforce the armhole and shoulder area.

**Garment design**

Garment design best describes issues relating to the visual and technical design of a garment. Designing more than one style of garment simultaneously and cutting these together from one piece of fabric can (but does not necessarily) reduce the amount of fabric waste. This approach is demonstrated in tailors’ practice of cutting two- or three-piece suits; the jacket and trouser pieces (and sometimes vest) are mixed on a length of fabric (Cabrera & Flaherty Meyers 1983: 57). Yeohlee Teng minimised waste on a seven-metre length of fabric by designing and cutting three different dresses within it simultaneously (Major & Teng 2003: 80-83). Holly McQuillan designed three garments together for Yield in 2011 (McQuillan & Rissanen 2011, 54). Potential disadvantages include an overly complex design process, and the fact that in manufacture
an equal number of each garment would need to be cut, regardless of whether an equal number of orders for each garment had been received.

Zero-waste fashion design requires simultaneous consideration of the garment’s technical and aesthetic elements, and simultaneous consideration of the garment in two and three dimensions. The latter is less common in conventional practice: usually the garment design is first resolved through a two-dimensional sketch, a two-dimensional pattern is then cut and finally the three-dimensional garment created. Furthermore, conventionally a pattern cutter may consider only a part of a garment at a time and progressively create the pattern pieces. To eliminate fabric waste, the entire garment must remain a consideration throughout the pattern cutting process.

It may take longer to create a garment with entirely interlocking pattern pieces (thus without wasting fabric) than to create one through more conventional methods. While this may initially seem a negative attribute, it has the potential of inciting a more carefully planned fashion design process. Waddell (2004: 40) notes how up to a fifth of sampled garment styles in a collection are not taken through to production, representing a considerable amount of wasted time and resources to the company. Zero-waste fashion design may offer an opportunity to consider more carefully which garment styles to take to sampling phase; this would require close consultation with the sales department.

2.3.2 Journaling

In and of themselves the garments created in this project are not new knowledge about fashion creation without fabric waste creation. It is likely that an external observer would see garments but not understand what new knowledge, if any, was created through designing and making them. Showing the garment pattern layouts demonstrating the zero-waste nature of the garment would only tell the viewer that – these are garments that were made without wasting fabric. The research question, however, asks what the opportunities are for such an approach to fashion creation. The garments and their patterns by themselves would likely reveal nothing about this. It is the processes of designing and making such garments, and the problems and insights encountered during those processes that are the subject of study in this project. Documenting these therefore is key to generating new knowledge in this study.

De Freitas (2002) states that active documentation must be strategically planned and managed as a studio working method. Active documentation is “a process of knowledge construction that may be regarded as a distinct research method appropriate to practice-based research projects”. De Freitas identifies four areas it is useful for: identifying “the evolution of a
work process”, capturing “accidental progress or problematic blocks”, articulating the “phases of work that become invisible with progress” and providing a “detached record that is necessary in the abstraction of research issues”. The latter can be expanded to include transparency in the research; while the design activity undertaken in this study is hidden from any external observer, the journal provides an auditable record of it. Richardson (2000: 923) notes that writing never completely captures the studied world but that nevertheless, writing can be a way of finding out about a topic: writing is a way of knowing. Prior (2004: 91) elaborates: “…each and every document stands in a dual relation to fields of action. Namely, as a receptacle (of instructions, commands, wishes, report, etc.), as an agent that is open to manipulation by others, and as an ally or resource to be mobilized for further action.”

A combination of concurrent and retrospective documentation of design activity in the form of reflective journal was chosen for the project. I was highly accustomed to this approach, first during undergraduate study and later through my professional design practice. However, modification to reflective journal documentation was necessary as in this study the objective of documentation was to generate data, as well as to serve as a design ideation documentation tool as in previous practice. The journal content falls into three broad types: written text, photographs and sketches. Written text in form of overlaid comments accompanies the latter two for the most part. Photographs are primarily of patterns (including on fabric), toiles and garments. Sketches are of both garments and their patterns.

Journal documentation was concurrent to designing and an intrinsic part of the design process. The journal was always close by during designing, pattern cutting and making. Apart from the vital role the journal played for this study, it was equally vital to designing. In particular, it was helpful being able to return to both verbal and visual accounts of challenging episodes of designing, on one hand to reread the issues and on the other to see them. At the time I regarded some of the documentation as retrospective, but on reflection it is difficult to document problem solving in retrospect without re-entering a problem solving, reflective mindset during the documentation. Thus, I regard all of the documentation as concurrent; it is inseparable from the design activity. When faced with a design problem, a designer is likely to process facets of the problem not only during pre-planned design activity but often extensively during other periods; the designing mind does not necessarily cease to operate during periods of leisure or rest. While at the time these “retrospective” episodes of documentation were not part of pre-planned design activity, on reflection they were a crucial aspect of it.

Pedgley (2007: 473) provides a useful overview of “good practice in diary writing”. In this
study “journal” is used over “diary”, namely because “diary” tends to have connotations of personal documentation or time management. I consider Pedgley’s overview the most useful for rigorous documentation in a research context; however, I discovered the overview some 18 months into the practice phase of the project.

<table>
<thead>
<tr>
<th>Good practice</th>
<th>Details</th>
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<tbody>
<tr>
<td>Chronology</td>
<td>Describe work in the same sequence that it occurred, ideally a bullet-points</td>
</tr>
<tr>
<td>Clarity</td>
<td>Keep entries intelligible, insightful and honest</td>
</tr>
<tr>
<td>Focus</td>
<td>Keep entries succinct: they should not be a crafted essay</td>
</tr>
<tr>
<td>Record images</td>
<td>Record still and moving images of developing and completed physical models</td>
</tr>
<tr>
<td>Out of hours</td>
<td>Account for instances of ‘out of hours’ designing in the next day’s diary</td>
</tr>
<tr>
<td>Diary admin</td>
<td>Ensure that all diary sheets are numbered and dated</td>
</tr>
<tr>
<td>Modelling admin</td>
<td>Ensure that all modelling outputs are numbered and dated to aid cross-referencing</td>
</tr>
</tbody>
</table>

Figure 2.33: Good practice in journal writing (Pedgley 2007: 473)

The first point concerns chronology and describing the work in the same sequence that it occurred. I expected this to be highly relevant for documenting a zero-waste fashion design process, an iterative process of problem defining and solving. Each journal entry was dated, and when several units of design activity were accounted for in a single day, the time of entries was also recorded. This allowed the chronological reconstruction of design processes for each garment designed during the project, and identification of major problems and how they were eventually solved. Not all processes can be wholly constructed in retrospect but nevertheless narratives for processes do emerge. At times I experienced the second point, clarity, as a challenge during practice. In particular, I was nervous that my documentation was primarily descriptive and somewhat lacking in insight. In this regard, it was helpful to ask, “What is different here in relation to a conventional design process?” On reflection, the descriptive entries are sources of insight about what was happening in terms of practice at a particular moment, while analytical entries point towards the thinking about that practice at that time.

Focus refers to succinct entries. This was not an issue and mostly the entries are brief, reflecting the intensity of problem solving patterns. During transcribing the benefit of succinct entries becomes clear. Images in this study comprise sketches and photographs, mostly overlaid with written notes. Sketches vary from conventional sketches of garments to sketches of pattern
piece shapes and preliminary tests of how pattern pieces might fit and interact on a fabric width. Photography was used extensively to document pattern development and toile fittings, as well as garment details. While Pedgley (2007: 473) mentions moving images, in this project no video was used to document design activity.

It may be impossible for a designer or a researcher not to process the day’s activity outside of designated hours. Unplanned or out-of-hours designing should be accounted for the next day. In this study, however, such documentation mostly occurred each night, with the benefit of documentation having occurred relatively soon after the activity, lessening the risk of decreased memory of what had actually occurred. Throughout the practice phase I had the journal nearby in case insights occurred well outside the designated times of designing. In this respect the chosen format of a ring-bound journal seems advantageous; it is easy to carry around. On occasions that it is not near, I propose documentation through available means, and incorporating this documentation in the journal when possible. This leads to my fist suggested addition to the list: appropriateness. The format of hand-written entries in a ring-bound journal is comfortable to me; at the time of commencing the practice phase it had been integral to my practice for a decade. This, however, may not be the case for everyone. The format of the journal should be what the researcher-practitioner is most comfortable with, in order for it not to impede on the practice it intends to document.

During the project four separate journals with 120 pages each were required. To ensure ease of later referencing, continuous page numbers were used. In other words, the first page of the second journal was designated 121, the first page of the third journal was 241 and so forth. In particular, during transcribing and consequent analysis rigorous administration proved useful. A considerable number of paper and card2 garment patterns, pattern layouts, toiles as well as finished garments were produced during the practice phase. Modelling administration in this study meant that all garment patterns and pattern layouts were dated to ensure that they could later be examined, if required, in conjunction with journal entries. Toiles were numbered and dated, and specification sheets were created for the finished sample garments to document details such as fabric usage and trims used for each garment.

This study would suggest two more additions to Pedgley’s otherwise useful points about good practice in journaling. The researcher is likely to benefit greatly from revisiting journal entries regularly during the practice phase. This might be daily or weekly activity; it should be

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2 Sometimes a first pattern, or part of, may be done on paper rather than card. After fitting the toile, the paper pattern is transferred onto card.
formally planned into a practice-based research project. In this study the greatest insights often emerged from returning to and reflecting on older journal entries, sometimes after a considerable period of time. The second recommendation is to transcribe either daily or weekly where journaling is done by hand; in this study the 400+ pages were transcribed after the practice phase. An alternative would be to maintain the journal digitally from the outset. In this study, the journal was also the sketchbook and the manual method seemed the most appropriate and natural.

All of these points, while aiming to contribute towards rigorous documentation, also ensure that the journals can be externally audited if the need were to arise. Transcription of the journal is included in Appendix C. The journal is a constructed representation of what occurred (Atkinson & Coffey 2004: 58) but nevertheless it externalises the experience of practice, contributing towards transparency and explicitness of that experience. Reflective journal documentation is a research skill like interviewing is a skill. Several years of journal documentation prior to this project proved helpful, although documentation during the study was more rigorous in a research-oriented design setting rather than the previous professional setting.

2.3.3 Overview of coding and categories

The coding and category building processes will be discussed in detail in Section 3.1 but chronologically these warrant a mention here. Methods outlined by Strauss & Corbin (1998) guided these processes. Coding was commenced six months after the initial practice phase and refined and completed over a two-year period. Instead of line-by-line coding common in much qualitative research, each journal entry was treated as a datum for coding. This ensured that the study remained in the domain of emergent, “up from data” research; this was deemed important as the field had been the subject of little formal investigation prior to this study.

2.3.4 Exhibitions

I exhibited garments from the project in four exhibitions: Bad Dogs (2008), Fashioning Now (2009), Zero-Waste: Fashion Re-patterned (2011) and Yield (2011). Exhibiting has been the primary means of showing the garments to a broader public. Mäkelä (2006: 75) deems the function of exhibition important in the kind of practice-based research she calls “retroactive”. In my experience, the informal conversations with exhibition visitors have proven most insightful, but the lack of documentation, the lack of a permanent record of these interactions, is an issue. The two exhibitions in 2011, Fashion Re-patterned and Yield, received some publicity
(for example, Scaturro 2011) but in my view there has been a lack of critique in these; perhaps it is time to put an end to a certain politeness around sustainability in fashion.

2.3.5 Other voices

Throughout this project I have been fortunate to receive feedback on the topic from external sources to supplement the faultless efforts of my supervisors. I first presented a paper from this project, focusing on the history of zero-waste fashion design, at a conference in Denmark in 2005. The feedback from the conference audience was enthusiastic. A number of people (other fashion design academics) asked whether I would take some of the findings forward into practice. This was significant in reassuring me that the planned practice (at the time another year into the future) was relevant; at the time (in 2005) there was still considerable lack of consensus about incorporating design practice into a PhD.

In 2006 I was invited to present work-in-progress at the InForm symposium at UTS; the focus of the symposium was practice-based design research. Following the presentation, I submitted a paper for review; one of the two reviewers rejected it from publication while the other accepted. One of the key criticisms from the former was that my research did not address the larger issue of fashion as waste through planned obsolescence and brief use lives. A paper that was accepted a year later (Rissanen 2007b) received a similar comment from one reviewer: “I am skeptical about the premises [sic] for the work - that it is important from environmental perspective to get rid of 10% fabric waste when the whole garment often is thrown away before it is used as much as it can. These questions and the conditions for the work is not discussed enough.” This was and remains a valid point; at the time I did not present zero-waste fashion design in its broader context of fashion and sustainability. In this thesis, and Chapters 1 and 5 in particular, however, I do. During 2007 I wrote a book chapter (Rissanen 2008a), for which I received feedback from the publisher. The book, Sustainable Fashion: Why Now? in some ways responded to these reviewers in that my necessarily focused chapter was one of 15 and thus sat in a broader picture of sustainability in fashion. The feedback from the publisher did not question the issue at hand.

At the suggestion of my then supervisor, Dr Cameron Tonkinwise and following the example of a fellow PhD student, Dr Zoë Sadokierski, I established a blog for my research in September 2006. The blog has been a useful platform in opening zero-waste fashion design to critique and allowing me to make contact with others around the world interested in the same topic. Kathleen Fasanella (2007b) first mentioned my research on her blog Fashion Incubator...
in November 2007, and this led to coverage from other bloggers. I first posted images of my garments and patterns in August 2009. The interest, in terms of comments left on the blog, visitor numbers as well as other bloggers taking the topic on, increased significantly from there on. The feedback at the time was mostly encouraging and positive.

One primarily negative online forum discussion on zero-waste fashion design and this research, took place in October 2011, on Artisan Square (http://artisanssquare.com/). While some valid points were raised in the discussion, many of the comments were ill-informed and narrow in vision. Oddly enough, the initiator of the discussion titled “Let me fume about zero-waste cutting” had emailed me two years earlier about the possibility of publishing a book based on this study.

During the final year of this project (2011-12) a number of companies have approached me regarding zero-waste fashion design. These have included Eileen Fisher, H&M and Marimekko. Furthermore, through teaching the zero-waste course at Parsons, I collaborated with Loomstate during 2010-11 on producing a zero-waste garment (Rosenbloom 2010). Concurrent to this industry interest, I have been invited by several universities to speak about zero-waste. These have included Samsung Art and Design Institute (Seoul 2010), Columbia College Chicago (Chicago 2011), Kwantlen Polytechnic University (Vancouver 2011), California College of the Arts (San Francisco 2011) and Aalto University (Helsinki 2011 and 2012).

When I wrote the proposal for this study in October 2004, I could not have imagined the rich conversations about zero-waste fashion design I would get to have with colleagues, students, and old and new friends. Nor did I anticipate the global interest in what I was setting up to study. While I acknowledge many individuals at the front of this thesis, I also want to acknowledge all of the individuals and institutions mentioned here: thank you. Many of the insights I have had during this study have arisen from the conversations with you.
3. OPPORTUNITIES FOR ZERO-WASTE FASHION DESIGN
This chapter presents opportunities that exist for fashion creation without fabric waste creation. These opportunities have been uncovered through the practice of designing and making fashion, and they are examined in the context of conventional fashion industry practices. First, the criteria for fashion design without fabric waste are discussed. The chapter then focuses on successful strategies in fashion design situations where fabric waste is a design criterion alongside other more conventional criteria such as appearance, fit and cost. It is anticipated that this chapter could function as foundation for a how-to manual for fashion designers who wish to include the criterion of fabric waste in their fashion design practices. In closing, the chapter presents broader issues about fashion design without fabric waste that this project has uncovered.

The chapter opens with an overview of how the coding process and subsequent analysis form the foundations for the project findings. Before the practice phase commenced in this project, three primary criteria for conventional fashion design were identified: appearance, fit and cost. In this project, a fourth criterion was added: fabric waste. Beginning with criteria for fashion design, I will argue that fabric waste as a design criterion needs to be balanced with the conventional criteria of appearance, fit and cost. The chapter then discusses the relationship between fashion design and pattern cutting, arguing that to eliminate fabric waste, pattern cutting needs to be an inseparable part of fashion design rather than a stage that follows design.

Through the contextual research in this project (Chapter 2) two broad approaches to “pattern cutting the body” were identified: tailored and square-cut. These are presented in the context of the practice phase, noting that the tailored approach dominates in literature on pattern cutting as well as industry practice, whilst historically square-cut garments dominated where woven fabrics were used to make clothes. It will be argued that fashion design without fabric waste is more feasible with a hierarchical approach to garment elements, resolving the garment shape (macro) first and then moving to resolve garment details (micro). This strategy is called “building a shape library”. The chapter presents “shape awareness” and “space awareness” as significant aspects of designing fashion without fabric waste, presenting strategies for managing scale during the design process. Marker making, conventionally in the domain of manufacture, is presented as part of fashion design, particularly within later stages of designing. Similarly, while grading patterns remains within manufacture, it needs to be considered during a zero-waste fashion design process.

In closing, the chapter discusses some broader issues relating to fashion design and sustainability uncovered in the contextual research phase of the project (Chapter 2). Whilst these were not the primary focus of this project, zero-waste fashion design practice must be
considered in the broader context of sustainability and fashion. Reflecting back on Chapter 2, I argue that fashion design can actively engage with its past beyond mere visual referencing of past fashion; knowledge gleaned from historical sources can be actively applied in current fashion design practice as it occurred in this project. The role of fashion design literature in this engagement will be discussed. Two issues relating to time close the chapter. First, it will be argued that fashion design can enable or disable future transformative practices relating to the physical durability and longevity of a garment. Fashion design can facilitate later repair and alteration of a garment as well as delay the need for repair; it is suggested that fashion design without fabric waste can provide strategies for enabling future repair and alteration. These issues were examined through practice with the garments created for Fashioning Now in 2009 (Rissanen 2011a). The second issue relating to time arises from a possible slowing down of the design process that may occur when the fabric waste criterion is included in fashion design. It will be argued that this may have positive implications for fashion design, allowing greater reflection and a deeper engagement between practice and the practitioner. Nevertheless, it is also acknowledged that the slower design processes experienced in the early stages of practice sped up with time and increased expertise; with sustained practice, zero-waste fashion design may not be any slower than conventional fashion design.

3.1 Overview of coding and categories

During the practice, the design processes of each garment were documented through writing and visuals (sketching and photography). After concluding the practice phase in the project, the journal was transcribed using Microsoft Excel (Appendix C). Each discreet entry was given a unique entry number, and each specific experiment and garment was given a style number. This allowed extracting a chronological account of the design process for each experiment and garment when collating and analysing this data. Whilst none of the accounts provides a complete picture of the process, many of the accounts are nevertheless rich in detail about the challenges encountered and how these were tackled.

As each journal entry was transcribed, it was coded; up to ten codes were assigned per entry. The coding process was commenced approximately six months after the practice phase had been completed. Codes were not preconceived; instead, they emerged from data and were created after examining the content of each entry. In other words, the codes arose from the
verbal and visual documentation of practice. The coding process was largely informed by that described in the context of grounded theory by Strauss & Corbin (1998). I recognised early in the research that grounded theory is an approach where codes and categories, and the resulting theory, is generated from data. As little was known about the practice of zero-waste fashion design, testing existing categories was not deemed relevant for this project. The contextual review (Chapter 2) had led to some hypotheses about zero-waste fashion design but these were tested through practice, not the coding and consequent analysis. For example, entry 339 from January 18, 2008, was the first written verbalisation of a significant realisation about how zero-waste fashion design might become easier to practice (Figure 3.1). This and other similar entries were given the code “Procedure”, with the aim that similar realisations together would contribute towards successful zero-waste fashion design strategies.

![Figure 3.1 Entry 339 from January 18th, 2008.](image)

Coding was a learning process in itself. Some of the initial codes were later deemed too vague or too detailed (e.g. “accuracy”; “neck”), whilst some unnecessary overlap occurred between some (e.g. “restricting movement” and “comfort”). Hence the codes were refined and consolidated several times...
to provide a more streamlined sense of the practice and the thinking that occurred during designing. For example, “neck” was subsumed into a more general yet descriptive code “body measurement”. As the codes became more refined, discreet categories began to emerge. Eventually the following eleven categories were constructed, noting that many codes appeared under more than one:

- Pattern cutting as fashion design tool
- Opportunities for fabric waste elimination through design
- Challenges for fabric waste elimination through design
- Sketching as a fashion design tool
- Fabric and fashion design
- Design for manufacture
- Design and sustainability
- Time and design
- Body and garment
- References to literature and extant examples of zero-waste/less-waste fashion during practice
- Practice-based research

Of these, “Pattern cutting as a fashion design tool” was eventually deemed the most significant. The realisation that sketching garments as a fashion design tool alone was not sufficient, but that pattern cutting needed to be integral to the design process, was a breakthrough moment in this project. Partly this realisation occurred during practice, partly through the later coding and categorisation. Once I had had the realisation during practice, the design of further garments became easier and faster. This was significant because up to this point in my practice I had not always viewed pattern cutting as “active” designing. Once I realised it needed to be, and that I had to commence pattern cutting before I knew exactly what the garment would appear like visually, practice freed up considerably.

The codes “Design through pattern” and “Pattern sketch” reflect this realization, both under the category “Pattern cutting as a fashion design tool”. From the earliest stages of practice these codes come up regularly. “Design through pattern” pertains to journal entries where designing was occurring through pattern cutting. An earlier code “Pattern design” was subsumed into this code, as on close inspection there was unnecessary overlap between the two codes. “Pattern sketch” refers to entries where sketches of patterns, as different from sketches of garments, are present. Figure 3.2 shows entries for T-Shirt 4004 (which I abandoned after the first two toiles) from very early on in the practice, and both codes appear with several sketches.
of garment patterns but no sketches of garments. Entries like this are typical throughout the journal. An entry from late in the practice for Jacket 1005 in Figure 3.3 (which was part of the exhibition Bad Dogs in August 2008) shows sketching of garments and patterns concurrently. It is important to note that sketching garments was not abandoned during practice; rather, sketching patterns was utilised alongside the more traditional approach of garment sketching. “Pattern sketch” is therefore a distinct code from “Design through sketch”; the latter refers to sketching garments. Notably, in total “Design through pattern” and “Pattern sketch” appear roughly twice as many times as “Design through sketch”; this indicates the significance of pattern cutting as an integral design tool in zero-waste fashion design.
Figure 3.3 Journal page 399 with coding
3.2 Garment appearance, fit, cost and fabric waste in designing fashion

Through the journal entries, the code “Fabric waste” appears in about ten percent of all entries. This indicates that at times fabric waste was not necessarily a foremost concern and might seem odd in a research project about fabric waste elimination. In conventional fashion design, the three main criteria for the fashion designer during designing are the appearance, fit and cost of a garment. This statement is based on my own practice as a fashion designer; to my knowledge no texts discuss them succinctly together. Appearance tends to be the focus of fashion design manuals for fashion students, fit is generally covered in pattern cutting manuals, while cost tends to be the focus of texts on fashion manufacturing. For example, in a manual aimed at undergraduate fashion design students, Sorger and Udale (2006) fail to include any discussion of cost or its impact on design. In a similar manual, Jenkyn Jones (2002: 141) concedes that the significance of cost as a criterion for fashion design in “fashion school” may not reflect its significance in the fashion industry. The Jenkyn Jones manual nevertheless includes a reasonable discussion on cost (54).

These three criteria are not stable concepts in that the company employing the fashion designer and the company’s core market impact on the relative importance of each. Appearance refers to garment appearance, or its “visual aesthetics”, and it is often treated as the most significant criterion of fashion design. Appearance includes attributes such as garment shape, balance, and use of colour, texture and line, sometimes described as principles and elements of fashion design (Jenkyn Jones 2002: 76-86). Fit refers to the relationship between garment and body. Particular aspects of fit are subject to little interpretation; a sleeve that swings forwards causing wrinkles in the sleeve/armhole junction and at the elbow, may be treated universally as “incorrect” fit. Nevertheless, fit is company-specific and therefore a subjective concept. Garment fit needs to reflect the core customer of a company, catering to customers’ notions of “good fit” and comfort. Cost refers to garment cost: how much it costs a company to produce a garment. Cost is made up of a number of variables. Fabric and other materials account for approximately 50 percent of garment cost and labour accounts for 20 percent, with the remainder comprising company overheads (Cooklin 1997: 9). In designing, the three criteria of appearance, fit and cost (along with other less central criteria) are rarely treated separately; for example, an examination of fit includes an examination of the garment appearance on the body, and possibilities regarding appearance are tempered by concerns about cost.

This is reflected somewhat in the distribution of codes. The code “Economic saving” appears only twice; on reflection, this is less reflective of cost not having been a criterion during
designing in this project but rather, given that the focus of practice was fabric waste elimination, I did not write about garment cost in the journal. My previous design practice in industry has imprinted me in that cost is almost always a consideration for me during designing; the exception would be a conceptual exhibition-only piece. Fit, as seen in the code “Garment fit”, appears significantly more often, in approximately 15 percent of the entries. This is reflective of the fact that fit is inseparable from the garment pattern, and fit was often a primary concern during practice. Appearance, as denoted by the code “Aesthetics in design”, appears in ten percent of the entries but almost entirely during later entries. Again, this is mostly reflective of appearance being a constant criterion in all of my design practice.

3.2.1 Criteria in designing fashion without fabric waste

Fashion design without fabric waste adds a fourth criterion: fabric waste. As a criterion it is equal in significance to the other three criteria. The criterion means that a garment is designed and made so that it retains all of the fabric required to make it. Where conventional approaches to fashion design result in approximately 15 percent fabric wastage (Cooklin 1997: 9), a zero-waste approach aims for zero wastage. It should be noted that the aim of zero-waste fashion design in this project is not to create clothes from less fabric. The quantity of fabric required for a garment determines the length of the marker; this depends on the designed garment. For example, an ankle-length skirt is likely to require more fabric than a knee-length skirt. A zero-waste garment will contain all of the fabric in the marker length and across the fabric width, regardless of how much fabric there is. Eliminating 15 percent wastage does not necessarily result in the garment requiring 15 percent less fabric; some of the usual “waste” may be designed as part of the garment. Whilst I could have added another criterion for the practice – “Minimising fabric usage” – I did not because the focus needed to be fabric waste elimination. The two are distinct. Notably, Sam Formo and David Telfer have created zero-waste garments where minimizing fabric usage was a criterion (McQuillan & Rissanen 2011).

The terms “zero-waste fashion design” or “fashion design without fabric waste” may seem to imply that fabric waste as a criterion is more significant than appearance, fit or cost. However, in designing and making a zero-waste garment, one needs to balance the concern about fabric wastage with concerns about garment appearance, fit and cost. Most of the challenges encountered in this project arose from trying to achieve this balance, for it would have been relatively effortless to

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1 Marker is the cutting plan of a garment containing all the pieces required to make a garment; these pieces are placed on a fabric width as closely as possible. The length of the marker tells us how much fabric is required to make a particular garment; this is often referred to as the yield or meterage/yardage.
create a zero-waste garment if the appearance of the garment was compromised, for example, or if garment fit was treated as a secondary criterion.

Research by the fashion design generally precedes fashion design activity. This includes thematic or concept research, and research into trends. Both areas of research vary in scope depending on the company and the market area. These research areas influence particularly the appearance criterion, and to perhaps a lesser extent the fit and cost criteria. The market area in this study was hypothetical given that there was no intention to manufacture the garments for sale. Nonetheless, a sense of an end user, or wearer, was present throughout designing the collection. While there was no particular theme or concept behind the collection, I chose the title Bad Dogs as it captured a particular mood and referenced an inspiring group of people in Sydney. As I have matured as a designer, the need for conducting visual theme research has disappeared. My inspiration is consistently the cloth I work with, and the human body it lives over.

In the early stages of designing the collection, the appearance criterion was difficult to balance with the fabric waste criterion; deciding on a particular garment detail would be tempered by concern about how that decision might impact on fabric waste, while attempts to design with fabric waste as the main criterion resulted in unsatisfactory outcomes in terms of appearance. Once I had ascertained that a hierarchical approach to resolving garment elements could be a useful strategy (section 3.3.3 on building a shape library), appearance became easier to resolve. While the design process may have become seemingly more constrained as it progressed, there was a comfort in not knowing what the final outcome might look like. The code “Openness to possibility” refers to this mindset during designing. The realisation that throughout the design process countless possibilities existed for the appearance of the final garment was a breakthrough. This is a significant point of difference between conventional fashion design and fashion design without fabric waste: in conventional practice appearance is resolved through sketching prior to pattern cutting. In fashion design without fabric waste, appearance is resolved incrementally through sketching and pattern cutting.\(^2\)

The fit criterion was significant throughout designing the collection, as fit was perceived as one of the major points of difference that would make this collection unique in the market place. On the one hand, this translated to significant amounts of toiles and fittings early in the design process to achieve satisfactory garment fits. On the other, in some cases the garment fit was cultivated as an aspect of the design that would remind the wearer he is wearing the garment. This does not mean deliberate discomfort but rather, a consciousness of the body built into the garment.

\(^2\) In both approaches the designer may also use draping.
Much of this is hidden internally in the garments, such as the jockstrap-like elastic in the leggings (Pant 2007), or the waist stay (a type of internal belt) in the wedge shirt (Shirt 3002). During designing, the most challenging issue relating to fit arose from garments described as “square-cut” (see section 3.3.2). This may have been due to my initial lack of experience in working with this approach to fashion design and pattern cutting – more time was required early on to develop and resolve fits for these garments. Later, as I became more experienced working with these pattern shapes, resolving “square-cut fits” did not differ from the more conventional tailored entries.

This project aimed to simulate a “real world” situation: designing garments for a small company within the designer ready-to-wear market that would produce garments with a strong and original design direction. Garment cost is an important criterion in a “real world” design situation (Sinha 2001: 173); the fashion designer needs to be aware of what the customer is willing to pay for a particular item and to understand the relationship between the retail and cost prices of a garment. As noted, the codes would imply that cost was not as significant a criterion during the practice in this project as it would be in a real-world fashion design situation. With experience, the cost criterion becomes embedded in designing; an experienced fashion designer will only consider using fabrics within an appropriate price range and is well-equipped to judge various garment elements in relation to cost. A post-practice examination of the collection suggests that the costs of the designed garments would not be a prohibitive factor if these garments were manufactured for market. The yields (amount of fabric required for a garment) are generally on par with those of conventional garments manufactured in industry, and the costs associated with construction are competitive, too, based on what the sample machinists employed to make some of the garments charged for their labour. In fact, some economic benefits may exist with zero-waste garments. Cutting becomes somewhat faster, as each cutting line separates two pieces. A “shared cut line” is less common in cutting conventionally designed garments, although this is considered desirable (Fasanella 1998: 114-5). A garment of 20 pieces generally takes longer to cut than a garment of ten pieces; a zero-waste garment of 20 pieces, however, is faster to cut than a similar conventional garment of 20 pieces, due to the shared cut lines3. Finally, fabric waste management and disposal costs are also reduced or eliminated. Neither of these may directly benefit the company employing the fashion designer, however; cutting is often subcontracted rather than performed in-house. To further complicate matters, different service providers may charge for their services differently. An independent cutter may charge by the hour, in which case some savings could occur for the client.

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3 If a garment piece contains one or more slashes (cut lines originating from a piece edge into the piece without dividing it into two pieces), cutting time would increase.
A larger cutting house, however, might charge by the number of pieces in a garment; in this case a zero-waste garment would cost the same to cut as a conventional garment if both contain the same number of pieces.

<table>
<thead>
<tr>
<th>Primary criteria</th>
<th>Secondary criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Appearance</strong></td>
<td><strong>Masculinity</strong></td>
</tr>
<tr>
<td>Garment appearance: ensuring garment is visually pleasing to consumers</td>
<td>Balancing garment elements to achieve a masculine feel in garment</td>
</tr>
<tr>
<td><strong>Fit</strong></td>
<td><strong>Fashionability</strong></td>
</tr>
<tr>
<td>Relationship between garment and body: ensuring appropriate fit and comfort</td>
<td>Ensuring appropriate Fit and Look at a particular point in time</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td><strong>Sustainability</strong></td>
</tr>
<tr>
<td>Garment cost: ensuring appropriate retail price through design choices</td>
<td>Fibre type; garment-in-use; visual longevity in a wardrobe; disposal/recycling potential</td>
</tr>
<tr>
<td><strong>Fabric waste</strong></td>
<td><strong>Future transformability</strong></td>
</tr>
<tr>
<td>Ensuring garment patterns interlock to form a no-waste cutting layout on a fabric width</td>
<td>Facilitating future repair or alteration of garment through design choices</td>
</tr>
<tr>
<td><strong>Manufacturability</strong></td>
<td><strong>Physical durability</strong></td>
</tr>
<tr>
<td>Ensuring garment can be manufactured. See Chapter 5.</td>
<td>Ensuring appropriate robustness of garment</td>
</tr>
</tbody>
</table>

Figure 3.4 Table of criteria for fashion design without fabric waste as they emerged from practice in this project.
Different companies may have different secondary criteria for the fashion designer to address. Similarly, several secondary criteria emerged during designing in this project as outlined in the table in Figure 3.4. For example, *Masculinity* as a criterion (and code) refers to a concern about achieving a balance within a garment that might include elements traditionally considered “feminine”. For example, silk/hemp satin may be perceived as a feminine fabric; to create a masculine feel in the wedge shirt (a shirt made from silk/hemp satin), the broad shoulders were exaggerated and waist narrowed to emphasize a sturdy chest. Robust stitching details contrast with the delicate surface of the fabric, further designating the garment as menswear. Conventionally women wear leggings; the front pouch of the leggings in the collection aims to be sympathetic to the male anatomy. Most fabrics used in the collection, however, are traditionally perceived as masculine. For many garments this criterion was not significant during designing.

*Fashionability* as a criterion in this project aims to ensure the appropriateness of appearance and fit at a particular point in time. Successful sales rely on this criterion. Fashionability varies significantly from one company to another, depending on the core consumer and his/her ideas and desires about fashionability. The fashion designer needs to be sensitive to these ideas and desires throughout designing. In some companies it may be a primary criterion for the fashion designer. In this project the criterion translated to designing clothes that were relevant for the market at that time, but that would also have longevity in a wardrobe beyond one or two seasons. This criterion was somewhat tempered by broader sustainability concerns in that I aimed to create garments that had a timelessness to them while appearing desirable to a particular group of men at the time of creation. This seeming tension between “being current” and timelessness has been undone in detail by Koskennurmi-Sivonen (1998: 204-205).

*Future transformability* (as criterion and code) refers to the ability of a garment to be altered or repaired over the lifetime of its use. This has been a consideration for me for some time. In 2005 I delivered a lecture titled *Design for Repair* within a course on bespoke tailoring; bespoke tailors generally provide a repair and alteration service for a suit if and as needed (Gwilt & Rissanen 2011: 75). Being able to repair a damaged garment or alter one that does not fit can potentially prolong the useful life of a garment. Similarly, while *physical durability* (as criterion and code) is not appropriate in every design situation (for example, medical garments that may need disposing of after a single use), with many types of garments durability can at least hypothetically lead to longer use lives and potentially lower levels of consumption. These considerations informed some of the early experiments as well as the design of Shirt 3006. For example, larger-than-usual seam allowances allow enlarging a section of a garment, and “excess”
fabric in a garment can later be used to repair a hole. Since the practice in this project, I have expanded this to include *visual durability*, the kind of timelessness in fashion described above.

### 3.2.2 Fabric waste as a criterion in designing fashion

Fabric waste is rarely a criterion for fashion design or pattern cutting; conventionally it is an economic problem for the marker-maker to solve at the commencement of manufacturing. The more fabric a garment requires, the more it will cost to make. Sometimes the pattern cutter will modify a pattern to reduce fabric usage, with minor consequences for the appearance criterion. For example, fullness in a skirt may be reduced to fit the garment pieces on less fabric. While fabric width is noted at such an instance, it is rare for fabric width to be considered during designing or early phases (if any) of pattern cutting.

Across designing garments during the practice phase, the criteria bore varying significance at different stages of the design process. While the fit criterion was significant early on, the fabric waste and appearance criteria increased in significance towards the end of the design process for all the garments. In other words, for the most part, fit was resolved before appearance and fabric waste. The overall silhouette (as relating to appearance) was resolved early along with fit, but garment details (for example, the shape of collar and cuffs on a shirt), were resolved concurrently with fabric waste later.

An early experiment of designing a pair of trousers by drawing the pattern layout on graph paper (Figure 3.5) demonstrates that fabric waste should not surpass appearance or fit in importance. The cut of the trousers draws from Thayaht’s tuta (Stern 2004: 43; Chenoune 1993: 142), an overall cut from rectangles. No conventional sketching was undertaken prior to drawing the pattern layout on graph paper – body measurements were used as a reference to ensure the garment would relate to the body. While the pattern layout included pocket patterns, I had not decided on pocket placement at this stage. The intention was to determine this in toile. Upon transferring this to full scale (with some modifications to further reduce the amount of wastage) and making the toile, I discovered the fit to be utterly unsatisfactory. The main leg and gusset patterns required significant alterations, and two subsequent toiles were made, resulting in significant changes to the pattern layout with increases in the amount of fabric waste. Other implications for subsequent practice resulting from this quick experiment will be discussed in section 3.3.3. I introduce the example at this stage to demonstrate that fabric waste cannot be the only criterion for fashion design: appearance, fit and cost are equally significant.
3.2.3 Hierarchies of fabric waste: Designing garments of multiple fabrics

Garments that make use of a contrast fabric for visual effect are common. In fact, very few garments contain only one fabric even if they seem to do so. Even a basic t-shirt often has a neckband cut from rib knit while the body and sleeves are usually jersey. A plain shirt will have fusible interlining hidden inside the collar and cuffs. A suit jacket may have several different interlining fabrics hidden between the outer shell and lining fabrics, each serving a separate
purpose. In manufacture, each of these fabrics will have a separate marker made for it. Cutting a garment of multiple fabrics is generally more time-consuming than a garment of one fabric only.

Adding another fabric to a garment makes the design and manufacture more complex when fabric waste is a criterion for design. At first one needs to decide whether the pattern layouts for each of the fabrics in a garment are to be zero-waste, or if only the main fabric (that which makes up the majority of the garment) should have fabric waste as a criterion. No “correct” solution exists; in this respect each garment needs to be judged on its individual merits. Nevertheless, I argue that it is more consistent to include the fabric waste criterion for each fabric.

Treating fabrics hierarchically is a useful strategy; this means that fabric waste as a design criterion is most significant with designing the pattern layout of the main fabric – the fabric that constitutes the most intensive material resource in the garment. This criterion may diminish in significance with contrast fabrics and interlinings; one may be more accepting of wastage in secondary fabrics if fabric waste and appearance cannot be resolved satisfactorily. Particular limitations exist for lining and interlining fabrics in relation to fabric waste. The pattern shapes of the main fabric determine the shapes of the lining and interlining pattern pieces, and the latter patterns are only made after the main fabric pattern has been perfected. A lining pattern is usually cut to replicate the shape of the outer shell it lines, even if it is made slightly bigger to ensure the lining does not pull on the shell. Interlining patterns, such as those for fusing, are often cut exactly the same or slightly smaller than the pieces they interline. From a functional viewpoint (feasibility of garment construction) this is more significant than the fabric waste criterion and therefore a compromise may be necessary and some wastage in lining and interlining fabrics is likely. This occurred with all of the shirts; the fusing patterns were not zero-waste as the main fabric pattern shapes dictated the pattern shapes in fusing. Similarly, some of the trouser pocket bags, in pocketing (lighter fabric than main) were not zero-waste. I nevertheless attempted to engineer these in ways that minimised the amount of fabric waste. In some garments, such as the denim trousers, the garment fabric was used as interlining, eliminating the need to use a separate interlining fabric. Lumsden (2010: 46) employed this strategy in some shirt designs.

A somewhat more flexible situation arises with a contrast fabric. It is not unusual in conventional practice to adopt a garment of one fabric, say a plain shirt, and create a new style by cutting the yoke, collar and cuffs in a different fabric for example. If this were a zero-waste shirt for which the pattern layout was already resolved, removing these pieces from the original layout would create “holes” (waste) in it. Furthermore, it would be unlikely that the removed pieces, once placed on the contrast fabric, would interlock perfectly for a zero-waste layout. If,
however, it is decided from the outset that this garment (without an exact idea of how the garment will visually appear) is to have these two fabrics and that both fabrics are not to be wasted, then fulfilling the criterion of no waste in either fabric is possible. The appearance criterion is not directly connected to the pattern shapes of lining and interlining fabrics but it is to those of a contrast fabric. With appearance comes “openness to possibility”, which in turn provides flexibility for the fabric waste criterion to be resolved.

One garment in the collection, the square-cut wedge shirt in silk/hemp satin with vintage kimono silk contrast, offers an alternative approach. Most of the shirt is of the satin and the pattern layout is zero-waste. Some waste does occur in the kimono silk, for two reasons. The fabric was mostly plain with some brocaded motifs placed rather far apart; I wanted to include these motifs in the garment. Furthermore, there were permanent stains across the fabric as well as all around its edges; the fabric was 40–50 years old, from a damaged kimono. I did not want to include the stains in the garment, unless I could hide them in the seam allowances. While wastage was high, using an otherwise “useless” remnant made the compromise easier to accept. Naturally this approach poses problems for mass manufacture; I was able to secure only two panels of this fabric that were not exactly the same length. After making the original sample garment I had the one panel left to make one more shirt; this would be problematic in fulfilling an order for 50 shirts. Kimono fabrics vary very little in width, however. It would seem plausible to source several fabrics of similar weight and colour (fabrics that would work equally well with the main silk/hemp satin) and offer these as alternatives to retailers.

Although the aim of fashion manufacture for over a century has been to produce multiple, identical garments, it would seem that in the past decade retailers have become more accepting, even welcoming, of some designed variation (as opposed to variation caused by errors during manufacture). In 2002–2003 I sold to one Sydney store t-shirts that had old cut-up t-shirts that had been appliquéd. While the t-shirts were identical in fit and the retailer dictated what the base colour was to be, I had complete freedom in sourcing the old t-shirts from charity stores. Furthermore, each appliquéd was unique as I worked with whatever was on the old t-shirt rather than create a standard approach. Admittedly this required some trust on behalf of the retailer (she did not know exactly what she had ordered until it arrived in store), and it was a more time-consuming and costly approach to manufacture than standardising would have been. Nevertheless, mass customisation may be one strategy in designing garments of multiple fabrics. Most research on mass customisation in fashion seems to concentrate on customised fit using new technologies such as body scanning, but the above example indicates that there are
3.3 Pattern cutting the body: Tailored and square-cut

Two differing approaches to pattern cutting the garments in the collection can be identified, even if the division is blurry: tailored and square-cut. “Tailored” is used here to refer to garment cuts and patterns that make use of curves to reflect the body that wears the garment. Patterns of square-cut garments, such as the trousers described in 3.2.2, make extensive use of rectangular shapes and straight lines, which may be at any angle. The body is abstracted in the garment through geometry, reflecting to some degree the concept developed by Roberts (2008) that garments are tunnels through which the body travels. Tailored garments are more common in conventional fashion design and their pattern shapes reflect the human body more closely through the extensive use of curves. This may be because currently most fashion design and manufacturing courses teach the tailored pattern cutting approach, although the square-cut approach was widespread until the late nineteenth century in Europe, and is still used in many forms of traditional dress around the world. The division in the collection is blurry because many of the square-cut patterns do incorporate some curves and most tailored patterns also include straight lines and parts of a garment that might better be classified as square-cut. Most garments are hybrids of the two, although early in the design process most of the garments fitted neatly into one category or the other.

Decisions made early in the design process of a garment can prove useful later on. For example, the angles of the edges of the main body pieces in the hoodie (square-cut with curved slashes) were determined early and were not altered because the two pieces interlocked with those particular angles. When a rectangle is bisected with a straight line, the angles of corners A and B at one end of the line will match those of corners A and B at the other end (Figure 3.6). Several garments in the collection benefited from this principle. For example, the left and right leg pieces of the asymmetric square-cut trousers (a pair in denim, another in check wool) form a rectangle bisected by an angled line. The cut is an intentional play on shape. In its overall outside edge, the left leg pattern is exactly the same shape as the right leg pattern, but the edge forming the waist in the left
leg becomes the hem in the right leg, and vice versa. Darts were used to ensure that the left waist and hem measurements matched the right waist and hem measurements respectively. In the square-cut wedge shirt pattern (one in silk/hemp satin, another in striped cotton), the angle of the centre front of the body matches the angle of the back sleeve seam. The body and sleeve patterns do not form a perfect rectangle but keeping these angles the same throughout the design process ensured that the pieces formed a larger unit. When I added more fullness to the sleeve hem while altering the initial patterns, the angle of the back sleeve seam changed as a result. I consequently changed the angle of the body centre front so it matched the angle on the sleeve.

![Figure 3.6 Matching angles in square-cut trousers and shirt](image)

In the initial experiment briefs I asked whether it would be easier to resolve the fabric waste criterion in square-cut as opposed to tailored garments. The predominance of straight pattern edges seemed to suggest so. On reflection, fit and appearance were more challenging to resolve in the early square-cut garments in this study, underlining that a single criterion cannot be resolved in isolation. Nevertheless, a number of people have noted on the predominance of square-cut garments in this study. Holly McQuillan’s work provides a useful contrast; curved lines dominate her garment patterns while resolving the criteria of appearance, fit and fabric waste. I would be cautious to compare square-cut versus tailored in resolving the fabric waste criterion; one may be more appropriate in a particular design situation. Furthermore, while many of the longer seams in garments in this project are straight, necklines in particular tend to be curved for appearance and fit. I would, however, encourage the teaching of the square-cut approach alongside the tailored approach in fashion design education; the potential for new garment forms that the approach offers is currently perhaps underutilised.
3.4 Fashion design and pattern cutting: strategies for integration

3.4.1 Con temporaneous sketching and pattern cutting

In conventional fashion design practice the fashion designer hands the pattern cutter a “final” sketch of the garment to guide the pattern cutting process. Usually pattern cutting does not commence until the sketched idea is resolved (Joseph Armstrong 1995: 80). Both the fashion designer and pattern cutter may use draping as an additional tool to explore or resolve aspects of a garment. Mostly the roles of fashion designer and pattern cutter are hierarchically separate in industry and there is some evidence that fashion design education may reinforce this separation (Aldrich 1996: 5). Figure 3.7 shows a simplified order of the process.

![Figure 3.7 Conventional fashion design approaches](image)

Based on this, in conventional fashion design practice it is hypothetically therefore possible to design a garment through sketching in one episode of designing. The appearance criterion is resolved before pattern cutting commences. It is possible to sketch a design, hand the sketch to a pattern cutter and have a sample cut and sewn using the pattern that will replicate the sketch in three-dimensional garment form. In reality, however, this rarely happens in one episode of designing; the garment idea is usually developed in a number of iterative stages through sketching, on one hand to refine the idea as an independent entity and on the other to ensure it serves a specific aesthetic and economic purpose within the overall collection of garments being developed. Regardless, once the sketch is resolved, the pattern cutter can cut the first pattern in one episode of pattern cutting and a toile can be cut and made to check the appearance and fit of the garment.

With fabric waste as a criterion for fashion design, such a process is unfeasibly difficult. Maintaining an awareness of the two-dimensional patterns on fabric while simultaneously sketching a three-dimensional garment is a formidable challenge. When a garment element such as a pocket is added to a sketch of a jacket for example, one would already need to know exactly what the patterns of the jacket body and sleeve would be like and how they might interact and interlock on the fabric, and design the pocket accordingly. At this stage the patterns for the jacket body and sleeves would not have yet been pattern cut, toiled, fitted and corrected. The
fit and appearance criteria cannot be evaluated until the garment is toiled and fitted on a body. It would be possible to speculate what the pattern pieces might be, but even a half centimetre alteration to one edge of a sleeve pattern later during fitting could have undesirable consequences for the pocket in the overall pattern layout.

Perhaps the greatest challenge of designing fashion without fabric waste is this: designing through sketching (if the designer employs sketching to design) and pattern cutting need to be contemporaneous, dynamically complementing each other. More precisely, as this project demonstrates, pattern cutting is an inseparable part of zero-waste fashion design, not a subsequent activity. Realising that I had to commence pattern cutting prior to knowing exactly what the garment would look like, the design process became easier and faster. This section will present useful strategies for fashion design and pattern cutting that emerged from this study, which work together to create garments that waste no fabric. Pattern cutting as a design ideation tool is present in them all.

### 3.4.3 Hierarchies of garment elements: Building a shape library

As the trousers discussed in 3.2.2 demonstrate that trying to resolve the appearance, fit and fabric waste criteria all at the same time is not feasible. Rather, one needs to give different weighting to each at different points in the design process, and pattern cutting is integral to resolving the appearance criterion. Furthermore, the appearance criterion needs to be broken down hierarchically to components such as silhouette, shape and details. Resolving the criteria is an iterative process, and tackling the various elements of a garment hierarchically can be a useful strategy. In the context of designing a collection of garments, I describe this as building a shape library. The basic garment shapes are pattern cut, toiled, fitted and corrected until they are “perfect” for the requirements at hand, including the desired and appropriate seam and hem allowances around each pattern piece. These patterns can be described as being half-way between a block pattern and a pattern for a specific garment; the garment shape is specific but details such as pockets or collars are not yet designed or pattern cut. For a shirt or a jacket this means perfecting the patterns for the body and sleeve; the neckline to which the collar will eventually attach is decided on, but the collar will be designed later. For a pair of trousers, the main leg patterns are perfected and waist measurement is determined even if the waistband or waist facing is not yet designed. To generalise, the largest pattern pieces need to be resolved first as these will dominate the eventual pattern layout. Here, zero-waste fashion design appropriates an element of conventional marker making (discussed in 3.3.5) where larger pattern pieces are placed on fabric first and smaller pieces where they fit (Cooklin 1997: 59). Once the larger
pieces that make up the basic garment shape are resolved, one can commence placing these on the fabric to explore potential for further designing.

In some instances garment details might need to be included in this process of building a shape library. If the fashion designer has a determined idea of how a particular detail should visually appear, it needs to be developed and perfected with the basic garment shape. Perfecting the pattern pieces for this detail before trying to resolve the final layout and design ensures that that detail remains true to the original idea. For example, the front pouch of the leggings (Figure 3.9) was such a detail, and the patterns for it were resolved relatively early because a particular appearance was desired.

Once these basic patterns for a specific shape have been toileted, fitted and perfected, one can begin examining how they may be placed on the fabric width to be used, what “leftover” shapes these placements create and how the leftover shapes may yield ideas for the details of the garment. By perfecting the basic garment shape first – resolving the appearance and fit criteria for the shape but not yet for garment details – ensures that the perfected pattern pieces will not change later. A later change to these would have implications for the interlocking of the pattern pieces on fabric, thus requiring that the main pattern pieces are made “perfect”, inviolable, before the design process moves forward to consider garment details. To sum, the design process begins with the early macro considerations (garment shape) and ends with the later micro considerations (garment details). Figure 3.8 provides a simplified comparison between conventional and zero-waste fashion design approaches.

![Figure 3.8 Simplified comparison between conventional and zero-waste fashion design approaches](image)

The perfected basic pattern shapes can function beneficially in developing a collection of garments, which is expected to comprise garments that relate to and complement each other through visual elements. It is important that no two garments in a collection compete for visual impact or sales with each other; each garment serves its own unique aesthetic and economic
purpose in a collection. The basic pattern shapes in the shape library yield an unlimited number of design variations, depending on how the pieces are initially placed on a fabric width and what one chooses to design from the resulting leftover shapes. Further variation results from utilising the basic pattern shapes on two different fabric widths. Variation in fabric width forces new placements for the basic pattern shapes, creating new leftover areas to design garment details with.

The asymmetrical check wool trousers and asymmetrical denim jeans were based on the same original basic shape. The two fabric widths were relatively similar (check wool 156cm, denim 152.5cm), but significant variation between the two garments was created using other strategies. Construction is an important difference; the choice of different seam types in the two garments require different seam allowances for each and this change has to be made to the patterns before exploration on fabric can begin. The denim jeans are constructed with a manual felled seam; to reduce bulk when the top seam allowance is folded over the lower seam allowance, the top seam allowance is double the width of the lower one. In the wool trousers, open seams are used and therefore uniform seam allowances are used throughout. The one exception is the back crotch where the seam allowance becomes wider towards the waist to allow later enlargement of the trouser waist if necessary. The large darts were also constructed differently in the two garments: the wool trousers have internal darts while in the denim jeans the darts are external with top stitch detail. Further difference is created by pocket design. The denim jeans have oversized welt pockets on the front and one patch pocket at the back, while the wool trousers have two back patch pockets and welt pockets covered by oversized flaps on the front. Although based on the same original shape, the two garments are sufficiently different to justify having both in the collection.

The Endurance Shirt I created in 2009 became a base for Endurance Shirt II created in 2011. The earlier shirt and both patterns are illustrated in Figure 5.2 in Chapter 5. The body shape remained the same but a change in fabric width (the later fabric was 13cm wider) resulted in some appearance changes in the latter garment; I eliminated the elbow patches because they did not feasibly fit on the fabric width without having to design further components into the shirt, which I did not desire to do. Because the fit was already resolved in 2009, designing and pattern cutting the latter shirt took less than a day. Over time, building a shape library will speed the process of zero-waste fashion design along considerably.

In designing the stripe leggings (Pant 2007), the basic leg shape was developed first. Beginning with a conventional, tailored legging pattern (Stage 1 in Figure 3.9, below), the inside leg seam was displaced to the front of the leg (Stage 2). After the pattern was converted from tailored to partially square-cut (I anticipated fabric waste elimination to be easier this
way), I had to split the leg pattern horizontally to achieve a closer fit around the knee. Conventionally one would achieve this by contouring the pattern edges (as in the original pattern in Stage 1) with curves. Splitting the leg and contouring the leg with straight edges (see dotted lines in Stage 3, resulting in the pieces shown in Stage 4) would allow butting the left leg pieces against the right leg pieces later (Stage 5, the final pattern layout); curved edges would not allow this, instead potentially creating new shapes between the pieces.

Although the decision to keep the main leg piece edges straight allowed some butting of pieces, the waist and crotch shape created somewhat awkward shapes within the pattern layout, regardless of how the pieces were placed on fabric. The front crotch became even more problematic once it was cut away to accommodate the pouch (referred to as “codpiece” and “cock cup” during designing). The pouch nevertheless seemed important as it made a traditionally female garment explicitly masculine by reflecting male anatomy. Once the pouch was resolved, however, I reached what seemed a dead end for the fabric waste criterion. The idea of using “waste as appliqué” allowed a simultaneous resolution of the fabric waste and appearance criteria. Infinite possibility existed for the appliqué design depending on how the leg and pouch pieces interacted on the fabric, how the resulting shapes were split up further and how the appliqué was placed on the garment. Small pieces were also used as filling inside the pouch (pieces F in Stage 5), giving it a somewhat smoother external appearance.

It may seem that in light of filling the pattern layout with appliqué, with its countless possibilities, converting the pattern from tailored to partially square-cut was unnecessary. It was my desire, however, to have the stripes meet at the front seams at mismatching angles. In a tailored legging pattern the stripes would barely mismatch close to the hem, while with this square-cut pattern the degree of mismatching remains uniform throughout the front seam.

Although both fashion companies and the fashion media perpetuate a myth that fashion changes every six months (in the retail stores of “fast fashion” companies collections may be replaced every six weeks or less), it in fact makes economic sense for companies to repeat some garment styles over two or more seasons (and collections). These styles are usually ones that have sold well and often they are not the most “fashion-forward” in a collection. Making and perfecting a pattern is costly and including some garment styles from previous seasons in a collection reduces these development costs somewhat. When a style is repeated, it is usually (but not always) offered in a different fabric or colour to previous seasons, to maintain an impression of newness. Certain garment styles could feasibly provide the foundations of a shape library, if a company was to shift from conventional fashion design to designing and
making garments without fabric waste. The main pattern pieces can be copied from a pattern set (for example, the body and sleeve patterns of a shirt or the leg patterns of a pair of trousers), ensuring consistency in fit across garment styles. Examining these on the new fabric width could provide the initial drive for the (re)design process.

Figure 3.9 Design of leggings demonstrating function of shape library building

### 3.4.3 Shape awareness and designing garment details

Over time, the pattern cutter develops an in-depth understanding of the relationship between the three-dimensional garment form and the two-dimensional patterns required. An experienced pattern cutter will have a clear sense of the pattern shapes before the patterns for a garment are made (Joseph Armstrong 1995: 80). Although most fashion design courses include pattern cutting in their curricula, most companies do not expect the fashion designer to make patterns for the garment he/she designs. In conventional designing the fashion designer does not need to possess an awareness of what the garment will look like as flat, two-dimensional pieces of fabric.

In designing fashion without fabric waste, this shape awareness is required: the fashion designer needs to understand how two-dimensional negative shapes on fabric, created by the basic pattern shapes, may be used in designing the garment further. A shape awareness – having a sense of the pattern shapes that one is working with – becomes increasingly important as the design process progresses from the basic garment shape to garment details. This includes an
awareness of both the pattern pieces and the negative spaces their edges will create in the pattern layout, negative spaces, which will become part of pattern pieces for other elements within the garment design. In short, designing fashion without fabric waste requires of the fashion designer a shape awareness similar to that which is conventionally the domain of the pattern cutter.

During the practice in the project it was helpful to regularly “doodle” with resolved pattern pieces and test variations in pattern composition to explore the kinds of negative spaces created by them, and the design potential of these shapes. This doodling proved an invaluable part of the practice. For example, it led to the discovery that the sleeve heads of a shirt could be brought to interlock (Shirt 3006) without compromising the fit criterion. Having these “shape doodles” visible within the studio space, by way of pinning them on the wall, for days or weeks at a time was useful. They served as visual memory aids and helped the design process along. In Figure 3.10 pages from the journal demonstrate shape awareness with three different garments. Sketching pattern shapes and incomplete pattern layouts, either quickly to get a sense of a situation or accurately (for example, on graph paper) sensitises the fashion designer to not only the pattern shapes but also the possibilities for further designing. In particular, once the patterns for the basic garment shape are ready for the designing to move forward to garment details, sketching these shapes within the confines of a fabric width can be a quick way of assessing potential for further designing. A pattern sketch also becomes a permanent record of a possible “design move” that can be referred to later.

Shape awareness is particularly important in the early phases of designing a garment, as it facilitates the designer seeing possibilities for further designing. As the design process
proceeds, space awareness – a critical attention to how the pattern shapes relate to each other – becomes increasingly significant.

3.4.4 Visualization strategies and managing scale
The primary ideation tool in a conventional fashion design situation is sketching. The fashion designer sketches the garment front and back several times, refining the idea iteratively and eventually hands the front and back sketch to the pattern cutter. The sketches are significantly scaled down; no examples of fashion designers sketching full-scale garments were uncovered during this project; sketching scaled-down garments is quicker and easier than sketching in life size would be. The actual scale used mostly depends on the fashion designer’s own preference.

Manual pattern cutting involves cutting patterns for a garment to actual scale; the patterns are used to cut fabric and these pieces are sewn together and therefore need to be full-scale. Nevertheless, the pattern cutter works on one pattern piece at a time and it is rare for the pattern cutter to need to be concerned with how all of the pattern pieces of a garment might interact on a fabric width. In conventional fashion design and manufacture this is the marker maker’s responsibility. The pattern cutter does consider the entire set of patterns in ensuring that two edges that need to match (seams in a garment), match, but he/she rarely needs to examine the entire pattern set on fabric.

Designing through draping or developing the patterns for a design through draping can occur in full scale or a reduced scale. Madeleine Vionnet’s approach of draping on a half-scale mannequin is well documented (Kirke 1991: 233-234). MFA Fashion Design and Society at Parsons The New School for Design provides all students with a half-scale mannequin to drape on. I adopted this approach during my undergraduate study in 1999. Draping in half-scale is faster, allowing a more diverse exploration of ideas in less time. The possible downside of draping in half-scale is the lack of accuracy. Kirke (1991) discusses some issues arising from translation to full-scale in Vionnet’s workroom. During my undergraduate study, Therese Rawsthorne, a fellow student, also draped in half-scale, then enlarging the resulting patterns using a photocopier. Due to a number of factors, including distortion caused by the photocopier, and the differences in shape between the half-scale and full-scale mannequin, at times the full-scale patterns resulted with fit problems not

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4 CAD pattern cutting is an exception. Pattern pieces are manipulated on a computer at a reduced scale, and the printed out full scale.
5 Occasionally during conventional fashion manufacture patterns may be changed slightly for more financially economic yields. This is referred to as pattern engineering, and should not be confused with zero-waste fashion design. When patterns are engineered for a more efficient overall yield, the look of the garment is changed as little as possible. In commendable texts on fashion manufacture, Fasanella (1998), Cooklin (1997) and Carr & Latham (1988) discuss aspects of pattern engineering, while pattern cutting manuals are generally silent on the topic.
present in the half-scale drape. I employed a different strategy; after resolving a design idea through half-scale draping, I draped the same idea in full-scale. While initially slower than the photocopying method, the resulting full-scale fit was generally more satisfactory.

With fabric waste as a criterion for fashion design it is important to be aware of the pattern shapes and how they might interact with each other on a particular fabric width. Working in full-scale can become overwhelming and time-consuming. Several times, I found myself standing on patterns placed on fabric, trying to make sense of possibilities and achieve space awareness; doing this afforded only a partial view. Even stepping back and seeing the whole does not always help – to visualise possibilities, one might have to shift a pattern a little, step back, shift again, step back – the process can be cumbersome (see Julian Roberts in Figure 3.11). Furthermore, whilst exploring possibilities regarding garment appearance, the designer needs to keep the fabric waste criterion in check; sketching while standing next to or on patterns is not easy. Several strategies exist to make designing more feasible and to manage the issue of scale.

Figure 3.11 Julian Roberts stepping back to assess developing pattern layout
After completing the square-cut trousers on graph paper in section 3.2.2, I transferred the pattern layout to full scale. Despite the problems with this particular approach described earlier, having sketched the pattern layout on graph paper made the making of the first pattern in full-scale fast. Another problem that may arise with drawing on graph paper is a tendency to draw rectangular pattern shapes at the expense of curves. Partly this may be due to the grid on the graph paper, and partly because curves are more difficult to draw accurately to scale. Pattern cutting software (CAD pattern cutting) could overcome this. Once the pattern for a basic shape has been made, toiled, fitted and altered manually in full scale, it can be digitised and worked on a computer screen at reduced scale. Although many styles that incorporated curves in the patterns were initiated early in the project, I never attempted to transfer these to graph paper due to the difficulty of drawing curves (such as armholes and neck lines) accurately and quickly on graph paper. A CAD system would have made this more feasible. The potential of CAD pattern cutting software for zero-waste fashion design will be discussed in detail in Chapter 5.

In designing most garments in the collection I did not sketch pattern layouts on graph paper while developing the final garments. Once the block patterns for each design were toiled, fitted and resolved, it would have been necessary to scale the block down to allow “playing” on graph paper. I deemed this too time-consuming and fiddly, but acknowledged that a CAD system for pattern cutting and marker-making would have served well for this purpose. These systems allow digitising the pattern pieces and exploring placements on fabric quickly. Currently pattern graders and marker makers use these to grade patterns and plan and make markers in the conventional way, resulting in approximately 15 percent wastage. If fashion designers were trained in these software systems, with the specific goal of designing without fabric waste, value would be added to the software systems without them requiring modification. For this project a CAD system was not available nor was I trained to use one during the practice phase. CAD and designing without waste should be the subject of future research.

Fletcher (2008: 153) features an “efficient pattern cutting concept shirt” by Andrew Hague. Hague describes the process: “So I found an image of a traditional shirt pattern on the web and pulled it into a vector-based platform (Illustrator, but almost any will work). From there, I manipulated the pattern almost arbitrarily to fill out all the holes that would leave wastage. I paid special attention to the armholes, but that’s about it. I let the shirt become what it wanted to be. Most importantly, I neither added, nor subtracted pattern pieces, so when I sat down to the sewing machine, I sewed the shirt the way I had been trained as a tailor’s apprentice.” (Hague in Rissanen 2008b). While Illustrator is not the pattern cutting software discussed here, Hague's
approach is an example of working at reduced scale, probably to make the design process faster and easier to manage. For Hague, fabric waste was the primary criterion: “The result is a decidedly Kawakubo effect, but the purpose and rationale are what makes it special.” The shirt nevertheless works visually, perhaps because it retains so many elements of a “classic” shirt.

Photography is a valuable tool for documenting pattern shapes for later examination at a manageable scale. It is also useful to photograph fabric pieces left over when a toile for a basic garment pattern is cut. The early toiles of zero-waste garments are generally not zero-waste; it is difficult to resolve the fabric waste criterion so early in the design process. Having a visual record of the negative spaces that the basic garment patterns will create aids in later designing. Photographing pattern pieces that are already resolved is a helpful tool in building shape awareness, as is photographing fabric scraps created in cutting a toile. A photograph of a pattern set makes it easier to acquire and maintain a sense of the pattern pieces in a way that simply looking at patterns on fabric does not allow. Examining actual patterns on fabric is an important regular activity nevertheless, as it gives a sense of the pieces in full scale. In the case of the striped hoodie, full-scale exploration provided me with an immediate sense that I could make a hood that fits a head out of the triangle shapes formed by the main body pieces. The photographs made that exploration quicker while functioning as memory aids.

Following experimentation through scaled down sketching and examination of pattern photographs, all final markers were developed in full scale. Working to scale at this stage had clear benefits. The sizes and shapes of “leftover” areas were easy to transfer from paper to fabric, allowing cutting and sewing of segments, which could be incorporated into and examined with the most recent toile. The hood of the hoodie (Figure 3.12) was resolved in this way, as were the

![Figure 3.12 Examining hoodie body and sleeve patterns on the fabric width](image1.jpg)
appliqués of the leggings. In some cases, the leftover shapes in paper were pinned to a toile, for example, the patch pocket shapes of the square-cut double wool pants. Working in full scale at this stage provides an immediate and reasonably accurate representation of the impact of a garment component within the whole garment.

3.4.5 Breaking pattern cutting “rules”

Pattern cutting education and manuals often present pattern cutting as a somewhat inflexible, impersonal and closed technical process with one “universal” approach or one “correct” solution. It has been established that pattern cutting is integral to zero-waste fashion design. Arguably fashion design, like all design, is a dynamic, creative and personal activity; it is unlikely that two fashion designers design in identical ways. It may therefore be difficult for a fashion designer to accept pattern cutting as part of the design process instead of as a subsequent activity.

Many rules exist in pattern cutting and some of these rules originate from strong rationales. Nevertheless, this project suggests that some rules, even with solid rationales, may be broken if it is deemed that fabric waste elimination becomes more feasible by doing so. The code “Breaking rules” emerged early in coding; I will discuss where I broke rules and conventions. Notably, two years after the practice and coding phase, Almond (2010: 16) called pattern cutting an art form, whose rules “can all be broken or manipulated”.

Perhaps the most common rule broken during designing the collection was in relation to trueing patterns and the resulting lack of flow-through. Trueing a pattern refers to checking on patterns that seams and darts, when sewn, will form smooth continuous lines, referred to as flow-through. Darts can be checked by folding the dart on the pattern as it will fold in the garment; the edge of the piece where the dart meets it should be smooth, without an indentation. This generally results in a shaped edge in the flat pattern, even if the fabric piece edge is straight once the dart is sewn. In designing the collection it seemed, however, that waste elimination would be easier if some of the darted edges were kept straight, for example, in the waist and hem of the asymmetrical square-cut trousers (Pant 3004). The resultant lack of flow-through was resolved by “incorrect” construction. The waist had an unusually large seam allowance (2cm; 1–1.2cm would be usual), which allowed the machinist to join the waist to the waistband in a curve without stitching too close to the raw edge while enclosing the dart allowance within the seam. Any pattern cutting manual would consider this approach incorrect. I, however, did this knowingly and communicated the required construction to the machinist. A somewhat simple act of rule-breaking made designing without fabric waste significantly easier without making
construction unfeasibly complicated. A “correct” approach of trueing the dart would have resulted in an uneven waistline instead of a straight horizontal one, resulting in a new negative shape to contend with in further designing.

At times, rules and conventions regarding fabric grain can be broken if it facilitates eliminating waste. In the denim coat (Jacket 1005), one front facing is on the “usual” warp grain, while the other is on the cross-wise weft grain (rotated 90 degrees). In some plain-weave fabrics this would pose no problem, but denim is a twill weave woven with a different type of yarn used in the warp and the weft. This has implications for the hang on the two grains, and it can cause the fabric to shrink differently along each grain during laundering. The coat was laundered after construction, and fortunately no detectable difference in shrinkage was apparent.

Some rules and conventions are arguably arbitrary. For example, it is common to make the fly facing shape from a rectangle with one corner cut away in a curve; the majority of trousers with zip flies have a curved stitch line on the front. There is no reason why the facing cannot be a rectangle instead. All of the trousers and jeans in the collection have a rectangular fly facing. This allowed a further innovation for the fly. A conventional fly is made of the fly and fly facing pieces, shaped as described. By using rectangles instead, I was able to combine the two pieces into one. This does not make construction faster as such (though nor does construction slow down once the machinist understands the construction method); rather, the appearance of the fly on the inside is arguably cleaner than the conventional fly construction. While only the wearer would see this when putting the garment on, arguable it nevertheless adds value to the garment.

While pattern cutting manuals provide a narrow view on the function of pattern cutting, some texts on pattern cutting do present a view of pattern cutting as flexible, and more significantly, integral to fashion design. Winifred Aldrich (1996: 5) makes a strong connection between cloth, explorative pattern cutting and garment form: “…the tension between precision and the speculative cut of new fabrics can generate new garment forms”. Julian Roberts (2008) argues similarly that pattern cutting “is about possibilities & what-ifs and experimentation… New ways of cutting come to life through a mixture of luck, risk & mistake.” In discussing her work, Yeohlee Teng (Koda 2003: 85) states: “You know, if you find a traditional pattern cutter, trained in Europe or in that tradition, you will find that they will want to conform to strict pattern cutting principles. And I don’t like that. My work is more organic.” This research

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6 In a plain weave fabric, a weft yarn crosses under a warp yarn, then over, then under again; the next weft yarn crosses over where the previous crossed under. The overall composition of the weave appears the same whether it’s viewed from direction of warp or weft. In twill and satin weave fabrics, the warp yarns cross over several weft yarns, then under one weft yarn, then over several weft yarns again. This has implications for the drape of the fabric, creating variations based on whether the fabric hangs on the warp, weft or bias grains.
strongly suggests that opportunities exist within fashion design education to better harness the creative potential of pattern cutting in fashion design practice, for new aesthetic possibilities as well as more sustainable design outcomes through reduced or eliminated waste.

3.5 Fabric Quantities

During designing a zero-waste garment, design and pattern cutting become increasingly constrained as the design process progresses. A mass-produced garment is cut from a rectangle of fabric (or multiple rectangles if multiple fabrics make up the garment): the width of the fabric and the length of the marker (cutting layout) determine the size of this rectangle. Although in zero-waste design the marker length remains unknown well into the design process, the resolved main pieces placed on fabric will give a reasonably accurate sense of the minimum marker length. Whether this will be greatly exceeded depends on how the garment is designed further. The designer has a choice of trying to resolve the design within the minimum marker length or exceed it, if the desired outcome requires more fabric than the minimum length. In resolving the leggings, the four leg pieces and waistband height determined the minimum length of the marker and this was not exceeded. It would have been perfectly plausible, however, to increase the amount of appliqué by using more fabric. Designing with a seemingly decreasing amount of “available” fabric may seem constraining, but fashion design is only as constrained as the designer allows it to be. Each emerging pattern shape and its design potential within the garment need to be examined creatively, and the minimum marker length may be exceeded if the fashion designer thinks the final outcome justifies it. An open mind regarding the final outcome is useful in this hierarchical way of trying to resolve the criteria simultaneously. It is nevertheless important to commit to certain decisions at particular points in time, to keep the design process moving forward.

3.5.1 Space awareness and marker-making in zero-waste fashion design

In conventional industry practice marker planning and making are a phase of manufacture. The aim of marker planning and making is to place the pattern pieces on the least amount of fabric possible; the rationale is economic. This occurs once the pattern has been perfected and approved for manufacture, and graded. The grain of the fabric provides a limitation to these placements; each pattern piece has a grain line marked on, which needs to adhere to the fabric grain during marker making
and cutting, to ensure the garment hangs and fits correctly. In some cases fabrics with a nap create limitations on how the patterns may be placed on fabric. Nap refers to the surface of some fabrics such as artificial fur or velvet: a raised surface that has a definite direction. The nap should be consistent throughout the garment, thereby limiting which way the pattern pieces may be placed and cut on a fabric. If the nap is facing up the front of a jacket, for example, it should also face up on the back and the sleeves. Similarly, a one-way textile print should generally be cut with the print facing the same way throughout the garment. Stripe and check fabrics may place further limitations on marker planning, if the aim is to match stripes or checks at seams. Generally, the larger the scale of the stripe or check, the more desirable matching is as any mismatch becomes more obvious with larger scale. The designer may deliberately, however, mismatch stripes or checks for visual effect. To sum, in conventional fashion manufacture minimising fabric wastage is the marker maker’s responsibility, and the result is approximately 15 percent fabric waste. As well as the limitations above, first and foremost the marker maker is limited by what has already been designed and pattern-cut. Small changes maybe made to the patterns to achieve a more efficient marker but the general aesthetic is inflexible towards change at this stage. Conventionally marker planning and making are subsequent to fashion design and pattern cutting.

In zero-waste fashion design without fabric waste, marker planning and making are an element of designing, particularly in the later phases of the design process. Once the basic patterns have been perfected, their possible placements on fabric and the potential for designing garment details can be examined. As the design is resolved further, the final design, patterns and marker come to be simultaneously. The final design refers to the garment, the final patterns are the pattern pieces needed to make that garment and the final marker is the configuration of those pattern pieces on fabric. Fabric waste is eliminated because it has been a criterion for design, and pattern cutting and marker making, traditionally subsequent activities following design, become part of designing. Furthermore, fabric width, conventionally not considered until manufacture, becomes a parameter within which the garment is resolved during designing. In these later stages of designing zero-waste garments, space awareness becomes increasingly significant. This refers to the designer being aware of how the pattern pieces relate to each other and the fabric width. Figure 3.11 (section 3.4.4) demonstrates how the marker length for the hoodie was determined by the combined length of the two sleeves. Whilst I could have used more fabric for more details in the garment, I chose to limit the fabric quantity to this amount.

A brief look at literature on conventional marker planning and making is warranted here. Tyler (1991: 53) notes human factors as a significant aspect of marker planning and making in
order to maximise fabric savings. From a design and pattern cutting perspective in zero-waste fashion design, human factors are equally significant. Drawing from Lounsbury and Gibson (1987), and their study into marker planning at Levi Strauss & Co, Tyler lists the following twelve personality characteristics as factors in effective marker planning:

1. mathematical ability and numerical reasoning
2. spatial visualisation, both two and three dimensional
3. spatial reasoning
4. the ability to integrate elements of patterns
5. abstract reasoning
6. global intelligence
7. the ability to perceive patterns in complex visual displays without distraction
8. short-term memory
9. perceptual speed and accuracy
10. manual dexterity and eye-hand-finger coordination
11. introversion/extroversion (with introverts performing better)
12. anxiety (with less anxious persons performing better)

In adapting the list for zero-waste fashion design practice that incorporates pattern cutting, a creative and critical ability to perceive aesthetic potential, or an openness to design potential, or an ability to imagine, should be added to the list. During the practice in this project, and in particular in the early phases, seeing beyond “awkward” shapes, and what their negative shapes could become within a garment, was perhaps the biggest challenge to overcome. This may have been because the early experiments were somewhat prescriptive, and at times it was difficult to creatively negotiate within the confines of the experiments, despite the loose nature of the design briefs. Once the thematic foundation of the collection became solidified, the design process freed up and new ways of seeing the potential of shapes emerged.

Returning to Tyler’s list, and examining the practice in this project, some of the factors seem more significant for design than others. Mathematical ability and numerical reasoning were important at times, to reconcile gaps still left in the pattern configuration and the garment areas yet to design. For example, the length of the facing in the hoodie (T-shirt 4006) was determined by spaces created by the body and sleeve pieces. The size of the inverted pleat in the hood was manipulated to ensure the facing fitted into the front edge it faced. It may well be the case that some designers and pattern cutters could overcome a lack of mathematical ability by
“working by eye” with the original pattern, but grading is mathematical by nature and therefore it seems likely that at least a rudimentary attention to mathematics is necessary in a zero-waste fashion design, to enable the creation of a size range (grading will be discussed in more detail in 3.3.7). Yeohlee Teng states: “I believe in the magic of numbers. Putting certain numbers together in a pattern can result in a perfectly proportioned article of clothing that works in many sizes.” (Steele 2003: 140). In the introduction to his school of subtraction pattern cutting, Julian Roberts (2008) provides an alternate view, however: “Pattern cutting is not all about mathematics and measurements: it’s about space and balance… Your hands, arms, legs and body length can all be used as reference when pattern cutting to understand space and distance, so incorporate yourself into the pattern.” Whilst Teng and Roberts’ comments may seem contradictory, they both suggest a creative potential for fashion design through pattern cutting and marker making that most pattern-cutting manuals and texts on fashion manufacture omit.

Perhaps the most important factors for zero-waste fashion design on Tyler’s list are two and three-dimensional spatial visualisation, spatial reasoning and the ability to integrate elements of patterns. Much of the zero-waste fashion design process occurs through two-dimensional pattern cutting, and the designer needs to understand how the patterns will look when made up into a garment. That is, of course, unless an element of surprise is allowed for, such as in Julian Roberts’ design approach. At times he might create a pattern shape without an exact idea of how the garment will appear; for him this serendipity seems to be an exciting aspect of fashion design. Roberts (2008) writes further: “As these pattern concepts involve a free-hand non-representational approach to pattern cutting, they are in their nature hypothetical, and open to interpretation.” He also notes that the approach demonstrated is not aesthetically prescriptive: “Whoever implements [the techniques shown], automatically adds something of their own style to them.” This is in stark contrast to conventional pattern cutting, which generally aims to recreate a pre-existing design in the form of a sketch, garment or photograph (the latter two amount to copying); the flexibility of Roberts’ approach does not really exist as the design tends to be less negotiable at the stage that the pattern cutter takes over it. In short, pattern cutting manuals tend to present pattern cutting as a closed process. In zero-waste fashion design, however, pattern cutting is an open-ended, creative endeavour, not unlike in the approach documented by Roberts.

Zero-waste fashion design could pose both opportunities and challenges for the marker-maker’s role. It is often a distinct role, although in the past the pattern cutter commonly made the marker and cut the fabric. In small companies this still occurs; during designing for Uvsu in 2001-2004, I occasionally performed all of these roles. Whilst it might seem that zero-waste fashion
design has the potential for eliminating jobs, it also has the potential to foster new ways for fashion designers, pattern cutters and marker makers to work together. This potential should be the subject for further research. Some of this potential will be discussed further in Chapters 4 and 5.

3.6 Sustainability issues not directly addressed through practice

The primary aim of this project has been to uncover strategies that make fashion design without fabric waste more feasible for the fashion designer. Findings from the project suggest, however, that designing fashion without fabric waste may address aspects of fashion design that are not directly connected to the problem of fabric waste. In this section I will discuss broader issues relating to fashion design that arose from designing the collection. The first part of this section discusses how knowledge of past practice drawn from literature may be applied in fashion design practice, with sustainability benefits for the practice and its outcomes. The second part discusses how fabric waste can highlight for fashion designers issues relating to garment use, with particular focus on garment durability, repair and alteration. The third part presents the issue of time in the practice of designing fashion and how avoiding fabric waste has the capability to slow down the design process; while seemingly a negative impact, the potential positive implications of slowing down fashion designing will be discussed. Finally, the aesthetics of fabric waste in fashion design practice will be discussed. The focus is on the aesthetics of practice as much as the aesthetics of its outcomes, garments.

3.6.1 A new approach to fashion publication: the need for visual presentations of both garments and their patterns

Fashion design, perhaps more than other design disciplines, constantly refers to things already designed. Looks are revived, modified, regurgitated. When past fashion is referenced, it is mostly superficial appropriation of elements of past looks. It is less common to see historical knowledge of pattern cutting and cutting studied and applied in fashion design. Literature on fashion and fashion designers hardly caters for such an approach. Fashion in contemporary literature is presented visually most commonly as garments. The design and manufacturing processes are rarely presented visually. This is in contrast to some of the earliest manuals for pattern cutting, such Juan de Alcega’s text from the sixteenth century, a manual that presents garments almost exclusively as two-dimensional pattern pieces. As I discovered during my investigation of the literature relevant to this
project, texts that include visual representations of garments and their patterns are very rare indeed. Yet every cut and sew garment prior to sewing is an assortment of flat shapes of fabric. As the discussion on shape and space awareness demonstrates, showing these shapes with the resulting garment could potentially contribute towards the reader developing a more refined sense of spatial intelligence and a heightened understanding of the relationship between two-dimensional flat pattern pieces and the three-dimensional garment. Figure 3.13 shows a cape by Yeohlee Teng (Major & Teng 2003) and jacket by Holly McQuillan (2005) – both garments and their patterns are illustrated. The catalogue for Yield (McQuillan & Rissanen 2011), an exhibition of zero-waste fashion, showed patterns for all of the included garments.

Figure 3.13 Cape and pattern by Yeohlee Teng (1982), jacket and pattern by Holly McQuillan (2005)
3.6.2 Zero-waste fashion design – acknowledging a history of practice and research

In examining the design processes of various garments in this project, regular instances of references to literature during practice become apparent; these instances helped move the practice along. For example, the gusset in the first toile of the first square-cut trousers fitted unsatisfactorily. Based on a memory of how Thayaht’s tuta was cut, I cut the gusset as a square, which resulted in excess fabric around the crotch. Upon returning to an image of the tuta, I realised Thayaht’s gusset was a triangle, and I was able to quickly rectify the fit. The bias sleeves of the hoodie refer to Madeleine Vionnet’s practice of cutting fabric on the straight grain but hanging it on the bias, as exemplified by a dress from 1918. This approach to bias has two distinct benefits: fabric waste elimination becomes easier as the main seams adhere to the fabric grain, and having seams on the straight grain does not constrain the intrinsic malleability of fabric hanging on the bias in the same way that vertical bias seams (most often side seams) do.

Studying historical design and make practices, and applying the gained knowledge to current design practice enriches the practice and its outcomes, while ensuring past wisdom is not lost. For example, early in her career Vivienne Westwood studied the cut of 1950s garments by unpicking actual garments (Wilcox 2004: 11) and later studied old shirt patterns at the Victoria and Albert Museum and applied this research to her work (Wilcox 2004: 15). During her studies in Paris in the 1920s Claire McCardell unpicked and studied second-hand dresses by Madeleine Vionnet to learn more about their cut; this research was evident in her later work in the USA (Yohannan & Nolf 1998: 26).

The contextual research of this project, and particularly the seminal research by Bernard Rudofsky (1947) and Dorothy Burnham (1973), highlights that zero-waste garments are probably as ancient as the practice of making garments from fabric. It is important to remember this, particularly in light of recent erroneous claims in the media promoting zero-waste fashion design as a new practice, for example Menkes (2008) and Doan (2008)7. The reference to making a garment from one piece of cloth in each article is somewhat meaningless in that, discounting any interlining, lining or contrast fabrics, all garments, whether zero-waste or not, are made from a single piece of cloth that is cut into pieces, except for garments made from a single piece of cloth (which Liu’s at the time were not). Whilst it is easy to understand that for much of the fashion industry and media, the works of Rudofsky and Burnham are somewhat

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7 Since relocating to New York, I have met Abigail Doan and discussed the cited article. Based on the discussion, I have a better understanding of how easily a misguided, erroneous press release can lead to repeated errors in the fashion press. An attempt to bring balance to the dialogue is apparent in the comments section of an online article by Mark Liu (2010).
obscur, the monograph on Yeohlee Teng (Major & Teng 2003) is a recent text that highlights Teng’s work in zero-waste fashion design during the past three decades. Similarly, two texts on Zandra Rhodes (Rhodes & Knight 1984; Zandra Rhodes: a lifelong love affair with textiles 2005) show that a concern for fabric waste has informed Rhodes’ design practice throughout her career. Similarly, an article on a zero-waste fashion design course that I developed at Parsons The New School for Design in 2010 (Rosenbloom 2010) led to claims about the course being the first of its kind in the world. I take responsibility for initiating the claims; the course is the first to adopt a singular focus on zero-waste fashion design. In fairness, however, the pioneering teaching work of Lynda Grose at the California College of the Arts and Holly McQuillan at Massey University must be acknowledged. Both (and possibly many others) have encouraged fashion design students to explore zero-waste fashion design for several years. Works by three of Grose’s students, Caroline Priebe (McQuillan & Rissanen 2011: 36) Andrew Hague (Fletcher 2008: 153) and Samuel Formo (Currey 2009) have received deserved attention, while McQuillan’s sharing of her own methods online (http://hollymcquillan.com/) is commendable.

### 3.6.3 Reflective and contemplative time in fashion design

The pace at which I designed the early garments in this study was considerably slower than one would find in industry. First, I was learning a new way of designing; the variation in pace is no different to that between someone learning to write and someone who has been writing for three decades. Second, I was performing tasks that in industry are usually performed by several individuals (designer, pattern cutter, marker maker, cutter, machinist). Third, I designed in a research context, which required substantial time for reflection. Coming from an industry background, working at a slower pace that allows time for reflection and contemplation is more enjoyable and rewarding. Nevertheless, I acknowledge that for industry the issue of time can be problematic; this has emerged in many informal conversations during this study. The simple solution: the earlier one is trained in zero-waste fashion design, the sooner he/she will work at a pace that would be acceptable in industry. The challenge is that zero-waste fashion design is currently taught in a limited number of institutions (Chapter 5 discusses fashion design education in greater length).

During this study, taking breaks from designing a particular garment was important, in particular when the process temporarily slowed down. When I found myself stuck, I moved to working on another garment. Often breakthroughs occurred after a period of time away from a problem; these breaks allowed for reflection and contemplation during which new possible solutions would emerge. This is still occurring. I designed the denim coat (Jacket 1005) in
Figure 3.14 more than three years before the time of writing. The shaded areas in the pattern diagram are waste. Looking at the garment and the pattern diagram now, a number of questions and possible solutions are apparent to me. As the overall intention was for the garment to be symmetrical, it may have been easier to develop the patterns towards a vertically symmetrical marker. This would have necessitated adding a centre back seam to each back panel (horizontal versus vertical symmetry) or engineering some of the back panels to be on the weft grain (undesirable). Some change in the length of the coat might have been necessary, too.

A zero-waste fashion design process could have the potential to facilitate more critical reflection than may be the case in conventional fashion design situations. This would, however, need
to be underpinned by a business model that acknowledges the importance of and supports critical reflection in design. Instead of producing a large number of sketches relatively fast, the designer needs to incorporate pattern cutting into the design process of each garment. A large proportion of a sample range is culled before mass-production. According to Waddell (2004: 40) “most design houses estimate at least 20% wastage at this stage”, and that the culling is done due to technical or financial feasibility, or for aesthetic reasons. The deleted styles (sample garments) represent a considerable amount of work by the design team, a cost to the company and a significant waste of physical resources. Research on whether a more reflective design process (and the kinds of business models that would support this) could potentially reduce this other kind of waste is therefore called for.

This chapter has focused on successful strategies in fashion design situations where the design criteria are appearance, fit, cost and fabric waste. A fashion designer may utilise these strategies as a how-to manual in tackling fabric waste as a fashion design criterion, regardless of the market he/she designs for. Fabric waste as a criterion for fashion design needs not and should not be of greater importance than appearance, fit and cost. Zero-waste fashion design is perhaps described as a play between the four criteria, a play that seeks to find out balances, not compromises. During the practice, a fifth significant criterion for fashion design emerged: manufacturability. The following chapter will focus on opportunities and challenges that fabric waste raises for fashion design and fashion manufacture.
4.

OPPORTUNITIES FOR MANUFACTURING ZERO-WASTE GARMENTS
This section focuses on the implications for garment manufacture arising from designing fashion without fabric waste that this study has uncovered. The previous chapter considered fabric waste as a fourth criterion for fashion design alongside appearance, fit and cost. From the data in this study a fifth significant criterion emerges: manufacturability. The code “Design for manufacture” appears in approximately five percent of the journal entries. This criterion is not limited to designing fashion without fabric waste; it relates to the designing of all mass-produced ready-to-wear garments, as distinct from unique one-off garments. The fact that ready-to-wear garments are produced in multiples requires that they be designed in such a way that they can be feasibly replicated in manufacture. Manufacturability as a fashion design criterion refers to aspects of a garment relating to manufacture, such as cutting fabric, grading, construction and the use of CAD technologies. As it is the aim of this project to provide fashion designers and the industry with new knowledge about designing fashion without creating fabric waste, manufacturability requires careful consideration. While manufacture of the garments in this study was not undertaken, I was employed in the fashion industry in Sydney, Australia, throughout the practice phase of this study. It is apparent from some journal entries that the industry work led to some considerations about manufacture during practice. Literature on fashion manufacture is used to support discussion of issues that the practice did not directly address.

The broader topic of this project, fashion creation without fabric waste creation, comprises fashion design and fashion manufacture. The project brings to the fore a number of issues about the relationship between fashion design and fashion manufacture. This section will focus on these issues, demonstrating that fabric waste as a fashion design criterion may help bridge a gap that some (for example, McRobbie 1998 and Kawamura 2005) argue exists between fashion design and fashion manufacture. Fashion creation without fabric waste creation presents challenges for fashion manufacture, some of which can be addressed through fashion design. In this section I will argue that tackling these challenges could result in a deeper engagement between fashion design and fashion manufacture than may currently be the norm. The chapter concludes with a discussion of the positive impacts for sustainable fashion design originating from this deeper engagement.

The chapter begins with the practice of cutting fabric to create fashion garments, as this creates a number of challenges for fashion manufacture, whether zero-waste or not. Some of these may become magnified with fabric waste as a fashion design criterion. Fashion design offers solutions to many of these challenges, whilst others require closer collaboration and communication between design, manufacture and in some cases, fabric mills. The chapter then...
examines pattern grading, proposing a number of possible pathways for creating size ranges of zero-waste garment. The construction of zero-waste fashion garments follows, noting the tension between the need for standardised industry practices and the occasional breaking with construction conventions. The chapter then examines the potential of Computer-Aided Design and Manufacture (CAD/CAM) in the context of zero-waste fashion design and manufacture; this study suggests that these technologies could be employed in new ways to facilitate zero-waste fashion design and manufacture. The chapter concludes with a proposal for transforming the industry hierarchies and the kinds of communications that occur between different actors in the fashion design and manufacturing systems.

4.1 Fabric and zero-waste garment manufacture

This section examines issues relating to fabric, the material from which the vast majority of fashion garments are manufactured. Arguably many of the issues relating to fashion design without fabric waste arise from a tension that exists between fashion manufacture and fabric. Since the Industrial Revolution it has been the aim of almost all manufacture of mass-produced goods to produce uniform, standardised products. The main material of mass-produced clothes, a length of fabric, despite being a mass-produced product in itself, often is not uniform in width, appearance and other characteristics. Rather than work with the variability of fabric, conventional fashion design and manufacture aim to overcome it. Extensive literature exists on strategies to address the variability of fabric. Some of these strategies lead to further fabric wastage. Whilst it would be easy to blame this on manufacturing practices, those practices currently serve fashion design, fashion business and fashion markets. Upon entering a clothing store, we consumers expect to see identical garments in multiples across a range of sizes. A careful examination of texts on fabric in fashion manufacture nevertheless reveals how poorly fabric is suited to the mass-manufacture of standardised products.

This section focuses on issues relating to fabric that design can address. Some of the types of fabric waste that Tyler (1991) covers in Chapter 6, Fabric Losses Outside the Marker, cannot be addressed through design, such as ends of piece losses. These occur when the total length of the fabric in a roll is not divisible by the length of the marker for an individual garment. The solution to this kind of waste would be to weave or knit the fabric based on the marker length. This is unlikely to be feasible, however, as little dialogue occurs between fashion design and fabric mills once the garment has been designed and the length of the marker determined. Furthermore, by the time the
required amount of fabric is known, the fabric is generally already woven or knitted, and often also ordered by the fashion manufacturer. The end of piece is an otherwise usable piece of intact fabric, and mainly waste to the company in an economic sense; as a piece of fabric it is very much usable.

### 4.1.1 Cutting fabric

A number of issues in fashion manufacture relate to cutting fabric, and the impact of fabric’s particular properties on cutting practices. Fabric waste as a fashion design criterion creates specific implications for how some of these issues may be addressed. The garments produced in this project were not mass-produced; only a sample garment of each garment style was cut and made. Consequently, relatively few manufacturing issues relating to cutting fabric arose during this project and for this reason literature on fashion manufacture is consulted to ensure that most issues that could arise, are considered. Nevertheless, the garments were designed with the intention of being feasibly manufactured.

Perhaps the most significant issue relating to fabric in fashion manufacture concerns the difference between cutting a single sample garment (this project) and cutting multiples during manufacture (industry). In order to cut multiple garments, the required number of fabric layers, or plies, is placed on top of each other on the cutting table. A length of fabric is laid down continuously with folds at the end of each ply. Once laid down, the plies constitute a lay. The garments are then cut; for example, if the lay is made of 50 plies and the marker contained one garment, 50 garments would be cut at once. Tyler states (1991: 69): “Since it is impossible to spread the fabric so that all the plies [layers of fabric in mass production cutting] are aligned precisely, the width of the marker must be made a little narrower than the fabric.” This means that only one selvedge (fabric edge lengthwise) can be lined up precisely at the cutting stage (Chuter 1995: 129). Tyler (1991: 71) suggests that relatively large variation in fabric width is best addressed by planning “markers to different widths and to sort pieces into batches according to their measured widths; additional labour costs are outweighed by the material savings.” These statements have clear implications for manufacturing zero-waste garments, as a zero-waste marker is made for a specific width. While this was not directly addressed in this study, a solution could be designing garments that allow for slight variation in parts. Evidence of increasing “mass-customisation” within fashion production exists, with specific implications for design, marker-making and cutting (Abernathy, Dunlop et al. 1999: 145-50). Although the objective is to offer “custom fit” in a mass-produced garment, extending the idea to “custom appearance” seems plausible. David Pye (1995(1968): 59-60) notes how the reign of standardised products since the Industrial Revolution has sidelined
imperfection and serendipity in design, but designing fashion without fabric waste could open opportunities to explore these notions when it comes to fashion manufacture.

4.1.2 Fabric selvedges

Tyler (1991: 34) discusses the problems caused by wavy selvedges in conventional production. Selvedges are the two long edges of a fabric length. In woven fabrics these are woven in a particular manner to prevent fraying. Some knit fabrics are knitted as a tube and then cut to a flat length, sometimes with glue used on the edges to create stable selvedges. Selvedges can be wavy, meaning they have not been subject to the same amount of shrinkage as the rest of the fabric. Conversely, selvedges can also be tight, meaning they have shrunken more than the fabric. In this study selvedges were incorporated into the garments, except in one. The cotton jersey used in the slashed top (T-Shirt 4007) had stiff glue along each selvedge that I could not incorporate into the design. The glue was visually undesirable to incorporate into the garment externally, and too rough in feel to incorporate internally. Not all glues are problematic, however; a different jersey from the same fabric manufacturer also had glue along the selvedges but due to its softness it posed no problems. In conventional fashion design and manufacture, selvedges are rarely incorporated into the garment design. Cutting them off, whilst also a solution for wavy or tight selvedges, provides the cutter with a visual confirmation that the plies to be cut are aligned.

In designing a chambray shirt for Timovsthang (spring/summer 2002-03, Figure 4.1) I incorporated the selvedges into the front placket and back yoke (the white stripes in the images below are the selvedges), and this shirt was cut in small production runs of multiple garments without any particular difficulty. The fabric was stable and an even width through the length, and the small quantities (15 or less per size) enabled accurate laying and cutting of the fabric. Similarly, the denim coat (Jacket 1005; see figure 3.14 in Chapter 3) uses both selvedges as external visual elements. The denim was stable but incorporating both selvedges into a zero-waste garment in mass-manufacture would require further testing. In an online discussion forum (which requires membership; the discussion is included as Appendix D) Kathleen Fasanella (2011a) points out that “the pressure on opposing selvages aren’t equal so one side will buckle slightly” [if sewn together]. Nevertheless, Fasanella discusses the use of selvedges in jeans; these are cut using both selvedges of the fabric. This contradicts the statements from Tyler (1991: 69) and Chuter (1995: 129) somewhat (section 4.1 above) that both selvedges cannot be lined up.
Shaeffer (2001: 49-50) discusses the use of selvedges to stabilise seams internally in haute couture. The potential of utilising selvedges as structural stabilising components in ready-to-wear is underexplored; the difference to haute couture is that these would be machine-stitched rather than hand-sewn. The garments in this study did not explore this, partly because the need for stabilising is less significant in menswear than in womenswear. Menswear garments, including those created in this study, tend not to have as many open necklines or armholes as womenswear. I have, however, used selvedges as stabilisers in other contexts; the technique is adaptable for ready-to-wear.

4.1.3 Cutting time
In discussing marker planning (how the pattern pieces will place on a fabric width most efficiently) in conventional fashion manufacture, Fasanella (1998: 114-115) advocates aligning the edges of two separate garment components in a marker as much as possible to speed up the cutting process. In designing and manufacturing without fabric waste this occurs automatically. When fabric waste has been eliminated from the marker, each cutting action contributes...
towards separating two garment components from the original fabric piece, where in conventional cutting only one piece is being separated most of the time. Whilst no attempts were made in this project to quantify the time saving, the saving could be considerable. It was my experience that cutting even relatively complex garments of many components, cutting was faster than “normal” for this reason. Formal research on gains in cutting time in manufacture is welcomed; this would need to occur in a real-world industry situation, beyond the scope of this study. Notably, Fasanella’s text demonstrates that in conventional fashion manufacture the responsibility for the speed of cutting is with marker planning and therefore fashion manufacture. As marker planning and –making becomes a part of designing without fabric waste, the responsibility for speed of cutting shifts from manufacture to design.

4.1.4 End-of-PLY losses
When multiples of garments are cut during manufacture, the required amount of fabric is laid on the cutting table in folded layers. Each layer, or ply, will provide the components to the number of garments in a marker; a marker one several garments marked on it. According to Tyler (1991: 69) “the limpness and extensibility of fabrics and the limitations of spreading machinery necessitate an allowance of some fabric at the ends of each ply. These losses… are typically 2cm at each end, or 4cm per ply.” Some stable fabrics may permit smaller allowances and some unstable fabrics may require more.” End-of-plies – the folds at the ends of each ply – can be a significant source of fabric waste (Figure 4.2). If a garment requires 1.5 metres of fabric and there are 50 metres on a roll, 33 garments can be cut from the roll. The end-of-PLY loss will amount to approximately 1.33 metres, or 2.7% of the entire roll.

Figure 4.2: End-of-PLY losses created during cutting, typically 2cm at each end of ply (Tyler 1991: 69)
Not unlike designing for variable fabric width, with limits, end-of-ply losses can be designed for, with some limitations. To truly account for end-of-plies and the fold at the end of each ply, it would be necessary to design a garment with “flexible components” and design the marker in a way that these components were placed at each end of the marker. This is not necessarily always feasible, depending on garment type and the desired design. Knit fabrics and soft, unstable woven fabrics (e.g. chiffon) could result in more significant challenges, which design can address to only a limited extent. Nevertheless, it would be advisable to design the marker so that ends of plies were areas with some degree of flexibility (generous hem allowances, for example) though at times this may not be feasible. The slashed jersey top is designed in such a way that each end of the marker is composed of hems and ends of the lacing cords. Whilst variability in the hem is undesirable, in this garment small variation would hardly register, as the looping of the slashes distorts the garment hem regardless. Similarly, the cords could feasibly withstand variation of a few centimetres. This garment is an example of fashion design being able to predict and address a problem that could (but would not necessarily) arise during manufacture; designing a garment that can tolerate some variation in the length of each ply during cutting.

The garments created in this study were cut from single plies so no end-of-ply losses occurred. This does raise the question: is the above method of laying fabric for cutting the only option in the manufacture of clothing? This may be a case of saving time. It is faster to lay the fabric in folds (plies) in one continuous length than to separate each ply by cutting. Further research on a technological solution to this is called for. For example, could a computer-operated machine cut a length of fabric to the required marker lengths and lay them? Some of the garments in this study do propose one less technologically oriented solution that could reduce if not eliminate end-of-ply losses per garment. Several garments were designed into a marker where one end was an irregular shape, but one that matched the exact same shape when rotated 180 degrees. This in effect means that such garments would be cut in pairs, which form a rectangle, as required by manufacture. This is illustrated in Figure 4.3. This only works in fabrics that can be cut in two ways (fabrics without an obvious nap or one-way print, stripe or check), but its potential is nevertheless to be acknowledged.
4.1.5 Fabric flaws

A fabric flaw or fault is “any feature within the usable width of a fabric that would downgrade the resultant garment” (Tyler 1991: 30). No fabric flaws were encountered in this project other than the stains in the vintage kimono silk, discussed in section 3.2.3 of Chapter 3. The issue of fabric flaws is partly subjective. For example, a hole in a fabric could end up on or near a seam, potentially compromising the structural integrity of the garment. This is safely described as a flaw. On the other hand, a slub or other inconsistency in the weave or knit is usually also considered a flaw, but a visual one. A number of companies I have worked for would sell such garments at a discounted rate through sample sales or factory outlets. What if, however, such flaws and imperfections were embraced? Once again, this raises questions about our expectations for uniformity in mass-produced garments. What if, for example, a fabric “imperfection” in a garment was embroidered to highlight it? With careful design, this could be possible. Potentially, such garments could be sold as unique pieces at a higher price, rather than relegating them to a discount rack. It could be that zero-waste fashion design and manufacture, within conventional industry practices and mindsets could magnify some of the challenges that fabric ordinarily poses for garment manufacture. I propose that we need to be more critical of some conventions, and search for and experiment with new possibilities.

Since cutting fabric is the source of many of the challenges relating to fabric waste elimination, manufacturing methods that avoid cutting fabric deserve further examination. In terms of fabric waste in knitted garments, fully-fashioned and seamless knitting are likely to increase in prominence (Allwood et al. 2006: 33), as either the garment or its components are knitted rather than cut to shape, resulting in little yarn waste and no fabric waste. Nevertheless, designing and making through cutting and sewing knitted fabrics can be a design choice; the
methods of construction and the resulting garment appearance are necessarily different in cut & sew and the fashion designer may prefer these for a particular design. Other possibilities exist for non-woven fabrics. Fabrican, developed by Dr Manuel Torres, (Gundry 2008: 287-289) allows the spraying of fibre directly onto the wearer to create a garment, a method of production perhaps more in line with objects of industrial design rather than fashion. Australian artists Oron Catts and Oinat Zurr of Tissue + Culture created Victimless Leather (2004) by growing cells onto a biodegradable polymer base. Similarly, their Semi-Living Seamless Jacket is grown into the jacket shape using cells (Braddock & O’Mahony 2005: 146–7). Whilst at developmental stage, this technique could have commercial applications in the future, as some of the ethical and environmental issues relating to leather harvesting and tanning could potentially be avoided (while possibly raising new ones – Catts and Zurr used human cells for some of the work). Sustainable fashion design and manufacture are about embracing diversity of materials and methods (Fletcher 2008: 38) and research into new possibilities of creating fashion deserves encouragement. Where cutting and sewing is determined to be the most appropriate method of fashion creation, fabric waste should nevertheless be included as a criterion.

4.2 Zero-waste garments and grading patterns

Grading is “the process of systematically increasing and decreasing the size of the master pattern to create a range of sizes” (Moore, Mullet et al. 2001: xv). In this study, the code “grading patterns” refers to moments where grading was a consideration during practice. The aim of grading is to retain the design (the appearance and fit criteria) unchanged through the resulting sizes. Grading is a method of producing a number of sizes of a garment (and body) shape; grading does not aim to fundamentally change the garment shape. For this reason it is advisable to keep the number of sizes of a garment design to five or less, for example, extra-small, small, medium, large and extra-large (Fasanella 1998: 170-1; see Figure 4.4). With the emergence of ready-to-wear clothing, grading became necessary in order for the fashion industry to efficiently offer ranges of sizes of garments for consumers to choose from. Grading is done once the fashion designer and the patternmaker have approved the garment patterns, and when there are confirmed orders for the garment style. Whilst pattern cutters are generally trained in grading, either manually or using CAD technologies, there are also pattern graders who are only trained in CAD grading but not necessarily pattern cutting. Figure 4.4 illustrates a nested, graded back panel of a garment. Nesting refers to having all of the sizes overlaid with each other.
Grading a zero-waste garment may initially seem challenging. The garment components have been designed to configure on a fabric width so that no fabric is wasted – there is no space between the components for them to grow. Through grading a larger size than the original, many of the garment components grow both horizontally in the direction of the warp grain, and vertically in the direction of the weft grain. Whilst it is difficult to generalise the amounts of growth, generally the largest relative growth occurs horizontally in chest, waist and hip circumference; the amount of vertical growth is relatively less. Vertical growth is easily addressed; the larger size will simply require a longer length of fabric. Horizontal growth is more of a challenge; as the garment components grow, their overall configuration will expand beyond the width of the fabric. Similarly, grading a smaller size than the original is not without challenges. As the garment components become smaller, spaces emerge between them on fabric, creating fabric waste. However, these challenges arise from the assumptions that the overall configuration of the garment components, the marker, remains unchanged, and that the conventional rules and methods of grading are used. These need not be the case.

This study proposes five possible pathways to creating a range of sizes of a zero-waste garment. As becomes apparent, in some pathways grading remains in the conventional domain of manufacture, whilst in others it shifts from manufacture to design. Due to time constraints, grading the garment patterns was not undertaken in this project. Rather, I did some visual testing to get a sense of the impact of grading on some of the garments created in this study. The five pathways I propose are:
1. One-size-fits-most
2. Conventional grading
3. Designing each size individually
4. Using a different fabric width for each size
5. A hybrid method

4.2.1 Pathway 1: One-size-fits-most

The need for grading can be eliminated by designing a garment that will fit individuals across a range of sizes. None of the garments in this study follow this pathway; even the somewhat loose hoodie (T-shirt 4006) would best be produced in two or three sizes. Yeohlee Teng has designed such garments throughout her career, describing them as “the ultimate efficiency” (Luther 2003: 18). Teng’s skirt in the Yield exhibition (McQuillan & Rissanen 2011: 12-17) is adjustable to almost any waist size. This pathway is limited to loose, adjustable or wrapped garments, and occasionally garments made from fabrics with considerable stretch. During the zero-waste collaboration between Parsons and Loom-state Organic in 2010-11, it was decided to manufacture Andria Crescioni’s winning anorak in one size only; the anorak was loose and adjustable through drawstrings.

4.2.2 Pathway 2: Conventional grading

Grading in the conventional manner remains an option. The benefit of this pathway is the familiarity and speed of the process to industry practitioners; grading remains within manufacture and digital technologies allow for fast grading. The subsequent sizes are likely to create fabric waste; conventional grading occurs without marker planning as a consideration. Not all of the garment components necessarily grade, whilst the ones that do, do so unevenly depending on the garment design. Once each component has been graded, it is unlikely that they will configure on fabric in a way that does not create fabric waste. Is it then truthful to claim a garment to be zero-waste, if in fact only the original size is?

4.2.3 Pathway 3: Designing each size

Each size can be re-designed using the original size as the starting point and a guide. The visual aspects of the designed garment will be retained as close to the original as possible across the resulting sizes while ensuring each size is zero-waste. Whilst relative to conventional grading this path-

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1 “One-size-fits-most” is my preferred term, as the commonly misused “one-size-fits-all” implies that the garment was test-fitted on the largest living person.
way may be time-consuming, one could argue that this is an example of deeper engagement with fashion design practice than what may be the norm (Van Kopplen & Vaughan 2003). Instead of handing over the patterns of a garment to a grader to produce patterns for a range of sizes, the fashion designer, working with the pattern cutter and/or grader, is responsible for each size; grading becomes a criterion for fashion design rather than manufacture. Changes to the design are inevitable but these would need to be kept to a minimum, in order to satisfy the expectations of retailers and consumers. One womenswear company, Materialbyproduct in Melbourne, Australia, produces size ranges of zero-waste garments (Dimasi 2009). Each size is visually slightly different; the retailers and presumably consumers are satisfied with this. The key aspect to note is that whilst different, each size is beautiful in its own right; the appearance and fit criteria are not compromised while the fabric waste and manufacturability criteria are adhered to.

In order to design each size, the designer would first need to determine the garment components that need to grade and by how much. These components may need to be given priority in the re-design process, as they may set the limits for the pieces that do not necessarily need to grade (for example, pockets, tabs, epaulettes, etc.) and smaller pieces that grade in one direction only (cuffs, collars, etc.) When it has been determined which components need to grade, two options emerge for the redesign process, depending on the garment design: changing or retaining the configuration of the garment components in the marker. Each will now be examined.

**Pathway 3A: Changing the marker configuration**

Once the garment components have been assessed for the need for grading, they need to be examined on the fabric width to see how similarly they may configure in comparison to the marker of the original size. A number of strategies exist to facilitate the redesign process. For example, pattern pieces that can be added or deleted to affect grading are a possibility. In 2003 Ahshui, a Sydney womenswear label, produced a skirt (not zero-waste) composed of several identical panels (gores), which measured 5cm at the waist; the skirt only had the one pattern piece, with the waist finished with a bind (Figure 4.5). Rather than grade the panel piece, the number of panels changed for each size, as the grade amount was also 5cm. For example, if a size 10 skirt were composed of 14 panels, then size 8 would be made from 13, and size 12 from 15 panels. This technique would only be appropriate for relatively simple garments, such as the skirt mentioned, where most of the growth through grading happened in one direction. Importantly, it would be unlikely result in a zero-waste marker for each size, except possibly where – if size 10 were the original size – sizes 8 and 12 were marked and cut together. It is nevertheless
an example of somewhat ingenious way of eliminating the need to grade a pattern piece.

Changing the marker configuration is likely to result in considerable changes in garment appearance. The marker for Endurance Shirt II (created in 2011) is considerably different from the marker for Endurance Shirt I (created in 2009). These are illustrated in Figure 5.2 in Chapter 5. Although the two shirts are the same size and thus the exercise of adapting a garment from one fabric width to another does not directly relate to grading, it is possible to nevertheless see that changing the marker for each size can significantly impact on garment appearance; the elbow patches from the early shirt were eliminated in the later one. Therefore it would seem that retaining the original marker as much as possible would better facilitate adhering to the criterion of fabric waste in grading.

**Pathway 3B: Retaining the marker configuration**

A number of possibilities exist for retaining the original marker configuration across sizes.

**Relative fullness in a garment**

In some garments where fullness (defined as amount of fabric considerably larger than the body
it covers) has been designed into the garment, it may be possible to not change the outline of each garment component to produce a range of sizes. What changes is the relative amount of fullness in a component. Pleats, tucks, darts and gathers can be employed to control fullness across sizes. For example, the wool trousers (Pant 2004) could be graded to a smaller size through the large front waist dart.

Materialbyproduct has created printed tops and dresses that have a number of vertical pleats through the body. A larger size will have relatively less fabric in the pleats than a smaller dress; each dress contains the same total amount of fabric regardless of size (Dimasi 2009). Gathering can be used similarly. If a garment has a large amount of gathering in an area, absorbing all or some of the grade into the gathers is possible. A smaller size would have an amount of fabric gathered into a shorter length while a larger garment would have the same amount gathered into a longer length. This would alter the design slightly by creating an uneven density of gathers across sizes, but it is nevertheless feasible in some instances. With approval from the designer and operations manager, in 2008 I graded the bodice of an evening dress for a client whilst not grading the full, gathered skirt component. This was done to save grading time and therefore production costs, as the number of garments to be manufactured was relatively low and the dress was only manufactured in three sizes. The gathered peplum of a blouse by Zandra Rhodes demonstrates this approach (Figure 4.6). While the waist of the blouse that the peplum joins onto grades in the conventional manner, the peplum component remains the same size across the three sizes. If a larger size range were to be produced, problems could arise but this method works when three sizes are produced, as in the case of the Rhodes bodice.

Figure 4.6: Zandra Rhodes bodice and graded pattern, in Zandra Rhodes (2005: 34-36)
Seam allowances

In this study I considered different seam allowance amounts for different sizes. If only two or three garment sizes were to be produced, and/or the variable seam allowances were limited to few garment components, this could be feasible. The collar, collar stand and cuffs of the Endurance Shirts would grade like this. The outline of each pattern piece would not change from size to size; simply, the notch for the seam allowance would move. Particular problems could arise with this approach during manufacture, however, if a larger size range was required, and/or if more garment components were graded in this manner. As the machinist uses the seam allowance as a visual sewing guide (Fasanella 1998: 130), the wider it becomes, the more difficult it becomes to sew. This approach would require additional vigilance from the operations manager as well as all the machinists. If this approach were to be adopted the larger size would need to be designed first to ensure it fitted on the fabric, or, if a median size were designed first, it would need large enough seam allowances to create the larger sizes, which would have smaller seam allowances.

It is possible to create a symmetrical pattern configuration (marker) of a garment where the central part (and/or possibly other components; for example, the selvedge areas) could tolerate some variation in terms of the appearance criterion. For example, the central part of the double-wool jeans (Pant 2003) marker is primarily composed of belt loops. The marker would change slightly for each size but varying the width of the belt loops for each size would allow these changes to be somewhat minor. Furthermore, as discussed in section 4.1.1, the width of a fabric may vary along its length. The allowance for variation within the appearance criterion could benefit manufacturing in that slight variations in fabric width might be overcome.

Figure 4.7: Pant 2003 marker; shaded area indicates belt loops
The grade amount is generally larger horizontally than vertically, which can make the conventional way of cutting on the lengthwise grain problematic, if more or less the same marker composition is to remain through the sizes. In other words, if the marker is tight for the sample size, usually in the middle of the size range, the larger sizes may not fit on the same width. Cutting on the cross-wise grain may be a solution in some instances. Shirt 3002 is one example of this. In some fabrics it could even possible to cut part of the garment on the lengthwise grain and some crosswise; I used both grains in the denim coat (Jacket 1005; Figure 3.14 in Chapter 3). Whilst switching grain is not feasible or desirable in many fabrics (e.g. knits, one-way stretch, velvet, one-way check, stripes and prints unless a particular visual effect is desired, etc.), it may be in some cases.

With some garments in this study, interlocking angles can bring about flexibility as well as challenges with grading. As shown in Figure 3.6 in Chapter 3, if a rectangle is divided into two equal parts with a diagonal line, the resulting angles in the two parts will be the same. I conducted a visual grading experiment with two of the square-cut pants (Pant 2004A and Pant 2004B). In trousers, the waist often grades 5cm (sometimes 4cm in menswear), or 2.5cm for half waist. The hem circumference grades half of that, 1.25cm. Therefore, if these trousers were graded conventionally, the angle on the left leg would no longer match the angle on the right leg. I propose that the horizontal grade amount is kept at 2.5cm throughout the leg length, thus preserving the matching angle. The exaggerated waist dart on the right leg and the hem dart on the leg left can be used strategically to facilitate this. Figure 4.8 demonstrates the original pattern, the impact of conventional grading on the angles, and the proposed solution.

Figure 4.8: Impact of conventional and adapted grade on seam angles

Sleeves grade similarly to trousers in that the grade amount is larger at bicep (usually 1.25cm) than at wrist (usually 0.625cm). Matching angles were used in the wedge shirt (Shirt 3002); the CF angle matches the angle of one of the sleeve seams. Through conventional grading the CF
angle would remain the same, while the sleeve seam angle would change. This shirt had two sewn tucks at sleeve hem; I propose that to grade this shirt, the seam angle would be kept the same and the hem tucks are used to absorb any “excess grade” (grading up) or release fabric as needed (grading down). Figure 4.9 illustrates the original pattern, the impact of conventional grading on the angles and the proposed solution.

![Figure 4.9: Impact of conventional and adapted grade on seam angles](image)

**Mixing two sizes in a marker**

The marker of the slashed jersey top (T-shirt 4007) is such that mixing two sizes in one marker could make grading more feasible. Two garments of the original size (Medium) fit across the fabric width, on the left in Figure 4.10. On the right are a Large and a Small. There are two limitations with this particular example. The vertical garment length has not graded, although this could be addressed by having a smaller hem allowance on the Large, and larger on the Small. The other limitation is that one would be cutting the same number of Smalls and Larges, irrespective of the actual orders received (Fasanella 1998: 117).

![Figure 4.10: T-shirt 4007: two garments in original size on the fabric width, and two garments, smaller and larger than the original](image)

**4.2.4 Pathway 4: Using a different fabric width for each size**

Historical examples of shirts demonstrate an approach to grading that could potentially offer a
solution for “simple” zero-waste garments of knitted fabrics. As noted by Baumgarten et al. (1999: 60, 108), the marker, or configuration of garment components on a length of fabric, did not change when a smaller or larger garment was required. Rather, a narrower or wider fabric was used. This was feasible at a time when a garment was made to order for a person, and the range of fabrics available was smaller but similar fabrics (in this case shirt linens) were available in a range of widths. In contemporary ready-to-wear manufacturing, fabric mills and wholesalers usually impose a minimum quantity per fabric (e.g. 100 metres, or one roll, etc.). Given that the looms would require some adjustment for different widths, and the time frame required to weave the different widths to quantities required by the received orders, it is unlikely that using a number of different fabric widths would be feasible or cost-efficient in a contemporary industrial context. Some garments made from knitted fabrics, however, provide an exception. It is not uncommon to see “basic” t-shirts and tank tops made from tubular knit fabrics (for example, jersey, rib), which allow the elimination of side seams in the garment. These fabrics are knitted in a range of “widths” (more accurately diameters, given the fabric is a tube) to allow the manufacture of a range of sizes. Fasanella (2007a) notes that for most woven fabrics this would not be feasible. In a more “complex” garment, for example, a pair of pants with pockets and other components, the mix of pieces, their orientation and placement on the marker, and the resulting mix of different grade amounts would possibly complicate rather than ease the problem of grading through use of different fabric widths.

4.2.5 Pathway 5: A hybrid method

Given the variability of garments within a collection, the varying size range requirements of a company, and variations in grade rules, grading needs to be resolved on a garment-by-garment basis; no single pathway exists. Moreover, in many cases combinations of the previous four pathways are likely. With the bodice shown in Figure 4.6, Zandra Rhodes breaks with some grading conventions. For example, the outside parameters of the sleeve patterns on the bodice (see pathway 3B) do not grade, to allow the marker composition to remain the same across the markers for the three sizes. Only the hole that joins the sleeve to the armhole in the bodice, enclosed within the larger square, grades. The bodice pieces, on the other hand, are graded almost conventionally, although the bodice length is the same for the middle and the largest sizes. This would suggest that the most appropriate way to resolve grading largely depends on the garment style and the number of sizes required.

The vast majority of grading in industry is now done using CAD, although a person
always checks a graded pattern (Fasanella 1998: 121). Manual grading is time-consuming, and regardless of the grading pathway taken, CAD grading has the potential to speed up the process when fabric waste is a criterion for design and manufacture. Managing scale would also be easier; the reduced scale that one works on with CAD would allow faster visualization of potential issues that could arise during grading a particular garment.

As this chapter has demonstrated, there is no one solution in regards to grading. The most appropriate solution needs to be determined on a case-by-case basis, depending on the garment type, garment style, the size range that is required, and fabric type and width. Overall, however, in designing fashion without fabric waste, this study suggests that grading needs to become a criterion for fashion design as well as for manufacture, bridging the gap between design and manufacture. Whilst placing grading in design might seemingly make the design process more complex, the overarching suggestion posed by this study is that deeper levels of communication between different roles in the industry can facilitate zero-waste fashion design and manufacture. This will be discussed further in section 4.5.

4.3 Zero-waste garment construction

This section builds on the previous two on cutting fabric and grading. For the most part, and depending on how the garment and its patterns are designed, a zero-waste garment is constructed not unlike a conventional garment. Construction conventions are somewhat rigidly discussed in literature, partly for the industry’s economic need for standardised and cost-effective procedures. Just as I departed from some pattern cutting conventions in this study (section 3.4.5 in Chapter 3), I broke with some construction conventions. This points to my secondary argument, that garment construction, pattern cutting and design are inseparable. How a garment is constructed is a design decision, and in this study resolving the fabric waste criterion at times justified breaking with conventions.

The most common convention broken with in this study concerns how darts are pattern cut and sewn. This breaking with convention is evident in all of the square cut trousers. The convention is that of trueing dart ends at seams; trueing is the blending and straightening of a seam line where the dart meets it (Joseph Armstrong 1995:10). A dart refers to the reduction of fabric in a particular garment area by means of sewing in order to create form and fit (Joseph Armstrong 1995: 11). To maintain a straight waist seam in the square-cut trousers, the darts
were not trued in pattern. Rather, a wider than usual seam allowance (2cm as opposed to the common 1cm) was used, and the trueing was done during sewing. Figure 4.11 shows the difference between the conventional approach to trueing a dart in pattern and trueing a dart during sewing, as in this project.

![Figure 4.11: A visual comparison between a conventional, trued dart and trouser waist darts in this study](image)

Using a wider than usual seam allowance can create challenges during manufacture. The machinist uses a seam allowance as a visual guide during sewing (Fasanella 1998: 130) and departing with convention could result in confusion and/or an incorrectly constructed garment. This is primarily a communications issue. I employed machinists to sew all of the square-cut trousers in this study. I communicated the dart construction verbally and with a toile and the garments were constructed as I had intended. However, given the somewhat longer supply chains and lines of communication in industry, it is not uncommon for there to be no direct communication between the designer and/or pattern cutter and the machinists in the factory. Such departures from convention would need to be communicated clearly through the various individuals in the line of communication.

Cooklin (1997: 10) regards hem and seam allowances as an economic loss; they are fabric hidden inside the garment and should be kept to a minimum. The wider 2cm seam allowance in this case facilitated resolving the fabric waste criterion and is arguably justifiable. Furthermore, Cooklin’s stand does not account for other potential benefits of wider seam allowances in some instances. If strategically placed, they can facilitate later garment alteration and/or repair as discussed in section 3.2.1 in Chapter 3, potentially prolonging the useful life of a garment. In zero-waste fashion design and manufacture, garment details such as seam types, and hems need to be determined relatively early as these impact upon the overall marker. Resolving the overall design and its marker and then changing a seam allowance would change the marker. To sum, zero-waste garments may require a more considered design and manufac-
turing approach than some conventional garments. From a sustainability perspective, I argue that this is a positive possibility for an industry that historically has directed much effort towards unsustainable product proliferation.

In all fashion manufacture, including zero-waste fashion manufacture, it is at time necessary to “waste” some fabric to facilitate garment construction. For example, sometimes seam allowances are trimmed after the seam has been sewn; the trimming cannot occur beforehand, as the machinist would not have enough fabric for accurate handling on the sewing machine. Quantitatively this waste is negligible, and it is best not considered waste, as it has a specific function during construction. In a sustainability context, ideally this waste would be collected and recycled; in my experience, currently this rarely occurs.

4.4 Zero-waste fashion design and CAD/CAM

A myriad of constantly improving CAD/CAM systems exist for fashion design and pattern cutting, grading and marker planning and –making. These were not used in the project for two reasons: I am not trained in any of the available systems, nor were such systems (nor an operator) available to use in the project. Instead, manual pattern cutting, grading and marker-making methods were employed. Through industry work I am, however, familiar with the capabilities and functions of these systems, and I propose that existing CAD/CAM systems for pattern cutting, grading and marker-making would lend themselves to fashion design without fabric waste without the need to change the systems whatsoever.

The brief foray into experimenting marker composition on graph paper early in the project felt initially promising. Working on scaled down patterns felt more manageable – it was easier to get a sense of the “whole” than it often was when working on full-scale patterns. A brief exploration into the capabilities of CAD/CAM systems has revealed that they can offer many of the same benefits. Such systems currently reside in the domain of fashion manufacture, rarely crossing over to fashion design although this gap is being bridged by development of new systems incorporating fashion design and pattern cutting (for example, OptiTex). The focus here, however, is on the first generation of CAD/CAM systems for pattern cutting, grading and marker planning and –making, and the new uses for them that could arise from fashion design without fabric waste.

**CAD pattern cutting and fashion design**

Holly McQuillan uses a combination of Adobe Illustrator and manual pattern cutting
and draping methods to create zero-waste garments (McQuillan 2011: 93). For example, she might develop the initial garment shape through draping, digitise the resulting patterns and then explore different possibilities on the fabric width digitally. Similarly, Andrew Hague developed a zero-waste shirt (Fletcher 2008: 153) using Adobe Illustrator rather than pattern cutting software (Rissanen 2008b). It is noteworthy that Adobe Illustrator is not intended for pattern cutting; rather, McQuillan and Hague have adopted existing software for a new use. Figure 4.12 shows McQuillan’s digital design development for a hooded jacket using Adobe Illustrator.

Figure 4.12: Holly McQuillan’s design exploration process using Adobe Illustrator (McQuillan 2011a: 92)
**CAD and grading zero-waste garments**

Most grading is now done using CAD systems; they are fast and therefore cost-effective. In zero-waste fashion design and manufacture, CAD could make the exploration of the different grading pathways faster (see section 4.2 on grading) than is possible through manual methods. In particular, where each size is designed, CAD would allow the designer to determine quickly which pieces need to grade and how much. Furthermore, CAD would facilitate fast exploration of the graded pieces on the fabric width.

**CAD/CAM marker making**

With fabric waste as a design criterion, marker making shifts from manufacture to design. Conventionally the responsibility for efficiency in fabric usage has been with the marker-maker; in zero-waste fashion design the responsibility for fabric waste shifts to the designer (and pattern cutter where the two are separate roles). Marker-making – the placing of garment components on a fabric width as efficiently as possible – might seem a primarily technical task, but research reveals that human imagination and ingenuity are crucial to marker-making, whether the aim is zero-waste or not. According to Gray (1998: 31), some CAD/CAM “systems offer an automatic procedure [for marker-making] but none has yet to beat a human performing the same task.” Tyler (1991: 55-57) presents findings from a comparative study of marker efficiency between an experienced marker planner, a beginner and an automatic CAD marker planning system. While it must be noted that two decades have passed since the study, with enormous developments in computer technology in that time (Tyler notes this, page 56), the beginner marker planner achieved slightly higher efficiencies than the CAD system, while the expert planner achieved considerably higher efficiencies constantly. More recently, in their detailed comparison between CAD and manual approaches to pattern cutting, grading and marker making, Ondogan & Erdogan (2006: 66) note that contrary to their original hypothesis, the use of CAD in marker-making was not superior to a manual approach in terms of speed, but better efficiencies of fabric usage were achieved through CAD, possibly demonstrating improvements in technology. Tyler’s study included one expert whose years of experience were not stated, while Ondogan & Erdogan’s study involved five CAD and five manual operators, the latter with 15-20 years industry experience each.

Interestingly, Ondogan & Erdogan find that manual pattern cutting of the first pattern was considered significantly superior to CAD, while CAD offered significantly
faster grading. This suggests that CAD as it currently exists should not replace human imagination but rather, be driven by it. In discussing the use of computer technology in creating A-POC garments, Dai Fujiwara from Issey Miyake considers the human imagination an indispensable raw material (Kries & von Vegesack 2001: 72). While efficiencies brought about by computers, whether in time or fabric usage, are welcomed, a statement from Ondogan & Erdogan (2006: 67) deserves attention: “Nowadays the shelf life of a product is not long enough to justify the time, labour and expense necessary for the design and production manually. This in turn makes CAD extremely important for apparel production.” From a sustainability perspective it is a concern that brief shelf lives of fashion garments are taken for granted in that study. I propose that CAD be harnessed in fashion and design and manufacture to create new efficiencies in materials and time; returning to the previous statement, the saved time could be used to strategise for prolonged product shelf and use lives.

4.5 Zero-waste fashion design and fashion industry hierarchies

Section 3.4.1 in Chapter 3 discussed the impact of the fabric waste criterion on the relationship between fashion design and pattern cutting: pattern cutting is fashion design. This chapter has suggested that in zero-waste fashion design and manufacture grading and marker making are also design. It now emerges that the criterion could facilitate transformation in the hierarchies that exist in fashion manufacture, with possible positive implications for both design and manufacture. In this study I performed all of the roles in the hierarchy. While such a situation is often not feasible in industry, it does point towards deeper levels of engagement between the different roles.

The hierarchical division of labour in fashion design and manufacture has its roots in practices established by Charles Frederick Worth in the late nineteenth century (de Marly 1980: 22). Worth was the first fashion designer in the modern sense, establishing the role as a predominantly creative profession (Rennolds Milbank 1985: 24-36). Although Worth is exclusively associated with haute couture, the fashion designer as a creative force driving fashion is arguably equally established in ready-to-wear. Figure 4.13 illustrates the conventional hierarchies of roles in fashion design and fashion manufacture.
In the first half of the twentieth century, Frederick Winslow Taylor’s *Scientific Management* (Taylor 1913: 39–40) was influential in the hierarchical organisation of many industries, including fashion manufacture. In Europe and North America in particular, the Second World War (1939–1945) also impacted on the industry. Sladen (1995: 104–5) and Waddell (2004: 27) discuss how the Utility Scheme in the UK during World War II strengthened the hierarchical organisation of the fashion manufacturing industry, in order to cope with rationed materials and reduced workforce. Breward (2003: 34) and Kawamura (2005: 65) discuss the institutionalised mythology surrounding the fashion designer and how the myth facilitates the promotion of fashion. Fletcher (2008: 186–7), on the other hand, argues that the myth of the genius designer has negative implications for consumers’ perception of their own skills and knowledge relating to garment alteration and maintenance.

McRobbie (1998: 39) provides a convincing critique of fashion design education in the UK leading up to and during the 1980s, arguing that historically there has been a desire for academics to separate fashion design from manufacture: “As part of the process of professionalism, fashion design distinguishes itself vigorously from production”. Fashion designers, as a legacy of their education, disavow the more menial side of manufacture, thus reproducing the traditional class divides in their working practices. McRobbie highlights many of the problems that this arguably causes for both fashion design and manufacture (59–60). In closing, McRobbie presents a challenge, “which is to envisage new forms of collaboration and co-operation (and also social insurance) which reflect the creative, unstable, experimental and fluid patterns of work in fashion” (189).
With fabric waste as a fashion design criterion, a reorganisation of the hierarchy could occur, because a close, engaged relationship between design and manufacture is required. Roles traditionally separated from design, pattern cutting, grading, marker planning and -making all become indispensable components of fashion design. Figure 4.14 illustrates a comparison between conventional hierarchies and a new possibility for industry organisation. As Chapter 3 demonstrates, zero-waste fashion design includes pattern cutting as a practice of design. With manufacture, the scope of design (including pattern cutting) expands to grading and marker making.

The diagram and how I performed these roles in this study might suggest that the roles of designer, pattern cutter, marker planner and maker would merge to one role, thereby eliminating one or more of these roles and sources of employment. I am not, however, suggesting this. I am proposing that the kinds of communications that occur between these roles could, and probably should, be transformed. In zero-waste fashion design and manufacture, the pattern cutter (if a separate role from designer), pattern grader and marker planner and maker need to be an integral part of the design process of a garment. Whilst this sounds a simple proposition, the current hierarchies and consequent structures in industry pose formidable challenges for this. For example, with off-shore manufacturing the pattern grader and marker planner are likely to be in a different physical location to the designer and pattern cutter; in some instances, the pattern cutter may be off-shore as well. The implications of such somewhat common situations should be the subject of further research in the context of zero-waste fashion design and manufacture. Where all roles are in the same location (at least in the same city if not the same
building) greater potential for transforming the kinds of communications could exist; future research should investigate this further.

Perhaps the greatest challenge to transforming the industry is the traditional elevation of fashion design above the rest of the industry roles. As noted earlier, McRobbie (1998: 59–60) and Fletcher (2008: 186–7) point towards different problems that this causes for design itself, the industry as well as consumers. At the same time, Fletcher & Grose (2012: 157–179) and Fry (2009: 41–103) present entirely new opportunities for design, including new ways of engaging not just with the rest of the industry, but with humanity in its entirety.
CONCLUSION:
DESIGNING A FUTURE
FOR FASHION DESIGN
In the light of escalating levels of fashion consumption, and increased environmental and social impacts associated with it (Allwood et al 2006: 11-14), fashion designers and fashion companies ought to have the space, time and economic incentive to design and produce less – in a material sense – but with more consideration and with an in-depth understanding of the complex nature of fashion and sustainability. This project supports this view and contributes to this understanding. More broadly, there is a pressing need to decouple fashion design, production and consumption from continuous economic growth. New visions for the future of fashion design – fashion design that functions towards sustaining all of us – are inseparable from new economic models, and new business models fostered by those. Conversations with countless fashion designers during this project have revealed that often fashion designers are constrained by the economic expectations of the company they work for. Therefore, real and meaningful changes towards a sustained and sustaining fashion industry require close collaboration between fashion design, fashion design education, economists, policy makers and consumers, and likely other stakeholders.

In Chapters 3 and 4 I discussed in length the opportunities for designing and manufacturing zero-waste garments. I have summarised the key findings of this study regarding zero-waste fashion design in the following eight points. My aim for this brief summary is to provide a simple yet robust framework for anyone planning to practice zero-waste fashion design. With each finding, the section that discusses it in detail is included:
1. Pattern cutting is integral to zero-waste fashion design practice; it cannot be treated as a separate phase or somehow “less than” fashion design. (Section 3.4)

2. Balancing the criteria of garment appearance, fit and cost with fabric waste is key: all are of equal significance, though the balance varies during the design process. (Section 3.2)

3. Balancing tailored and square-cut pattern cutting approaches can facilitate later fabric waste elimination. (Section 3.3)

4. In zero-waste fashion design marker planning and making are design rather than manufacturing activities. (Section 3.5)

5. In zero-waste fashion design pattern grading is design rather than manufacturing activity. (Section 4.2)

6. Openness and flexibility regarding outcomes, tempered by a critical approach to aesthetics, are key to designing zero-waste garments successfully. (Section 3.4)

7. Zero-waste fashion design cannot function within conventional fashion industry hierarchies. Equally, it can facilitate rethinking these hierarchies. (Section 4.5)

8. Zero-waste fashion design needs examining in its broader context of fashion and sustainability. A zero-waste garment is not inherently “good”; the context is decisive. (Section 5.6)

This chapter closes the current project, while aiming to point towards new ones. The first section in this chapter sums up the key argument: pattern cutting is fashion design, even if fabric waste (or sustainability) is not a criterion for design. Drawing from the key argument the second section briefly reviews what shifts might be necessary in fashion design education in order for zero-waste fashion design to be incorporated into it. The third section proposes new research areas emerging from this project. The fourth section reflects on the success of using practice in this project to examine the research question, and how that led to the key argument. Further opportunities for the use of practice in research will also be discussed. The fifth section proposes that sustainability can provide a platform for new kinds of creativity in fashion design. The chapter and this thesis close with a proposal for us all. Much work remains to be done around sustainability in fashion, and sustainability in society. This is work that invites participation from all of us in order for it to be successful. I propose that this work will not be as difficult as may currently seem, despite its complex challenges. A shift in our collective mindset about the world – made of people with a natural propensity for empathy – will make this work easier and more rewarding than how we might currently see it.
5.1 Zero-waste fashion design and pattern cutting

In an essay titled To cut is to think, Germano Celant (1996: 22) states: “The cut is the soul of clothing.” It is partially the cut that transforms cloth into clothing, but I question whether most clothing today can claim to have a soul. The essay title, however, rings true for zero-waste fashion design, and should for all fashion design: we should think with every cut we make into cloth. Cutting and making garments are fashion design. As a practice, fashion design could be seen as a rich fairground of various crafts and critical thinking, and needs to be taught as such. Patternmaking (USA, Australia) and pattern cutting (UK and to lesser extent Australia) are often presented and used as interchangeable terms, depending on location. This project suggests that pattern cutting is nevertheless more descriptive of a fashion design practice of the future. Its creative scope is broad, and it suggests action rather than re-action. Alternately, patternmaking could be renamed pattern design (Fasanella 1998: 130; Van Koppllen & Vaughan 2003). This project, as well as the works of Julian Roberts, Holly McQuillan, Yoshiki Hishinuma and many others, has demonstrated that pattern cutting can be a powerful design ideation tool like sketching is. This is not to say pattern cutting should replace sketching; each has its own unique advantages and the two are complimentary. For example, in designing Endurance Shirt I (figure 5.2) I used sketching extensively. Sandra Ericson and her company, Center for Pattern Design, have been championing pattern cutting-led designers like Shingo Sato, Roberts, McQuillan and myself. The significance of cutting – mutilating – cloth is reflected in the title Roberts, McQuillan and I chose for a joint research project, The Cutting Circle (thecuttingcircle.com). On one hand we see the cut as essential to design practice, and on the other, we recognise that the cut has implications beyond our initial intentions as designers. To cut is to take a risk, whether an aesthetic, economic or ecological risk. It is also, however, liberating; St James (2010) notes that once the first cut – a disturbance – has occurred in the fabric, the fear of failure dissipates: “Once the fabric is cut it’s no longer perfect, no longer pristine, no longer untouched, and can both mentally and literally be transformed.”

Relatively early on during practice in this project I realised that how I had previously designed – mainly through sketching – was not working in this project. Pattern cutting became part of the design process. The function of a garment pattern is not only to help realise the designer’s idea aesthetically and produce a garment of appropriate appearance and fit at an appropriate cost (all of these specific to the company employing the designer) but also, the pattern should facilitate efficient construction time during manufacture and be efficient in terms of fabric use even if fabric waste in an ecological sense is not a criterion. Whether or not fabric waste is a criterion,
the garment pattern impacts on the other three criteria. The garment appearance and fit are entirely inseparable from the garment pattern, and depending partially on how the garment pattern is designed impacts on the cost of the garment. Pattern cutting is therefore fashion design.

Figure 5.1: Comparison of initial criteria for fashion design in this project, and proposed criteria for fashion design in the future.

Figure 5.1 shows on the left the criteria for fashion design that emerged from the practice in this project, discussed in detail in Chapter 3. The four primary criteria were appearance, fit, cost and fabric waste. On the right is what I propose as criteria for fashion design moving forward. What I had earlier considered to be secondary criteria can be viewed as subsets or sub-categories of the four new criteria: appearance, fit, cost and sustainability. The new sustainability criterion covers considerations relating to environmental and social issues not included by the criteria of fabric waste, future transformability and physical durability; fabric waste is one sub-category under sustainability. The four criteria are of equal importance; fashion design is a
The table in Figure 5.1 is a simplification; particularly the criterion of sustainability is too complex to discuss at the necessary length here. As a guide, Parts 1 & 2 of Fletcher & Grose’s *Fashion & Sustainability* (2012) provide a useful framework to break down the criterion. Part 1 of the book concerns transforming fashion products while Part 2 focuses on transforming fash-
ion systems. (Part 3 is about transforming fashion design practice; the three parts are inseparably linked.) As Fletcher notes (2008: 166-169, 175), appropriateness is key; different garment types are used by the wearer in different ways and at different intensities, and this variability needs to be accounted for during design. Therefore, the different sub-categories under sustainability will bear different weights depending on the garment being designed. As an example, where durability and future transformability were key criteria for the two Endurance Shirts, they would not necessarily be for a garment that would need to be disposable – for example, in designing a hospital gown used by patients with infectious diseases. I also acknowledge that the table barely points towards the human aspect of sustainability, whether it is the right to a living wage by the machinist, a cotton picker’s right to work in a non-toxic, non-life-threatening environment on a cotton field, or a fashion consumer’s right to a satisfying self image through the means of fashion. Perhaps these could be covered by a sub-category of “ensured quality of life for every individual along the fashion chain”.

Fashionability may seem somewhat at odds with sustainability; it is easy to associate fashionability with fast change. I propose that the connection is an unnecessary one to make. Some contemporary fashion designers, who show a new collection twice a year, do not equate showing seasonal collections with making obsolete the previous season’s clothes. Issey Miyake puts it bluntly: “To change every six months…is crazy. It’s designer suicide.” (Frankel 2001: 48). A statement from Maison Martin Margiela elaborates: “We have always had garments that we continue to propose for many seasons in a row (in some instances twelve!). It remains more important for us that someone finds their way of dressing as opposed to a way of dressing as prescribed by anyone else or an over-riding trend.” (35) Fashionability here refers to appropriate appearance and fit at a particular point in time; it in no way implies that that the appearance and fit somehow become inappropriate at a particular speed. As an example, Dr Gene Sherman, Executive Director of the Sherman Contemporary Art Foundation in Australia, could be described as “fashionable”, given that part of her past wardrobe is now housed at The Powerhouse Museum in Sydney. Some pieces in her current wardrobe are more than a decade old (Gwilt & Rissanen 2011: 119). While fashion changes as society does, the pace of real fashion change – that is, the change in what most of us wear – is not as fast as the fashion media and many companies would have us believe.

This project demonstrates that a fashion designer with an understanding of pattern cutting and garment manufacturing practices, particularly pattern grading and marker making, is able to design garments while greatly reducing or eliminating the amount of
fabric waste produced in the production of the garment. Zero-waste fashion design may differ from design processes that are currently being taught within fashion design courses worldwide, but the skills learned during fashion design education as well as through working in the fashion industry can be harnessed for an approach that eliminates or dramatically reduces the amount of fabric wasted. This project demonstrates that existing skills and practices can have value added to them by utilising them in new ways. Moreover, I argue that pattern cutting is fashion design.

5.2 Zero-waste fashion design education

From August to December 2011 I taught the first course titled “Creating a Zero-Waste Garment” at Parsons The New School for Design, partnering up with a New York-based company Loomstate Organic. The primary findings from this project, as outlined in Chapters 3 and 4 of this thesis, were used to develop the course curriculum. The course received a substantial amount of publicity, as well as fashion industry interest. Partly as a result of this interest, I was also invited to develop and teach some one- or two-day intensive zero-waste workshops at Columbia College Chicago (Chicago, USA), Kwantlen Polytechnic University (Vancouver, Canada), Massey University (Wellington, New Zealand) and California College of the Arts (San Francisco, Canada). I was also invited to deliver lectures on zero-waste fashion design in South Korea, Australia and Finland, as well as companies in New York. While the extent and nature of the publicity would suggest that teaching zero-waste fashion design is somewhat limited to Parsons (for example, Rosenbloom 2010; Zalopyany 2011), it needs to be acknowledged that Lynda Grose (California College of the Arts), Arti Sandhu (Columbia College Chicago) and Holly McQuillan (Massey University) have supported students in exploring zero-waste fashion design for a number of years. Each takes a somewhat different approach; in McQuillan’s case, she shares her own approaches with students, while Grose and Sandhu refer to McQuillan and myself, as they have not practiced zero-waste fashion design themselves but recognise its value in fashion design education. For example, when Samuel Formo was working on his zero-waste jacket (Rissanen, 2009a), Grose, his teacher, approached me via email, followed by an email conversation between Formo and I. Furthermore, some entrepreneurial students have decided to explore zero-waste fashion design in their final collections, for example Laura Poole (University of Technology Sydney, Australia, 2010) and Simone Austen (Fach-
Reflective journal entries were a weekly requirement within the course at Parsons, to provide a space for the students to reflect on and recognise their own learning. Work from the course was exhibited in the Aronson Gallery at Parsons in February 2011, alongside reflective statements from the students (Appendix E). In my experience of teaching the course, the most significant challenge for students was to understand that they could not design the garment in its entirety through sketching garments; each student realised this at a different point in the course. However, once students began to understand the potential of designing fashion through pattern cutting, their design processes moved forward speedily. A.C. elaborates: “I have come to realize that there is no right or wrong way to create a garment, and by using unconventional methods such as zero-waste I have come up with interesting new silhouettes and design details that I wouldn’t have thought of otherwise.” This is echoed by G. G. who calls zero-waste fashion design “the freedom to explore your creativity to develop new and interesting ideas”. A garment designed by Andria Crescioni (Figure 5.4) was chosen by Loomstate Organic and was manufactured for November 2011 retail launch.
Drawing from this research and my experiences of teaching zero-waste fashion design, I argue that a key challenge for including zero-waste fashion design in fashion design education is that pattern cutting is at times taught as somehow separate from or at best supportive of fashion design, while fashion design is presented as inspiration and market research, fabric and colour selection, and extensive sketching. Pattern cutting tends to be presented as subsequent rather than concurrent to fashion design. Furthermore, pattern cutting courses as well as texts tend to present pattern cutting as a somewhat closed, rule- or convention-bound and technical process, rather than the open, creative and creating process it can be. These factors might risk conditioning students and thus future fashion designers to perceive pattern cutting as a primarily technical endeavour – which it also is – potentially preventing them from seeing the creative and sustaining potential of pattern cutting in fashion design. I argue that pattern cutting and making garments are inseparable from and integral to fashion design, because the garment pattern is inseparable from the criteria of appearance, fit and cost, as well as sustainability. During my undergraduate study, I received a robust yet limited and limiting education in pattern cutting. We were assessed on how accurately our patterns reflected the sketch. Such a
narrow approach denies the opportunity to use pattern cutting as a dynamic design ideation tool, one that could lead to unexpected forms somewhat more easily than sketching. At the time of writing, I have taught fashion design for over eight years, mostly dominated by sketching. In that time I have seen the same sketched ideas from students countless times; students tend to sketch what they already know. It is more challenging to draw the unknown, the new. Pattern cutting, combined with sketching, can enrich the exploratory ideation phase in a design project. In September 2011, third year students in the BFA at Parsons were encouraged to use the letters of the alphabet as a basis for designing a t-shirt through pattern cutting. While it is early to assess the success of the project, preliminary results would suggest that incorporating pattern cutting into the design process impacted positively on the students’ exploration of form.

A broad challenge for fashion design education is that for a long time, sustainability-focused or –related courses were only offered as electives. This was the case for the zero-waste fashion design course I developed for Parsons, although current conversations at the school include faculty workshops, which could in the longer term mean that zero-waste fashion design could be incorporated into core courses. Overall, the situation seems to be slowly shifting. There are now degrees focusing on sustainability in fashion, such as the MA Fashion and the Environment offered by London College of Fashion, established in 2008, and a Masters program in Sustainability in Fashion offered by ESMOD Berlin, established in 2011. Whilst the increased presence of sustainability issues in fashion design education is to be commended, the challenge is to incorporate it into core courses at undergraduate and postgraduate levels. Presenting “sustainability” as somehow separate from “conventional” fashion design is risky, in that it can marginalise the complex, inevitable problems that the industry and humanity are facing, while potentially doing a disservice to students’ learning.

For future courses on zero-waste fashion design, a key issue to address is the relationship between fashion design and fashion manufacture. As Chapter 4 demonstrates, certain challenges for zero-waste fashion design arise from manufacture. This thesis calls for closer collaboration between fashion design and fashion manufacture; this needs to be supported by education in both. If the two reside within different departments or institutions, collaborative projects between them should be developed and fostered. There are areas of expertise unique to each, but the goals are common, and these goals rely on the specific fields of expertise. Demolishing the traditional hierarchies of the industry is also required; traditionally fashion design has dominated the way in which the industry is presented to the public through media. Remarkably, more than a decade ago McRobbie (1998, 2000), called for bridging the gap between fashion
design and manufacture in fashion education, albeit for different reasons. McRobbie noted the financial difficulties that fashion designers in the UK ran into, when they were encouraged to set up their own businesses soon after graduation on one hand, but were not knowledgeable on manufacturing or business practices on the other. A new reason can now be added to the overall rationale for introducing manufacture and business into fashion design education in a richer way: sustainability.

5.4 New research areas in fashion design

The contextual research (Chapter 2) in this project demonstrates that fabric waste can be addressed through fashion design using three primary methods: cut & sew, fully-fashioned and A-POC. This project focuses on cut & sew, the most common of the three, contributing towards a stronger foundation from which to identify new research topics. This section begins with potential new research topics relating to cut & sew, and then discusses the other methods, and some speculative issues that arose during this project relating to them. The section concludes with some potential prospects for research into the larger context of fashion design and sustainability.

Interviews with the living designers covered in Chapter 2 could potentially uncover detailed accounts of their design processes, thereby enriching the field of knowledge. The findings from this project could be utilised to develop the interviews. For example, in the case of some designers it is unclear whether the fashion designer is also the pattern cutter. Informally this process has partially taken place during the curation of Yield; while writing the catalogue, Holly McQuillan and I spoke informally with most of the included designers about their working processes. It seems that not one designer works in the same way (McQuillan & Rissanen 2011), a point highlighted when McQuillan and I co-taught a zero-waste workshop in New Zealand in 2011. Our working practices are different, which made for a richer workshop. The participants could see the possibility of creating their own way of creating zero-waste garments.

This research has not included the dominant industry situation where the designer and pattern cutter are two individuals, rather than one as in this research. Such a situation could dramatically differ from the design situation in which the practice in this project took place and therefore some of the findings from this project might not be directly transferable to that situation. An investigation into a zero-waste fashion design approach involving a team or teams of a fashion designer and pattern cutter would deepen our understanding of zero-waste fashion
design in a more common situation in industry, where the fashion designer and pattern cutter are two individuals. In particular, situations where the designer and pattern cutter are in different physical locations (relatively common with off-shore manufacturing) could create unforeseen challenges that invite further research. The research could ask: If the interpretation and realisation of a “zero-waste” idea occurs substantially through pattern cutting, what are the implications for fashion designers who do not have an understanding of pattern cutting? What challenges does a geographic separation between the fashion designer and pattern cutter present for zero-waste fashion design?

Based on the practice undertaken in this project, I believe that CAD (Computer-Aided Design) pattern cutting and marker making systems offer great potential for speeding up parts of the design process. In particular, exploring the potential of the initial pattern shapes on a fabric width was time-consuming. A CAD system would allow doing this relatively fast, while allowing fast documentation of design attempts that did not work. In my case, each garment resulted in several full-sized, “failed” markers, some of which represented more than an hour of work each. Working at a reduced scale on a computer screen rather than at full scale on a cutting table would be faster. Pending funding, I will receive training in OptiTex, one such CAD system, in 2013 (no CAD system was available at UTS when the practice phase was completed) and I will be examine how much faster I can design using CAD as a tool alongside manual methods, which I do not expect to abandon. In my practice, manual methods at the early phase of designing in particular seem indispensable to me.

A common question from industry is regarding the speed at which zero-waste garments can be designed. While CAD may bring some benefits in this regard, whether CAD is used or not, as one’s skills build up, the design process becomes faster. While I did not time the design processes, my experience of four different periods of design – 2008 for the Bad Dogs exhibition, 2009 for Fashioning Now, early 2011 for Zero-Waste: Fashion Repatterned, and mid-2011 for The Cutting Circle, tells me that I have become faster as my expertise and skills have developed. A formal comparative study of speeds of designing in conventional fashion design and zero-waste fashion design, of designers of varying levels of expertise in both, could be helpful in providing the industry with statistics about speed; this might help with allaying some of the concerns industry may have about zero-waste fashion design.

Although the approach taken in this project focuses on cut & sew, some questions arose relating to fully-fashioned and A-POC. Perhaps the most interesting question is around fully-fashioned weaving: that is, weaving the garment pieces to their required shapes. While Burn-
Ham (1973: 10) suggests that some basic garments were historically woven to shape, up until recently I knew of no contemporary mass-produced example in fashion (hand-woven examples are not unheard of). In 2009 I was contacted by Siddharta Upadhyaya of the company August; the company’s Direct Panel on Loom (DPOL) technology implies that this is fully-fashioned weaving. The company website (http://august.synthasite.com/, viewed 10 May 2011) states: “Using DPOL, one can produce ready to stitch shaped woven garment components which are finished at the edges by selvedge.” The technology is patented, and available to other companies as a service. Whether other companies have taken this up to date is unclear from the August website. I encourage further research in this area.

Other, less commonly used methods of fashion creation also warrant further research. Issey Miyake’s A-POC, launched in the late 1990s, has not to date to my best knowledge been adopted by other companies. From a waste perspective, however, the technology seems to possess great potential. It would be particularly interesting to see how a designer with a different aesthetic to Miyake’s would use the technology. Finally, more recent developments, such as growing “fabric” from living tissue or spraying fibre directly on the body (covered briefly in Chapter 2) may have greater future potential as the technologies develop.

As the previous section on education suggests, more formal research on fashion design education is needed. Particularly, current approaches to teaching fashion design and pattern cutting require investigation. How do these vary, if at all, from university to university, and country to country? What are the different foci globally in fashion design education overall? On pattern cutting, I’d like to make a personal call for a new kind of pattern cutting manual; this project provides direction towards one that makes no separation between fashion design and pattern cutting.

The issues relating to manufacturing zero-waste garments in Chapter 4 could be researched more formally through practice, that is, through manufacturing zero-waste garments. It was beyond the scope of this project, both temporally and financially to manufacture any of the garments in any great number. Alternately, the researcher could team up with a company that already manufactures zero-waste fashion, such as Materialbyproduct in Australia, and actively test the speculative findings from Chapter 4 through this means. Without doubt some real challenges would emerge, but ones that would likely be resolved through closer collaboration between design, manufacture and business management. Relating to that, some broader questions exist around the links that might need forging between fashion design, manufacture and economics in the context of sustainability. Any shifts in
design or manufacturing practices need to be integrally supported by the company business model, which could pose new challenges for a company on the whole. This, however, could provide rich opportunities for interdisciplinary research, bringing together fashion design and economics.

5.4 Reflecting on practice in research

On reflection, incorporating fashion design practice as a research method within the project has resulted in rich project findings. This project utilised fashion design practice to investigate the practice-oriented research problem. The findings were then articulated for other fashion design practitioners, so that they might be able to make connections to their own practice, enabling them at least hypothetically to modify their practices. What can other practitioner-researchers learn from this project? What potential does this method have for other design disciplines, such as visual communication design or product design?

A key finding, the inextricable link between fashion design and pattern cutting, emerged from the practice in this project. This resulted from a shift in perception, reflected in a journal entry from 13 March 2007: “It’s almost as if I’m learning to design again.” On reflection, I was. Once I had realised that pattern cutting had to be actively present in the design process, the practice started to move along. Through trial and error, I essentially taught myself how to design fashion without creating fabric waste, to provide myself an understanding of a possible process. Whilst I had many hunches about this kind of designing before the practice or the project commenced, the practice slowly revealed the unknown. Some hunches were confirmed, others discounted, but most significantly, unexpected discoveries and design solutions emerged from practice.

UTS requires each research student to present the progress from the first year of research in a doctoral assessment. During the first year I anticipated grounded theory, particularly the approach described by Strauss & Corbin (1998), to be an integral aspect of the research design of this project. On reflection some five years after my assessment the link between grounded theory and how I used practice in this project is clear to me. Both are “up-from-data” approaches. The creation of codes and the eventual categories in this project is similar to grounded theory approaches. A more formal investigation into richer use of grounded theory in practice-based research seems warranted.
5.5 Sustainability as a creative catalyst in fashion design?

“I never saw any point in stopping at the way in which a conventional wisdom decreed a jacket should be cut. Early on, I realised how important it is just to be curious. You mustn’t be frightened or hide behind pre-conceived ideas. You have to experiment. You just do it and it’s beautiful because you discover an energy there which feeds you. There are no rules.”

In and of itself, zero-waste fashion design does not pose great limitations to creativity in fashion design. This relies, however, on the designer accepting that he/she needs to perceive and approach fashion design practice in new ways. Pattern cutting needs to be integral in the design process; it is a key ideation tool. This could pose a challenge to a designer without some knowledge of pattern cutting, although in a potentially positive sense, it could mean a lack of preconceived ideas about the potential of a two-dimensional shape in three dimensions. This could lead to new forms and possibly be an entrance to previously unseen possibilities.

Designing without wasting fabric is knowing the space one is working within. When one knows the parameters of that space, the possibilities are endless. In terms of fabric itself, it must be noted that the space is open rather than closed. While the end result – the marker, or pattern configuration on a fabric width – is enclosed within four sides (the selvedges and the marker ends), during the design process there are only three closed sides (Figure 5.5).

![Diagram](image.png)

Figure 5.5: The working space for zero-waste
Of course the designer can choose to add a new criterion, that is, a preconceived marker length; this was the case for Samuel Formo’s jacket and David Telfer’s coat in *Yield* (McQuillan & Rissanen 2011); both had wanted to create the garments from as little fabric as possible. The pyjamas I made for *Zero-Waste: Fashion Re-Patterned* in 2011 were similarly limited in size, due to the fact that I was creating the garments from two 60-year old bed sheets (Rissanen 2011b). The length of each sheet, and therefore my working space, was predetermined. This was actually an enjoyable challenge, and partly responsible for the silhouette of the trousers, as the length of the sheet, balanced with the width of the waistband, determined the trouser leg width, while the width of the sheet determined the trouser leg length (Figure 5.6).

![Figure 5.6: Pyjamas made from two sheets of predetermined size.](image)

Notably, all design exists and functions within set parameters and criteria. In the case of fashion design, the three primary criteria have been appearance, fit and cost. Not unlike Formo and Telfer’s work, occasionally resource use in fashion design can become a significant criterion. For example, it was during the Utility Scheme in the UK during and after the Second World War, from 1941 to 1952 (Sladen 1995). The Victoria & Albert Museum in London has several Utility garments by prominent UK designers of the era in its collection (Mendes 1984: 89-90). Despite the quantified limitations imposed on design at the time regarding the amount of fabric, number of buttons, number of pleats and many other features in a garment, one could
argue that these garments were and are beautiful. I would not propose a limit on resource use on a garment per se – this would depend on the overall life cycle assessment of a garment – but we need to remain aware of and learn from historical instances where resource scarcity may have been a catalyst for human creativity. A current example is the website AfriGadget (http://www.afrigadget.com/ viewed 10 July 2011), which documents ingenuity in creation in a situation where abject poverty is a constant presence. For a novice, zero-waste fashion design is best viewed as a game in which creative negotiation of limits will lead to victory.

5.6 Beauty: A paradigm shift for fashion?

“Calculating, industrial society is obliged to form consumers who don’t calculate; if clothing’s producers and consumers had the same consciousness, clothing would be bought (and produced) only at the very slow rate of its dilapidation.”
Barthes (1990(1967): xi)

“We make no pretense to knowing what’s ahead… People may come to look upon clothing as investments to keep and wear all their lives. On the other hand, they may come to desire clothing cheap enough to be soon discarded.”
Kidwell & Christman (1978: 207)

“Design timely things, things that can last longer by being able to change over time. Design things that are not finished, things that can keep on by keeping on being repaired and altered, things in motion.”
Tonkinwise (2005: 27)

For fashion design practitioners and the industry to adopt zero-waste fashion design, a major paradigm shift is required within the industry and among consumers. Fletcher (2008: 60-61) discusses Donella Meadows’ list of places to intervene in a system. According to Meadows, the mindset or paradigm is the most effective place to intervene and the mindset that requires particular attention in regards to fabric waste and sustainability in fashion is a rethinking – or redesign – of fashion design and its role not only in the fashion industry but also in society in general. What I am pointing towards is beauty in fashion.
Fashion design and fashion consumption, and consequently fashion design education, are in a state of flux. Design is often described as problem solving; arguably the design problem in fashion has predominantly been the relentless creation of seemingly new styles at the lowest possible price appropriate to a market as fast as possible, to simplify crudely. It is time for us to reconsider the nature of fashion’s design problems. These problems are complex and challenging but also rich and stimulating. For example, while the prospect of designing a system in which a garment exists with us may seem daunting, it is also exciting. As explored in length by Fletcher (2008: 60-73; 2009: 374-378), transformation at the level of systems requires new ways of observing the world we inhabit.

For the last year of this project I had a post-it note above my desk at work, stating “Sell ‘being clothed/wearing’ as a service instead of ‘clothing’ as a product” (Figure 5.7). Zero-waste fashion design as I have defined it in this project, is product- rather than systems-focused. The zero-waste philosophies that inform every aspect of operations in companies like Alabama Chanin and Dosa Inc point towards the bigger picture. Both companies operate in a way that no textile waste leaves the company premises, including factories; everything is used. Alabama Chanin works with local artisans in Alabama, while Dosa Inc works with artisans in India (McQuillan & Rissanen 2011: 66; Fletcher 2008: 71); both companies use textile waste as embellishments on fabrics and as filler for cushions, as two examples. An even larger picture, however, is before us. How do we create fashion – fashion as an industry of systems and fashion as a product – that
is zero-waste? The kinds of zero-waste garments, from a strictly fabric waste point perspective, created in this project could be created to serve the current business models of fast fashion companies like H&M (Raper Larenaudie 2004). These business models are arguably inherently ecologically unsound (Lee 2007), in that they are designed to encourage the purchasing of large volumes of garments, of garments that are designed and made to last, and to be possessed, a relatively short time. Even if such companies adopted zero-waste fashion design, the levels of consumption their business models perpetuate would remain unsustainable. The population of the entire developed world could refrain from buying a single garment for a year (and probably longer) with negligible impact on a personal level as far as “being clothed” is concerned, while leading to the collapse of a global industry and the loss of hundreds of millions of jobs. What I am pointing to is that zero-waste fashion design is not “good” in and of itself; it needs to be examined in a much broader context. Furthermore, entirely new ways of thinking about how the industry could exist and function while allowing humanity to flourish are required. This points towards a new, expanded vision for fashion design: as well as designing and making garments, fashion design needs to design the consumption, wearing and using of garments, and design, collaboratively with other fields, the systems in which the wearing and using occurs. All of these require examination through a lens of beauty.

Leppens (2000: 37) has called for the establishment of an Australian Federation of fashion designers modelled on a similar federation in France, in order for Australian fashion designers to better compete in the international fashion market. Leppens also notes that France has a well-established guild system to protect professions. Certainly this is an interesting proposition in light of fashion design and sustainability. With relatively small financial investment, anyone can become a fashion designer by starting a small business. As the current environmental crisis worsens, it is fairly easy to surmise that in the near future fashion design practice may be increasingly governed by ecologically led legislation. This might be somewhat easier to control if the professions of fashion designer and pattern cutter were defined and governed by a guild-like system, with specified minimum skill levels and demonstrated awareness of ecological issues surrounding the practices. Caution, however, should also be applied. Fletcher (2008: 187) critiques the glorification and mythologising of fashion design by the media and the industry, and the resulting “passive fashion” and “deskilled” consumers. The elevation of the fashion designer to a mythical genius, with its associated personality worship, has been part of fashion since Charles Worth in the mid-nineteenth century. This is a formidable challenge for the industry and education to overcome. The problems we face are too complex and interdiscipli-
nary for one designer, university or company to solve, and designer ego and its perpetuation through media can only be a hindrance. New inter-disciplinary collaborations are needed, not for endless product “innovation”, but to propose and explore multiple solutions to the problems we face. The fashion industry hierarchy that places the designer at top, and the paranoia that cripples knowledge sharing within the industry, need to be done away with. This is already happening. Since 2006 I have shared the progress of this research on my blog, and there are similar examples throughout the Internet: Holly McQuillan, Julian Roberts, Otto von Busch, Caroline Priebe, Tara St James of Study NY and Titania Inglis, to name a few. This knowledge sharing is driven by a common goal of a transformed industry and society, and ultimately, a better quality of life for everyone.

This project demonstrates that pre-consumer fabric waste created during fashion manufacture is an ecological problem as much as it is an economic one. This is not to say that the economic concern is unimportant. Designing wastefully should make no economic sense but nevertheless fashion businesses make a profit despite wasting on average 15 percent of the fabric they use. Profitability increases could come from reduced waste management costs and speedier cutting procedures; future research could quantify these. As companies like Alabama Chanin and Dosa Inc show, a zero-waste philosophy can inform a business model, ensuring profitability in the long term. In her foreword to the Yield exhibition catalogue, Lynda Grose (2011: 6) points toward a possible future direction: “Zero waste … brings a new logic and imperative for design and for the fashion sector as a whole. Through its pluralistic and enchanting aesthetic it subtly notes the drivers underpinning human consumption and opens up the potential for social change. It questions the nature of design and of making clothes, mobilizes designer-makers, gives form to an inspiring new order and yields the potential to transform not only the way we design, but also the way we think.”

Zero-waste fashion design ultimately is a philosophy of making garments – just as Paul Palmer’s (2001) vision for zero-waste is a “being-in-the-world” – where cloth and the processes of design and making, and the wearing of garments, are valued in new ways. Our common goal should be to make “sustainable fashion” a redundant term, by working towards fashion that sustains and is beautiful. This is possible by working towards not only more sustaining design practices and supply chains, but by adopting a more holistic approach that includes the cultural and economic systems within which garments are worn and used. I believe that beauty is key in the kind of questions we need to ask. If a child is taken out of school for several months to pick cotton for no pay, as is currently the case in Uzbekistan, to provide cotton for a seemingly beau-
tiful blouse, is the blouse really beautiful? If we knew that a homeworker in New York City, who did not receive a living wage, made a seemingly beautiful designer dress, is the dress really beautiful? If a seemingly beautiful image in a fashion magazine results in a teenager to set an unrealistic, unhealthy goal for him/herself regarding body weight, is the image really beautiful? And then, if we knew that a seemingly beautiful shirt contained only 85 percent of the cloth required to make it, meaning a loss of 15 percent of the investments embodied in the fabric, really, is the shirt beautiful? What I call for is a holistic vision for beauty in fashion: fashion that does not negatively impact on the quality of life of any individual touched by it. At the time of finishing this thesis, this is a concern for over seven billion of us - humanity.

This project has investigated one solution to one problem with the aim of inspiring fashion designers to adopt sustainability thinking, including a concern for fabric waste, into their practices. This project aims to also inspire fashion designers to engage in research. My goal is also to inspire all of us, users of fashion, to ask more questions. Our future looks brighter the more possible solutions we have at hand. Go forth fearlessly. Drawing from experience, I assure you that you will not travel alone.
This glossary fleshes out the brief definitions and descriptions introduced in Chapter 1 and used throughout the thesis. During this study I have recognised that there is some variation and overlap in the terms that are used in industry, literature and education in fashion design, and more so in other related fields such as fashion studies. Fashion design as a field of academic research is young, and transparent terminology and language usage are imperative for fostering cohesive discourse among the international research community. Nevertheless, local variations in language use should be celebrated. Where relevant, I explain the rationale for using one term over others. Overall, with the exception of “pattern cutting”, the terminology used arises from Australian industry and fashion design education, but where relevant, terms used in the UK and US are also included here to ensure the accessibility of this research internationally. This appendix begins with an examination of fashion, proposing the term “designerly fashion” – a term from within and for fashion design. Definitions of zero-waste garment, fashion design and pattern cutting follow.

**Fashion**

“He has some interesting ideas which he repeats without touching the dress.”


“Amongst the entire body of academic work relating to fashion, there is scarcely a word written by a practising designer, or given a designer’s perspective’.


During this study I have been asked to define “fashion” a number of times; as I see it, fashion is at the heart of this research. I see and experience fashion as an intrinsic part of human material culture, as a consumer, designer, researcher and teacher. I perceive fashion as a potentially positive force while acknowledging that it often does not exist as such. During this research fashion has proven difficult to define, yet I strongly feel that the field of fashion design can and must contribute towards a discourse about fashion and make such discourse its own while engaging
with the related fields of fashion studies and dress history. Many existing discussions about fashion seem insufficient in light of fashion design practice. Therefore, the propositional term of “designerly fashion” is introduced here, nevertheless noting that throughout the thesis the shorter “fashion” is used. Fashion in this thesis refers to physical clothing: fashioned fashion garments. Fashion is not always a result of fashion design; for example, within a subculture, a “fashion” may originate through members of the subculture experimenting with customising and wearing clothes. This thesis, however, focuses on designerly fashion: fashion garments designed by design teams and manufactured by the fashion industry.

The word “fashion” has its roots in Latin and French (Kawamura 2005: 3). While the etymology of a word should by no means be accepted as the current meaning of a word per se, it reveals that historically “fashion” has material roots. The Latin “facio” means to make, create or compose, while “factio” refers to making, doing. The French “une façon” means a way of doing or making up, while “façonner” means to shape, make or work. From Latin and French, fashion thus emerges as a practice as de Marly (1980: 24) notes: “Fashion is une façon, a way of doing things - in other words, a style.” In a designerly sense, therefore, a design team of experts creates fashion. The team traditionally consists of a designer, pattern cutter, cutter, machinist, grader and marker-maker, although every company is different in its organisation. Designerly fashion is a synthesis of the areas of expertise. On this basis fashion production, or rather, creation, is independent of the institutions and “fashion cities” as stated by Kawamura (2005: 40), that is to say, designerly fashion can be created anywhere the team is located.

Debates on the nature of fashion have historically taken place outside of fashion design. The study of fashion design (as distinct from fashion studies) is gradually finding its niche alongside design studies. This is an emerging area of research, lagging some decades behind both fashion studies (the study of fashion in historical, cultural and sociological contexts, as exemplified by the journal Fashion Theory) and design studies (the study of design, represented by the journal Design Studies¹). As evidence of this recent emergence, two new journals emerged in 2008 on fashion (design) practice: Fashion Practice (by Berg, publisher of Fashion Theory since 1997) and International Journal of Fashion Design, Technology and Education (published by Taylor & Francis). No long-established tradition exists for fashion designers or other practitioners to move into research on their own discipline or practice. This also is changing, as evidenced

¹ A search for “fashion design” within Design Studies on April 7, 2008 yielded only the same two articles as a search three years earlier, from 1993 and 2001. A search for “industrial design” resulted in 60, “product design” 167, “graphic design” 20 and “interaction design” in 45 articles. “Interior design” fared similarly to “fashion design”, with four articles. Design Studies may inadvertently discourage papers on fashion design. As of July 2011, four out of five keywords in a paper submission must come from the journal’s list, and “fashion design” is not included, while “product design”, “graphic design” and “interaction design” are.

Nevertheless, the recent lack of avenues for rigorous fashion design discourse posed certain challenges for this study, particularly in the early phases. Margolin (2001: 16) defines discourse as “the conversation that takes place within the community that leads to a greater understanding of its shared subject.” Further, discourse contributes to research standards by “critiquing research and by exploring its implications for further investigation”. Poggenpohl et al (2004: 589) could be discussing fashion design studies when they state: “…the lack of a specific design discourse with ongoing development, argument, criticism, research findings etc. hampers development of design as a discipline and prevents design from contributing its knowledge more broadly.” The authors nevertheless note that design’s “lack of an infrastructure is both a problem and an opportunity” (604). In the case of this study, both the challenge and the opportunity are situating it in an appropriate context: fashion design and manufacture, and sustainability. Fashion design and fashion manufacture tend to be examined separately; Fasanella (1998) is one commendable exception. As for sustainability in fashion design and manufacture, the first books of notable rigour on the topic by Fletcher and by Hethorn & Ulasewicz were published in 2008.

Fashion garments and the activities that occur to create them can be divided into different categories, even if the boundaries are soft. Jenkyn Jones (2002: 25-28) divides fashion into two broad categories: haute couture and prêt-à-porter (ready-to-wear). This study sits within ready-to-wear fashion, distinguished from haute couture by the mass-manufacture of garments. Haute couture\(^2\) is the highest level of the fashion system in France. An industry body protects the industry heavily, and the garments are made-to-order and –measure, from fabrics that may be hand-woven or woven to order, and most of the sewing and embellishment is done by hand. It also differs from ready-made clothing in that a client may have some say in the design of the garment. For example, a neckline might be adjusted for modesty, or a colour changed slightly to suit the client, as long as the overall integrity of the garment is preserved (Martin & Koda 1995: 23). Whether haute couture exists outside of France is up for debate but garment design and making practices prevalent in haute couture are practised worldwide. For example, Koskennurmi-Sivonen (1998) presents a case study of Riitta Immonen, a Finnish designer whose practices best fit into haute couture, while Palmer (2001) outlines the reproduction of haute

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\(^2\) French for “high sewing”.
couture garments in Canada. Shaeffer (2001) has attempted to make haute couture practices accessible to everyone.

Sorger & Udall (2006: 110-115) break ready-to-wear down into luxury super brands, mid-level brands and designers, independent designer labels, casualwear and sportswear brands, high street, and supermarkets. The garments created in this study best fit into “independent designer label”, which is defined by a small team, a high level of control over aspects of design and manufacture, and the designer’s ability to juggle many different skills. The study, however, aims to contribute new knowledge towards fashion practices across all levels of ready-to-wear fashion. The primary difference between the levels concerns garment cost; fabric and labour are two primary sources of garment cost. While some fashion design and pattern cutting practices may differ across the levels, the focus in this study is on commonalities in practices.

Leppens (2000: 10-14) discusses the terms “fashion” and “fashion designer” in some length, noting that fashion “is less often described and analysed by the actual designers than by sociologists and historians. Yet it is the primary goal of designers to create dress and they might be expected to have something to contribute on the subject.” (9) There has been little discourse on what “designerly” fashion is or could be, while (as Leppens correctly points out) sociologists in particular have been proactive in defining fashion. A sociologist, Crane (2000: 1) proposes fashion to be “strong norms about appropriate appearances at a particular point in time”, divorcing fashion from physical clothing. Kawamura (2005: 1) goes further, claiming that “fashion and dress/clothing, are different concepts and entities which can be or should be studied separately”. Kawamura (44) further separates the concepts of “clothing” and “fashion”: “Clothing is material production while fashion is symbolic production. Clothing is tangible while fashion is intangible. Clothing is a necessity while fashion is an excess. Clothing has a utility function while fashion has a status function.” (44). As a fashion designer I do not question the validity of Kawamura’s “fashion” in a sociological context. Kawamura’s fashion does not exist without consumption, while designerly fashion, I argue, is grounded in production: design teams (and less commonly individual designers) design fashion. In a design context, fashion is made “real” through making; this implies that fashion designers alone do not create designerly fashion; there are teams involved.

Sustainability is strongly though not exclusively concerned with the materiality of consumption and production, therefore fashion in a sustainable, designerly context comprises the physical clothes we design, make, wear, care for and dispose of. On the other hand, Shove’s (2003) approach to sustainability in practices of everyday life suggests that the attributes
(symbolic value, change, novelty, etc.) of Kawamura’s “fashion” are equally important. A different view of fashion emerges from Fletcher (2008), in a seminal text on sustainability and fashion and textile design. In contrast to Kawamura’s “fashion-as-excess”, Fletcher reclaims fashion as a positive aspect of culture (173–4). While directing the text at fashion designer and fashion design students, Kawamura (2005: 2) does not investigate ideas about “fashion” within the fashion design community. Au (2001, 2003, 2004) provides such an investigation, through three grounded theory studies of fashion designers and their inspirations. Au does not use the term designerly fashion but the studies inquire into fashion designers, fashion design educators and students’ ideas of fashion. A strong sentiment that designerly fashion is rooted in production (or making, or creation) comes through, with links to the social and cultural context of the moment. This also emerges in Koskennurmi-Sivonen’s (1998: 281–284) discussion of Riitta Immonen’s work. It is clear that fashion has a significant temporal aspect, with consequent implications for sustainability. Fletcher (2008: 161–181) discusses speed in the context of fashion and sustainability, and this discussion is expanded by Fletcher & Grose (2012: 126–130), noting that fast and slow speeds are complementary in fashion as they are in nature, society and culture. Koskennurmi-Sivonen (1998: 282) notes how garment timelessness was important to both Immonen and her clients, perhaps in contrast to a company like H&M that changes the entire store contents within three weeks (Raper Larenaudie 2004).

To sum, fashion in this study concerns material garments, physical manifestations of expertise of a number of individuals. While the express aim behind the garments created in this study has been to investigate zero-waste fashion design, an underlying concern for resilience has informed the design processes: it has been my aim to create garments to live in and with for a long time.

**Zero-waste garment**

Zero-waste garment in this thesis refers to garments that have been designed and made to contain all of the fabric required to make them; pre-consumer fabric waste is eliminated through design that integrates pattern cutting. Such a garment does not address the vast quantities of wasted garments created by the dominant pursuit for economic growth; zero-waste garments as defined in this thesis could easily contribute towards this larger issue of post-consumer waste, if created within the dominant fashion system. Natalie Chanin, founder of the US company Alabama Chanin, has built a zero-waste philosophy into the company business model, pointing towards a holistic approach for the whole of the fashion industry (McQuillan & Rissanen 2011: 66).
Fashion design

“This designer is about the most unhappy and unnecessary species of the day. He is uncreative by profession, unprepared for any task but copying, and unaware of the possibilities of his profession. There are practically no schools to give him an adequate training, because there are no adequate teachers. The designer lives on what he calls inspiration – a good and wholesome word which, by common consent and abuse, was perverted into the contrary of its original meaning. Inspiration, as the designer understands it, is far from the sublime moment of spiritual communion with divinity; to him it simply means the copying of insignificant and meaningless details from past epochs or foreign countries, which he cements together into that pastiche called THE STYLE.”

Bernard Rudofsky (1947: 223) on fashion designers

“Fashion is very important. It is life-enhancing and, like everything that gives pleasure, it is worth doing well.”


A question about what a fashion designer is and what a fashion designer does is also a question about design. What is design and what is designing? I acknowledge a vast and useful debate over the past several decades, which is perhaps best summed by Walker (2009(1989): 42-43), who notes the insufficiency of definitions of design, in that design can refer to process, result, product or look, and that language changes over time. While I will close with a look at fashion design in the second decade of the twenty-first century, a brief history necessarily opens the discussion.

The birth of the modern fashion designer within the French haute couture is well documented (for example, de Marly, 1980: 14-23). Charles Frederick Worth (1826-1895) was the first modern fashion designer: he was responsible for creating the visual aesthetic of the garments he supplied to clients. Previously, determining the visual aspects of a garment had been a collaborative effort between the client and a tailor or dressmaker. Worth established the role of the fashion designer as a predominantly creative profession from the 1860's onwards. Just as fashion exists at many levels, so does fashion design, from haute couture to ready-to-wear to mass market. This research focuses on fashion design at ready-to-wear level. As noted earlier, this study treats “fashion” as a designed and made entity, acknowledging that other approaches of examining fashion exist.
Wiberg (1996: 140-148) provides a critical account of the emergence of the industrial designer. While the context is textile design, Wiberg’s study has relevance for fashion design. With the cataclysmic societal shifts that accompanied the two world wars, the fashion industry gradually shifted from haute couture to ready-to-wear, with the latter surpassing the former in significance by the late 1960s. Both the designer and the pattern cutter (see next section on pattern cutting) were important in the shift from made-to-order clothes to mass-production; to some extent the differentiation of these roles is a result of this shift.

As noted earlier, few focused larger studies about fashion design have taken place. In a study into the opportunities of Australia fashion globally, Leppens (2000: 3) presents a designer-centric definition of a fashion designer: “…a fashion designer is an observer and catalyst, uncovering, legitimising and popularising underlying currents in society.” “Fashion design…should reflect the identity, creativity, ingenuity and social insight of a designer.” In contrast, Fasanella (1998: 35) provides a business-centric perspective: “In industry, designers are the managers of the product development department. Their task is to translate the vision and purpose of the company’s specialty into products that consumers wish to buy. This is difficult because designers rarely get to design products they like; designers must produce items that represent the needs of the company.” Fasanella (19) states that good design in fashion generates “profit for a manufacturer”.

Fashion design manuals aimed at undergraduate fashion design students provide some information about fashion design, although how much of what is presented is grounded in critical study of the profession is open to question. Manuals of this kind seem to be primarily based on the authors’ opinions. In their manual, Sorger & Udale (2006) break down the fundamentals of fashion design. Chapter 1, “Design and Research” is separated from pattern cutting in Chapter 3, “Construction”, by Chapter 2, “Fabrics and Techniques”. What does this mean? Elements of fashion design that the authors cover are: being “fashionable” (12), researching a theme (16–25), communicating the theme (26), designing (28), understanding the body (30–33), silhouette, proportion and line, details, fabric, colour and texture (34–47), and communicating ideas through rendering (48–53). Notably both Sorger & Udale (2006: 12) and Jenkyn Jones (2002: 8–10) suggest that a certain personality type is required of a fashion designer. The latter also states that above all, a designer needs “talent”: “the ability to research, absorb and synthesise ideas and skills” although this talent is not defined further (Jenkyn Jones 2002: 9). Jenkyn Jones (76–84) classifies silhouette, line and texture in “elements of design”, while repetition, rhythm, graduation, radiation, contrast, harmony, balance and proportion fall under “principles of design”. More manuals could be analysed but they are very similar in content. To sum, fash-
ion design is primarily described as the responsibility for the aesthetics of the garment. Pattern cutting is categorised under making, which is afforded less significance.

**Pattern cutting**

Despite this study being located in Australia, where “pattern making” is the dominant term (as it is in the US), I deliberately choose to use the UK term “pattern cutting” in this thesis. For me, the inclusion of the word “cutting” implies a closer engagement with cloth, particularly in the context of zero-waste fashion design. Winifred Aldrich is a UK-based fashion designer and pattern cutter and one of the most published authors on pattern cutting in fashion design. The texts by Aldrich (1990; 1996; 2002, to give a few) are noteworthy in that she does not make a clear distinction between fashion design and pattern cutting, although in the industry these often are two hierarchically separate roles. Aldrich (2002) offers a concise yet thorough history of pattern cutting. She explains how it developed from tailoring and dressmaking into a profession of its own gradually, with the rise of ready-made clothing. This is perhaps the broadest available history of pattern cutting in its scope.

In much of the industry and according to much of the literature on fashion design and pattern cutting, the pattern cutter develops the designer’s idea (usually presented as a sketch) into a pattern, either manually on card or on a computer using a CAD (computer-aided design) system. The first pattern is used to cut out the garment in fabric. Fasanella (1998: 35-36) regards pattern cutters “the technical backbone of the production process. Their task is to translate “fuzzy” (a sketch) into concrete fact. They develop the engineering blueprints which manufacturing needs in order to produce a design cost effectively. Fasanella’s criteria for a competent pattern cutter include perfectionism, concern with detail, superior sewing ability and effective communication with design, sampling and production. Sorger & Udale (2006: 105-107) somewhat concur, noting the role’s emphasis on accuracy to achieve good fit and to make construction easier. Nonetheless they acknowledge that the designer may also be the pattern cutter. Countless manuals on pattern cutting (or pattern making, if by Australian or US authors) present pattern cutting as something that supports fashion design in realising ideas. Writing outside of fashion and pattern cutting, Pye (1968: 55) states: “The workman is essentially an interpreter.” Perhaps then, according to some in fashion the pattern cutter is the workman, the interpreter, applying technique through workmanship to interpret the designer’s idea.

In contrast, Almond (2010: 16) asks more of pattern cutters: they need “openness to and an awareness of experience; self-reliance, independent approach to finding solutions; flexible
playful attitude towards manipulating concepts", overall proposing pattern cutting as a creative
deanvour. Jenkyn Jones (2002: 115) is more reserved but along similar lines: “Pattern drafting
can seem a very dry, dull and mathematical subject at first until the magic of it starts to work
under your fingers and you realize the infinite possibilities that can be achieved with a snip here
and a curve there.” In the context of zero-waste fashion design, Fasanella (1998: 36) points
towards a key insight of this study, that pattern cutting is fashion design: “Education and expe-
rience is strongly recommended, as their [patter cutters’] task is the most critical link in the
entire production process. Pattern makers have more control over waste, sewing problems, and
quality than any other single person in the company.”

The final word in this appendix will go to Julian Roberts, writing in 2003 in an online
book that led to the print version (Roberts 2008). The 2003 version is no longer available but I
have it on file; the language is richer in the original: “Pattern-cutting is about possibilities &
what if’s & experimentation & fuck-up’s & cool new things which unexpectedly surprise you.
New ways of cutting come to life through a mixture of luck, risk & mistake. Being an amateur
is always an advantage.”
APPENDIX B:

BRIEFS FOR DESIGN EXPERIMENTS
[AS THEY WERE 8 DECEMBER 2006]

Note: The experiment numbers do not YET necessarily refer to the order in which the experiments are conducted.

Findings from literature are used to develop design briefs for a series of experiments. Some experiments also build on the findings of previous experiments. Some may be conducted more than once. The findings from these experiments are then utilised to develop a design brief for a collection of menswear. Utilising results from the experiments in the collection will give the experiments a ‘real-life’ grounding, and the knowledge generated by the experiments is arguably better communicated to industry practitioners through a collection of clothes. The collection aims to show that fabric waste can be eliminated from all types of garments.

Capping the number of experiments at five; why?
Is the collection an experiment?

Documentation of experiments

• Thinking during the experiments (protocol analysis)
• Thinking after the experiments: Review, Reflect, Refine (‘What is done differently here in relation to more conventional design practices?'; ‘What is going on here?’)
• Physical ‘evidence’ generated in the experiments:
  • Sketches of garments with notes
  • Sketches of patterns on graph paper, with notes
  • Written notes (What kinds of notes? Reflective, descriptive, etc.)
  • Paper patterns (with notes)
  • Card patterns (with notes),
  • Fabric toiles (with notes)
  • Photographs
• Connection between thinking and physical evidence: How do I show what I was thinking while I was creating the different aspects of the evidence? Are the notes enough, and if not, why not?
• If I carefully date and time all of the above evidence, a chronological analysis of each experiment is possible. I can talk through the evidence in chronologically, recording and later transcribing this
talking, I can then analyse the talking itself. Do I need to do this?

- Involvement of peers? Who, why, what?
- At this point, 8 December 2006, I think videotaping the experiments and then talking through the video will produce an unmanageable amount of data that would need transcribing.

A question about production cutting

Normally in mass production, the pieces of a garment are plotted on a rectangular length of fabric. This is because it is fast to cut a roll of fabric into rectangles of uniform size. These rectangles are then placed on top of each other and several garments are then cut at once. Is it feasible to cut a roll of fabric up into lengths with non-linear ends? Is zero-fabric-waste fashion design (and all clothing production) limited to working within a rectangle of fabric? One experiment could involve a designing within a piece that didn’t have non-linear ends; note that to eliminate waste the ends do have to be exactly the same.

Aspects not yet covered by the below experiments:

What kind of researching is this? (See Datum introduction)

Can ‘wasted’ fabric be incorporated into ‘decorative’ elements? This could be explored more in the collection. For example, it seems quite easy to make a ‘conventional’ t-shirt and design an appliqué using the waste pieces.

Curves: can these be eliminated with straight lines through the displacement of pieces in relation to one another? How can curves be ‘force’ to interlock?

EXPERIMENT 1

Use the sketch and pattern of an existing design, and test various ways of placing the pattern pieces on a particular fabric width. When the least wasteful way of cutting the garment has been discovered, look at the gaps between the pattern pieces (fabric waste) and begin to redesign the garment by incorporating these gaps into it. Use sketching, informed by what is happening on pattern, to explore different possibilities of incorporating the wasted fabric into design. Modify the patterns until waste has been eliminated. (Is zero-waste more important than the design outcome here? Should it be?)

Questions this experiment will address:

What are the implications of trying to eliminate fabric waste from an existing, ‘wasteful’ design? How much modification does the design need? Can the amount of change be quantified?
How can sketching be used in designing out fabric waste?
What advantages does designing through sketching present? What disadvantages does it present?
What advantages does designing through patternmaking present? What disadvantages does it present?

EXPERIMENT 2

This experiment draws from the works of Yoshiki Hishinuma, Yeohlee Teng, Issey Miyake and Julian Roberts, among others.

Decide on the garment type and begin to draw interlocking shapes on a rectangular length of fabric and see what kind of garment can be made out of these shapes. (This experiment could be conducted separately for different garment types.) There are three segments to this experiment, differentiated by the types of shapes to be drawn on the length of fabric:

- Draw only rectangular interlocking shapes to make a garment.
- Draw only curved interlocking shapes to make a garment.
- Draw a combination of rectangular and curved interlocking shapes to make a garment.

The same could be done on graph paper; if fabric width is determined, and the garment size (for example, men’s 48) is known, it may be possible to plan and design the pattern to scale, but perhaps much faster.

Questions this experiment will address:

What are the implications of this kind of designing, where the garment is related back to the body after its patterns have been designed? This kind of designing does not rely on sketching initially to relate the garment to the body. Although fabric waste reduction/elimination is not a goal in his work, Julian Roberts exhibits a similar approach in his designing. The patterns of the garment are designed and the garment is made up to find out what it looks like; sketching is not used. How well Roberts is able to predict the final appearance of the garment, and its relationship to the body, is unclear. There is some evidence (Quinn, 2002) that Roberts allows a degree of unpredictability in his garments.

Is it that clear-cut: When designing through sketching, one tends to relate the garment to the body? Through patternmaking it may be easier to design independently of the body initially, and once the issue of waste has been addressed, relate the garment back to the body.

What about sketching quick pattern layouts, as opposed to sketching garments? Is this a different type of sketching? (See graph paper above)

Is it through experience or practice that one becomes able to consider fabric waste and the body
on pattern simultaneously?

Are there different levels of relating the garment to the body? For example, a fitted shirt with darts and a close-fitting collar echoes the body in a way that the body is identifiable in the garment even when it is not worn. On the other hand, the jumpsuit made of triangles by Hishinuma gives some indication of the body through its openings, but when not worn, it is difficult to ascertain how the garment is worn and what it looks like when it’s worn.

EXPERIMENT 4 (Not enough ‘meat’ on the bones)

Working on a mannequin, design a garment from one rectangular piece of fabric, slashing into the piece and then displacing the slashes onto other parts of the slashed piece. If an entire piece is cut away from the main fabric rectangle, this piece is to be incorporated into the garment somehow.

Questions this experiment will address:
What are the implications of waste elimination if the piece of fabric isn’t broken up in the first place? When designing through sketching, one tends to divide the garment up with seams. This goes back to one of the fashion design fundamentals: line. One common way of creating line in a garment is through seaming. The pieces of the garment are thus determined in sketch; to eliminate waste, these then would need to be interlocking when flat.

EXPERIMENT 5 (late in series of experiments/ in the collection?)

This experiment will draw from the findings of experiment 1.

Design and patternmake two garments simultaneously in the same fabric, within one length of fabric. Before commencing the experiment, the garment types (e.g. a jacket and a pair of trousers) need to be determined. The pattern pieces of the two garments’ components will be mixed within the one length, and they are cut together.

Questions this experiment will address:
Is it easier to eliminate fabric waste by designing more than one garment together? Men's suit, whether two- or three-piece, are cut together, and Teng maximised a 7-metre piece of fabric by designing three different dresses within it simultaneously.

What does one need to know about sizing if designing like this? If the garments form a suit, they need to be for the same size.

What does one need to know about sales strategy if designing like this? For example, are
these garments going to be sold together, like a suit, or are they two ‘independent’ designs, to be sold separately?

**EXPERIMENT 6 (late in series of experiments/ in the collection?)**

Design and patternmake a zero-waste garment in a particular fabric width. Then try to adapt the same garment design to a different fabric width. Is this done by trying to plot the largest pattern pieces first, and then filling the gaps with smaller ones, and filling any further gaps through modifying the garment design?

*Questions this experiment will address:*

*How much modification is necessary?*

**Experiment 8 (late in series of experiments)**

Using a zero-fabric-waste from an earlier experiment, examine the interlocking of the patterns, trying to assess how the same garment can now be adapted to different sizes. Develop two versions of the design, one a size smaller and one larger than the original design, using one of the size charts used widely by industry.

*Questions this experiment will address:*

*Can a size range of a zero-fabric-waste garment be created without modifying the design? Width-wise grading might be possible if garment was cut on cross-grain, i.e. perpendicular to the selvages.*

*How much modification is needed?*

*Is it possible to include the grade amount in the seam allowance? This would mean that each size would have different amounts of allowance on some seams. What are the implications with this? How feasible would this be in industry?*

*Questions this experiment is likely to raise:*

*What alternatives exist to traditional grading in order to achieve a size range of a garment design?*

*What level of variation in appearance/proportion between each size would be deemed acceptable at retail level?*
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<tr>
<td>116</td>
<td>12-Apr-07</td>
<td>90</td>
<td>Jacket (general)</td>
<td>Square-cut: not necessary? Similar to square-cut shirt because for same part of body. Tailored: with two-piece sleeve and collar-revere.</td>
<td>Procedure</td>
<td>Garment-specific part</td>
<td>N/A</td>
<td>N/A</td>
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<td>118</td>
<td>12-Apr-07</td>
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<td>Shirt (general)</td>
<td>Square-cut shirts.</td>
<td>Design through sketch</td>
<td>Garment-specific part</td>
<td>Body and design</td>
<td>Garment fit</td>
<td></td>
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<tr>
<td>119</td>
<td>16-Apr-07</td>
<td>91</td>
<td>Jacket (general)</td>
<td>[pointing to sketch above] This shape would work better as a jacket.</td>
<td>Design potential</td>
<td>Openness to possibility</td>
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<td>355</td>
<td>18-Jan-08</td>
<td>310</td>
<td>Jacket 1001</td>
<td>Photograph of front drape.</td>
<td>Design through drape</td>
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<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>356</td>
<td>18-Jan-08</td>
<td>311</td>
<td>Jacket 1001</td>
<td>Photograph of back drape.</td>
<td>Design through drape</td>
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<td>N/A</td>
<td>N/A</td>
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<tr>
<td>357</td>
<td>18-Jan-08</td>
<td>312</td>
<td>Jacket 1001</td>
<td>Two photographs of shoulder details.</td>
<td>Design through drape</td>
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<td>N/A</td>
<td>N/A</td>
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<tr>
<td>358</td>
<td>18-Jan-08</td>
<td>313</td>
<td>Jacket 1001</td>
<td>Poss. Pkt details.</td>
<td>Three photographs of drape details</td>
<td>Design through drape</td>
<td>Openness to possibility</td>
<td>N/A</td>
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</table>
Jacket 1001: Garment not developed past first drape.
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<td>12-Apr-07</td>
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<td>Jacket (general)</td>
<td>Square-cut; not necessary? Similar to square-cut shirt because for same part of body. Tailored; with two-piece sleeve and collar-revear.</td>
<td>Procedure</td>
<td>Garment - specific part</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>118</td>
<td>12-Apr-07</td>
<td>91</td>
<td>Shirt (general)</td>
<td>Square-cut shirts.</td>
<td>Front and back sketch of square-cut shirt that is based on a jacket I made in 1969. Comment pointing to shoulder: &quot;Yoke/ Gusset at neck to accommodate slope of shoulder.&quot;</td>
<td>Design through sketch</td>
<td>Garment - specific part</td>
<td>Body and design</td>
<td>Garment fit</td>
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<td>N/A</td>
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<td>16-Apr-07</td>
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<td>Jacket (general)</td>
<td>[pointing to sketch above] This shape would work better as a jacket.</td>
<td>Design potential</td>
<td>Openness to possibility</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>201</td>
<td>4-Jun-07</td>
<td>155</td>
<td>Jacket 1002</td>
<td>To do at home: choose an old USVSLU garment to turn into a zero-waste design. OR should this be part of the collection? Rather than one of the experiments. Or both? Because it would be interesting to see how difficult this is in general, maybe I should start with the jacket and re-design that. Possibilities: Juha denim jacket? Vanity tee? Snake tee?</td>
<td>Research administration</td>
<td>Fabric waste</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>203</td>
<td>4-Jun-07</td>
<td>156</td>
<td>Jacket 1002</td>
<td>Juha jacket without pockets.</td>
<td>Sketch of Juha jacket [USVSLU winter 2004]</td>
<td>Design through sketch</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>423</td>
<td>1-May-08</td>
<td>354</td>
<td>Jacket 1002</td>
<td>Patterns for Juha jacket late 2003. This is the jacket I chose for experiment 1 - it mirrors Andrew Hague's account of making the shirt in Fletcher's book. This experiment is better done now than earlier as I now have a clear sense of the collection &amp; how it'll look. And no, waste is not more important than &quot;design&quot; (see brief opposite).</td>
<td>Photograph of jacket pattern pieces</td>
<td>Shape awareness</td>
<td>Fabric Waste</td>
<td>Andrew Hauge</td>
<td>Kate Fletcher</td>
<td>Aesthetics in design</td>
<td>Collector development</td>
</tr>
<tr>
<td>424</td>
<td>1-May-08</td>
<td>355</td>
<td>Jacket 1002</td>
<td>Experiment 1 brief. Highlighted: &quot;Is zero-waste more important than the design outcome here?&quot; Comment: &quot;No, the design is what matters.&quot;</td>
<td>Three photographs of the jacket from 2003.</td>
<td>Research administration</td>
<td>Aesthetics in design</td>
<td>Fabric Waste</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>451</td>
<td>1-May-08</td>
<td>390</td>
<td>Jacket 1002</td>
<td>Sketch of cropped denim jacket, and sketch of complete look with denim jacket, tabbacoth shirt, leggings.</td>
<td>Design through sketch</td>
<td>Collection development</td>
<td>Design in context</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>489</td>
<td>30-May-11</td>
<td>403</td>
<td>Jacket 1002</td>
<td>This was suggestive of breaking up the large check pattern with lots of seams</td>
<td>Sketch of jacket front.</td>
<td>Design through sketch</td>
<td>Striped, printed, checked fabric</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>500</td>
<td>14-Jun-08</td>
<td>424</td>
<td>Jacket 1002</td>
<td>An exercise to do: place jacket (Juha) pieces directly onto calico: 'design' leftovers (pockets etc). Maybe leave collar out, or only trace in edge that fits into neck. Same with Sleeves.</td>
<td>Research administration</td>
<td>Fabric Waste</td>
<td>Garment component</td>
<td>Leftover fabric</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Jacket 1002: This was going to be based on jacket I had designed in 2002. The garment was not developed beyond first toile.
<table>
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<td>Jacket (general)</td>
<td>Square-cut: not necessary? Similar to square-cut shirt because for same part of body. Tailored: with two-piece sleeve and collar-revers.</td>
<td></td>
<td>Procedure</td>
<td>Garment - specific part</td>
<td>N/A</td>
<td>N/A</td>
</tr>
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<td>118</td>
<td>12-Apr-07</td>
<td>91</td>
<td>Shirt (general)</td>
<td>Square-cut shirts.</td>
<td>Front and back sketch of square-cut shirt that is based on a jacket I made in 1999. Comment pointing to shoulder: “Yoke/Gusset at neck to accommodate slope of shoulder.”</td>
<td>Design through sketch</td>
<td>Garment - specific part</td>
<td>Body and design</td>
<td>Garment fit</td>
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<td>119</td>
<td>16-Apr-07</td>
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<td>Jacket (general)</td>
<td>[pointing to sketch above]: This shape would work better as a jacket.</td>
<td></td>
<td>Design potential</td>
<td>Openness to possibility</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>435</td>
<td>9-Apr-08</td>
<td>376</td>
<td>Jacket 1003</td>
<td>Tunnel jacket/Velour. First toile/cotton jersey. Using two-piece sleeve from Juha jacket. Velour - one-piece.</td>
<td></td>
<td>Design through pattern</td>
<td>Julian Roberts</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>436</td>
<td>13-Apr-08</td>
<td>376</td>
<td>Jacket 1003</td>
<td>The first two go's at this didn't work; I inadvertently twisted the whole thing &amp; it was impossible to get on. Another read of Roberts' school made me realise what went wrong.</td>
<td>Two pattern layout sketches with comments “This what I should have done” and “This is what I did - twice - NEXT!” Four photographs of toile, and a photograph of flat fabric after cutting sleeves to show pattern layout.</td>
<td>Design through pattern</td>
<td>Julian Roberts</td>
<td>Twisting</td>
<td>Space awareness</td>
</tr>
<tr>
<td>437</td>
<td>2-May-08</td>
<td>377</td>
<td>Jacket 1003</td>
<td>This was something I tried two weeks ago; instead of cutting out circles like Roberts above, I cut out a top sleeve &amp; undersleeves for a jacket, creating the holes for the tunnel. I didn't look at Roberts' notes, though, &amp; sewed the holes together wrong; it was not possible to get the body through as the tunnel was not continuous - rather, there was one main tunnel &amp; one internal tunnel. What was exciting - no knowing at all what would emerge from this free-hand exercise.</td>
<td>Print-out from Julian Roberts' school showing tunnel technique.</td>
<td>Design through pattern</td>
<td>Julian Roberts</td>
<td>Uncertainty regarding outcome</td>
<td>Article/referen e</td>
</tr>
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</table>
Jacket 1003: An experiment with Julian Roberts’s subtraction cutting. This was not taken past first drape.
<table>
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<tr>
<td>118</td>
<td>12-Apr-07</td>
<td>50</td>
<td>Jacket (general)</td>
<td>Square-cut not necessary? Small to square-cut dress because for same part of body, tailored with no pleats and no collar.</td>
<td>Front and Back sketch of square-cut dress that is based on a jacket made in 1995. Concept: drawing is of a dress.</td>
<td>Procedure</td>
<td>Design</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>118</td>
<td>12-Apr-07</td>
<td>51</td>
<td>Skirt (general)</td>
<td>Square-cut SHHH!</td>
<td>Front and Back sketch of square-cut dress</td>
<td>Design through sketch</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>119</td>
<td>15-Apr-07</td>
<td>51</td>
<td>Skirt (general)</td>
<td>[No text]</td>
<td>Front and Back sketch of square-cut dress</td>
<td>Design through sketch</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>461</td>
<td>11-May-08</td>
<td>507</td>
<td>Jacket 1034</td>
<td>[No text]</td>
<td>Design through sketch</td>
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<td>511</td>
<td>Jacket 1034</td>
<td>[No text]</td>
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<td>Jacket 1034</td>
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**Appendix C**

- Mixed prints: Stintman 102, 200 needles made on stintman. Width: 1.25m. AU: 12 needles for a coat (maybe a waistcoat?). Guess that I can't stitch the fabric I want. I might buy two of these. (5 minutes later) I don't want to have two matching the size, I can start sewing. Suits: cut out - Julian Roberts. 15th May 2008. 10 pairs for use.

- Mixed prints: Stintman 102, 200 needles made on stintman. Width: 1.25m. AU: 12 needles for a coat (maybe a waistcoat?). Guess that I can't stitch the fabric I want. I might buy two of these. (5 minutes later) I don't want to have two matching the size, I can start sewing. Suits: cut out - Julian Roberts. 15th May 2008. 10 pairs for use.

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- Mixed prints: Stintman 102, 200 needles made on stintman. Width: 1.25m. AU: 12 needles for a coat (maybe a waistcoat?). Guess that I can't stitch the fabric I want. I might buy two of these. (5 minutes later) I don't want to have two matching the size, I can start sewing. Suits: cut out - Julian Roberts. 15th May 2008. 10 pairs for use.
Jacket 1004: Coat and vest designed from two blankets. Coat was designed through “conventional methods”; vest was draped using leftover “waste” pieces.
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<td>Jacket (general)</td>
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<td></td>
<td>Procedure</td>
<td>Garment-specific part</td>
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<tr>
<td>118</td>
<td>12-Apr-07</td>
<td>91</td>
<td>Shirt (general)</td>
<td>Square-cut shirts.</td>
<td>Front and back sketch of square-cut shirt that is based on a jacket I made in 1999. Comment pointing to shoulder: &quot;Yoke/Gusset at neck to accommodate slope of shoulder.&quot;</td>
<td>Design through sketch</td>
<td>Garment-specific part</td>
<td>Body and design</td>
<td>Garment fit</td>
</tr>
<tr>
<td>119</td>
<td>16-Apr-07</td>
<td>91</td>
<td>Jacket (general)</td>
<td>[pointing to sketch above]: This shape would work better as a jacket.</td>
<td></td>
<td>Design potential</td>
<td>Openness to possibility</td>
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<td>409</td>
<td>353</td>
<td>1005</td>
<td>Jacket ideas</td>
<td>Two sketches of jacket ideas</td>
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<td>N/A</td>
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<td>455</td>
<td>4-May-08</td>
<td>362</td>
<td>Jacket 1005</td>
<td>Sketch of jacket front with pattern sketch and three detail sketches indicating selvedge.</td>
<td></td>
<td>Design through sketch</td>
<td>Fabric width</td>
<td>Space awareness</td>
<td>N/A</td>
</tr>
<tr>
<td>464</td>
<td>15-May-08</td>
<td>369</td>
<td>Jacket 1005</td>
<td>Waistband to finish B50. P56 = 105. 18cm wide. If tuck here, no need for tuck @ U/A?</td>
<td>Four sketches showing front, waistband detail front and back, pattern layout</td>
<td>Design through sketch</td>
<td>Design through pattern</td>
<td>Body measurement</td>
<td>Design details</td>
</tr>
</tbody>
</table>
Jacket 1005: Denim coat
This was based on a womenswear coat I had designed in 1999.
Appendices 189

Pant 2001: First square-cut trousers, based on Thayaht’s tuta, designed on graph paper.
I recalled the gusset wrong; I made it a square instead of a triangle, with somewhat catastrophic effect around front and back crotch. In terms of insight within the study, this early garment was significant as I realised that the criteria of look and fit could not be compromised by the criterion of fabric waste.
<table>
<thead>
<tr>
<th>Case</th>
<th>Year</th>
<th>Event Date</th>
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<tbody>
<tr>
<td>1</td>
<td>1985</td>
<td>February</td>
<td>Event A</td>
</tr>
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<td>2</td>
<td>1990</td>
<td>March</td>
<td>Event B</td>
</tr>
<tr>
<td>3</td>
<td>1995</td>
<td>April</td>
<td>Event C</td>
</tr>
<tr>
<td>4</td>
<td>2000</td>
<td>May</td>
<td>Event D</td>
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**Notes:**
- Event A occurred due to unforeseen circumstances.
- Event B was planned in advance.
- Event C was delayed by two weeks.
- Event D was postponed for a year due to budget constraints.
Pant 2002: Second square-cut trouser, with waist lowered from Pant 2001. Not taken beyond second toile, but this garment was significant in insights about trouser fly construction in one piece, and external dart construction.
<table>
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<td>192</td>
<td>30-Mar-27</td>
<td>9</td>
<td>Plant (no today)</td>
<td>Plant out is firm - no leaves growing. More soil - got some signs of growth.</td>
<td></td>
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</tbody>
</table>
Pant 2003: Tailored, “conventionally” cut jeans. The main insight was that while the pattern layout may be symmetrical, the garment need not be.
194 | APPENDICES
Pant 2004: Experimental square-cut trousers that became two garments: One in a large wool check, the other in denim.
Pant 2005: Square-cut, tapered trousers. Final pattern was lost.
<table>
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<td>7 Mar 78</td>
<td>6</td>
<td>Paint/线路画</td>
<td>same as above/ see 19857</td>
<td>Paint/线路画</td>
<td>Design/ flush/ flow</td>
<td>Fabric/ Organisation</td>
<td>Printed/ registration</td>
<td>Inlay/ jamb/ tool</td>
<td>Anti-collision/ decoration</td>
<td>Noticeable/ matted</td>
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<td>19857</td>
<td>8 Nov 78</td>
<td>8</td>
<td>Paint/线路画</td>
<td>Paint out/ no pattern/ fade</td>
<td>Paint/线路画</td>
<td>Design/ flush/ flow</td>
<td>Fabric/ Organisation</td>
<td>Printed/ registration</td>
<td>Inlay/ jamb/ tool</td>
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<tr>
<td>87</td>
<td>13 Oct 78</td>
<td>1</td>
<td>Paint/线路画</td>
<td>Different/ pattern/ paint/ new grey/ no isolated leg segment/ blank/ cut</td>
<td>Paint/线路画</td>
<td>Design/ flush/ flow</td>
<td>Fabric/ Organisation</td>
<td>Printed/ registration</td>
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<td>Anti-collision/ decoration</td>
<td>Noticeable/ matted</td>
<td>NA</td>
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</tbody>
</table>
Pant 2007: Leggings in stripe interlock.

A: Left top leg appliqué
B: Right bottom leg appliqué
C: CF pouch
D: Right bum appliqué
E: Left bottom leg appliqué
F: Pouch filling
G: Side pouch
H: Right bottom leg appliqué
I: Right cuff appliqué
J: Left top appliqué
K: Left bottom leg appliqué
<table>
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<tr>
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<td>93.83</td>
<td>6-07</td>
<td>144</td>
<td>Shirt</td>
<td>Short sleeve, point collar, button front, pocket, short sleeves, short back.</td>
<td>PATTERNS: Not shown.</td>
<td>Sheath design</td>
<td>Story and</td>
<td>Symmetry and</td>
<td>Fabric Weights</td>
<td>Shape Awareness</td>
<td>Design through pattern</td>
<td></td>
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<tr>
<td>93.83</td>
<td>4-09</td>
<td>128</td>
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<td>PATTERNS: Not shown.</td>
<td>Sheath design</td>
<td>Story and</td>
<td>Symmetry and</td>
<td>Fabric Weights</td>
<td>Shape Awareness</td>
<td>Design through pattern</td>
<td></td>
<td></td>
</tr>
<tr>
<td>115</td>
<td>8-09</td>
<td>96</td>
<td>Shirt</td>
<td>Square cut, slit, need to develop pattern &amp; time. Other button hole too tight need one separate. Tacked hem, about 1/2 to be taken off.</td>
<td>PATTERNS: Not shown.</td>
<td>Sheath design</td>
<td>Story and</td>
<td>Symmetry and</td>
<td>Fabric Weights</td>
<td>Shape Awareness</td>
<td>Design through pattern</td>
<td></td>
<td></td>
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<tr>
<td>115</td>
<td>8-09</td>
<td>91</td>
<td>Skirt</td>
<td>Square cut, slit, need to develop pattern &amp; time.</td>
<td>PATTERNS: Not shown.</td>
<td>Sheath design</td>
<td>Story and</td>
<td>Symmetry and</td>
<td>Fabric Weights</td>
<td>Shape Awareness</td>
<td>Design through pattern</td>
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<tr>
<td>120</td>
<td>12-09</td>
<td>31</td>
<td>Skirt</td>
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<td>PATTERNS: Not shown.</td>
<td>Sheath design</td>
<td>Story and</td>
<td>Symmetry and</td>
<td>Fabric Weights</td>
<td>Shape Awareness</td>
<td>Design through pattern</td>
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<td>Story and</td>
<td>Symmetry and</td>
<td>Fabric Weights</td>
<td>Shape Awareness</td>
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<td>9-09</td>
<td>111</td>
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<td>Story and</td>
<td>Symmetry and</td>
<td>Fabric Weights</td>
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<td>Sheath design</td>
<td>Story and</td>
<td>Symmetry and</td>
<td>Fabric Weights</td>
<td>Shape Awareness</td>
<td>Design through pattern</td>
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<td>113</td>
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<td>PATTERNS: Not shown.</td>
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<td>Story and</td>
<td>Symmetry and</td>
<td>Fabric Weights</td>
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<td>Fabric Weights</td>
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<td>Symmetry and</td>
<td>Fabric Weights</td>
<td>Shape Awareness</td>
<td>Design through pattern</td>
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</table>
Shirt 3001: Tailored shirt with body cut in one piece. Although not taken beyond second toile in the first phase, this shirt became the basis for the Endurance Shirt I exhibited in Fashioning Now in 2009. In particular, the experiments with interlocking sleeves proved significant.
Shirt 3002: Square-cut shirt in silk/hemp and vintage kimono remnants.
Shirt 3003: Shirt designed to use up one vintage, circular tablecloth. Final garment was lost.
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<td>2808</td>
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<td>Shirt</td>
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<td>Body build</td>
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Shirt 3004: Pattern based on Shirt 3001. The aim was to use a vintage kimono remnant. The garment was not developed past first toile.
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Shirt 3005: The cut is based on Shirt 3002. Both garment and final pattern was lost.
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**Appendices**
T-Shirt 4001: Jersey top cut with sleeves cut in one with body. Although the garment not developed beyond first toile, it was significant in terms of insight into shape and space awareness.
<table>
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<th>Content (verbatim)</th>
<th>Image/Visual/Sketch</th>
<th>Code 1</th>
<th>Code 2</th>
<th>Code 3</th>
<th>Code 4</th>
<th>Code 5</th>
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<tbody>
<tr>
<td>111</td>
<td>12-Apr-97</td>
<td>97</td>
<td>T-shirt (general)</td>
<td>Closefit: T-shirt/Silk-chiffon (meaning garments cut from knitted fabrics)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Squares-cut: explore in new circle of textile with textile. Tailed, tshirt:</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>tailed; tailoring for several reasons: maintaining design, cut on the bias.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>114</td>
<td>15-Apr-97</td>
<td>99</td>
<td>T-shirt (general)</td>
<td>Pinned on late T-shirt as well as the one on p. 68 - not sure where either</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>is going yet. I've tried on this one yesterday &amp; thought it had more potential</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>than when I first had a look at it two weeks ago. Need to rest it over the</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>next couple of days. The idea of fibre/line looks to me &amp; the garment feels</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>quite comfortable - it's not falling off as much as I thought it would. I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>do think it may still need some kind of harness to anchor it on.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>358</td>
<td>16-Jan-98</td>
<td>314</td>
<td>T-shirt (no code)</td>
<td>Photo different in trend to anything else. Original sketch: T-shirt Nov. 97.</td>
<td>Photograph of drape back.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>360</td>
<td>16-Jan-98</td>
<td>315</td>
<td>T-shirt (no code)</td>
<td>Design through drape</td>
<td>Striped, printed, checked fabric</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>361</td>
<td>16-Jan-98</td>
<td>316</td>
<td>T-shirt (no code)</td>
<td>Design through drape</td>
<td>Striped, printed, checked fabric</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>362</td>
<td>16-Jan-98</td>
<td>317</td>
<td>T-shirt (no code)</td>
<td>Design through drape</td>
<td>Striped, printed, checked fabric</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
T-Shirt 4002: Based on T-Shirt 4001, not developed beyond first toile.
T-Shirt 4003: Based on T-Shirt 4002, garment not developed beyond first toile.
<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
<th>Column 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data 1</td>
<td>Data 2</td>
<td>Data 3</td>
<td>Data 4</td>
<td>Data 5</td>
</tr>
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<td>Data 6</td>
<td>Data 7</td>
<td>Data 8</td>
<td>Data 9</td>
<td>Data 10</td>
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<tr>
<td>Data 11</td>
<td>Data 12</td>
<td>Data 13</td>
<td>Data 14</td>
<td>Data 15</td>
</tr>
</tbody>
</table>

Note: The table continues with similar formatting and data entries.
T-Shirt 4004: Hybrid tailored/square-cut over-sized t-shirt. Garment not developed beyond first toile.
220

APPENDIXES
T-Shirt 4005: Based on T-Shirt 4004, with sleeve cut from hem. Garment not developed beyond first toile.
<table>
<thead>
<tr>
<th>Entry</th>
<th>Date</th>
<th>Page</th>
<th>Department/ garment type</th>
<th>Contact (verbatim)</th>
<th>Image/Visual/Sketch</th>
<th>Code 1</th>
<th>Code 2</th>
<th>Code 3</th>
<th>Code 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>114</td>
<td>14-Mar</td>
<td>299</td>
<td>T-shirt (general)</td>
<td>We held on this shirt as well as the one on 1-18 - not sure where either    is going yet. I feel that this one is going to work well with the others we have in mind now. I feel that this one is going to work well with the others we have in mind now.</td>
<td>T-shirt with pocket front</td>
<td>Design potential;果然</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>354</td>
<td>18-Jan</td>
<td>330</td>
<td>T-shirt 40006</td>
<td>Quarter-cut, pocket, top, pocket, back. T-shirt with pocket front.</td>
<td>Photograph of design</td>
<td>Design through sketch</td>
<td>Striped fabric; checkered fabric; N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>355</td>
<td>18-Jan</td>
<td>331</td>
<td>T-shirt 40006</td>
<td>No pocket, left to front anything else. T-shirt with pocket front.</td>
<td>Photograph of design</td>
<td>Design through sketch</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>356</td>
<td>18-Jan</td>
<td>332</td>
<td>T-shirt 40006</td>
<td>Photograph of design.</td>
<td>Photograph of design</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>357</td>
<td>18-Jan</td>
<td>333</td>
<td>T-shirt 40006</td>
<td>Design through sketch.</td>
<td>Design through sketch</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>358</td>
<td>18-Jan</td>
<td>334</td>
<td>T-shirt 40006</td>
<td>Photograph of shoulder straps.</td>
<td>Design through sketch</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>359</td>
<td>18-Jan</td>
<td>335</td>
<td>T-shirt 40006</td>
<td>Design through sketch.</td>
<td>Design through sketch</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>360</td>
<td>7-Feb</td>
<td>354</td>
<td>T-shirt 40006</td>
<td>Photograph of design.</td>
<td>Design through sketch</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>448</td>
<td>3-May</td>
<td>385</td>
<td>T-shirt 40006</td>
<td>Design through sketch.</td>
<td>Design through sketch</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>502</td>
<td>14-Jun</td>
<td>475</td>
<td>T-shirt 40006</td>
<td>Design through sketch.</td>
<td>Design through sketch</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>503</td>
<td>14-Jun</td>
<td>476</td>
<td>T-shirt 40006</td>
<td>Design through sketch.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>504</td>
<td>14-Jun</td>
<td>477</td>
<td>T-shirt 40006</td>
<td>Design through sketch.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>505</td>
<td>15-Jun</td>
<td>478</td>
<td>T-shirt 40006</td>
<td>Design through sketch.</td>
<td>Design through sketch</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>517</td>
<td>27-Aug</td>
<td>435</td>
<td>T-shirt 40006</td>
<td>Design through sketch.</td>
<td>Design through sketch</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>518</td>
<td>28-Aug</td>
<td>436</td>
<td>T-shirt 40006</td>
<td>Design through sketch.</td>
<td>Design through sketch</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>528</td>
<td>30-Jun</td>
<td>446</td>
<td>T-shirt 40006</td>
<td>Design through sketch.</td>
<td>Design through sketch</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>529</td>
<td>30-Jun</td>
<td>447</td>
<td>T-shirt 40006</td>
<td>Design through sketch.</td>
<td>Design through sketch</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>530</td>
<td>3-Jun</td>
<td>454</td>
<td>T-shirt 40006</td>
<td>Design through sketch.</td>
<td>Design through sketch</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>531</td>
<td>15-Jul</td>
<td>455</td>
<td>T-shirt 40006</td>
<td>Design through sketch.</td>
<td>Design through sketch</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
T-Shirt 4006: Hoodie in stripe interlock knit.

![Diagram of T-Shirt 4006 layout with hood and sleeve components labeled.]

- Fabric width 172cm
- Left body
- Left sleeve
- Right body
- Right sleeve
- Hood lining
- Cuff
- Hem
- Top right facing
- Bottom right facing
- CB
- CF

Key Points:
A: Hood keeper
B: Eyelet backing pieces
<table>
<thead>
<tr>
<th>Entry</th>
<th>Date</th>
<th>Page</th>
<th>Experiment/ garment type</th>
<th>Content characteristics</th>
<th>Image/Visualization</th>
<th>Code 1</th>
<th>Code 2</th>
<th>Code 3</th>
<th>Code 4</th>
<th>Code 5</th>
<th>Code 6</th>
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<tbody>
<tr>
<td>111</td>
<td>12 Jul 97</td>
<td>97</td>
<td>T-shirt [general]</td>
<td>Cotton t-shirts made of knit cotton 100%</td>
<td>Photograph of drapes back</td>
<td>Visited</td>
<td>Referencing in design</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>113</td>
<td>15 Jul 97</td>
<td>99</td>
<td>T-shirt [general]</td>
<td>White knit fabric  t-shirt</td>
<td>Photograph of drapes back</td>
<td>Visited</td>
<td>Visited</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>359</td>
<td>18 Jan 98</td>
<td>314</td>
<td>T-shirt [no code]</td>
<td>T-shirt made of knit cotton</td>
<td>Photograph of drapes back</td>
<td>Visited</td>
<td>Visited</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>350</td>
<td>18 Jan 98</td>
<td>315</td>
<td>T-shirt [no code]</td>
<td>T-shirt made of knit cotton</td>
<td>Photograph of drapes back</td>
<td>Visited</td>
<td>Visited</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>351</td>
<td>18 Jan 98</td>
<td>316</td>
<td>T-shirt [no code]</td>
<td>T-shirt made of knit cotton</td>
<td>Photograph of drapes back</td>
<td>Visited</td>
<td>Visited</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>365</td>
<td>15 Jan 98</td>
<td>317</td>
<td>T-shirt [no code]</td>
<td>T-shirt made of knit cotton</td>
<td>Photograph of drapes back</td>
<td>Visited</td>
<td>Visited</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>366</td>
<td>5 Feb 98</td>
<td>365</td>
<td>T-shirt [no code]</td>
<td>T-shirt made of knit cotton</td>
<td>Photograph of drapes back</td>
<td>Visited</td>
<td>Visited</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>367</td>
<td>5 Feb 98</td>
<td>366</td>
<td>T-shirt [no code]</td>
<td>T-shirt made of knit cotton</td>
<td>Photograph of drapes back</td>
<td>Visited</td>
<td>Visited</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>377</td>
<td>5 Feb 98</td>
<td>367</td>
<td>T-shirt [no code]</td>
<td>T-shirt made of knit cotton</td>
<td>Photograph of drapes back</td>
<td>Visited</td>
<td>Visited</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>384</td>
<td>30 May 98</td>
<td>406</td>
<td>T-shirt [no code]</td>
<td>T-shirt made of knit cotton</td>
<td>Photograph of drapes back</td>
<td>Visited</td>
<td>Visited</td>
<td>N/A</td>
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<tr>
<td>400</td>
<td>17 Jul 98</td>
<td>480</td>
<td>T-shirt [no code]</td>
<td>T-shirt made of knit cotton</td>
<td>Photograph of drapes back</td>
<td>Visited</td>
<td>Visited</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Notes:
- **Entry** refers to the entry number from the table.
- **Date** is the date of the entry.
- **Page** is the page number from the table.
- **Experiment/ garment type** describes the type of experiment or garment.
- **Content characteristics** provides details about the experiment or garment's characteristics.
- **Image/Visualization** indicates whether an image or visualization was used.
- **Code 1** to **Code 6** refer to different codes or categories used in the table.
APPENDIX C:

JOURNAL TRANSCRIPTION, CODES AND CATEGORIES

CATEGORIES – UPDATED 20 JANUARY 2012

Body and Garment
Body measurement
Body and design
Comfort in wearing
Design through drape
Garment Fit
Garment dimension
Garment measurement
Garment type
Garment component
Masculinity
Openness to possibility
Space awareness

Time and design
Article/reference
Design decision
Design ideation
Garment durability
Future transformability
Garment repairability
Grading patterns
Article/reference
Laundering [LCA]
Openness to possibility
Order of pattern pieces
Perceived mistake
Procedure
Time gap
Uncertainty regarding outcome

Pattern cutting as fashion design tool
2D/3D visualization
Aesthetics in design

Body measurement
Breaking rules
Creative move
Design decision
Design for manufacture
Design ideation
Design limitation
Design through pattern
Fabric grain
Fabric waste
Fabric width
Garment measurement
Garment type
Grading patterns
Increasing complexity
Interlocking shapes
Julian Roberts
Leftover fabric
Marker planning
Number and size of pattern pieces
Openness to possibility
Pattern alteration
Pattern sketch
Procedure
Reducing complexity
Scale – Management strategies
Seam elimination
Shape awareness
Shape library
Space awareness
Splitting and slashing shapes

Design for manufacture
Breaking rules
Construction Design  
Cutting  
Design briefs  
Design for manufacture  
Design in context  
Economic saving  
Fabric grain  
Fabric sourcing  
Fabric waste  
Garment component  
Garment yield  
Grading patterns  
Marker planning  
Multiple fabrics  
Procedure  
Seamless knitting  
Shape library  
Striped, printed, checked fabric  

**Challenges for fabric waste elimination through design**  
2D/3D visualization  
Aesthetics in design  
Fabric grain  
Breaking rules  
Creative move  
Design decision  
Design for manufacture  
Design ideation  
Design limitation  
Design satisfaction  
Design through pattern  
Design through sketch  
Fabric waste  
Increasing complexity  
Marker planning  
Pattern alteration  
Perceived mistake  
Openness to possibility  
Reducing complexity  
Scale – management strategies  
Shape library  
Time gap  
Uncertainty regarding outcome  

**Opportunities for fabric waste elimination through design**  
2D/3D visualization  
Aesthetics in design  
Breaking rules  
Creative move  
Design for manufacture  
Design ideation  
Design potential  
Design through drape  
Design through pattern  
Design through sketch  
Economic saving  
Fabric manipulation  
Fabric waste  
Folding  
Future transformability  
Garment component  
Garment repairability  
Interlocking shapes  
Marker planning  
Openness to possibility  
Originality in design  
Pattern sketch  
Procedure  
Reducing complexity  
Referencing in design  
Scale – management strategies  
Seam elimination  
Seamless knitting  
Serendipity in design  
Shape awareness  
Shape library  
Space awareness  
Splitting and slashing shapes  
Symmetry and asymmetry  
Time gap  
Twisting  
Using photography in design

**Sketching as a fashion design tool**  
2D/3D visualization  
Aesthetics in design  
Creative move
Aesthetics in design
Garment component
Design decision
Design ideation
Design through sketch
Garment dimension
Openness to possibility
Pattern sketch
Procedure
Scale – management strategies
Serendipity in design
Shape awareness
Uncertainty regarding outcome

Successful strategies in fabric waste elimination – now combined with ‘Opportunities for fabric waste elimination’

References to literature and extant examples of zero-waste/less-waste fashion during practice
Andrew Hague
Article/reference
Bernard Rudofsky
David Pye
Design for manufacture
Dorothy Burnham
Article/reference
Julian Roberts
Kate Fletcher
Madeleine Vionnet
Mark Liu
Otto von Busch
Practice-based research
Rei Kawakubo
Research methodology
Sonia Delaunay
Julian Roberts
Thayaht
Yeohlee Teng
Yoshiki Hishinuma
Zandra Rhodes

Practice-based design research
Article/reference

Exhibition of project work
Article/reference
Design briefs
Design in context
Practice-based research
Reflective writing
Research method
Research administration

Fabric and fashion design
2D/3D visualization
Striped, printed, checked fabric
Design through drape
Fabric faces
Fabric grain
Fabric manipulation
Fabric sourcing
Fabric waste
Fabric width
Interlining
Leftover fabric
Multiple fabrics
Striped, printed, checked fabric

Design and sustainability
Aesthetics in design
Breaking rules
Fabric waste
Future transformability
Garment durability
Garment repairability
Kate Fletcher
Laundering [LCA]
Otto von Busch
<table>
<thead>
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<tr>
<td>1</td>
<td>4-Mar-07</td>
<td>2</td>
<td>T-shirt 4001</td>
<td>Two t-shirts were placed on the mannequin. The front and back were placed one piece in the same front, back, and top of sleeve in the same place. The shirts were placed on the mannequin. The front and back were placed one piece in the same front, back, and top of sleeve in the same place.</td>
<td>Photo of t-shirt draped front, grain illustrated</td>
<td>Design through Fabric Grain</td>
<td>N/A</td>
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<td>T-shirt 4001</td>
<td>Two t-shirts were placed on the mannequin. The front and back were placed one piece in the same front, back, and top of sleeve in the same place.</td>
<td>Photo of t-shirt draped front, grain illustrated</td>
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Notes: N/A = Not applicable
Design through sketch patternmaking. All have, to me, been important aspects of ideation the process but I could imagine another designer bypassing one, possibly two of the mediums. Note: initial idea was sketched roughly a week before the draping/patternmaking, possibly two of the mediums. Note: initial idea was sketched roughly a week before the draping/patternmaking.

Note: initial idea was sketched roughly a week before the draping/patternmaking.
It seems that when working on patterns, a question that becomes relevant is: "What could this shape become?" I think it's relevant when making a pattern piece, the piece might have a cut-away area of an irregular, trompe-l'oeil shape, yet if waste is to be eliminated, that shape needs to be part of the garment.

When making a pattern, I've only used the shape as a loose guide as it was roughly draped, I've never checked that it's back weren't long enough, nothing was "accurate". This is a very basic idea of shape. I imagine to cut out as a block or a cutting point for shaping the pattern corner. After the pattern is cut, the gusset looks more like a underside of a two-piece piece.

I usually mark a few pieces each and add these to my portfolio two years ago. I abandoned it because at waste point of view, I've decided to cover the loose point of view. However, I've underlined the quote: "How do I wrap an essentially two-dimensional form, fabric, around a three-dimensional body?" That's what the comment about all fashion design refers to.

I have a few ideas of how to make it so: 1) piece the gusset & fill the gaps left by the main piece, 2) cut neck area into 'wedges', leave or rather, develop into decorative details. This will now be shirred, tucked, etc. etc.

It seems that there's more than one way of approaching no-waste? The graph-paper way seems to attempt to fill the fabric while keeping all pattern pieces in check - 'keeping an eye on the pieces'. On the other hand, the t-shirt shown above, I think it is "accurate". The t-shirt is very basic in many other designs. Underarm gusset shape? After making it, the gusset looks more like an undersleeve of a two-piece slash.

I do have a few ideas of how to make it so: 1) piece the gusset & fill the gaps left by the main piece, 2) cut neck area into 'wedges', leave or rather, develop into decorative details. This will now be shirred, tucked, etc. etc.

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sometimes the machinist needs to trim away fabric but it is essential for ease of construction for that fabric to be there in the first place. Also, overlocking trims a minimal amount of fabric as it sews. The research is not concerned with this; it’s safe to assume that this waste almost always would amount for less than 1% of total fabric.

**Grading:** in some garments cutting on the weft rather than the warp grain may be justifiable to allow horizontal grading.


**Future:** The pants allow allowances. In this pant, perhaps more, given the width. But, arguably ok as future alteration more possible, or rather, possibly easier to achieve without adding fabric.

**Sketches showing single pattern piece, with 5cm width facing; the bind was purchased separately. [arrow] Contact Michael - see if possible to photograph skirt and pattern.

**Photos of patterns for body and the undersleeves as per comments. Also, leftover piece at neck is shown in photo.**

**Zero-waste designing - simultaneously ‘designing out’ waste while designing a garment of a particular appearance**... At this point, Timo has not sketched the design nor made the toile so he doesn’t know exactly what the pants looks like. Perhaps this may be one of the more difficult aspects of zero-fabric-waste designing - simultaneously ‘designing out’ waste while designing a garment of a particular appearance...
Garment

Symmetry and Pattern sketch N/A N/A N/A

Sketches of sleeve head patterns interlocking, as well as slashing shapes as asymmetry shapes. The sleeve in the latter is cut in two pieces, with lower sleeve split through centre. The sleeveheads interlock but one sleeve is thrown off-grain. See also p. 25. looking at pattern shapes important? It helps with imagining new ways of splitting and interlocking. Awareness

59 13-Mar-07 43 Grading: A hunch: it is possible to design a garment where all grading was achieved through seam allowance change (I.e. smaller the garment, larger the seam allowance) [arrow] Design largest size, to ensure it fits on fabric. Design through pattern manipulation strategies

60 13-Mar-07 44 Pant 2002 Photo taken on graph paper. I added the fly facing, pocket welts and pocket bearers; these do not appear on the original graph paper drawing. Future

61 18-Mar-07 45 Pant 2001 Distortion in calico meant that this side was out by around a 55cmx250cm piece perhaps. Manufacturing

62 18-Mar-07 46 Attempt at woven singlet. I don't think I should limit myself to the exact half-width to begin with. Strap 32cm, includes 6cm overlap [arrow] slash 32cm strategies

63 18-Mar-07 47 #2. I think draping might be the way to go with this one. Strap 32cm, includes 6cm overlap [arrow] slash 32cm strategies

64 18-Mar-07 48 Photo on calico as above, but showing gusset, pocket, etc. Amount of waste remaining is highlighted, as is the repair piece. Design for alteration

65 18-Mar-07 49 Pant 2006 Pant #2 - rectangle version where total hem = half waist. Problem with back yokes: "Waistband has 'built-in' interlining in self". Design through pattern manipulation strategies

66 18-Mar-07 50 Pant 2006 Straight' pant/pant #2 on graph paper. CB is a problem - I'm not sure how I can get a 'good' shape that will actually resemble the waist/bum area, with what I've drawn so far - on the left. Based on pant #1, I think it may be better to design for alteration via a crotch gusset [arrow] Need to explore. Design through pattern manipulation strategies
18-Mar-07 54 Pant 2001 General: cost. I’ve just cut out the first toile for pant #1 (see Economic pages 44-46 for the calico with markings). Two things that I manufacture didn’t expect or anticipate: 1) The cutting out is really fast because each cut is ‘releasing’ two pieces from the whole. This could be exciting, although the cutting is not the most expensive part of manufacturing, the overall impact might not be that big. And number of issues relating to cutting in production still need further thought. What are these issues? 2) This struck me when I did the first graph paper but I was reminded again: the pants take 118cm fabric. From memory this is less than most pants I’ve worked with, but needs to be checked.

18-Mar-07 55 Yesterday I did some freelance work for a client (R.G.). The industry work was Splitting and Shape pattern was for a dress with a long full skirt of six pieces: two right fronts - very close interlocking but they are the same from just as 1), two left backs. (2) Left front & right back: not good, but could be worked on. This is what I need to concentrate on. (The underline could be raised as could the sleeve head to make the two meet, kind of like averaging the two to make them meet.) I was able to make a pattern that matched the designer’s ideas. (I) In fact a dress that was given to me to copy. Nothing was changed – every detail was copied as was. Whether this can be regarded as design, I don’t know.

18-Mar-07 56 With another client, Fabric Width became a consideration. The fabric had a double border: a border print running along each selavage. While making the pattern, I had to be aware how much space was left between the front and back to ensure the bodice fitted in between (seam). So, when I’ve said in the past that very rarely does Fabric Width need to be considered with Cut & Sew making, it was nice to come across a situation where it needed to be considered. I was able to make a pattern that matched the designer’s initial ideas, it would have been interesting to see the design changes if this wasn’t the case. (I) When I say ‘the designer’s idea’, I mean a dress that detail was copied as was. Whether this can be regarded as design, I don’t know.

18-Mar-07 57 Pant 2006 See page 53. This is where I paused; the legs + yokes, gusset, waistbands & loops were in place. Apart from loops, these were the pieces I knew I needed. I took the pause to concentrate on. The underarm could be raised as could the sleeve head to make the two meet; kind of like averaging the two to make them meet.

18-Mar-07 59 Pant 2006 This is the completed pattern. I didn’t time it but this took it was incomplete. Front armhole, back armhole - shirts, t-shirts, jackets. Front crotch, back crotch - pants, jeans. Neck/front, neck/back - shirts, t-shirts, jackets.

19-Mar-07 61 Singlet in jersey. Not sure… why the basic singlet shape? There were three pieces described, with slashing used to create self-facing to create the armhole and neck curves.
20-Mar-07 63 Problem: only one selvage can be lined up precisely at cutting, according to Chader (1995). Is this correct?

24-Mar-07 63 First no-code

24-Mar-07 65 Second no-code

24-Mar-07 66 Comments - the rest, although not exactly, could be incorporated into the pleats. Thus, I think, Worth thinking about while working in the pants. With a pattern sketch of conventional "balanced" pants, comment: "What do we do with this?" painting to leftover area in crotch and inside leg.

24-Mar-07 66 Round up: please incorporate pattern grading chart for pleating. The square-cut rectangular pant pattern would grade 2.5cm.

20-Mar-07 67 This is a process boundaries of garment tailoring with experiment brief. Semi-boundary - may include some elements of square-cut but also use interlocking elements to keep the overall proportion across sizes as similar as possible to the square-cut.

24-Mar-07 67 In these patterns the 'extra' fabric always become leftover areas. This checks out always. Amortization could become dibble patches. Need actual fabric swatches - WEEDTH Design design on graph paper; refer to block pattern for amighthouse. Make a scale block? Shoulder angles - slants, tucks, gathers etc; neck curved? Waist could suit with self-interlining.

20-Mar-07 68 This is a process boundaries of garment tailoring with experiment brief. Semi-boundary - may include some elements of square-cut but also use interlocking elements to keep the overall proportion across sizes as similar as possible to the square-cut.

24-Mar-07 68 Page 6 of Intro in the School of Patterncutting. I've included the first section here because I think it's a good example of communicating ideas about form, cut and making very simple as clearly.

25-Mar-07 69 T-shirt. The pattern in the fabric, on the pattern, where the two pieces would overlap are shown. Does this make sense? As this pattern is getting smaller, smaller scale patterns are easier to work with. To see what's there without it overwhelming you, I can take photos of the pieces of a block, print them out. Then use these to try and see what to do with them. Sketch of half of body and sleeve, with comment "t-shirt should be in a stripe, lots leftover. To try next: CB as a seam, piecing where the two sides overlap. I'll do this full-scale, using dot&cross paper.

25-Mar-07 70 T-shirt 4001 Photo of left body of t-shirt on fabric, with right body pattern sketched on top of photo. Areas where the two pieces would overlap are shown.

26-Mar-07 71 Thayaht's tuta Italian version of the cut of Thayaht's tuta. No comments. Pattern sketch
All the text was digitized, or handwritten text has been transcribed. I've stuck these diagrams of Thayaht's tuta here for reference. I realized after looking at them again after a long time that I remembered some aspects differently. The chest gusset is treated differently to the one I've used in my pants, by plugging them in next pair.

Because the top isn't tight-fitting, I have sewn on the great sleeve doesn't have to be on the stretchiest grain. The above is what I ended up cutting. On the right, in one alternative, both show that the shapes as they are at the moment are quite awkward. But, I view this first toile as an opportunity to evaluate fit. Once that's out of the way, I can begin testing the designs' potential through splitting it if possible.

I'll try this out in the next pair.

Photo of right top sleeve pattern on fabric that has body grain labelled with comment "will create neck hole". Sleeve is 236. The moment are quite awkward. But, I view this first toile as an opportunity to dealing with, or rather, using up waste.

Because the top isn't tight-fitting, I have leevay on the grain of the sleeve doesn't have to be on the stretchiest grain. The above is what I ended up cutting. On the right is one piece, if open all the way.

I've taken them out of the t-shirt body itself. I have a hunch of how this will look but we'll see once the toile is made up.

I've circled with comment "These are the right armhole leftover pieces have been circled with comment "will create neck hole". Sleeve is labelled with comment "I reckon I can turn this into some kind of pleat."

Photo of front of pant toile. Note the waist area & the gusset. Another thing that worked is cutting the fly facing with self-fabric interlining. Normally this is fused, but I cut it with an extra layer which folds under and works like the fusing.

Toiles (x4) made yesterday. Pants. Very funny. The gusset is much bigger than necessary & not an entirely appropriate shape. Two options - make it smaller & change the shape, pending a proper fitting - see Thayaht's tuta's gusset for reference. Pages 76-77. Or, exaggerate it drastically - make it obvious. At the moment on the front the gusset looks 'tucked', suggestive of female genitalia. Wait to see how area doesn't fit well, esp. at the back. These are also awkward - they reach the natural waist & I think this requires a more refined shape. But, some things worked well: I think the leg area & the gusset. Another thing that worked: I cut the leg facing with self-fabric interlining. Normally this is fused, but I cut it with an extra layer which folds under and works like the fusing.

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<td>Trousers (general)</td>
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<td>127</td>
<td>127</td>
<td>15-Apr-07</td>
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<td>Comments while toileting - first toilets made 28/3/07: Alana asked me if I was going to use fluid fabrics &amp; to me it seemed she was ‘judging’ what I was doing as finalised designs. At that point, ironically, I didn’t think in terms of a consideration at all. I’m not sure she understood I was only experimenting with cut at that point. Yesterday (16/4/07)</td>
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<td>128</td>
<td>128</td>
<td>15-Apr-07</td>
<td></td>
<td>Old’ notes I found. 4/3/07: Rethinking experiments: Graph paper - designing patterns more manageable this way. Worth giving a go.</td>
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<tr>
<td>129</td>
<td>129</td>
<td>15-Apr-07</td>
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<td>Old’ notes I found - part 2. 5/3/07: Fashion design practices/Categories. 1) Sketch (or photograph - copying) - Pattern - Toiles - (Design alt.) - Pattern alt. - Sample garment. These categories used in an attempt to ensure accessibility of research to industry practitioners with various ways of practice. Not all will be covered in project (copying from sample garments, photos - these are not about designing): zero-waste prob. not possible as it wasn’t necessarily a consideration at the time. These patterns contain pre-empt fabric usage, and the design (c) designer) was open to change, therefore possible. Design guides: Fabric, Pattern Design + Current Design - based on literature, may be added to: may change after practice.</td>
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Notes: observing, journal/auditable back-up. Evolution involved: Basic: Researching Your Own Practice (Practitioner) - ‘The Discipline of Noticing’, Mason. Writing with invisible ink...
Many manuals on fashion design seem to work from an assumption about what fashion design is. They aim to categorise fashion design and pattern-making practices (Stockholm Nordes paper) - relevant/pertinent or A-PoC always - some differences. Include Joe Au's studies (Keep Steep), Katherine Townsend, Yoshiee Tang, Julian Roberts (also Quinn - criticise), Zandra Rhodes, Claudia Eckert/Seitamaa & Hakkarainen? Review pattern-making manuals: Aldrich: "Fabric, Form and Flat Pattern-cutting".

Thoughts on and problem-solving (eliminating design potential awareness fabric waste) [an old document from 2005, with following comments from 16 April 2007]: See further - are there any concrete examples [of Vivienne Westwood's approach to thrift]? Rudofsky tried to achieve this [simplification of sewing] with his range of clothes. Now I know this [altering a finished pattern will alter the overall marker], after cutting out a few toiles. Tricky for menswear but worth considering [regarding covered buttons]. Turn into an experiment, using a 'traditional' t-shirt pattern [using 'waste' shapes].

From 2006: I think this dates from Feb' 2006 [a document from 2006 with subheadings "Fabrics for collection", research sketch development thoughts"]. Will be difficult [in reference to sourcing 'sustainable' fabrics]. 16/4/07 Why would you do this - possibly tricky in industry, to sell the same amount of two different shirts [in reference to designing and cutting two shirts together]. This has been turned into experiment brief - Design: sketching cannot be done on pattern. 16/4/07 See also pp. 108-109 for a plan for the collection from August 2006. I now feel the collection may not need to be this big for the research (22 pieces) but it could be, to reflect 'real world' better.

But it [sketching] can be used very well to explore possibilities and to 'make visible' possibilities sketch possibility research pattern diagram sketches of garment cuts, etc.

On page of above: "Guaranteed to make the shirt - narrow width an additional cuffs, collars, etc: - Last section in Oslo paper - cut out and include here"

Sketches showing waistband and yoke being turned into pinned (12mm each side, 24 mm total), add 12mm to one piece. Sketch of leg dart on outside, with comment "Slash dart open, hem down with overcast stitches". Double Raise waist centre back - may end up two waist darts. Bottom of fly can be raised, for 15 cm zip. Double Raise waist 1-1.5cm at CB if possible. What about sewing dart on outside? cannot be lowered. Later: neither can front. I've shortened the fly.
145 14-Apr-07 106 Shirt (no code) Fitting notes/shirtblock. Add 1cm to shoulder. Raise neck.

146 14-Apr-07 107 Note: From a book on tangrams, puzzles based on geometric shapes. I think there may be some helpful concepts in the book, there are some similarities to (cause the pieces are flattened.)

147 14-Apr-07 107 Shirt (no code) Extends all darts to hip. Move front darts towards sides 1 cm.

148 16-Apr-07 108 Print-out of ‘Plan for the collection’ dated 7/8/06, first page

149 16-Apr-07 109 Print-out of ‘Plan for the collection’ dated 7/8/06, second page

150 19-Apr-07 110 I need to write about grainlines: facing grain (working at Vallen), skirt grain/chevron (working at Vallen), shirt yoke pockets.

151 19-Apr-07 110 Further on comments from others. About a month ago Alison asked how many looks (complete outfits) I was going to design. I thought was, I’m not designing looks — I think designing like that is most appropriate if you are planning to do a catwalk show. I’ve always felt that designing separates, that can come together in various looks, is much more contemporary.

152 19-Apr-07 110 The shape left behind from the shirt armhole. I think it will become an elbow patch.

153 19-Apr-07 110 (Grainlines continued) Finally, on the bus a guy in front of me was wearing a striped shirt. The stripes formed a chevron at CB but were far from true bias; shortly. I incorporated the selvedge into the inside waistband.

154 19-Apr-07 110 Pant 2003 Photo of jeans block patterns

155 19-Apr-07 110 T-shirt 4001 Notes on pattern pieces of one-piece t-shirt. I sewed the toile today - photos shortly. Some potential with the way I made the neck but needs more thought. [Pattern notes]: 13/4/07 For the next toile I’ll leave the neck uncut, but will put the tucks in and see what happens; Seam allowances have been changed to 12mm (they were 25mm); I’ve made accommodations for shrinkage; The sleeve now has no tucks, for easier construction; 24/4/07 and a cleaner look — it next toile I’ll sew the CF seam closed to the notch; 19/4/07 I’ve lowered the [CF] notch to ensure head fits through.
my competitor? yes, at an attempt to begin building this context in which I'm designing. Yamamoto, Miyake, Comme des Garçons, Margiela. Theme of collection? Straight curves. A curved straight line.

Objectivity - need to clarify position in first chapter. Objectivity Practice-based Knowledge & Reality - perspective, need a position.

Using Design through photography in design Openness to Reflection in Design. Using design and research journals (neither ever took of anyway, properly). Theme for the collection: Alana thought it would be no-waste, but that would make the entire no-waste issue temporary, worth only the attention of one collection. I'm proposing it can be a way of designing, not a 'theme'. At the name) suspected no-waste designing would be really limiting; she said to her the look of the garment, intertwined a way I tried to (quite badly) explain that it is limiting but not. The hood that's not?}

Print-out of 'Thoughts on Design for Disassembly' dated 27/5/05

Fabric waste dated 24/5/2005

Print-out of 'Thoughts and notes on sustainability in general' dated 27/5/05, first page

Old notes from 2005 stuck in

The page opposite is from over two years ago (early 2005) - I still remember what I was made (but more expensive) clothes would last in use longer. Much more complex - it was discussed quite a bit at the conference in Oslo. A number of things are missing from the 'calculations'; material inputs, transport, laundering, disposal, etc. But, a nice thought, if naive.

Sketches from 2004

Sketches from 2004 and 2006

Old notes from 2005 stuck in

Thoughts from Nordes conference (I shouldn't have left this so late). I was asked why we should bother about waste - I talked about the damaging nature of fibre talk but he asked me about aesthetics (“What about aesthetics in all this?); I think I answered ‘incorrectly’ or not what she was asking - I talked about how some designers have perceived practice as not so. But, in general, aesthetics, or the regards for visual aspects, is embedded in the practice anyway.
27/5/07 Print-out of 'Thoughts on labelling garments' dated 25/5/07 (two years later). "Kate Goldsworthy is looking into uniform-content garments I think (polyester), for recycling."

Comment 27/5/07 (two years later): "Kate Goldsworthy is looking into uniform-content garments I think (polyester), for recycling."

Inside some interesting thoughts from early 2005 on 'good fashion design' [in reference to old notes]

3-Jun-07 Meeting with Julian Roberts yesterday - thoughts. I asked if Julian Roberts Breaking rules Sketching Design through pattern he sketches before he cuts (=makes a pattern) & he said he no longer does. He also said he used to get into trouble in his student days because his garments didn't look like his sketches. Since he was out of college, he dispensed with sketching. He noted that he did illustration work for others, though. When I noted that my students tend to regard fashion design & pattern cutting as separate things, he responded that not only that but fashion design - patterncutting - sewing. This is not unlike the hierarchy I noted when I first started my PhD. See page 54.

3-Jun-07 Julian Roberts commented on paper he was doing projects where students would cutaccording to prints on fabric ("cut your coat according to your cloth??) He also noted the rigidity in the way patterncutting is taught in various courses; he tells the students to just get in, experiment; there are no rights & wrongs, just experimentation.

More than anything, JR's design process is of interest to me - I need to look through it again and see what I don't know.

3-Jun-07 TESS - tiling software - like MC Escher. Creates interlocking shapes in tiled systems. Construction difficulties: seam allowances on curved seams, no sitting flat. Solution: clipping of seams incorporated into cut lines; close to stitchlines in areas of lots of shaping. Mainly dresses but also a skirt & jacket. Julian Roberts Breaking rules Bias garment Seam also mentioned a pair of spiral jeans, although I didn't see these. Almost all seams on outside. Also, sometimes 'printed' waste cut and applied as decoration, not unlike lace applique in Shaeffer's "Couture Sewing Techniques."


4-Jun-07 Need to email Alexandra Palmer & find out what the book was she mentioned, poss. From the 70s. She said the author (a woman) was a pioneer re: fabric waste.
Re: Mark Liu. It was reassuring to find someone else had trouble finding information regarding it. I did feel Mark's work was stronger as a textile design rather than a fashion design project—even he felt the dresses weren't as well conventional and safe. Some weren't resolved yet (even he thought that); one strapless dress had tucks in the top edge, presumably to reduce gape; these had clearly been added after the dress was made. But, he's working in a new way for him & has no prob been quite smart in beginning with the simpler shapes.

Rather than one of the experiments. Or both? Because it would be interesting to see how difficult this is in general, maybe I should start with the jacket and re-design that. Possibilities: Juha denim jacket? Vanity tee? Snake tee?

Mark spoke of the need for tolerance of error with all the garments—something he is thinking further.

Historical
Aesthetics in Collection
Teng learned "how to do patterns" when she was nine (p. 142) [12/6/07 Interesting: 'how to do' versus 'how to make' versus 'how to cut' patterns, Teng's interested in "how clothes will affect the wearer's posture, gait and gestures, whether you can lounge or pose or have an attitude in them." (p. 142) - Not unlike Vivienne Westwood. (Sagli 'Yeohlee book) Richard Martin on Rudofsky... "Rudofsky's only clothing design was scientific experiment." BUT, these were also sold, no? But perhaps Martin has a point. It's like that question posed to me in Helsinki: "Where are the aesthetics in all this?" (p. 152) "In Yeohlee's three-dimensional art, the flat pattern is a recreation at parity with the beauty of the garment itself." (p. 152) P. 153: "Yeohlee accords the fabric a respect, bordering on religious awe."
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### Appendix 243

- [Read the full text of the appendix here](#)
255 13-Jul-07 256 T-shirt 4003 I think 4003 is a good one to experiment further with graph paper. Aesthetics in garment management strategies.

257 13-Jul-07 256 T-shirt 4003 Chest may be a bit tight & pull open - possibility. Garment fit.

258 12-Jul-07 257 T-shirt 4004 What if slashed through here? Open shoulder seam to design through drape.


260 15-Jul-07 260 T-shirt 4003 Sewing day. 4003: CB is on weft grain (across fabric) and piece would be too long. I do think the seam needs to be on the outside of the garment to make it more comfortable to wear (although not as much if overlocked) - a plain seam on outside could work, then letting it roll. Or flatlock, or on neck & pkt areas on mannequin.

261 16-Jul-07 261 Pant 2005 Tapered pant. One-piece fly - still need to refine but worked quite well - zip would be tricky, button fly would be better.

262 16-Jul-07 261 Pant 2005 Photograph of pattern pieces Shape library.

263 16-Jul-07 262 Pant 2006 Photograph of pattern pieces Shape library.

264 16-Jul-07 263 Pant 2005 Photograph of leftover space created by two back crotches Shape library.


266 16-Jul-07 264 Pant 2002 Photograph of back waist darts on toile Breaking rules.


268 16-Jul-07 264 Pant 2001 I sewed the waistband in as a facing instead, & topstitched where indicated with dotted line. Back darts on 2nd toile of pocket.

269 16-Jul-07 265 Pant 2002 Photograph of back waist darts on toile Breaking rules.

270 16-Jul-07 266 Pant (general) To avoid the godet-like flare happening where the gusset joins CB; join CF's; join inside leg?; OR join inside leg, the gusset could also have curves for better inside leg shape.

271 16-Jul-07 266 Pant (general) Gusset Construction.


274 17-Jul-07 267 Pant 2001 Photograph of knee dart on toile Breaking rules.

275 17-Jul-07 267 Pant 2001 Photograph of knee dart on toile Breaking rules.


277 17-Jul-07 267 Pant 2001 Photograph of knee dart on toile Breaking rules.

278 17-Jul-07 267 Pant 2001 Photograph of knee dart on toile Breaking rules.


280 17-Jul-07 267 Pant 2001 Photograph of knee dart on toile Breaking rules.


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293 17-Jul-07 267 Pant 2001 Photograph of knee dart on toile Breaking rules.


296 17-Jul-07 267 Pant 2001 Photograph of knee dart on toile Breaking rules.

297 17-Jul-07 267 Pant 2001 Photograph of knee dart on toile Breaking rules.

283 19-Jul-07 229 T-shirt 4003 Sewing of zip versus collar needs thought Photograph of top of zip in toile Aesthetics in design

284 19-Jul-07 230 T-shirt 4003 Photograph of t-shirt pattern Shape

285 20-Jul-07 230 T-shirt 4003 I need to work out half way of fabric & perhaps redesign Fabric Width Design

286 19-Jul-07 231 T-shirt 4003 Photograph of pattern detail showing CF neck dart and front hem mitre. Design through sketch

287 19-Jul-07 232 T-shirt 4003 Gusset - most of undersleeve no incorporated into main piece. Use 3mm seam to join collar to neck, on outside; collar will hide. Shoulder tuck from under the collar. CB seam: 2.5 allowance, will be sewn a plain seam on outside to allow for inaccurate marking.

288 22-Jul-07 233 T-shirt 4003 I think this base top can go in a few directions (which I think I always could have). It's a variety of fabrics: jersey, knit, lace, mesh, denim.

289 22-Jul-07 234 T-shirt 4004 Alteration to first toile 22/7/07: slashed and twisted Photograph of shoulder detail Design

290 22-Jul-07 235 T-shirt 4004 4004 22/7/07 thoughts Four photographs of toile front with variations drawn on top Design through sketch

291 23-Jul-07 236 T-shirt 4004 Change to yoke. Trace of two yoke patterns superimposed on top of each other. Shape

292 24-Jul-07 237 T-shirt 4004 This is the grain I used for the second toile (cut but not sewn as yet) - grain matches front, while in first toile grain butting.

293 24-Jul-07 238 T-shirt 4004 Change to yoke. Trace of old and new sleevehead on dot & cross paper Fit

294 24-Jul-07 239 blank page

295 24-Jul-07 240 T-shirt 4004 I'm starting a separate fabric folder today, with all info to date on fabrics. This should allow me to begin sourcing. I can't remember if I've written it here before but I also think it's ok for me to use fabrics I already have; fabrics that have been sitting on rolls for 3-6 years have to date, in a way, been 'wasted'. But, if I use white cotton jersey for example, I really need to think about design that enables wearer to wash it. Fabric Waste Laundering

296 24-Jul-07 241 blank page

297 24-Jul-07 242- Article on Shinmi Park Article/referenc

298 24-Jul-07 243 blank page

299 24-Jul-07 244 T-shirt 4004 Change to yoke. Trace of old and new sleevehead on dot & cross paper Fit

300 24-Jul-07 245 T-shirt 4004 This is the grain I used for the second toile (cut but not sewn as yet) - grain matches front, while in first toile grain butting.

301 25-Jul-07 246 T-shirt 4004 This is the grain I used for the second toile (cut but not sewn as yet) - grain matches front, while in first toile grain butting.

302 25-Jul-07 247 T-shirt 4004 Trace of old and new sleevehead on dot & cross paper Fit

303 25-Jul-07 248 Doubled-sided photocopy of two old square-cut shirts. Historical reference

304 25-Jul-07 249 Article on 'green' fashion Article/referenc

305 25-Jul-07 250 Article on 'curated' wardrobes Article/referenc

306 25-Jul-07 251 Fabric Waste Article/referenc
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A collection of notes and references related to fashion design and sustainability.

- Extracts from various articles and publications on sustainable fashion practices and innovations.
- Sketches and ideas for various clothing designs, including shirts, dresses, and accessories.
- Notes on materials, techniques, and concepts such as cut & sew, print, and finishing.
- Plans for exhibitions and events, including details on garments, installation, and audience engagement.

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1. Extracts from articles and references on sustainable fashion practices and innovations:
   - Use of hemp/cotton denim for pants and jackets.
   - Design through pattern, drape, and construction.
   - Fabric waste, open waiting, and possibilities for transformation.
   - Masculinity aesthetics in design.

2. Notes on materials, techniques, and concepts:
   - Cut & sew clothes: sections on fabric width and the kinds of waste shapes they create.
   - Design through pattern, drape, and construction.
   - Fabric waste, open waiting, and possibilities for transformation.

3. Plans for exhibitions and events:
   - Exhibition of garments in staircase windows.
   - Incorporation of waste shapes in staircase windows.
   - Fabric waste, open waiting, and possibilities for transformation.

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4. Additional notes on materials, techniques, and concepts:
   - Cut & sew clothes: sections on fabric width and the kinds of waste shapes they create.
   - Design through pattern, drape, and construction.
   - Fabric waste, open waiting, and possibilities for transformation.

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5. Plans for exhibitions and events:
   - Exhibition of garments in staircase windows.
   - Incorporation of waste shapes in staircase windows.
   - Fabric waste, open waiting, and possibilities for transformation.

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6. References and citations:
   - Historical references for future transformation.
   - Fabric waste, open waiting, and possibilities for transformation.
   - Design through pattern, drape, and construction.

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7. Additional notes on materials, techniques, and concepts:
   - Cut & sew clothes: sections on fabric width and the kinds of waste shapes they create.
   - Design through pattern, drape, and construction.
   - Fabric waste, open waiting, and possibilities for transformation.
| 437 2-May-08 377 | Jacket 1003 | This was something I tried two weeks ago; instead of cutting out circles like Roberts above, I cut out a flat sleeve & shoulders for a jacket, creating the bias for the first darts like Roberts notes, though, & sewed the hems together wrong! It was impossible to get the body through as the tunnel was not continuous - rather, there was one main tunnel & one internal tunnel. What was exciting - no knowledge at all of what would emerge from this free-hand exercise. |
| 438 3-May-08 378 | Print-out from Julian Roberts' school showing tunnel | Pattern sketch |
| 439 3-May-08 378 | Print-out of article from style.com on fashion in 2007 | Article/referenc |
| 440 3-May-08 378 | Photograph of Gaultier waistcoat from eBay | Article/referenc |
| 441 3-May-08 379 | Dancing? See crochet lace with girls | Photograph of figures made from buttons and photocopy of Aesthetics in N/A N/A N/A N/A N/A N/A |
| 442 3-May-08 380 | Do's and Don't's from Vice magazine | Article/referenc |
| 443 2-May-08 381 | Beading on top? Bleed. Three photocopies of lace | Design in context |
| 444 2-May-08 381 | Pant 2007 Codpiece/leggings. These measurements based on first toile and side - no notes - just note: if existence exists in real, collection might need to end where waist seam is now. Piece, made pattern as shown above, then try to reconcile with waste pieces. | N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A |
| 445 3-May-08 381 | Pant 2007 Awkward shapes. But, let's toile this first & check the shape | N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A |
| 446 2-May-08 382 | From a waste point of view, this & other knit garments, should be integrated into | N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A |
| 447 3-May-08 382 | Sketch of cropped denim jacket, and sketch of complete look with denim jacket, tablecloth shirt, leggings. | Design through sketch |
| 448 1-May-08 390 | Shirt 3003 Sketch of cropped denim jacket, and sketch of complete look with denim jacket, tablecloth shirt, leggings. | Design through sketch |
| 449 3-May-08 391 | Catalogue contributors? Vicki - male body. Peter - waste in fashion. Val. Alison - design. Alana. Alex Palmer. Sally - administration. Me: the collection. Kees: foreword? | N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A |
| 450 8-May-08 393 | Pant (general) This was a completely new concept & a revelation to me | Print-out from Fashion Incubator forum about cut of pants |
| 451 4-May-08 393 | Photocopies of lace and thread codes from NearSea Naturals, and a photocopy of vintage lace with tape threaded through | Shape |
| 452 1-May-08 395 | Pant (general) Reversible? Tucks will be a problem (reverse); pockets | Design details |
| 453 9-May-08 396 | Army blanket Rough sketches of coat and pant ideas | Design through sketch |
| 454 11-May-08 397 | Old comments from Fletcher's book: p. 71 Dosa's products support rural communities” - ‘hand’ to come through in each garment. One collection a year - me too: 2010 summerwinter | N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A |
| 455 15-May-08 399 | Jacket 1005 Waistband to finish B50, F56 = 106. 10cm wide. If tuck here, no need for tuck at U/A? | Design through pattern |
| 456 17-May-08 399 | Collar stand, collar, cuff - this [collar stand] has perhaps the least ‘design freedom’ - needs to ‘connect’ shirt and collar, accommodate neck | Design through pattern |
| 457 11-May-08 397 | Jackets bogo | robe through pattern |
| 458 12-May-08 397 | The current issue from Fletcher’s blog. p. 74 A lovely product come with a sense of energy and touch of the maker and support rural communities”. hand to come through in each garment. One collection a year - the 2012 | N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A |
| 459 13-May-08 397 | Throughout the year and across various customers from various sourcing. | Design through pattern |
| 460 15-May-08 397 | Four sketches showing front, waistband detail front and back, pattern layout | Design through pattern |
| 461 17-May-08 397 | Design through pattern | Design details |

**APPENDICES**
The idea behind the seam line shapes was to make them symmetrical along a horizontal axis to allow multiple interlocking.

Three sketches of pant, one of jackets Design through space

Make them symmetrical along a horizontal axis to allow awareness

Multiple interlocking awareness

Design through sketch

A jacket I did in 2002 for Timovsthang

Design through sketch

Printed, checked fabric

Checked blanket coat

Checked blanket coat

Lace on inside hem?

A jacket I did in 2002 for Timovsthang

Design through pattern

Fabric Grain Striped, checked fabric

Cuffs maybe? Armhole partly cut, the 'Fits' has been incorporated into sleeve. Grainline - I did this so the stripes would fall on an angle when I put the drape on the mannequin again, the fabric was collapsing a little. 10cm Hem.
8th 8-Jun-08 415 Shirt 3002 Changes to 3002/Wedge Shirt - Waist tucks - added 2.5cm to the body circumference (this was actually a good thing, but then the neck was out). - The yoke 'grew' 2.5cm to both front body and back body; the front was a design choice, the back came about as the front and back are still level. But, having looked at the toile, I think back side seem will fit too; CB has a split at the bottom, for better hang and I like the look of splaying open, too. - As I've noted on pattern, sleeve packet length and shape will probably depend on leftover fabric. - Also, grain on yoke is flexible.

8th 8-Jun-08 415 Shirt 3002 -Waist tucks -> inverted component
-Neck filled in - but, I realised only today that I accidentally made the shirt and neck bigger. The placket was meant to be a placket facing; by sewing it wrong, I added 2.5cm to the body circumference (this was actually a good thing, but then the neck was out). - The yoke 'grew' 2.5cm to both front body and back body, the front was a design choice, the back came about as the front and back are still level. But, having looked at the toile, I think back side seem will fit too; CB has a split at the bottom, for better hang and I like the look of splaying open, too. - As I've noted on pattern, sleeve packet length and shape will probably depend on leftover fabric. - Also, grain on yoke is flexible.

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8th 8-Jun-08 415 Shirt 3002 -Waist tucks -> inverted component
-Neck filled in - but, I realised only today that I accidentally made the shirt and neck bigger. The placket was meant to be a placket facing; by sewing it wrong, I added 2.5cm to the body circumference (this was actually a good thing, but then the neck was out). - The yoke 'grew' 2.5cm to both front body and back body, the front was a design choice, the back came about as the front and back are still level. But, having looked at the toile, I think back side seem will fit too; CB has a split at the bottom, for better hang and I like the look of splaying open, too. - As I've noted on pattern, sleeve packet length and shape will probably depend on leftover fabric. - Also, grain on yoke is flexible.
502 14-Jun-08 425 T-shirt 4006 Cardigan 4006 Not sure if this idea for the neck will work; will find out in toile.

503 14-Jun-08 425 T-shirt 4006 I worked on the Cardigan 4006 today and changed the pattern quite a bit from January. The hem is no longer curved but with a darted corner; the hem angles match those on the sleeves. The sleeves were too fiddly to turn from draped pieces to card pattern so I ended up patternmaking them from scratch. The sleeve is actually smaller than the armhole so I will stretch the armhole to fit the sleeve. SIA needs facing for zip.

505 16-Jun-08 426 T-shirt 4006 Stripe cardigan - leftovers: BIAS: Mobius scarf (Vionnet, see Kirke's book) => to be 'sold' with cardigan. STRAIGHT: selvedges are all neat, not tight; perfectly usable in a straight diagram of flat pattern where sleeve attaches.

Still unsure how valuable it's been to spend a lot of time on Seamless Referencing in knit garments (in jersey or interlock). The technology exists though from research point of view it has been valuable - methodology for knits (see Allwood et al) and from a fashion perspective it provides a flexible design and production possibility. Could even spiral slightly, in Dart or tuck to make seams match. Though from research point of view it has been valuable - methodology for knits (see Allwood et al) and from a fashion perspective it provides a flexible design and production possibility. Could even spiral slightly, in Dart or tuck to make seams match.

Exhibition - research into a methodology of making. Theme - this collection - touchstone, not the focus of. Guide to the exhibition. Contextualise - practice based research. Role of exhibition. Have as a sheet too. Blurb about garment with plot x pattern diagram. Claim about proper reuse copying ok as long as copy no-waste. Sustainability and how it has informed collection. Theme...
548 14-Jul-08 454 Pant 2005 Double wool 154 cm wide. Skin Pant 2005. Finalising design on dot and cross paper => the possibilities are endless as to how to interlock - there are only four pieces (leg, waistband, fly and gusset) that are 'set' (I know they fit and work) and as to how they get placed can result in countless variations. HOWEVER, there is one issue: TIME. The exploration of ideas takes a lot of time so decisions need to be made as quickly as possible. I explored 2 variations and will settle on one.

549 15-Jul-08 455 Pant 2005 Looking at 2005 'final marker, grading will be an interesting problem to explore.

550 455 Grading - knits - is it reasonable to assume that multiple widths could get knitted for production.

551 455 Pant 2005 2005 - reinforcement pieces and larger seems used (waistband) as per Oslo paper.

552 16-Jul-08 455 T-shirt 4006 Hoodie Big thick drawstring - white cotton. So far with Pant 2005 and hoodie 'final' laying out (=design) of garment not as time consuming as expected. Sew hem before zip but leave hem facing facing width from beginning to end.

553 17-Jul-08 456 Pant 2007 George pointed out leggings are 'set' in length - for a tall person - because of knee seam placement and cuff. Looking at pattern layout, a shorter version is (easily) possible. While I decided on knee seam placement based on aesthetics, it happened to make upper length same length as lower length on the pattern. Changing both the same amount would not be too difficult.

554 17-Jul-08 457 I think better to waste some than force it all in. Reflective writing

555 17-Jul-08 457 Shopping list/Greenfield list of things to get Research administration

556 17-Jul-08 458 Pant 2007 George pointed out leggings are often a length - for a tall person - because of knee seam placement and cuff. Looking at pattern layout, a shorter version is (easily) possible. While I decided on knee seam placement based on aesthetics, it happened to make upper length same length as lower length on the pattern. Changing both the same amount would not be too difficult.

557 459 T-shirt 4006 Sketch of eyelet for hoodie by George Plionis Design through sketch

558 17-Jul-08 460 T-shirt 4007 Jersey width 160-2+2cm (selvedges). Selvedges simply not usable because of glue in this particular style - slash top. This something that needs collaboration with fabric mill. The glue is hard.
APPENDIX D:
FASHION INCUBATOR DISCUSSION

Claudine’s silk blouse

Place holder for today’s entry; I need the link for my post. I’ll come back later and post my comments in advance of tomorrow or Wednesday’s follow up.

Also, if you get here before I do, no need to wait on me.

Please don’t PM me. Use the email button or via kathleen@fashion-incubator.com. Thanks!

Okay, here are my rough notes on today’s entry, no photos yet for documentation but I’ll suss it out tomorrow.

Claudine’s blouse is really quite complex and there’s several things going on. It’s also an ambitious project. You only go into it knowing you will have to do several iterations.

Okay, pattern and fit wise, this style is very tricky to critique for several reasons, one of which could be because it is shown on a mannequin that quite possibly, is not the size the blouse is intended to fit. Keep that in mind.

What I think is really neat about Claudine’s work is that she shows the garment inside out. I think you’ll agree that can take a lot of confidence.
Strengths:

Look at the back view, specifically the sleeves. I suspect these sleeves are better than typical. Namely, they're shaped to hang on the front of the body (that is where your arms are, they aren't on the sides of your body) and to fit forward in the front armhole. I say this because you can see folds radiating vertically from the sleeve cap down just past the back elbow dart. Imagine if you will, the sleeves on a body with the arms in a normal position (slightly forward) and those folds would disappear. The other reason I think the sleeves are cut forward on the body is due to the little back wrinkle showing the horizontal back spread is cut for range of motion. Still, there is no sure way to know unless the garment can be seen on the body for which it is intended to fit.

Sewing... looks pretty solid. There is little to quarrel with but there's something about overlocking that front seam that has me ill at ease and I'm at a loss to define it. I totally understand why the front seam was overlocked but with the facings, it's causing a bit of a problem at the fold-over where the two sides join. If this seam had not been overlocked, there might have been less of a bump.

Pattern design (engineering, sewing) I think a deeper hem allowance (total 2") is called for if you're making better goods. This is a nice fabric (silk charmeuse) and the price is moderate ($140) so I'm not quibbling with value at all.

I would have done the front facings differently. I like that they are one piece with the front (clever and less work imo). I would have pivoted out that dooptey doop of the facing near the armhole.

I don't know if this piece has any fusibles in it. If it were me, I'd put in some whisper thin at the hems (sleeve too, they'll wear longer) and crossing the fold line of the facings and entire facing. Actually, I would want to be certain that shoulder point where front and back come together is solidly reinforced.

The one front side of the neckline (the longer right side, viewing) could be taken up a hair, it looks a little loose. The way I would do this is to take out a vertical 1/8" to 1/4" on that side (making it narrower). It looks like the (left) side is doing all the work of holding up that neckline.
The only major-ish thing are the front gathers. Assuming this should fit this form more or less, I would raise the gathers a bit (see photo above). I would also take out some fullness, maybe that last third (gathers that lie just below the bottom arrow). Again I could be off because those gathers would be good on a fuller busted gal (Claudine's dimensions are 38” bust, 35” waist, 41” sweep) but taking out the lower gathers would get them off the tummy which may help slim the figure a bit.

Finishing... The hem is buckling. Sure, she could have pressed the hem flat and eliminate that but I don't think she was looking for a crisp line to finish it off (and I would agree). It did need some sort of pressing but it could be an equipment issue. I think a hand held steamer could help. In most cases like this (nice blouses not intended to have hard lines), these are pressed on a blow up dummy. I really don't know what the solution would be with her equipment set up. Another possibility is a very light fusing to full out that fold line.

_________________
Please don't PM me. Use the email button or via kathleenATfashion-incubatorDOTcom. Thanks!
oh, there is also a minor thing going on with the CB seam. I can't tell pressing or a cutting issue. Claudine, are those selvages at CB? That is the only question I'll ask you, I can't tell. I used to exploit selvages - they're awfully handy! - but then I learned there can sometimes be problems. It show denim but often, the pressure on opposing selvages aren't equal so they buckle slightly. If you cut using selvages you intend to join together the CB seam, you can minimize any distortion if you cut the back from the same side of the goods rather than the opposite side. Otherwise, you have to cut it a tip.

Please don't PM me. Use the email button or via kathleenATfashion-incubatorDOTcom. Thanks!

They are selvedges at center back. I did not know that about selvedges unequal. I like the suggestion of moving the gathers up. This is the second iteration of this blouse that I made, and I already moved them up a bit.

Finishing... The hem is buckling. Sure, she could have pressed the hem and eliminate that but I don't think she was looking for a crisp line to fall off (and I would agree). It did need some sort of pressing but it could be equipment issue. I think a hand held steamer could help. In most case this (nice blouses not intended to have hard lines), these are pressed / blow up dummy. I really don't know what the solution would be with equipment set up. Another possibility is a very light fusing to full out line.
I have a feeling that I will just give in and start pressing hems. I am leery of fusibles. I tend to use them very sparingly. If I were to fuse the hem, how to go about it? Should I fuse just the hem allowance? Or fuse the hem from the point of the stitching to the raw edge? Your suggestion of a steamer made me smile. Coincidentally, I ordered a hand held steamer today. I'm not sure what a blow up dummy is, but it may be out of my price range at the moment.

Claudine, I’ve never had a problem with the fusible interfacing that is that nylon tricot (knit) kind. Kathleen says when you fuse the hem, it's the hem allowance plus a bit (1/4") so that the fold line has fusible. It has really helped with the blazer type jackets I've made, but they're heavier fabric than your charmeuse. I don't know if that kind is too heavy, but I've seen another tricot fusible that was way lighter and finer threads.

Claudine, I’m glad you mentioned the deeper hem allowance. I may make the hem deeper to conform to the 2" that you suggested in the future. A couple of people
commenting on the blog mentioned that a narrow hem would work better
am inclined to disagree.

"doopety doop of the facing near the armhole" near the armhole front or I
Pivot how? Are you talking about the inside-out photo?

Esther, My finished work that I was graded on did not have pressed hems
classes that I took were couture construction classes at FIT in New York. I
teacher was an old man who had a couture dressmaking business in the c
50's and 60's, so it is entirely possible that his views are a bit archaic. My
about using fusibles very sparingly also came from him.

Claudine Celebuski wrote:
I get a lot of flack for my lack of hem pressing. I learned in school that a h
should never be pressed flat, but very few other people, even fashion peop
seem to agree. I have a feeling that I will just give in and start pressing he
As a designer, it is also up to you to design the finished effect. I don't thi
agree this hem should be pressed flat, I think a soft line is good for this s
Esther says you shouldn't press hems until the item is finished. I follow th
half the time (jackets no, tops & pants, yes). I know she is right but for or
what's the harm? If you pre-press this before stitching, you can use a len
wool folded in half and set it at the blouse fold line and press over that. It
create a soft line but prevent it from becoming too crisp.

Quote:
I am leery of fusibles. I tend to use them very sparingly. If I were to fuse t
hem, how to go about it? Should I fuse just the hem allowance? Or fuse th
hem from the point of the stitching to the raw edge?

You should fuse the depth of the hem allowance plus 1/2" to cross the fol
looks nasty when people stop the fusible right at the fold line, I can see t t
ime.

I totally understand your teacher being anti-fusible. As I teased Esther th
day, I'd probably be anti-fusible too if I were 20 years older. He/she was
anti-fusible because when they came onto the market, the technology wa
there yet. Since then tho, it has matured beautifully. just don't use the
homesewing stuff. Pam Erny has some lovely products. You need to test t
effect.

Here are some entries that may be helpful:
http://www.fashion-incubator.com/archive/how-to-apply-interfacing/
http://www.fashion-incubator.com/archive/interfacing_10_tips/
Please don’t PM me. Use the email button or via kathleenATfashion-incubatorDOTcom. Thanks!

Esther
 Moderator
Joined: 18 Mar 2006
Posts: 1315
Location: ID Spudville
Posted: Thu Mar 03, 2011 2:53 am   Post subject:

Quote:

Esther says you shouldn’t press hems until the item is finished. I follow this about half the time (jackets no, tops & pants, yes). I know she is right but one-offs, what’s the harm?

The truth is this is what I was taught, it’s not what I actually do. I guess I am a bad student. Whether I press before or after sewing depends entirely on fabric, equipment available, and perhaps my mood. I do know that when the line using an industrial hemmer, it is best to press the hem AFTER for things. It’s ok to be flexible on this so long as you get the result you need.

Regarding the 2” hem on the blouse, I have only one concern. I would be wary of the hem stitching showing through to the right side unless extreme care is taken by hand stitching. I can’t imagine getting a decently looking hem of charmeuse on most of the hemmers I’ve used. I guess I fall into the side narrow hem. You could even consider a rolled hem with a Merrow machine which would be my preference, even for a $140 blouse, though maybe this is too class?). The only way to know is to experiment and see what you like.

Claudine Celebuski
 Member
Joined: 25 Feb 2011
Posts: 24
Location: NJ Summit
Posted: Thu Mar 03, 2011 4:27 am   Post subject:

That’s a good suggestion. Thanks.

Claudine Celebuski
 Member
Joined: 25 Feb 2011
Posts: 24
Location: NJ Summit
Posted: Thu Mar 03, 2011 5:00 am   Post subject:

That’s a good suggestion. Thanks.
I am planning on re-doing all of my photos, and I will press the hem!

Claudine Celebuski wrote:

But reading the comments on the blog, I realize that the hem is distra
don't want people who have no idea how things should be done ("I'll ca
"customers") to think my blouse is not made well because the hem is
pressed.

At the risk of making myself unpopular, I don't think we're talking ab
thing. Yes the hem stands out because it is not pressed. But pressing
mean it must be a hard pressed crisp line. The option is what kind of
Using a soft press does not mean the hem will continue to stand out.
it's your product and your decision.

Please don't PM me. Use the email button or via kathleen@fashion-
incubator.com. Thanks!

Claudine Celebuski wrote:

Thank you to Kathleen and everyone who commented. Even if I disag
suggestion, it is enlightening to know what people are thinking when
my work. This was actually very exciting. Perhaps I need to get out r

At this point, I am thinking that the changes that I will make for my r
are:

test some fusibles and interface the hem. I have a collection of fusible
occasionally. I believe they are good quality. I bought them from Stei
Stoller in New York.

Interface the shoulder seams to reinforce them.

Move the gathers up.

Widen the hem to 2". Soft press it during construction.

Take the facings and make them slightly smaller than the blouse.

Sew the front seam differently to take out the bump at the neckline w
pieces meet

Did I miss anything?
Btw, I updated yesterday's entry to include links to your etsy shop and I apologize for the oversight.

I like your plan but then I would 😎.

About interfacings, I'm not suggesting the ones you have aren't good (not) but do keep in mind that you probably need a much broader variety than you may think. I just went and counted mine, I have at least 22 different kinds, you have to test which are the best performing for the fabric you are working with. After awhile you get a feel for which are best so you don't need to test every once in awhile. For dummies and prototyping one of the knit tricots (even on wovens) because their performance is uniform on so many things.

Other than the links I left before on interfacing (do see those if you haven't already), follow the links to the transcript. In part, it explains the terminology of competence, how we gauge quality levels in the industry (low, single n "couture"). A follow up entry is a refresher on basic industrial sewing which may also be helpful.

I'm also very excited, laud you for your bravery and am looking forward to your next project. If you follow up, I will do yet another entry on it to follow before and after. I think it would be very exciting for everyone to see how dramatic the differences will be. It is amazing how little things add up to a refined patina. That's the whole point of the RML series.

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Please don't PM me. Use the email button or via kathleenATfashion-incubatorDOTcom. Thanks!
APPENDIX E:

REFLECTIVE STATEMENTS
FROM STUDENTS, JANUARY 2010;
ZERO-WASTE COURSE SYLLABI
FROM FALL 2010 AND FALL 2012

Statements from students in the first Zero-Waste Garment course, Fall 2010, solicited in January 2011 for the exhibition of their work at Parsons The New School for Design, New York City.

C.Ca.
O-waste garments are not just about creating a product to sell. They are about exposing the design process, and invoking curiosity about how and where a garment is made. O-Waste garments are a symbol of human effort to make a better future, and by having the intention of sustainability these fashion statements are given a greater meaning. O-waste garments are made to inspire others to make their own efforts towards a more sustainable future.

G.G.
Zero-waste is more than pattern-cutting - It is an ethos of designing.

One that calls upon your conscious to create, in tandem, with your aesthetic. The freedom to explore your creativity to develop new and interesting ideas. A nod to a sustained future in which design reassures that we can live harmoniously. Zero-waste reveals the potential to innovate and inspire.

E.D.
After taking the Zero-Waste Garment course, I now view zero-waste as method through which I can challenge myself in a way that is meaningful to me. I like to set boundaries for myself because it stretches my mind while helping me focus - and within every boundary there are endless possibilities, so I never have to worry about my work becoming less creative. I see zero-waste in the same light. It is a method that should continue to be explored because it allows designers to express respect for their resources and for life on the planet while doing something they love.
A.C.
Incorporating zero-waste techniques into my design process has given me the opportunity to completely re-think how clothing can be made. I have come to realize that there is no right or wrong way to create a garment, and by using unconventional methods such as zero-waste I have come up with interesting new silhouettes and design details that I wouldn’t have thought of otherwise. When designing ethically-minded clothing we usually look first to our choice of fabric, but with zero-waste we are forced to really consider how the fabric is going to ultimately be used, which is just as important in my opinion.

C.Ce.
To me Zero-waste design is a process that works horizontally and thus more purposefully. Where there is equal importance put onto each step and the final garment is the culmination of these well thought out steps. It pushes you as a designer to think deeply into a design and suddenly all elements have a specific reason for existing and nothing is arbitrary. It lets the garment take you to it, once you begin the process leads to the finish. And the finish is not just any garment but a piece which changes the impact of manufacturing and works towards a more sustainable industry all this coming from solely within the design itself.

J.A.
Bartering with fashion, as it stands, is a tentative transaction; more often than not I have found that no matter the value of my sacrificial exchange, I must always succumb to the beast’s heavy hand. And though I am only a short distance into my travels through this foreign land, it seemed clear that this was an inevitable element in the complex process we exalt as design. But what if—you caught the beast by surprise—what if you launched your attack from behind, turned the process on its head, and let the game commence in reverse; zero waste puts design in its place. It exemplifies necessities more true than aesthetic and marketability; it harvests garments that are honest and true, garments that are complex out of necessity, not the superfluous necessity to be complex, or as it stands, “designed”. Zero waste trumps fashion at its own game, and as one vehemently opposed to the game, I will air on the side of the “un-designed”.

No flat segment of tensile material wants to find a portion of itself missing here, another absent there, just as no individual wants to lose a finger or a toe; every flat segment of tensile material, however, envisions itself as any given garment and as tradition has told, the creation of any given garment requires the waste of a portion here, the negative of a neckline, another there, the inverse of a collar. Decency should implore then that it is only humane to ensure that a given segment of material will not be divorced of its fingers and toes, but the reality of these convictions however is this: tradition must be defiled. So to the dregs with tradition! We will use every last portion to insure that that segment of material, though reorganized, remains whole and with all its fingers and all its toes!

M.E.H.
Through the process of designing a zero waste garment, I realize that many of the elements develop from exploration as well as critical thinking. Whether using draping methods or intricate, geometrical pattern pieces, the designer must tackle the negative space as equally as the positive space, akin to a jigsaw puzzle, while taking into consideration the final look of the garment. Ultimately, zero-waste (demands or requires or necessitates a whole new way of thinking about (the construc-
tion of) everyday items, like clothing. As designers, we are responsible not only for producing creative, yet workable, solutions, but to foresee and address possible problems. Zero-waste is a way to produce commercial garments by applying a new concept to traditional methods that results in sustainable change.

N.L.
A challenging design process, which seems to be restricting yet, opens up possibilities for innovation. In a field like fashion, where everything has already been made, it’s refreshing to come across such an inspiring process. What’s also interesting about the process is that there isn’t a formula, meaning that there are multiple ways in which each individual designer can work to come up with an end result. Zero Waste is a method that would save company’s money in the long term, would assure good, thoughtful design and is sustainable. This method definitely has potential for growth and if integrated properly with technology can be very efficient.

J.H.
After taking a course Zero Waste Garment, I found that even though there are certain limitations set in constructing the garment, it really doesn’t stop you from making an interesting design. At first I thought that there wasn’t really a possible way of making an attractive zero waste garment but happily enough I found that incorporating zero waste within my design process I came up with ideas that I might never have come across before. I especially like the spontaneity that comes with designing a zero waste garment along with utilizing all the materials and having no waste.
Parsons The New School for Design
Fashion Design Department

Zero-Waste Garment
Course Syllabus and Curriculum

Course Title: Zero-waste garment
CRN: 7133
Academic Year: Fall 2010

Instructor: Timo Rissanen
Office: 232 West 40th Street, Room 1107
rissanet@newschool.edu

Dean, The Fashion School Mr. Simon Collins
Office: Parsons The New School for Design
560 Seventh Avenue, 5th Floor
New York, NY 10018

Course Description
This course presents a new way of exploiting and building upon the students’ existing fashion design and patternmaking skills with focus on sustainability in fashion design. It introduces the students to designing a garment without creating fabric waste in the process. In designing and producing a zero-waste garment, the students will develop a deeper understanding of the relationships between cloth, fashion design, patternmaking and draping, and in a broader sense, the connections between material, design process and final product, and the broader context in which these connections exist. On completion the students will be able to utilize patternmaking and draping as tools for innovative, sustainable fashion design. In this course sustainability provides a tool for the students to examine their design practices in a critical light. Commercial considerations arising from the partnership with Loomstate will ground the coursework in a real-world context.

Learning outcomes:
Upon completion of this course, students should be able to demonstrate:

- An understanding of sustainability issues in fashion design. In particular, students will learn about the various types of textile waste and strategies to minimize them.
- An ability to address one type of pre-consumer textile waste through strategic fashion design.
- An ability to use patternmaking as a dynamic tool in creative fashion design through an understanding that existing skills may be used in unexpected ways.
- A better understanding of the interrelationship between cloth, two-dimensional pattern and three-dimensional garment
- A more critical understanding of fashion design in its broader industrial and social context.
- An understanding of designing fashion for a market and for manufacture.

Course Requirements
All assignments are to be completed fully and on time. Project deadlines are unbending and late work is not tolerated even due to illness. Attendance is mandatory. Three absences result in a final grade of “F”, and two “lates” count as one absence.

Attendance will be taken at 3:00pm; students will be considered absent if they arrive after the first 30 minutes of class. All assignments are due at 3:00pm unless otherwise specified. Reflective journals must be brought to every class along with required supplies for those days designated as “in-class work days”. Class participation represents a percentage of the final grade.

Incomplete work is not reviewed by instructor and is graded accordingly.
Evaluation and Grading

Undergraduate Grade Descriptions

A  Work of exceptional quality, which often goes beyond the stated goals of the course.
A- Work of very high quality.
B+ Work of high quality that indicates substantially higher than average abilities.
B  Very good work that satisfies the goals of the course.
B- Good work.
C+ Above average work.
C  Average work that indicates an understanding of the course material; passable.
C- Passing work but below Good Academic Standing.
D  Below average work that indicates a student does not fully understand the assignments.
F  Failure, no credit.
WF Withdrawal Failing. Instructors may assign this grade to indicate that a student has unofficially withdrawn or stopped attending classes. It may also be issued when a student fails to submit a final project or to take an examination without prior notification or approval from the instructor. The WF grade is equivalent to an F when calculating the grade point average (zero grade points) and no credit is awarded.

Supplies
Reflective journal: format to be determined by student with instructor's consultation

List sketching, patternmaking, draping and sewing supplies

Selected Resources
www.loomstate.org
http://www.fashion-incubator.com/tutorials/
www.katefletcher.com
www.localwisdom.info
www.wgsn.com (access through the library website)
www.style.com
www.Vogue.com
www.NYTimes.com (Tuesday and Thursday Style Section)
www.businessoffashion.net
www.jcreport.com

Recommended texts
Sustainable Fashion and Textiles by Kate Fletcher
Cut My Cote by Dorothy Burnham
Madeleine Vionnet by Betty Kirke
Yeohlee: Work by Yeohlee Teng & John S. Major
Costume Patterns and Designs by Max Tilke
The Entrepreneur’s Guide to Sewn Product Manufacture by Kathleen Fasanella
The Art of Manipulating Fabric by Colette Wolff
Couture Sewing Techniques by Claire Shaeffer
### University Fall 2010

| Registration | April 5–30 (Registration for continuing students)  
| Classes Begin | Aug. 23-27 (Registration for new students; late reg for continuing students)  
| Convocation | Mon., Aug. 30  
| Last day to add a class | Thurs., Sept. 2  
| Last day to drop a class | Mon., Sept. 13  
| Last day to withdraw from a class with a grade of W | Mon., Sept. 20  
| Undergraduate Students | Fri., Oct. 15  
| Parsons Graduate Students | Fri., Oct. 15  
| All Other Graduate Students | Mon., Dec. 20  
| Labor Day weekend | Saturday September 4-Monday September 6  
| Rosh Hashanah | Wed.-Thurs., Sept. 8 eve*-Sept. 9  
| Yom Kippur | Fri.-Sat., Sept. 17 eve*-Sept. 18  
| Thanksgiving | Wed.-Sun., Nov. 24-28:  
| Winter Break | Tues.–Fri., Dec. 21-Jan. 21  
| Make ups and Rescheduled Days | On Tuesday, Nov. 23, classes follow the Thursday schedule.  
| Spring ’11 Registration | Nov. 1-Nov. 29 (Arranged by program)  
| Juries | Arranged by Program  
| Classes & Exams End | Mon., Dec. 20  
| NSO Session A | 8/30-12/20  
| NSO Session B | 8/30-10/29  
| NSO Session C | 10/11-12/20  

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### University Fall 2012

| Registration | April 2-27 (Registration for continuing students)  
| Classes Begin | August 20-24 (Registration for transfer students and late registration for continuing students)  
| Convocation |  
| Last day to add a class |  
| Last day to drop a class |  
| Last day to withdraw from a class with a grade of W |  
| Undergraduate students | Friday October 12  
| Parsons graduate students | Friday October 12  
| All other graduate students | Tuesday December 18  
| Labor Day weekend | Saturday September 1-Monday September 3  
| Rosh Hashanah | Sunday September 16 evening*-Monday September 17  
| Yom Kippur | Tuesday September 25 evening*-Wednesday September 26  
| Thanksgiving | Wednesday November 21-Sunday November 25  
| Winter Break | Wednesday December 19-Friday January 25  
| Make-ups and Rescheduled Days | On Tuesday, November 20, classes will follow the Wednesday schedule. Tuesday December 18 daytime classes will not meet.  
| Spring 2013 registration | November 5-30 (Arranged by program)  
| Classes and exams end | Mon., May 14  
| Graduation | Fri., May 18  

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270 | APPENDICES
To get you started:

Basic design guidelines
Reflect upon your design work to date in a critical light and try to identify your opportunities for learning exist. This course is an opportunity for this learning; feel free to discuss this with the instructor. This course will require an openness to a variety of solutions throughout the design process so while ideas will become clearer through the process, try not to commit to one end result too early.

It is not uncommon for fashion design students to think of the body in terms of a front and a back, and as a consequence often the front tends to receive more attention during designing than the back. Remember, the body does not have seams – consider the body as one whole; Madeleine Vionnet’s work is worth investigating in this respect.

Reflective Journal guidelines
The size and format of the reflective journal is up to you, but keep in mind that you will be bringing this to class each week – keep it user-friendly for you and the instructor. Nevertheless, the journal should communicate you as a designer. You are to work on the journal each week and all entries must be dated. Please refer to the end of the syllabus for further guidelines.

Research
Research is an ongoing process. While it precedes design, the research process will continue and focus during the design process. While research will initially drive design, at times you may find design driving more focused research in order for you to get deeper into the topic.

Please do not include fashion images as part of your research. It is very difficult to create something new by looking at something that already exists.

Documentation
Please bring a camera to every class or organize to share one with another student. Print out photographs of your process each week and include these in your journal. You should write notes in your reflective journal through the problem-solving process, as well as sketch fearlessly – sketching allows designers to think and problem-solve.
Creating a Zero-Waste Garment
Curriculum Fall 2012

Class meets Thursdays 9-11.40am, 32 W 40th St, room 1106
Classes begin Thursday August 30th 2012.
Classes end Thursday December 13th 2012.

Week 1: Introduction, Research and Explorations (8/30)
Lecture: Introduction to zero-waste fashion design
Assign: Read document on Reflective journal at the end of the syllabus.

Reflective journal:
Research: identify 3-5 moments from the past 12 months where you have felt inspired and document these visually and verbally.
Learning: what do you want to learn from this course?

Week 2: Research and Explorations (9/6)
Exercise one: Fashion tunnels: Draping with muslin
Using two rectangles of muslin*, without cutting into the pieces, drape 5-10 ideas in class and document through photography, sketching and writing.
*The pieces should be the full width of the muslin and each should be at least 40” in length. It is recommended that the two pieces are a different length. You can replace muslin with another woven fabric but use a light color as dark colors photograph poorly.

Exercise two: Signatures
On a piece of paper, draw your name or initials. Cut through some or all of the lines and using tape, begin creating three-dimensional garment form. Repeat two more times, to result in three different forms. Document through photography, sketching and writing.

Due: Reflective journal
Assign: Reflective journal:
Design: explore two of the strongest ideas from class through sketching in reflective journal

Week 3: Research and Explorations (9/13)
Just cut: Cutting and draping with muslin
Interpret elements of inspirational moments from reflective journal into lines on flat muslin pieces from last week. These lines could be slashes, they could start from the muslin edge or not, they could separate a piece enclosed within a larger piece, etc. – there are no rules. Without trying to predict the results, drape 5-10 ideas with the resulting piece(s) of muslin and document through photography and sketching.

Due: Reflective journal
Assign: Reflective journal: Identify two of the strongest ideas from Weeks 1-3. Plan how you would most effectively explore these further through cutting and draping in next week’s class, and come to class in Week 4 prepared accordingly.

Research: Determine which of the inspirational moments from last week’s task you feel most strongly about and identify a few possible paths that your research could take from here.
Assessment 1: Reflective journal.

Week 4: Design – Phase 1: Silhouette (9/20)
This week you need to decide on the garment types (e.g. jacket, dress, etc.) that you will design in this course. In class you will begin to pattern cut and/or drape the basic shape (e.g. body and sleeves
Assign: Zero-waste marker

**Week 11: November 12th 2010**
Design

Due: Zero-waste marker

Assign: A toile

**Week 12: November 19th 2010**
Final fittings, resolving design issues with garment

Due:

Assign: Alterations

**Friday November 26th 2010: Thanksgiving holiday**

**Week 13: December 3rd 2010: Student peer review of 5-6 best pieces**
Loomstate presentation on merchandising (TBC)
Designing for manufacture - key issues

Due:

Assign: Final alterations to toile

**Week 14: December 10th 2010: Final presentation of garments to Barneys (TBC)**

Due: Fully finished toile of garment

Assign:

**Week 15: December 17th 2010: Course finishes**

Due: Fully finished toile of garment
Garment patterns and marker, cutter's must, specification sheet
Reflective journal

Assign: Exhibition briefing with Jonathan Kyle Farmer

Monday December 20th 2010: Projects sent to Loomstate

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February 5-7 2011: Install exhibition in the Aronson gallery.
February 8-16 2011: Exhibition of coursework in the Aronson gallery.
February 17 2011: De-install exhibition.
Course Title: Zero-waste garment

PUFD: 2020-A
CRN: 7515
Academic Year: Fall 2012

Instructor: Timo Rissanen
Office: 232 West 40th Street, Room 1107
rissanet@newschool.edu
By appointment only.

Course Description
This course presents a way of exploiting and building upon the students’ existing fashion design and pattern cutting skills with focus on sustainability in fashion design. It introduces the students to designing a garment without creating fabric waste in the process. In designing and producing a zero-waste garment, the students will develop a deeper understanding of the relationships between cloth, fashion design, pattern cutting and draping, and in a broader sense, the connections between material, design process and final product, and the broader context in which these connections exist. On completion the students will be able to utilize pattern cutting and draping as tools for innovative, sustainable fashion design. In this course sustainability provides a tool for the students to examine their design practices in a critical light.

Learning outcomes:
Upon completion of this course, students will have gained a substantial introduction to sustainability issues in fashion, and they should be able to demonstrate:

- An understanding of the various sources and types of textile waste, and an ability to minimize one type of pre-consumer textile waste through strategic fashion design.
- An ability to critically reflect on one’s own learning, and use reflection as a strategic tool in fashion design.
- An ability to use pattern cutting as a dynamic tool in creative fashion design through an understanding that existing skills may be used in unexpected ways.
- An understanding of the interrelationship between cloth, two-dimensional pattern and three-dimensional garment.
- A critical understanding of fashion design in its broader industrial, cultural and social context.
- A foundational understanding of designing fashion for a market and for manufacture.

Course Requirements and policy regarding grading late submission
All assignments are to be completed fully and on time. Project deadlines are unbending. In case of illness leading to absence or late submission, the instructor must be notified in advance. Attendance is mandatory. Three absences result in a final grade of “F”, and two “lates” count as one absence.

Work is considered late if it is not turned in on time when it is due. Students are given one week to turn in late work. This is due at the beginning of the next class session, at which point the work (if deemed passable) will receive the highest passing grade of a D. If not, the work will receive a grade of F.
In the event of a holiday, students will be required to turn their work in on the day after the holiday by
9:00 a.m., and again, if the work is deemed passable, it will be capped at a grade of D. If not, the work will receive a grade of F.

There are no incremental degrees of 'lateness' and therefore no incremental lowering of grades in between the date when work is originally due and the next class session when late work is due.

We realize there will be exceptional circumstances where faculty will need to exercise discretion. In these instances faculty are encouraged to work with Advising towards a solution for the particular student on a case by case basis. (Please read the Attendance Policy in the syllabus regarding extenuating circumstances).

**Attendance will be taken at 9:00am;** students will be considered absent if they arrive after the first 30 minutes of class. All assignments are due at 9:00am unless otherwise specified. Reflective journals must be brought to every class along with required supplies for those days designated as “in-class work days”. Class participation represents a percentage of the final grade.

Incomplete work is not reviewed by instructor and is graded accordingly.

### Evaluation and Grading

#### Undergraduate Grade Descriptions

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Work of exceptional quality, which often goes beyond the stated goals of the course.</td>
</tr>
<tr>
<td>A-</td>
<td>Work of very high quality.</td>
</tr>
<tr>
<td>B+</td>
<td>Work of high quality that indicates substantially higher than average abilities.</td>
</tr>
<tr>
<td>B</td>
<td>Very good work that satisfies the goals of the course.</td>
</tr>
<tr>
<td>B-</td>
<td>Good work.</td>
</tr>
<tr>
<td>C+</td>
<td>Above average work.</td>
</tr>
<tr>
<td>C</td>
<td>Average work that indicates an understanding of the course material; passable. Satisfactory completion of a course is considered to be a grade of C or higher.</td>
</tr>
<tr>
<td>C-</td>
<td>Passing work but below Good Academic Standing.</td>
</tr>
<tr>
<td>D</td>
<td>Below average work that indicates a student does not fully understand the assignments. Probation level though passing for credit.</td>
</tr>
<tr>
<td>F</td>
<td>Failure, no credit.</td>
</tr>
<tr>
<td>WF</td>
<td>Withdrawal Failing. Instructors may assign this grade to indicate that a student has unofficially withdrawn or stopped attending classes. It may also be issued when a student fails to submit a final project or to take an examination without prior notification or approval from the instructor. The WF grade is equivalent to an F when calculating the grade point average (zero grade points) and no credit is awarded.</td>
</tr>
</tbody>
</table>

**Required supplies**

Reflective journal: format to be determined by student with instructor’s consultation; brought to class each week.

Design, pattern cutting and sewing equipment brought to class each week.

**Recommended texts**


Select Online Resources
Fashion Incubator  http://www.fashion-incubator.com/
Kate Fletcher  http://www.katefletcher.com/
Local Wisdom  http://localwisdom.info/
Yield  http://yieldexhibition.com/
The Cutting Circle  http://thecuttingcircle.com/
Ecouterre  http://www.ecouterre.com/
Center for Pattern Design  http://www.centerforpatterndesign.com/
15%  http://sweatshop-in-shop.com

Designers/practitioners
Timo Rissanen  http://timorissanen.com/
Holly McQuillan  http://hollymcquillan.com/
Holly McQuillan’s portfolio  http://issuu.com/foyacollective/docs/portfolio_holly
Holly McQuillan’s Wolf/Sheep  http://issuu.com/foyacollective/docs/wolf_sheep_workbook
Julian Roberts  http://julianand.com/
Tara St James  http://4equalsides.com/
Yeohlee Teng  http://yeohlee.com/
Titania Inglis  http://blog.titaniainglis.com/
Carla Fernandez  http://www.flora2.com/ (downloadable book)
Caroline Priebe  http://pleasesavemefrommyself.blogspot.com/
Alabama Chanin  http://alabamachanin.com/
David Telfer  http://daviddtelfer.co.uk/
Dosa Inc  http://www.dosainc.com/
Materialbyproduct  http://materialbyproduct.com/
Friederike von Wedelparlow  http://vonwedelparlow.com/
Laura Poole  http://newwaysto.wordpress.com/
Simon Austen  http://simone-austen.com/

Some useful posts
Holly McQuillan
http://hollymcquillan.com/2010/12/20/developing-design-for-yield/

Timo Rissanen
http://timorissanen.com/2011/04/05/zero-waste-fashion-re-patterned-photos/

Caroline Priebe
**University Fall 2012**

Registration

April 2-27 (registration for continuing students)
August 20-24 (Registration for transfer students and late registration for continuing students)

New students register over the summer for the fall term. Please see the New Students Web page for more details.

- Classes begin: Monday August 27
- Last day to add a class: Monday September 10
- Last day to drop a class: Monday September 17

**Last day to withdraw from a class with a grade of W**

- Undergraduate students: Friday October 12
- Parsons graduate students: Friday October 12
- All other graduate students: Tuesday December 18

**Holidays**

- Labor Day weekend: Saturday September 1-Monday September 3
- Rosh Hashanah: Sunday September 16 evening*-Monday September 17
- Yom Kippur: Tuesday September 25 evening*-Wednesday September 26

*Sunday and Tuesday classes scheduled for 4:00pm or later do not meet. No classes meet on Monday and Wednesday. See rescheduled days below.

- Thanksgiving: Wednesday November 21-Sunday November 25
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Design: explore two of the strongest ideas from class through sketching in reflective journal

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Research: Determine which of the inspirational moments from last week’s task you feel most strongly about and identify a few possible paths that your research could take from here.
Assessment 1:
Reflective journal.

Week 4: Design – Phase 1: Silhouette (9/20)
This week you need to decide on the garment types (e.g. jacket, dress, etc.) that you will design in this course. In class you will begin to pattern cut and/or drape the basic shape (e.g. body and sleeves
for a jacket). The two garments could create a look (e.g. trousers and top) or they could be the same garment type (e.g. two dresses).

**Due:** assessment 1: Reflective journal due for in-class critique. 7 minute presentations.

**Assign:** Research: continue
Toile to test basic shape fit

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**Week 5: Design – Phase 1: Silhouette (9/27)**
Toile fittings in class.

**Due:** First toile

**Assign:** Assessment 2:
Write a short (250 words maximum) synopsis of the research informing your design work.

Alterations to patterns based on fitting.
Fabric choice needs to be finalized for week 6: you need to know the exact fabric width in order to design.

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**Week 6: Design – Phase 1: Silhouette (10/5)**
Determine whether you need to make another toile of the basic shape. Once you are satisfied with fit, begin exploring pattern shapes on the fabric width, documenting through sketching and photography, reflecting on progress and possibilities through writing.

**Due:** Synopsis on research
Altered patterns
Final fabric choice

**Assign:** Finalized first pattern and toile

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**Week 7: Design – Phase 1: Silhouette (Mid-Term: 10/12)**
Continue exploring pattern pieces on fabric width, documenting through sketching and photography, and reflecting on progress and possibilities through writing.

**Due:** Assessment 2: In-class critique:
Research synopsis
Finalized first pattern and toile
Reflective journal

**Assign:** Reflective journal
Based on exploration of pattern pieces on fabric width, visually document 15 possible ideas for further designing. These could be ideas for garment details (e.g. collars, cuffs, etc.) based on the exploration of pattern pieces on fabric.

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**Week 8: Design Phase 2: Zero-waste garment (10/19)**
Design: Continue exploring possibilities on fabric width.

**Due:** Reflective journal
15 design ideas

**Assign:** Reflective journal: Identify possible opportunities and limitations for finalizing your garment design. Plan following week’s class accordingly.

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**Week 9: Design Phase 2: Zero-waste garment (10/26)**
Design: Continue exploring possible solutions for your garment design according to your plan.

**Due:** Plan for this week’s class
Assign: Continue design and pattern cutting
Reflective journal documentation

**Week 10: Design Phase 2: Zero-waste garment (11/1)**
Design: Continue exploring possible solutions for your garment design according to your plan.
Due: Reflective journal
Assign: Zero-waste marker on final fabric width

**Week 11: Design Phase 2: Zero-waste garment (11/8)**
Design: Assessing issues with garment, pattern and marker; exploring possible solutions.
Due: Zero-waste marker on final fabric width
Assign: Final garment

**Week 12: Design Phase 2: Zero-waste garment (11/15)**
Design: fittings, resolving design issues with garment
Due: Toile for fitting
Assign: Alterations to garment, marker

_Thanksgiving break_

**Week 13: Design Phase 2: Zero-waste garment (11/29)**
Due: Final garment, marker
Assign: Final alterations to garment and marker

**Week 14: Design Phase 2: Zero-waste garment (12/6)**
Classes finish
Due: Assessment 3: Finished garment
Assign: Garment patterns and marker, cutter’s must, specification sheet

**Week 15: Exhibition of work, critique (12/13)**
Assessment tasks:

Assessment Task 1: Drape exercises documented in reflective journal
Due: Week 4
Weighting: 15%
- Documentation of in-class work
- Reflection on in-class work and own learning
- Research
- Initial design exploration

Assessment Task 2: Design phase 1: Silhouette and shape
Due: Week 7 (mid-term)
Weighting: 35%
- First patterns and toiles for garments
- Reflective journal
Please note: your garments may not be zero-waste at this point but you should have your final fabrics selected at this phase.

Assessment Task 3: Design phase 2: Two zero-waste garments
Due: Week 14
Weighting: 50%
- Completed markers for garments demonstrating zero-waste
- Finished garments
- Reflective journal
REFLECTIVE JOURNAL GUIDELINES
You are asked to keep a visual reflective journal during the course. The reflective journal is a place for you to have conversations with yourself about your progress. Entries should be made at least once a week. The purpose of this commitment is to enable you to begin to examine the extent of your learning and to develop an ability to critically reflect on the design process that you are engaged in. The ability to reflect is key to being an effective learner.

The reflective journal provides you with a ‘bearing’. In Visualizing Research, Gray and Malins (2004) suggest that your research is like a map without any landmarks. Your journal is the means of creating structure, borders, and spaces as to what territory you are intending to investigate. The nature of research means that it is not always possible to state exactly what the outcome will be, but it is important to speculate, and forecast what you might envisage happening.

WHAT IS REFLECTION?
Critical reflection is an important component of research and design processes, as well as your learning. Reflection is a process of reviewing and thinking critically about our activities in the world around us. It goes beyond describing what we do, to thinking about why we do things, whether they have gone as intended, why we think they worked well (or didn’t) and how we might do them differently next time. Recording these reflective thoughts can help us crystallize our understanding of experiences, make connections between different aspects of our work and identify possible improvements. Recording personal reflections has the added benefit of documenting learning over time through recognizing the changing nature of your reflections.

Reflection includes constantly testing the assumptions and actions related to our work. Brookfield (1995) describes reflective teaching in the following way - design can be thought about in a similar way:

"Critically reflective (teaching/design/practice) happens when we identify and scrutinize the assumptions that undergird how we work. The most effective way to become aware of these assumptions is to view our practice from different perspectives. Seeing how we think and work through different lenses is the core process of reflective practice."

In the case of design/practice, the different “lenses” that Brookfield refers to could include your personal beliefs, and the perspectives gained from students, colleagues, the client, potential users, audiences and your contact with the project brief and the designing process as a consequence of research, creativity and analysis, and management and presentation issues.

GUIDELINES FOR REFLECTIVE WRITING
Many of us reflect on our creative process, designing experience, interaction with others, project management issues, but do it in our heads. Sometimes we write notes to ourselves about things that did or didn’t work well in our process. A reflective journal is an effective way of having a coherent process for thinking about these reflections more deeply and making connections between these thoughts and other sources of information.

A reflective journal operates at two levels:
1. DESCRIPTIVE WRITING
Descriptive writing is not reflective. It simply describes events and does not attempt to provide reasons for these events or thoughts about their implications. Descriptive writing is useful for recalling what happened, and we’d expect that your reflections would include it, but description alone is not adequate for the level of critical reflection we expect in your reflective writing.

2. REFLECTIVE WRITING
Reflective writing is different from the descriptive writing used in diaries or records of meetings. Hatton and Smith (1995) provide a useful way of recognizing different types of writing. The terms they use are not particularly important, but note the distinctions they make between the different types:

Descriptive reflection includes both a description of events and some reasons for why they occurred.

Dialogic reflection (as in conducting a dialogue with yourself) involves a greater stepping back from events and exploring alternative explanations and courses of action in context. The writing might make more connections with a range of experiences from differing perspectives including team interaction, meetings with clients, research methodologies, management and communication issues, creative processes, literature and other sources. These might begin to
reflect back on earlier reflections and challenge earlier assumptions. This is the type of writing that we hope your reflective journal entries will demonstrate.

Reflection can also be thought of in relation to action:
- Reflection on action allows you to look at your past work (where you are now) and allows reflection on the early phase of development.
- Reflection in action is based in presence, in relation to your current questions, thoughts and practice.
- Reflection for action formulates the principle thoughts for the future of your research i.e. planning, action, testing etc.

The following questions can act as a guide for your reflective entries in your journal, to gauge the progress of your research:

- What has been your experience of your research process this week?
- How well did you do it? How valuable was it?
- What has been your experience of observing the world around you?
- What did you learn? What didn’t you learn?
- How did you feel about it? (Please avoid using ‘I like…’ to describe feelings.)
- What sources of information did you find? How valuable were they?
- Why did you make certain decisions?
- What was the most difficult thing?
- What was the most satisfying thing?
- What would you have done differently?

While reflective writing is expected, formality is not and there is no single right way to develop a reflective journal. Reflective journal entries can include disconnected paragraphs, stuck in post-it notes with later annotations and odd sentences indicating thoughts to be followed up at a later date, research/designing information provided these are later tied together or complemented with more critical and informed reflections.

Make a habit of writing something (however small) at least once each week. Make sure that you put dates on your reflections and that you keep them together in some way in the journal supplied. Reflecting progressively in this way will then provide a rich range of material for you to work within.

The importance of careful documentation

Organizing your research is a key element in the managing of your research and provides you with invaluable skills.

Studio ‘tools’ might include but are not limited to: sketchbooks, portfolio, digital photographs, 3D prototypes, toiles, and fabric swatches, magazine cuttings (not limited to fashion images), contextual and reference materials. All of these elements become central to the development and progression of your research, and can be articulated around this list:
- Background
- Contextual material/evidence
- Information on methods
- Evidence, evaluation, analysis
- Conclusions and discussion
- Bibliography

The reflective/research journal becomes a key tool for planning, describing, evaluating and summarizing your thoughts and feelings about your research. It will have a bibliography, which should be added to continually.

Visual devices

Mind maps, matrices and diagrammatic visualizations are all useful visual means of evidencing your thinking and research directions, tools such as Mindgenius (http://www.mindgenius.com/).

Photography is a key visualizing method, but should always include annotations to provide information such as who or what is in the photograph, when and where it was taken, and why it is relevant to your research.

For designers sketching is an important visual thinking tool. Leonardo da Vinci kept a journal full of notes and sketches throughout most of his life. The sketch book was where da Vinci (practitioner-researcher) demonstrated his understanding of detail, accuracy and analysis, structure and form,
function and interaction, materials and their characteristics, expression and compositions, appropriate use of media, change and development of a concept, and the various design development stages a piece of work might go through.

Gray and Malins suggest that this is ‘the first coherent example of what might be called a Visual Research Method. Visuals are used in many disciplines to:

- Gather and/or generate data
- Organize, describe and communicate ideas
- Explain or understand a phenomenon or situation
- Propose and persuade
- Evaluate, analyze and interpret
- Resolve and communicate findings

Visual perception and visual thinking (particularly the work of Rudolf Arnheim that explores how the mind interfaces with the world of reality) in visual arts prompts a multi-sensory/multi-media method as a mode of inquiry: There isn’t a one-size-fits-all approach to the reflective research journal, and there is allowance for you to create the kind of document, which best suits your activities.

‘Most reflective journals would contain contextual references. Many practitioners amass great collection of visual examples of other practitioners’ work and some selected examples could be included in your journal. However it is not enough to simply paste in a postcard or magazine cutting – do not forget to provide details about the work and, most important, what you think of it and why it is significant’ (Gray & Malins, 2004, p. 60)

It is the place for different types of information, to monitor the pace and progression of the work, schedules, charts, etc. It could be considered as a diary or log of the documentation of work (research) in progress, with contextual references, with analysis and evaluation of process or progress. It is a store where the information is ‘bound’ together in its purpose, aim and objective.

**Finding the right method for you is the important factor.**

The reflective journal and the process of reflection might include different phases. It will probably include elements of:

- **Description**
  - Identification of processes and material investigation
  - Factual descriptions of what you did and what happened next

- **Reflection**
  - Asking ‘how’ and ‘why’ questions about the progress of your research

- **Summary**
  - Pros and cons/strengths and weaknesses
  - What does it all mean?
  - Identification of new areas of research, and different research paths that have become evident as a result of your current research journeys

All of this will be based on doing, reflecting, summarizing and testing.

**References**


REFERENCES


Ericson, S. 1992, Designing by Draping. 1930s. RetroPrints, St. Helena, CA.
Faerm, S. 2010, Fashion Design Course, Barrons Educational Series, Hauppauge NY.


McCall's sewing in colour 1964, Paul Hamlyn, London.


McQuillan, H. 2009a, Conversation with the author, personal communication, 29 July, Sydney.


Tilke, M. 1956, *Costume patterns and designs: A survey of costume patterns and designs of all periods and nations from antiquity to modern times*, A. Zwemmer Ltd, London.


Woman's Institute of Domestic Arts and Sciences, 1923, *Woman's Institute library of dressmaking*, Woman's Institute of Domestic Arts and Sciences, Scranton, PA.


