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Second Skin: Investigating the Production of Contoured Patterns for the Theatrical Costume Industry

By LIZ GARLAND AND KEVIN ALMOND

This paper discusses research into pattern cutting via mould-making techniques for body conscious, contoured clothing used in the theatrical costume industry (film, television and theatre). With their considerable experience as costume makers, the authors recognized a gap in knowledge and documentation for this approach to pattern cutting. The intentions were to expand the range of techniques available for theatrical costume professionals, allowing practitioners to draw complex style lines directly onto the body shape and onto inanimate objects. The research explored different approaches through a series of three-dimensional experiments, which included contouring the body with moulds to achieve sculptural or abstract forms and discovering the capabilities, advantages and restrictions of the technique. The enquiry includes a variety of methodologies, which investigated the practical, technical and historical background to contoured pattern cutting. Object-based research considered the design and manufacture of body conscious garments. Action-based research and semi-structured interviews with practitioners, considered the skills costume makers use to produce contoured clothing and the ethics connected with drawing styles directly onto the human body. In order to contextualize the practical investigations, a review of the literature revealed the limited extent of contemporary and historical research dedicated to contoured pattern cutting.

KEYWORDS: *second skin, contour, pattern cutting, theatrical costume, industry, body, ethical*

INTRODUCTION

Male and female clothing has been fitted to the body from the thirteenth century onwards.¹ The term contoured pattern cutting has evolved to refer to methods used to cut a garment, which tightly fits the body. Ideas about what constitutes a close fit can differ according to the fashionable silhouette of the period under consideration. This research considers the making of contoured patterns for non-stretch fabrics. Garments made out of stretch fabrics do not require such an accurate fit as they ease to accommodate different body shapes. Fabrics cut on the cross grain or bias have a greater stretch and elasticity which can help contour the body, for instance in earlier centuries men wore tightly fitted hose, commonly cut on the cross in order to give some ease.² Some nineteenth-century female bodices had their centre-front lines cut on the cross in order to fit tightly and allow for the straight grain to give tension at the neckline.³ Such garments however, still require accurate pattern cutting to fit the individual shape. Corsets have been in common use as undergarments from the fifteenth century until the start of the twentieth century. They manipulate the body into the required silhouette around which a dress or other items of clothing can be tightly fitted. Professional costume makers are often required to make corsets to fit individual body measurements and cut a dress pattern that fits tightly over the top.

Within the theatrical costume industry there are two main methods of pattern cutting: flat pattern drafting and cutting on the stand. Flat pattern drafting uses

measurements taken from the body and following a pre-formulated draft, the pattern is drawn upon paper in a two-dimensional format. This pattern can be altered to form the style lines required. Making up the garment in calico allows for the shape to be refined and altered when fitted on the body in order to fully develop the required style and silhouette. Within the costume industry much pattern cutting is done on the dress stand (this is usually referred to by the French term, *moulage* in the fashion industry).⁴ A tailor's dummy is padded out with wadding to create the individual shape of the artist. Smoothing and draping calico over the shape begins to create the individual pattern pieces and the seams are pinned together. Using a sharp 2B pencil to eliminate drag on the fabric the seams are drawn onto the calico pieces. Pattern pieces are made from the calico shapes and the garment is made up and fitted on the performer.

Theatrical costume making has always involved experimentation and requires inventive approaches. It was therefore important to develop the second skin pattern cutting method in different ways in order to investigate its full potential and identify its prospective use within the industry. By covering a tailor's dummy or the human form in cling film and masking tape the pattern cutter can produce a pattern in three dimensions on the body, which can then be cut into to develop a flat pattern. It helps the costume maker visualize how a two-dimensional pattern can transform into a three-dimensional garment and understand the processes used in developing and altering a two-dimensional pattern block, with the use of seams and darts that work in relation to the contours of the body. The second skin pattern-cutting method also inspired investigation into other areas where this method could be used. Covering a top hat and a mannequin head for instance, assisted in the creation of a pattern that would be difficult to produce with traditional

techniques. It concentrated on the positioning of darts and seam lines, in order to create an accurate fit.

Having worked closely with several costume departments within the industry, the authors were aware of how text books and the development of new processes can have an effect on the production of theatrical costumes. Their research suggests that if the second skin method is developed into a finely tuned process it could be successfully used in the design and cut of a variety of different items for the theatrical costume industry. The enquiry also analysed similar processes already in use by some practitioners and the future development for this process within the profession. The main aims and objectives were to investigate:

- 1) The potential of the second skin process to produce accurate patterns for contoured clothing and for clothing that manipulates the body without requiring fitting.
- 2) The development of the process to enhance the understanding of pattern making techniques and the use of unusual seams and darts within contoured pattern cutting.
- 3) The potential widespread adoption of the process within the costume industry.

METHODOLOGY

In developing this research the authors used methodologies found in both Gray and Malins and Kawamura's work.⁵ Applied research through systematic enquiry helped to develop a clear understanding of pattern cutting techniques through practical experimentation and application. The main research methods employed included object-based enquiry, which permitted the close examination of garments considering their use, wearability and construction. Both contemporary and historical contoured garments were

examined in retail outlets and museum collections in order to consider established methods for contoured cutting. Ethnographic research allowed the authors to use fieldwork carried out within their usual working environments as costume makers and lecturers. Working in the studio also allowed the authors to conduct semi-structured interviews with practitioners in order to gather different perspectives about contoured pattern cutting from costume specialists. Consideration was given to the existing literature on the development of historical pattern-cutting techniques and those books most used within the industry from Nora Waugh in the 1950s up to the present time and to consider the advantages and disadvantages of these practices in comparison with the second skin method.⁶ This review also considered the different approaches to contoured pattern cutting used within the costume industry, in order to evaluate the relevance of the techniques developed within this research.

WHAT IS CONTOURED PATTERN CUTTING: AN HISTORICAL OVERVIEW

The search to find information about contoured pattern cutting proved problematic, as the role of the dressmaker, seamstress and tailor has changed throughout history. It was even more difficult to discover ways in which it had evolved within the costume-making industry therefore the following is a brief overview of the development of contoured pattern cutting within the garment trades, and the techniques which have subsequently been adopted and used by theatrical costumiers.

Dressmakers were skilled professionals with customers from across all social groupings; seamstresses – domestic or professional, might alter garments but the availability and making of garments including altering second-hand clothing is a complex

area and depends upon which centuries are considered. The word tailor comes from the French word *tailleur* meaning to cut. Tailors served long apprenticeships in order to become respected craftsmen and they were also required to pattern cut. The majority of clothing was kept for a long period of time and not made particularly well in the first place, and information about early, original patterns is scarce. There are many modern books dedicated to reproducing patterns of historical clothing and details regarding historical clothes, from Waugh in 1968 to Salen in 2012, however it appears very little is known about the development of pattern cutting and how patterns were actually achieved, pre-1750s.⁷ There was some recording of pattern cutting in Diderot's encyclopaedia, which became well known from the mid-1770s and antiquarians knew something of earlier Spanish tailoring manuals.⁸ Obligatory school attendance only became common in parts of Europe during the eighteenth century so it is doubtful that tailors, stay makers or seamstresses would have been able to read and write prior to this. Therefore it is reasonable to assume that techniques were learnt and passed on through craft guilds, by hand or by word of mouth. The dress historian, Naomi Tarrant justified this when she said, 'One consequence of the guilds' regulations was that the tailors' trade secrets remained just that, and we have no idea of their patterns or details of their sewing techniques except what we have learnt from surviving garments'.⁹ The authors interviewed curators of museum collections, such as Lucy Johnston, who had worked at the Victoria and Albert Museum in London and presently works at Dorset County Museum and Sarah Nicol of the Symington Collection, Snibston Discovery Museum, Leicester.¹⁰ Dress stand makers, Kennet and Lindsell were also contacted to discuss the history of the tailor's dummy.¹¹ The costume historian Janet Arnold suggested that the

term *tailor* took on its modern sense in the late eighteenth century, however prior to this, ‘Tailors patterns may have been drawn out of stiff paper or kept as flat buckram shapes’.¹² It is unlikely that patterns like this were made for individuals, apart from wealthy clients as using paper and materials would have been expensive. Tailors would have roughly drawn out the pattern pieces directly onto the cloth with soap using a variety of different techniques and measurements gained from the individual client using a notched tape.

The review of relevant literature considered original nineteenth-century tailoring manuals, for example: Hearn (1821) and Giles (1887).¹³ Tailors used a drafting technique known as ‘old thirds’ in the early part of the nineteenth century. The system was based on the idea that the body’s proportions all related to the measurement of the breast, the cross back measurement, arms, scye (the term for an armhole measurement) and front, including the lapel. These were each measured as one third. It brought about the start of proportionate grading tables used by the ready-to-wear trade. An advancement of this came through the work of a tailor Guillaume Compaing and a mathematician Frederick Wampen, who both studied body proportions.¹⁴ They developed a drafting system that used both horizontal and vertical plotting lines and created a basic block for men and women of different sizes but of average proportions. Many of these drafts were extremely complicated and did not allow for the shape of the individual’s figure. Descriptions of the ‘old thirds’ system can be found in E B Giles’s book and in two detailed essays by Winifred Aldrich, which also discuss the merits of the systems published by Guillaume Compaing and its later development by his son Charles Compaing (1842).¹⁵ In 1823 the tailors Williams and Hearn published the direct measurement system, which is discussed

in Aldrich's book about women's tailoring.¹⁶ Their draft used measurements taken directly from the body, which enabled the creation of patterns for disproportionate figures. They also developed a drafting technique that contoured the individual's body shape. Although the inch, was not regulated by the British Standards Institute until 1930, the use of the inch is apparent in the early-nineteenth century, as the highly mathematical drafts required a small unit of measure that could easily be subdivided.¹⁷ The need to take body measurements meant that tape measures came into common use in the 1860s. A patent was filed by Alvin J. Fellows in 1868. Although rickety and basic it was the first attempt to make a spring tape measure and the advancement of technology enabled a non-stretch tape to be developed. In the 1860s women's journals began to offer advice on how to measure the body. Patterns were drafted to fit the contours of the individual body shape and began to be used by the modern clothing industry.

Corsets were used to shape the body, and were laced to fit. It was not necessary for them to be made to individual sizes and off-the-shelf corsets were standard for the average woman. When examining existing nineteenth-century corsets you find a multitude of different styles. Sarah Nichol from the Symington Collection, in Leicestershire explained that the company stopped making made-to-measure corsets in 1860. The patterns produced for their ready-to-wear corsets were based on waist measurements from eighteen inches, going up in increments of one inch, up to thirty inches. We know from pictures taken within the factory that blocks of each size were produced in cardboard. Dress patterns were also being mass-produced for the standard size. In 1863 an American tailor, Ebenezer Butterick created the first mass-produced graded sewing pattern.¹⁸ The pattern came complete with detailed instructions, which

they called a 'Deltor'.¹⁹ These allowed home dressmakers to create fashionable garments, however in order to create accurate fit, adjustments needed to be made.

Although the first brassiere was patented in the 1920s, it was initially designed as a support garment. Throughout its history the brassiere has played different roles and as such its construction, fit, design, shape and fabrication have varied greatly. Brassieres were designed in the 1930s to highlight emphasis on the bust by using the newly invented nylon, which was a more flexible material than fabrics such as cotton, which had previously been used. In 1935 Warner Bros, a leading American manufacturer introduced the cup sizes for brassieres to ensure the best fit for the ready-to-wear market.²⁰ In 1943, actress Jane Russell (1921-2011) starred in the film *The Outlaw*.²¹ The director Howard Hughes (1905-1976), in a bid to enhance her bust on camera, developed a brassiere with curved steel rods under the breast, which connected to the shoulder straps. It enabled the straps to sit further away from the neck and allowed for a more exposed breast. Although reported as being extremely uncomfortable it was the beginning of the underwired bra.²² The entrepreneur, Lisa Lindahl and costume designer Polly Smith from the USA, developed the first sports bra by sewing together jockstraps and it was christened, Jogbra.²³ This allowed women of all sizes to take part in sport.

The silhouette of women's fashions changed dramatically at the beginning of the twentieth century. Between 1908 and 1913, the influence of French designers such as Paul Poiret, had a great impact.²⁴ They developed a more natural, softer look, which allowed for greater movement and hastened the demise of distorted, corseted body shapes. The need for less restrictive dress was enhanced by a changing society. Sports, dance, opportunities to work and especially two World Wars all played a part in the

evolution of freedom of movement in fashion. Since clothing was no longer fitted closely to the body, ready-to-wear clothing made with basic blocks became acceptable to women of all classes. The expansion of the ready-to-wear industry led to the introduction of standard sizing from America in the 1930s.²⁵ The majority of patterns cut for contoured clothing were achieved by manipulating standard blocks. Toiles would be made up in standard sizes, to check for shaping and style. Corrections would be made to the patterns, which were cut in stiff card when finalized. Only clothing made for the *haute couture* market would be individually drafted to precise body measurements and then fitted accurately to the body shape. The introduction of Lycra brought about liberation in the comfort and fit of clothing. Invented in 1958 as a replacement for rubber in corsets, Lycra was revolutionary for its stretch and recovery properties without creating bagging and was three times more powerful than previous elastics. Only a small percentage needs to be woven with other fibres to create multi-way stretch fabrics. This fibre enabled the production of girdles and other control clothing that would not ride up the body. Lycra continues to evolve, developing tightfitting two-way stretch jeans, leggings and leotards in the 1970s and compression shorts using *Lycra power* to reduce the muscle fatigue of athletes in the 1990s.²⁶ Today, contoured garments are made for underwear, sportswear and fashion items but seldom made to fit the individual. Visiting De Montfort University, Leicester, the authors had a meeting with David Morris, Principal Lecturer in Contoured Clothing.²⁷ It was interesting to discover that students make prototypes of contoured clothing by covering a silicone body form with masking tape, drawing on the desired style lines then cutting off the pattern using a Stanley knife. Prototype patterns are all cut to a standard 34B and graded up and down during the manufacturing process.

Pattern design systems (PDS), using computer technology were introduced into the clothing industry in the early 1980s and were initially used to alter existing patterns, calculate the pattern layout and store data. Japanese researchers were using computers in the 1980s to measure and evaluate the fit of clothing on the body using moiré topography. Experiments using soft mannequins to imitate the human body were undertaken and scientists were able to measure the pressure of clothing on the different areas of the body. 3D body scanning has been available since the 1980s and can be used to provide accurate measurements, generate patterns for the individual body and evaluate clothing fit and style.²⁸ Computer technology can now cut accurate patterns to fit standard sizes and individual figures scanned into the computer. Garments can be viewed in a 'virtual fitting room' allowing for alterations to be made to the patterns to improve fit and style. This has revolutionized pattern cutting, particularly with regards to contoured clothing. Its use in the theatrical costume industry however is limited by budget and application. Techniques for producing clothing for performance are very different to those used for fashion. Theatrical costumes are usually one-offs, made to the measurements of the individual performer and specific to the design requirements of the production. The cut and construction of the garment has to consider these design restrictions and the capabilities of an experienced manual pattern cutter often override that of the computer.

Today's theatrical costume industry relies on the talent and expertise of the individual pattern cutter. Although occasionally they are drafted flat, most contoured patterns are cut by manipulating calico onto a dummy that has been padded to the size and shape required. This is only part of the process, as cutters rely on fittings in order to gain an accurate shape. The importance of the first fitting is accentuated by problems that

occur when obtaining accurate measurements, as patterns are often produced for artists using old measurements or those taken by other people. This means a cutter uses their experience to decipher any abnormalities and any inaccuracies of cut are corrected at the first fitting. The accuracy of fit is only part of the cutter's skill. Interpreting the design and relating it to historical references, a good cutter will style the pattern to the individual's body shape in order to best represent the feel of the character and the period portrayed. This is best done when cutting on a stand, as the cutter can stand back and check the balance and flow of the style lines created against the requirement of the design. Although mould-making is being used to produce patterns within the shoe and lingerie industry, it is not used to produce garments for an individual figure. The research for this study revealed little documentation of the process in the theatrical costume industry, which highlights a gap in pattern cutting skill and knowledge.

Although the authors acknowledge the techniques used to take body moulds are not original, the following section explores the capabilities of the second skin method through practical experiments, taking moulds from different areas of the human body. These are considered in relation to contoured garment styles, popularly used within theatrical costume, the capabilities of the second skin technique and the practical experiments carried out. Recognising its pedagogical capabilities the techniques were refined and used as an experimental teaching aid within the pattern cutting lessons for costume students at the University of Huddersfield. This led to some interesting and creative directions for the technique and these are discussed at the end of the practical experiments section.

PRACTICAL EXPERIMENTS

This section is a reflective evaluation of some of the practical experiments undertaken and their results. Experimenting with a variety of objects and using the mould making process to manipulate the body, we developed an understanding of the possibilities and limitations of the technique. We created patterns for eight different styles, which included a hat block, a torso, a leg mould, a top hat, a bust suppressor, a nineteenth-century corset, a Tudor corset and a head shape. The development of four of these styles is discussed in greater depth in order to analyse the process. These are a hat block, a torso, a leg mould and a bust suppressor. The intention with all the styles was to develop individual contoured patterns with no fittings.

As discussed earlier, the research considers the making of contoured patterns for non-stretch fabrics. The authors recognise that a variety of body-contoured garments can be made from fabric with a Lycra or elastic content, which allows the garment to stretch. The costume designer however needs to use many fabrics without any real flexibility in order to realize a particular look or effect. With some garments the pattern cutter will build in a degree of ease to allow for the bodies' movement. The second skin method was evolved for garments or shapes that do not necessarily require ease because they need to hold and contour a fixed body shape, such as corsets, bodices and millinery. There are limitations to this technique, an example being the need to consider simple movements, which include raising the arm. It became clear from the practical experiments that making the body cast and a pattern derived from it, was problematic for this area of the body. These disadvantages might be used creatively by performers in a devised movement piece, which could use the lack of flexibility as an element of the performance. In the

main such lack of flexibility would be unwelcome to most performers and considerable problems could arise from such inflexible garments, invariably generating a need for more fittings than usual. Unlike today's fashions, historical costume often restricted bodily movement, therefore garments such as bodices are usually cut and worn over tight corsets thus controlling the body shape and allowing for a tight fit.

The first shape to be trialled was a basic hat block. This was a quick and easy experiment assessing the viability and accuracy of the process. The block was covered with cling film, then with masking tape. The first experiment took the form of a traditional skullcap with seams meeting in the centre, at the top. This resulted in an accurate fitted pattern, however as such seam lines are easy to fit using flat pattern cutting, there were no clear advantages to using the new method. The next experiment commandeered seam lines that would be extremely difficult to draft flat or cut on the stand. Seam lines were drawn running from the front to the back of the crown, equal distances apart (Figures 1 and 2). The pattern developed from this created an accurate fit and provided a great starting block to produce further styles, for example extending into a hood or adding a brim.

In order to test this technique in garment making, the next step was to cover a torso. There are obvious ethical considerations when using this method directly on the body. It was important to make sure the model was fully aware of the procedure and asked regularly if she was happy to continue. The female model wore a simple vest top and the mould was taken of the torso finishing at the high hip level. The model was covered with one layer of cling film, making sure the body was not contorted and the cling film fitted into the contours of the body. In order to obtain a natural body shape it

was important the model stood in a natural pose with arms slightly bent and forward. The masking tape was applied in an orderly fashion, keeping the lines smooth, avoiding creasing or pulling too tight (Figure 3). Having covered the main torso and shoulders, problems occurred when applying the tape under the arms as the model had restricted movement as a result. It was also difficult to stick tape to the valley between the breasts and more attention was needed in using cling film in this area.

Having completed the covering, seam lines were carefully drawn in place beginning with the centre back and centre front line. Abstract seam lines were drawn on the left hand side, that spiralled the body, creating style lines, difficult to render through flat pattern cutting. Lines curved from centre front around the body to the centre back, first eliminating shoulder and side seams. One panel piece ran into the sleeve pattern spiralling around the arm creating the underarm seam and continuing diagonally around the arm and down to the cuff. On the right side a traditional princess line was applied. A traditional armhole and under arm sleeve seam were also drawn. For the sake of reference the bust dart was marked and all aspects of the mould were photographed before its removal in order to record the process.

The centre back and centre front seams were marked up with balance marks and cut through carefully because of the close fit of the mould. It then became necessary to cut through both sleeve seams leading into the armpit. Beginning with the side marked with princess seams, each piece was carefully annotated with balance marks and cut through accurately. The pattern pieces were then laid out on the table. It became obvious they were not going to lie flat, as there are too many curves in the body to reproduce the torso shape accurately with a four-piece princess line pattern. The sleeve was very

confusing. Due to the shape of the arm the pattern piece did not lie flat and using a seam or a dart into the elbow, as used in a more traditional cut would not alleviate this problem. It became apparent that in order to create such a close fitting pattern, many more seams would be required to create the fit.

To consider the twisted pattern, the mould was placed onto a mannequin to view the seam lines. Redrawing some of the seams gave a better balance and an extra seam was required over the bust. These lines were defined by using a different coloured pen. Repairs had to be made to the mould under the arm where access had proved problematic. Using the lines created by the masking tape made it easy to see what was required. It was not possible to use the one-piece sleeve pattern created, as it was too long for the fabric, therefore a seam was added cutting diagonally across the pattern piece in order to flow with the design. Once happy with the new lines created, balance marks were drawn across each line at intervals of around 8cm. The seams were then cut through in order to create the individual pattern pieces. Each piece was made up in fused, polyester cotton, which eliminated stretch and allowed for seams to be cut short and left unfinished (Figures 4 and 5). The stiffness and strength of the fabric also gave the garment some structure. This cutting method proved to be a successful way to create an accurate contoured second skin of taken from the model. The technique enabled the development of interesting, flowing style lines, unachievable through flat pattern drafting and cutting on the stand. As a garment however the end result was difficult to wear as the sleeve was too tight to allow the hand to travel through. This problem could be resolved by making up the design incorporating a fastening such as a zip into the sleeve. The style lines on the

curved side of the body proved more successful than that of the princess line due to the majority of seams, which permitted a more accurate fit.

Having successfully employed this technique for the torso, the next step was to experiment with cutting patterns that contoured the bottom half of the body. Producing a pattern for men's hose following typical sixteenth-century seam lines has proved problematic for many costume makers to draft. To make the example in Figures 6 and 7, mannequin legs were used. When creating a body mould for legs you can achieve an impression as to where to place seams by considering the direction in which the masking tape naturally lies flat. The centre front and back seams were drawn in place, running straight through the crotch. The only other seam line ran from the waist through the middle of the buttocks down the back leg, incorporating the main curves of the leg. Cutting through these seams allowed the mould to be removed from the legs and this was laid flat in order to create the pattern.

The process was then used to manipulate the body into an alternative silhouette. Costume makers often need to distort the natural shape of the body in order to create garments and in this case the suppression of the bust was considered. The model wore a simple vest top with no brassiere or bust support. Starting at the top of the breast and under the arms, the model was wrapped as tightly as possible in cling film, covering the waist and over the shoulders. The masking tape was applied starting at the top of the body and concentrated on pulling the breast in tightly and pushing it down, trying to avoid too much bulge under the arms. Having flattened the bust and created the desired silhouette, the centre front, centre back, neck line, arm hole and waist line were drawn in as accurately as possible (Figure 8). After placing balance marks on the centre back line,

it was carefully cut through and released. To make a useable symmetrical pattern only half of the mould needed to be used. The centre front line was cut through and then clipped together, one on top of the other and the waist and bust measurement of both sides were checked against each other. Using the existing lines as a guide the side seam, shoulder seam and armhole were drawn in place and balance marks were marked. Drawing a dart from the underarm seam to the bust point did not allow the pattern to lie flat, due to the shaping under the bust. The pattern was then made up in the fused polyester cotton and fitted on the model.

In order to investigate a wider use, first year students on the BA (Hons) Costume with Textiles degree at The University of Huddersfield, United Kingdom, were introduced to the technique. As students will often think beyond traditional processes and make unexpected discoveries, the method was introduced halfway through the course, once the students had been taught the basics of flat pattern cutting and *moulage*. The process immediately captured the students' imagination. Although the journey of learning was more important than the final outcome, it was found that students who are had previously struggled with pattern cutting and felt restricted through their lack of experience were able to develop accurate patterns for complex designs with eye-catching style. Two student styles are illustrated in Figures 9 and 10.

The majority of the students felt they understood the process and it allowed them to be more creative. Many feel stifled by the formalities in pattern drafting and view the drafting process as a mathematical challenge, with rules that prevent them from working freely. This can create a negative relationship with pattern cutting, resulting in students not reaching their potential and inhibiting their costume design and development. Using

the mould making technique breaks down some of these barriers, enabling them to disobey previously formulated rules and enhance their understanding of pattern cutting. As mistakes can be rectified simply by taping the mould back together, students are less afraid of experimentation. Figures 11 and 12 show two costumes worn in the University of Huddersfield Costume Show (2013) developed using the mould making technique. Created for individual performers they demonstrate how the technique is used to help produce finished garments.

Ultimately, the authors considered the experiments to be successful, as they created patterns that accurately contoured different anatomical shapes. They also assisted in the manipulation of the body shape into a required silhouette and produced toiles that did not necessarily need fittings. The exploration enhanced the authors' understanding of the possibilities inherent in contoured pattern cutting as well as limitations, which included restricted movement and issues with stance and posture.

THE USE OF THE SECOND SKIN TECHNIQUE WITHIN THE THEATRICAL COSTUME INDUSTRY

This section discusses the possibilities for using the second skin process within the theatrical costume industry. The initial ideas were presented at The First International Symposium for Creative Pattern Cutting, held at the University of Huddersfield in 2013 (Figure 13).²⁹ This was a two-day conference at which over thirty-six international delegates presented research discussing aspects of pattern cutting. It provided a rare opportunity to gauge opinions from global pattern cutting experts. Valuable feedback was gathered from a variety of theatrical costume professionals including costume makers, milliners, supervisors and prop costume makers, who were shown the technique through

photographs and then interviewed either face-to-face, via e-mail or in telephone conversations. Students who had begun to use the technique whilst developing costumes for their degree shows were also interviewed, gathering perspectives from those about to enter the industry as costume making professionals. In evaluating the responses it was important to consider an individual's expertise and working environments, and the ways in which they felt the second skin technique could be successfully adopted within their own practice.

The work drew a lot of attention at the symposium, mainly due to the head mould positioned in the middle of the table. This demonstrated the mould making technique, with the idea for a mask pattern superimposed on the mould (Figure 14). The conference delegates quickly identified the difficulty of cutting an accurate fit for a head shape, and were interested to discover how it had been achieved. There was a general fascination with the way such a simple process could produce such highly successful results. Delegates wanted to know more about the twisted torso pattern, which was also displayed and were particularly impressed with the back panel piece that continues in one pattern piece around the arm and down to the wrist. It was problematic to document feedback during the symposium, as a lot of time was spent answering questions rather than asking them. The overall impression gained was how fascinated people were, with the methods used and their results. Many of the delegates asked whether there was a publication or blog regarding the method and a number asked if the authors would be interested in running workshops.

In order to gather more feedback the delegates were e-mailed with the following questions.

- Do you think this is a valid way of pattern cutting?
- Would you consider using this technique in the future?
- If so in what areas do you think it would be useful?
- Do you feel this technique offers a freedom in the use of style lines that could not be achieved by the methods you currently use?

From the 160 emails sent, thirty-eight replies were received all supporting the validity of this pattern cutting method. A few replies confirmed their knowledge of similar processes used within the shoe industry. Clothing professor, Melanie Carrico, commented that although she felt many of the designs could have been made using other approaches, the second skin method appeared to be more efficient and immediate and considered ways she could use the process as a teaching aid to develop connections between two-dimensional pattern pieces and three-dimensional garments.³⁰ She also confirmed she would try the technique on herself, to create trousers with a perfect fit in the hip/crotch area. Lecturer, Ines Simoes definitely thought it a valid pattern cutting method, a technique she would use in the future.³¹ She said, 'I think it would be very useful in customization, a good example being my research student, who is developing the perfect pants for the African women's morphology'.³²

In discussion with costume industry experts, concerns were raised regarding the time constraints and invasive nature of taking the cast. Wardrobe supervisor, Debbie Gamble was confident that it could be used within her own theatre workroom, with a consenting actor.³³ Freelance costume maker, Ivo Coveney felt it would be difficult to convince film actors to have a cast taken in this way however he is often sent full body casts of actors, to work on.³⁴ This gives a clear indication of the artist's true body shape

so he can make armour and other closely fitting costume pieces. The second skin technique could be used over a body cast yet Ivo expressed concern that the consistency of the posture would ultimately affect the nature of the fit. This argument was also raised by wardrobe supervisor, Stephen Snell who questioned the value of the process in relation to the torso, as it would be difficult to ensure that the flesh was not compressed.³⁵

Using the technique for head coverings, mask making and inanimate objects was discussed in a more positive way. Ivo admired the look of the fitted hood and mask and could envisage himself using the process. Milliner, Sally Baxendale felt that the second skin process could have many applications within the millinery industry; she said, '[...]very interesting and the top hat pattern is a thing of beauty in its own right'.³⁶ She had previously been asked to make something similar in relation to an historical reference. Costume maker, Monique Hollingshead was excited by the prospect of using the technique in relation to producing masks and animals' heads, particularly in regard to future research into 3-D printing and scaling up patterns.³⁷

Many concerns were raised regarding the use of appropriate fabrics. Freelance costume maker, Becky Graham considered if working this way cancelled out the nature of the fabric, such as using the bias to fit curves on the sides of the top hat.³⁸ Ivo Coveney commented, 'Your trouser idea is great, but would only work on something like leather that has no grain'.³⁹ As with all garment making, use of the straight grain and the nature of the fabric had to be considered when carrying out the experiments. Although the grain can be added whilst the cast is still on the body, to allow for the most effective use of the pattern it also can be added whilst on the flat. In the hose experiment the fabric used was a loose weave wool cut on the cross following historical methods, to increase ease of

movement. There was a general appreciation of the development of interesting style lines through use of this system. Ivo was impressed with the shaping gained on the twisted trousers and Debbie Gamble likewise felt that using this method could liberate the pattern cutter in the development of seam and in style lines, which not required in the everyday making of costumes, could be advantageous for future projects.

A number of the people interviewed were quite reticent about the technique, especially practitioners whose main expertise relates to traditional forms of costume construction. Becky Graham questioned the relevance of making a Tudor corset with this technique when the cone shaped silhouette it strives to produce can be produced through flat pattern drafting as opposed to working on a curved body form. While this observation is valid an accurate pattern that required no fitting was achieved through the second skin process. Flat pattern drafting, through scaling up historical patterns, does not always reflect the individual's proportions and therefore requires a fitting and often alterations.

The nature of costume making requires experimentation and in general the feedback from the interviewees from industry, revealed their curiosity about the second skin process and to quote Becky Graham 'Any method of getting a pattern is valid as long as it works'.⁴⁰ Most commented on the similarities with wig and beard making and already had some understanding of the technique. With the pressures and time restraints in the industry, there was a general reluctance to experiment with a new method of pattern cutting when familiar, traditional techniques are considered adequate and there is confidence in their success. Arguably this could be considered a reaction to the photographs of the limited styles discussed with the interviewees, such as the top hat, twisted trousers, facemask and hood. In order to use the second skin process successfully,

extra time would need factoring in prior to cutting, making the mould making more long-winded and potentially costly. The majority of the experts interviewed were freelancers, who had many years experience within their field. Although none of them disregarded the technique, it is unlikely that they would commit to using a time restrictive technique without previously experiencing success in its capability. Those employed on permanent contracts however had fewer concerns over the time constraints and were more open to considering the use of the process. The overall enthusiasm for the method could be summed up in Stephen Snell's comment, 'I can't wait to have a go myself'.⁴¹

CONCLUSION

In order to assess the capabilities and limitations of the second skin technique it is necessary to reflect on its effectiveness in creating an accurate pattern for the natural body shape, the manipulation of the body shape, and for abstract forms. The practical research undertaken revealed it was possible to produce very accurate patterns, which contoured three-dimensional shape. When copied precisely onto fabric these patterns fitted exactly around the contours of the original shape. However for these patterns to be used successfully, it is important that seam allowances are taken into consideration and the moulds are cut and drawn around accurately. The process allowed for more freedom in seam lines. It enabled the visualization of proportions far more effectively than flat pattern cutting and seam lines could be more complicated and fluid than with cutting on the stand. It therefore facilitated the development of patterns in a creative way, giving precedence to the creation of the style lines, as the fit had already been directly achieved by the mould making.

The pattern cutting process was effective in creating an accurate contoured pattern in all the experiments undertaken on the natural body shape. However, due to the nature of the close fit, the finished shapes were not always wearable when made in a non-stretch fabric. The reasons for this difficulty are posture, movement and the need for an opening in the shape. The posture affects the wearability because the mould is taken with the model standing in one position meaning that the garment will strain during movement and cause adverse wear and tear as well as discomfort. Due to the cut of the garments it is not always possible to incorporate openings or fastenings that maintain a close fit but allow the garment to be taken on and off. When used in smaller areas of the body these issues were eliminated for example with head coverings. In some cases making the garments in a stretch fabric would reduce or eradicate the issues, however stretch fabric also removes the need for such an accurate close-fitting pattern.

Many of the patterns achieved could not be successfully produced through more traditional flat pattern cutting and the authors consider it a valuable method of making patterns. Time restraints, ethical issues and experience are the main obstacles in disseminating the technique within industry. Further research into the process could develop a clearer understanding of its advantages and the research journey has uncovered many interesting areas for further investigation. Additional exploration into the manipulation of the body could incorporate the use of the process in conjunction with boning, the aim being to refine the technique in order to produce corsetry patterns and to enhance an understanding of the structural underpinnings, such as canvas, boning and interfacing that are used in making such garments. Additional experimentation could also consider the implications of using 3D printing to develop a maquette from which moulds

can be taken to develop patterns of abstract forms. These could subsequently be enlarged with a photocopier to the required scale and quantify the process as an aid for creating props and costume thereby furthering the employment of the technique in this area. As identified in the literature review, there is a lack of documentary evidence relating to alternative forms of pattern cutting including contour work, further research could expand information in this area through the production of publications and blogs, which would serve to further promote the process within the global theatrical costume industry.

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¹⁰ Lucy Johnston was curator of nineteenth-century fashion in the Victoria and Albert Museum's Department of Furniture, Textiles & Fashion. She is now at Dorset County Museum. Her published work includes, *Shoes* (London: V&A Publications, 1999), which she co-authored with Linda Woolley; Sarah Nicol is curator of the Symington Collection at Snibson Discovery Museum, Leicestershire, UK. Her published work includes, *Foundations of Fashion book: The Symington Corsetry Collection 1860-1990* (Leicestershire: Leicestershire County Council, revised ed., 2013), which she co-authored with Philip Warren.

¹¹ *Kennett & Lindsell Ltd.* was established in 1877 and is still owned and run by descendants of the founders; it manufactures hand-crafted models for women's, men's and children's garments at its UK factory in Romford, Essex, using traditional skills and a mixture of both classic and modern materials.

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³¹ Ines Simoes, Fashion Lecturer, Technical University of Lisbon, Portugal, interviewed by Liz Garland, 6 February 2013.

³² Ines Simoes, Fashion Lecturer, interviewed by Liz Garland, 6 February 2013.

³³ Debbie Gamble, Deputy Head of Wardrobe, Sheffield Crucible Theatre, interviewed by Liz Garland, 8 March 2013.

³⁴ Ivo Coveney, Prop costume maker and supervisor for film credits include: *Star Wars*, *Gladiator*, *The Borrowers*, *Gulliver's Travels* and *X-Men*. He works both from his own studio with his wife, costume maker Kaye Coveney, and as required on site in various film studio workshops. As a prop costume maker he is called on to make armour, helmets, body suits, animal suits etc. Interviewed by Liz Garland, 10 March 2013.

³⁵ Stephen Snell, Wardrobe Supervisor and Costume Designer at West Yorkshire Playhouse, Leeds. Stephen has over thirty years experience in theatre industry. As a

maker his specialisms are millinery, prop costume, dying and breaking down costumes. He previously worked as a tutor and has employed students from a range of different education establishments. Interviewed by Liz Garland, 11 March 2013.

³⁶ Sally Baxendale, milliner theatre and film, interviewed by Liz Garland, March 14 2013.

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³⁸ Becky Graham, freelance costume maker for film and theatre specializing in tailoring, with over twenty-five years of experience. She mainly works from her own workroom. Interviewed by Liz Garland, 10 March 2013.

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