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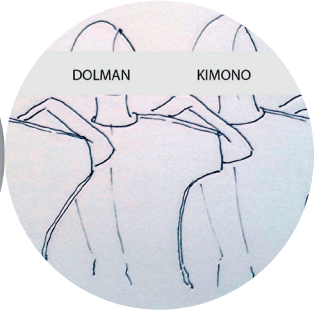
THE PROBLEMS WITH THE EXTENDED SLEEVE STYLES OF POST-WAR DRESS

EXTENDED SLEEVES | POST-WAR CLOTHING | PATTERN CUTTING | GUSSETS | FIT



ABSTRACT

THIS STUDY IDENTIFIES AND EXPLAINS FIT PROBLEMS FOR THE EXTENDED SLEEVE: A TERM USED THROUGHOUT THIS WORK TO RELATE TO A SLEEVE THAT IS CUT IN ONE, OR AS PART OF THE MAIN BODY OF A GARMENT.

Evidence of a lack of knowledge and experience in how extended sleeves should fit and perform has been accrued from a series of short commercial courses that identified and diagnosed fit issues, run at De Montfort University since 2007. The apparel professionals attending these courses were buyers, designers, pattern cutters and technologists. A commonality in their queries indicates a need to establish a clear set of expectations when looking to design, pattern cut and fit a garment with an extended sleeve.

The results of an investigation into contempor ary clothing and pattern shape provide a basic understanding of fit expectation for the loose fit extended sleeve in comparison to the cut and function of the set-in sleeve. 54 garments were examined during wear and a range of movements was carried out to identify problems with extended sleeves. The common areas for fit problems are supported through the analysis of Post-War women's clothing, where the inherent problems with this design are revealed. The methods of cutting for these vintage

pieces detail how the extended sleeve could be cut closer to the arm, an important consideration if the trend becomes fashionable once more. With a gap in pattern cutting literature there was a need to test the data found, so explanations for the styles and their respective fit were validated. Test garments were created that reflected the cut of the most common vintage styles. After testing, fit expectancy was informed through a sound body of research.

INTRODUCTION: EXTENDED SLEEVES

Considered a style in its own right (Aldrich 2008, Kunick 1984), there are five main types of extended sleeve. Figure 1 illustrates the: Extended, Kimono, Batwing (also known as Magyar), Dolman and Raglan sleeves.

An interest in the problems surrounding extended sleeves developed as a result of consistent queries from professionals working in the apparel industry. Designers, pattern cutters, technologists and buyers discussed the lack of awareness surrounding the fit and performance for the loose cut extended sleeve in contemporary practice, with concerns that a closer cut style may be more problematic to fit. It was clear that their educational experiences had not focused on clothing fit. Coupled with a lack of explanatory pattern cutting and clothing fit literature, there was little that could help instruct a better fit of such garments. This uncertainty was evident in the short courses on garment fit, run at De Montfort University since 2007, and signalled a need to discover more about this design of sleeve. The findings from this paper inform fit expectation on loose cut styles, as well as close cut styles that have potential to re-emerge into fashion when trends dictate (Bhardwaj & Fairhurst 2009).

This study used object-based analysis (Kawamura 2011, Cohen et al. 2011, Breward et al. 2008, Taylor 2002) to assess the deterioration found in Post-War clothing to indicate possible theories on fit. The findings were confirmed and validated through a triangulated study that included wearing garments to determine fit expectations related to style. Further to this, replica garments were made and tested, corroborating findings from the clothing studies. Women's wear was selected as the study area, providing a rich source of extended sleeve styles and a greater variation in cut.

AIMS AND OBJECTIVES OF THE STUDY

The primary aim of this study was to document fit problems for the extended sleeve and analyse their underlying causes. The aim was addressed through the following objectives:

- Outline the fit expectations for the extended sleeve.
- Examine the good and poor extended sleeve design of Post-War clothing.
- Analyse the extended sleeve in contemporary design.
- Assess the fit and performance of the most popular extended sleeve styles to identify designs that could lead to an increased satisfaction in fit and performance.

RESEARCH METHODOLOGY

A gap in the literature search indicated a need to closely investigate and analyse clothing in order to determine related fit issues and the expectation for satisfactory fit. A qualitative approach to the research was taken with an object-based methodology selected, because much can be learnt from the study of a garment. Increasingly used among researchers of clothing history, it is valued as an approach that allows the object to inform the direction of study (Kawamura 2011, Breward et al. 2008, Taylor 2002), as well as the generation of theories to shape the study (Cohen et al. 2011). The primary risk associated with an object-based methodology was the potential fallibility of researcher interpretation (Cohen et al. 2011). For example, what could be seen to be deterioration in a garment through poor sleeve design, could be related to another issue. With debate surrounding reliance on aesthetics and physical characteristics (Kawamura 2011) care had to be taken to validate findings and ensure results are credible and trustworthy, so triangulation was used.

The study of Post-War clothing revealed deterioration that could be linked to the cut of the extended sleeve. It also revealed a range of style options for how the patterns for sleeves were cut, not seen in contemporary clothing styles on the high street. Object-based study alone could not define the reasons for deterioration, nor support a growing theory that differences in the way sleeve patterns were cut around the underarm could lead to some benefits in sleeve fit. A study of clothing available through the high street was carried out with extended sleeve styles, assessed for fit on a model. This established a good awareness of differences in the cut of the simple and loosely fitted styles and how they performed through a range of movements. It also helped to highlight the differences in the fit of the extended sleeve with that of the set-in sleeve, as realistic expectations in how a garment should fit according to cut are vital to the fit approval process in the apparel industry. Delays can often occur in fit approval if a buyer is waiting for something unachievable to happen. To understand how successful the cut of the studied vintage garments were, they had to be replicated and tested. Due to the wide range of style

options discovered, the study was limited to the most common designs. This verified initial thoughts and helped to determine a sound body of findings that explain the reason for fit problems with an extended sleeve style.

FIT EXPECTATIONS FOR THE EXTENDED SLEEVE

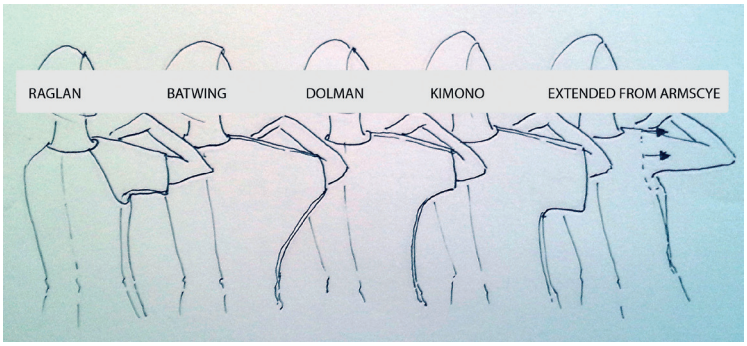
For those working in the apparel industry, it may not be known that problems are inherent with a style of sleeve that is cut in one or as part of the main body of a garment. Through the continuation of material from the bodice to the sleeve there are restrictions to be found in wear with the forward and upward movement of the arms (Katsu et al. 2011). Although extended sleeves are popular in women's contemporary clothing, there appeared to be a lack of certainty in knowing how to fit them. When problems were found in a fit situation for an extended sleeve garment, apparel professionals were not sure what the cause was, what fit was acceptable, or what could be improved.

EXISTING LITERATURE

A patent from 1935 (Berman 1936) was the earliest evidence found showing research into improving the fit of extended sleeve styles. Other patents related to men's wear used pattern-cutting methods that increased the volume under the arm, or added a greater lift in the arm (Grilliot et al. 1992, Nishimura & Watanabe 2001, Hari 1995, Revolta 1951). None of the reviewed patents had direct relevance to a close fitting design, although they did discuss the insertion of gussets at the underarm, or raising the pitch of a sleeve as solutions for a greater range of movement.

Fashion source books show, what appear to be, loose cut Kimono and Raglan sleeves as popular fashion in the 1920s (Peacock 1977) and 1930s (Blum 1986). As illustrative design sources, there was no detail given to show how they were cut, or the expected fit. Despite being a renowned clothing historian, the work of Arnold (1977), showed no details on the cut or pattern shape for an extended sleeve.

The instruction for cutting loose and close cut extended sleeve styles with an additional gusset or a panel was found in pattern cutting key texts (Joseph-Armstrong 2013, Aldrich 2008, Bray 2003, Kunick 1984, Minott 1978, Mac Ewan 1956), but with no guidance given on relative fit issues. The reviewed styles lacked explanation on what type of fit was representative of the design. Details or descriptions of acceptable or problematic fit for extended sleeve styles were not evident in any of the reviewed literature.



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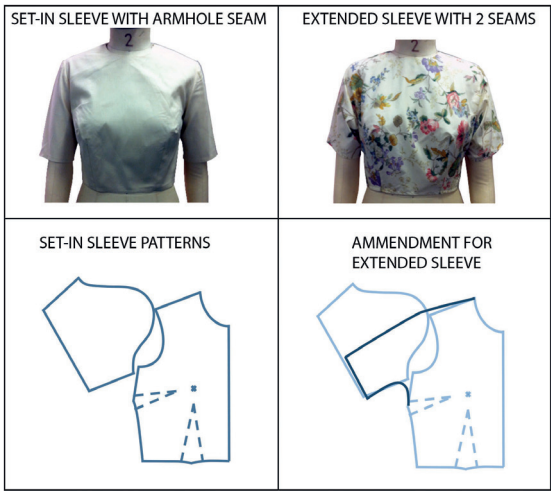

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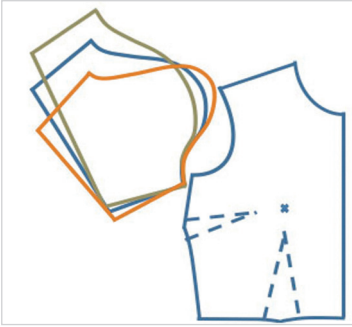
CONTEXT: SET-IN AND EXTENDED SLEEVES

The extended sleeve differs from the standard set-in style, shown in figure 2. The set-in sleeve is joined to the main body of a garment through a seam around the armhole and is designed to accommodate the range of movement in the shoulder and arm (Veblen 2008). Where there is a seam in a garment the two adjoining



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pieces can have varying amounts of shape designed into them, allowing volume to be added to the sleeve head to accommodate movement (Duan 2010). The sleeve head is designed to shape over the shoulder area with an allowance of ease. The seam on the sleeve head is usually slightly bigger than the armhole, so when eased into the smaller top section of the armhole there is a more fabric to accommodate the shoulder (deltoid muscle).

The extended sleeve in figure 2 achieves shape through a seam that runs over and under the arm. This leaves little volume for the fulcrum of the arm. The main noticeable differences in both images are issues raised by apparel professionals. On the extended sleeve, excess fabric is found to wrinkle at the underarm and the sleeve hem at the outer arm tips away from the body. These problems are expected with this design. The wrinkling is eliminated on the set-in sleeve because of the shaping, as can be seen in the patterns. This extended sleeve lacks shape for the shoulder, so the fabric that remains around the armscye (shoulder point to underarm area) collapses into folds and wrinkles when the arm is relaxed. The tipping at the sleeve hem is caused by a lack of volume around the shoulder, as the material over the shoulder becomes tight.

WRINKLES EXPLAINED

The height of a sleeve head differs according to style and affects the angle of the sleeve in relation to the side of the body. A highly shaped sleeve head creates a narrow sleeve that is situated close to the body. It fits minimum of wrinkling at the underarm when the arm is relaxed, but wrinkles are created at the sleeve head when the arm is raised. The higher the sleeve head the more material there is to distort when the arm is raised. A flatter sleeve head is wider with less volume, so has less wrinkling when the arm is raised. However, when the arm is relaxed there is more fabric to wrinkle at the underarm. Figure 3 shows three cuts of sleeve with different sleeve head height, all remaining the same measurement.

The wrinkling of material is inevitable in a sleeve and creases occur in clothing through body movement when worn. Restricting factors occur in extended sleeves because the fulcrum motion of the arm is from the centre of the armhole (Nishimura & Watanabe 2001) and the sleeve has insufficient material around the armhole that undertakes stress when the arm moves.

POST-WAR SLEEVES

Vintage garments were selected for analysis based on whether they had a closely cut set-in, extended sleeve, or a sleeve that could offer interesting cutting methods. They were located in collections from four archives (Snibston 2014, Victoria and Albert Museum 2014, Gallery of Costume 2014 and Marks and Spencer's company archive 2014) and from three private collectors. The earliest example accessible to study was dated mid 1940s, the Post-War era. Styles from this era, such as the Dolman (in figure 1), a signature look of the 40s were useful to study due to the cut and techniques used.

The majority of garments were dated from mid 1940s to the 1980s, most were worn and some revealed where possible stress points existed in their design, because deterioration was evident. Figure 4 shows three images with deterioration around the armscye. The rose print has a small hole by the side of the gusset seam corner and the striped example looks to have had deterioration in the same place, although it has been repaired. The deteriorated fabric has been pinched together and stitched, creating a dart from the corner of the gusset towards the neck. The third image shows repair to the side seam and additional stitching under the arm that may have been used for reinforcing the seam. It was around the underarm that deterioration was found to be most common.

BRAND & SOURCE	DATE	SLEEVE	CONDITION	SIGNS OF DETERIORATION
5 x Horrockses	40s	Extended	Worn	Weakness at the clipped area of the underarm seams.
5 x M&S	40/50s	Extended	Worn	Seam breakdown above original zip at LHSAW. No signs or breakdown on one. Hand stitch repair at underarms. Staining at underarm.
Sambo Fashions	1962	Extended	Worn	No deterioration.
6 x Horrockses	40/50s	Extended with gusset	Worn	Signs of repair by hand-stitch and deterioration at gusset corners. No deterioration.
2 x Unknown	50s	Extended with gusset	Worn	No deterioration.
Dior	55/60	Extended with large diamond gusset	Worn	Signs of deterioration at front and back gusset apex.
PhylisTaylor Balenciaga Jean Allen	1946 50s 1954	Extended with seamed gusset	Worn	At gusset apex, mostly at front. Front and back gusset apex. No signs or breakdown.
5 x Horrockses	40/50s	Extended with gusset panel	Well worn	No deterioration on one. Remaining show deterioration at gusset corners.
Leah Marks Unknown	50s	Extended with gusset panel	Worn	No deterioration.
Digby & Morton Dior Dior Dior	1953 40/50s 40/50s 2000s	Extended sleeve with additional seaming	None wear	No deterioration. Breakdown of back seam. Hand stitch repaired.
Horrockses Hardy Aimes	40/50s	Batwing/ Magyar	Worn	Distortion & deterioration at underarm due to a single clip. Stress on stitched areas around girth.
Unknown Balenciaga Givenchy Jaques Fath Jean Muir John Bates Next Karen Millen	40s 1968 1970 49-50 1979 1973 80s 80s	Raglan	Worn	Deterioration of stitches at underarm join. Shoulder areas stretched on the shoulder due to hanging on the padded satin hanger. Repair at underarm seam on one. No deterioration in 80s samples.
Unknown Next	40/50s 80s	Batwing – loose style	Worn None	No deterioration.
Unknown Unknown J. Wainwright Jeff Banks Ossie Clark	35/40 40/50s 70s 70s 70s	Volume in extended sleeves	Worn	No deterioration on all – except: Deterioration at join on Ossie Clark where waist seam meets underarm.
3 x Horrockses	50s	Set in sleeve. Close fit/pitch – little arm elevation.	Worn	Deterioration at front armhole.
2 x M&S	40/50s	Set-in sleeve, full length with cuff.	Light Worn	No signs or breakdown. Seam breakdown above zip at LHSAW.
Ossie Clark V. Westwood	70s 2000	Stretch extended sleeve with paneling. Excellent cuts.	Worn	No signs or breakdown – stretch – good cut to investigate.

TABLE 1

56 vintage examples were chosen from the collections with the majority dated pre 1960, due to the changes in sleeve style after that date. The garments used to inform the findings were made from woven materials, so any deterioration found would relate to the cut of the style and be a consequence of body movement. Those made of stretch would have additional ease to move with the body making any issues with the cut of the garments less obvious. The examples chosen represent at least eight high street brands, such as Horrockses and eleven designers, such as Dior, with the designers offering a greater range of methods in cutting the sleeve at the underarm. Fifteen dated garments from Horrockses showed how the brand had progressed: from their first 1946 style of extended sleeve, a basic shape with an overarm and underarm seam; to a style with a gusset or gusset panel. Boydell (2014), reasons that this was due to the restrictions found with the first design.

Table 1 shows the number of garments in the dress study, grouped by source, date, type, and condition, with some notes on deterioration.

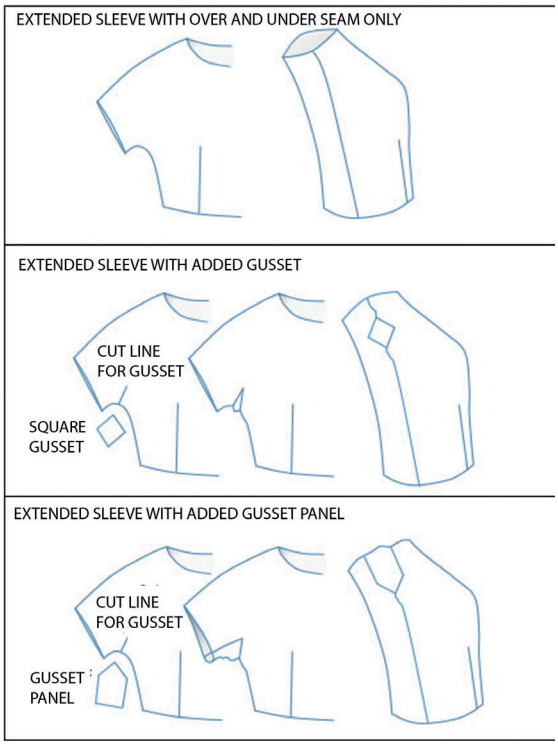
Due to the value of the vintage garments, combined with difficulties in finding a model to fit each size and style, trying on and testing was not considered. Analysis indicated problems related to the underarm area, but with a large design variance, the study focused on several of the most prominent designs for a narrower focus. These are shown in figure 5 and include:

- The basic extended sleeve with overarm and underarm seam
- The extended sleeve with a square gusset
- The extended sleeve with a gusset panel

Figure 6 shows the positions (circled) where deterioration was frequently found. To confirm if these problems were inherent with the design, a greater understanding of extended sleeve fit was accomplished through the following study.

THE EXTENDED SLEEVE IN CONTEMPORARY DESIGN

A general awareness of extended sleeve fit derived from contemporary clothing study, where garments were worn and analysed for fit through a series of movements that were



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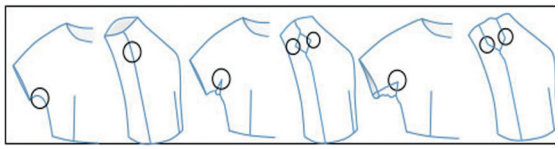

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representative of everyday tasks. Carried out in March 2015, 54 extended sleeve styles of tops, dresses and coats were analysed, with restrictions in movement found that correlated with the main areas of deterioration located on the extended sleeves from the vintage dress study.

The majority of contemporary styles consisted of an overarm and underarm seam as the main method for shaping, although gussets were found on two coats that followed a closer cut. The gusset is discussed in detail in the 'Gusset and Gusset Panels' section. This indicated that some retailers had begun using different cutting techniques for their extended sleeve styles. Regardless of cut, all styles were assessed on a live model to identify any problems with fit and a series of movements were carried out with clothing matched to the models size and measurements. The positions related to a relaxed body position, a high degree of movement and an extreme degree of movement, that could be expected through everyday wear. It emerged that a 90-degree angle was sufficient to show where points of stress would occur in an extended sleeve. Distortion of the sleeve material occurred when the arm was moved resulting in wrinkling and tensioning of the material around the armscye, shown in figure 7. This image also shows how lifting of the arm causes strain on the sleeve material below the centre of the arm. As this study was carried out over a short duration, the long-term effect was not measured beyond the movement trial. However, through the range of movements studied, a good understanding of the constraints of fit became clear after repeated trials, as evidenced in figure 7. The findings from this study revealed restrictions of the extended sleeve design that were consistent with conclusions drawn from figure 2 as discussed in the previous section. The area of stress was also where deterioration was found in the Post-War garments of the same simple cut.

These findings show nothing unexpected and concur with the previous studies of Nishimura and Watanabe (2001) and Katsu et al. (2011) where the fulcrum of the arm is found to be the cause of stress on the material, as the movement of the sleeve has a conflicting pivotal point. The difference in position of both points is that the arm's fulcrum is central to the arm socket and the sleeve's fulcrum is from the underarm to midpoint of the front armscye area. This means the two points will work against whatever type of sleeve is worn and will be more apparent if the sleeve has little or no shaping to accommodate movement under the arm. This signifies that material stress is to be expected with an extended style sleeve with an overarm and underarm seam.

Assessments of the styles revealed that when they were laid flat and compared, there was no exact commonality with the shoulder pitch (angle), overarm shape or lift achievable under the arm. This was also found to be the same in the vintage garments, suggesting that each style had been developed separately to any other and may intimate that differences in material could have influenced the way the sleeve fit had been developed. It was found that any reaching movement caused even the loosely cut styles to show tightness at the back shoulder to the underarm area.

GARMENT TRIALS AND DISCUSSION

Test garments were created and trialed on a model to see if the areas of stress related to the same places identified in the previous studies. The test garments were based upon the three main extended sleeve styles (figure 5) and were developed from a master bodice with a set-in sleeve (figure 2), so consistency in fit around the body was maintained and replicated a close-fit representative of the clothing styles from the Post-War era.

OVERARM AND UNDERARM SEAM

The basic extended sleeve trial with the overarm and underarm seam was found to be the most restrictive for movement. As previously explained, the flat expanse of material that extends from the bodice is only shaped in the seam at the overarm and underarm. This doesn't allow for volume at the shoulder and the underarm doesn't fit as close to the underarm as the set-in sleeve.

The earliest extended sleeves were made with a simple overarm and underarm seam. In the worn vintage garments the underarm seam had experienced problems with fibre or seam deterioration. The length of the extension from the shoulder point was over one and less than four centimeters on the examples found, with a modest sleeve opening that could be considered restrictive. Figure 8 shows an extended sleeve from the mid 1940s. Due to the curve of the underarm seam it was clipped (cut) to relieve tension caused by the smaller measurement of the neatened edge of the seam allowance. This can be seen to distort the appearance of the curve from the outside. It was common to find a cotton twill tape stitched on the seam to strengthen the clipped areas,

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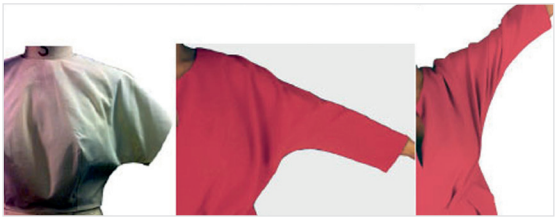

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as these areas would become weaker when cut close to the stitch line. This is evident, as the fibres have deteriorated beyond the clipped points. This would happen through wear.

This design indicated a potential risk and appeared to show that deterioration could occur in the underarm seam. Where the seam was curved and clipped, distortion in appearance and breakdown of the fibres occurred, exacerbated through movement in wear. Analysis of contemporary styles found that simple styles cut with the overarm and underarm seam, revealed areas of tension on the sleeve material, as shown during wear in figure 7. Where wrinkling occurred when the arm was raised, the model explained that the restriction felt in the sleeve came from the underarm. As detailed in table 1, there was a common finding in seam deterioration at this area, for sleeves of this style.

Trials revealed that the closer this sleeve was cut, the greater the stress on the material through arm movement would be. The smaller the opening for the arm, the more restriction was found. When the arm was lifted the bodice side lifts with it. If this is anchored in place by a fitted waist in a dress this would put the seam of the waist under stress at the side position. Figure 9 shows one of the trial garments that shaped the arm well, but when the arm was lifted the side seam was raised. It also shows one of the garments from the contemporary study. This also lifts the waist when the arm is raised higher than the angle that the overarm style line was cut, to shape. However, it does show that as a loosely cut style it still causes wrinkles when the arm is lifted, but the model felt less restriction due to the volume in the sleeve.

If extended sleeves were cut more closely, it would be unwise to follow the simple overarm and underarm seam style. Examples have not been trialed with stretch materials but could provide a potential solution for pattern shapes to remain simple for production. The alternative was to look at using gussets and seaming as seen in the development of the Horrockses label.

GUSSETS AND GUSSET PANELS

As Boydell (2010) had stated, styles towards the late 1940s progressed with the addition of a gusset: a shaped piece of material inserted into the underarm to improve the range of movement in an extended sleeve (Joseph-Armstrong 2013, Mac Ewan 1956). Figure 10 shows a Horrockses Bolero with an underarm gusset. Although it increases volume at the underarm it isn't directly noticeable and doesn't look to add much bulk to the garment. It is made to an excellent standard and features a double gusset; inside and out, requiring a high level of expertise to position, while creating reinforcement in that area. No deterioration is evident in this garment, although it has been worn.

The addition of a gusset allows for additional length through the underarm, resulting in improved arm lift at the side of the body. It is restricted to lift at the side of the body, as no additional width is added between the front and back corner of the gusset. This is made to fit the opening cut into the bodice. Figure 11 shows a gusset panel held to show

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TYPE	DETAIL	NUMBER	NUMBER SHOWING DETERIORATION LINKED TO SLEEVE STYLE
Square Gusset	Four corner points	5	3
Gusset Panel	Three corner points	6	4
Diamond Gusset	Varying lengths	4	1
Kite Gusset	With seams to shape excess material from the gusset	3	1
Part Gusset	Set-in to underarm like a set-in sleeve	4	1

TABLE 2

the sleeve shape and lift before and after gusset insertion. The sleeve is cut at a measurement of around eight centimeters into the bodice from the centre of the underarm towards the neck (Aldrich 2008) and the gusset is inserted with care. Stitching the front and back corners of the gusset into the opening requires skill, due to the acute angle of the cut that leaves a minimal amount of seam allowance, making this an area of weakness. The gusset resembles a square shape, although it can have greater length down the centre, taking on a diamond or kite shape, or extending into a panel to the sleeve hem.

Width can be added if the gusset develops into a panel. This gives additional room for arm lift as additional material is provided in the width, relieving some of the strain caused by the forward movement of the arm. This is visible in figure 12, where the internal and external view of a single gusset panel is shown. Single gussets were commonly found and a cotton twill tape was often stitched to the front and back corners of the gusset to reinforce those points. The edges of the gusset panel are attached to the cut edges of the bodice. The panel width at the sleeve hem indicates the amount of width that has been created.

Despite the associated benefits found from the success of the gusset in garment studies (Huck 1991, Senser & Lewis 1992), a number of issues were detected. There were twenty-two garments in the vintage study with a type of gusset, with ten showing signs of deterioration. The fibre at the front or back gusset corner was the primary situation for weakness to be found. As expected, the styles with breakdown had all been worn to varying degrees. The findings are provided in table 2.

The standard square gusset shape and the gusset panel were the most common styles found and had the highest commonality in deterioration. As this was situated at the front or back corner of the gusset, it indicated that this was the area of design that experienced the most stress in wear. The deterioration found in the other styles also corresponded to the same points, indicating a need for additional study. The kite and part gussets appeared to fit at the underarm with the inclusion of an underarm seam, however deterioration was still evident at the corners of the back gusset. This signified that gusset styling involving angles could be problematic. This could not be proven by testing the vintage garments, as they could not be worn. This raised concerns over the

validity of the findings, as discussed later. Where gussets can be based on oval designs, therefore eliminating the potential issues related to the angles, none were found in any of the woven garments studied.

The trial garment with the square panel gusset resulted in an increase in arm lift from the side of the body. The sleeve was able to lift and reach forward until the corners of the gusset started to come under tension. The back gusset corner was under the most strain through arm movement, with the front apex experiencing some degree of tension. There was a strong correlation in the findings of the stress points that occurred in this test garment with the deterioration found on some of the vintage garments.

The trial garment with the gusset panel confirmed the findings that this design offered the best range of movement in wear, however, through movement beyond a 90 degree lift, or a lift combined with reaching forwards, there were areas of stress that occurred on the back corner points of the gusset panel.

VALIDITY OF VINTAGE STUDY

QUALITY

The condition of the clothing was a factor in determining the wear of the garment, but little about the cut could be understood through looking. Deterioration and soft materials could indicate high usage, however Davies (2015) raises a number of issues that could lead to fibre deterioration, as well as, or other than the cut of the style. These are:

- *Quality of material. Longer fibres have a higher tensile strength than short staple fibres that are weaker.*
- *Perspiration in the underarm area is likely to contribute to a weakening of the fibres.*
- *The washing process and how vigorously the garment may have been scrubbed at the underarm could affect deterioration (Davies 2015).*

The wear and care of the garments was unknown with fibres expected to deteriorate with age, as well as with use. Object-based study without laboratory testing is unable to reveal the quality of fibres and usage. Therefore, the findings that point towards a theory for the weakness in the design of the extended sleeves cannot be proven without further study. Information that accompanied some of the garments, detailed shared wear of the garment, but no data was provided to indicate the wearer had been the correct size and shape for the garment.

SIZING

Garment deterioration could have been exacerbated if the wearer had been too large, creating pressure on the fibres and seams, particularly around the girth of the body. In this case fibre and seam damage would not be isolated to the armscye area. Two garments showed deterioration in seams additional to those related to the sleeve, indicating they had been worn by a size too large. 1947 saw the first standardisation in sizing for women's garments within Britain (Fan et al. 2004), but with issues surrounding shape and sizing still prevalent today (Gribbin 2009), there is little expectation that earlier examples of clothing bought in store would fit exactly to the wearer's requirements. This may explain why adaptations had been made to a few of the dresses in this study. The side seams had either been let out or taken in to adjust to body size.

CONCLUSION: UNDERSTANDING FIT PROBLEMS AND CAUSES

The main aim of this research was to document fit problems for the extended sleeve and analyse their underlying causes. It is evident that extended sleeves do not allow for additional volume around the fulcrum of the arm, or accommodate arm movement as effectively as the set-in sleeve. As shape is difficult to build into a sleeve through the overarm and underarm seam alone, it has to be recognised for fit expectation that the side of the garment will lift with arm movement and wrinkles will occur.

With greater restriction to be expected through a close fitting extended sleeve (figure 8), the curved underarm seam should be clipped to relieve seam tension and reinforced with tape. Deterioration was found in the worn vintage garments at the clipped areas, implying that this design could be problematic when cut closer to the arm. This highlights the need to consider additional seaming or the addition of gussets to enhance movement, as was used in Post-War clothing, particularly during 1940 to 1960. It was found that deterioration was most likely to occur in the front and back corners of the gusset or gusset panel corners, indicating that tension occurred around the girth of the upper body through arm movement (figure 6). Object-based study proved useful for conducting research into these issues as it revealed areas for concern in many designs. However, in isolation with little known of the garments' history of wear and care, the findings revealed issues for further research, to determine if the deterioration found is linked to the design of the sleeve.

Analysis of current styles revealed that the greatest tension on material

occurred around the lower half of the armhole, where deterioration was evident on the Post-War garments. The creation and testing of garments verified what the object-based study had found, and confirmed that the design of the underarm was crucial in enabling a good range of movement. Through assessing the fit and performance of the test garments, it became clear that the gusset panel provided the best range of movement by increasing the material at the underarm section and width at the bicep. This design did increase the sleeve hem, with the volume of fabric from the panel situated at the underarm, enabling the best range of movement out of the tested styles. However, the angles in the design pose a weakness. As a construction technique, it is challenging to insert a gusset into a garment and there is a risk of deterioration due to a narrow seam allowance. This signifies that further work needs to be carried out, looking at the shape of the gusset and alternative methods for shaping at the underarm. The triangulated approach to validating the collected data gives creditability to the research and avoided reliance on researcher interpretation. The work provides reasoning that can help understanding in pattern cutting and fit.

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FIGURE & TABLE CAPTIONS