

Title: Women's knitwear for a 'growing' population.

Sub title: *Digital knit to fit; challenges and solutions in fashion knitwear for larger sizes.*

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Abstract

(This paper is extrapolated from part of the findings from authors PhD research 2010)

The following paper is centred upon practice based research, developing a capsule collection of custom fitted knitwear for the individual body shapes of a cohort of British women over UK size 16 (Eu 44), with parallels to other European female consumers. The intent of the research has been to develop a new knit system offering minimally extensible knitted garments for larger size women, producing tangible knitted results which exemplify a theory.

The 2003 SizeUK survey established that the average woman in the UK is a size 16 (Allen et al., n.pag); since then further body size surveys have been carried out in France, China, Mexico and Brazil. Recent studies show that 36% of the female population in the UK could be obese by 2020. (Press Association, n.pag) Thus a significant amount of the female population falls into the plus size clothing market. Despite this trend, research has concluded that larger women experience dissatisfaction with clothing fit. (Chowdhary and Beale, p1; Kind and Hathcote, p323; Shim and Kotsiopoulos, p1038)

Fashion abhors fat and the ageing process (Evans, p94); thinness symbolises wealth, youth, beauty and power. (Nussbaum, p5) Average women can have up to 38% body fat by middle age (30% when younger) whereas models with as much as 22% less than average body fat are the ideal for whom clothing is designed. (Wolf, p192) As a woman's socio-economic status rises she acquires the financial ability to achieve this ideal. (Arnold, p89) Through this social mechanism, larger size, which often correlates with low income, is relegated to 'low fashion'. (*Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults the Evidence Report*) This research seeks to redress this by improving the fit of commercial knitwear.

Spanning three main areas: clothing fit, larger body shape and knitwear manufacture, this participatory, user centred research has adopted a case study method derived from Yin (Yin, p46), to enable working with real bodies of real women. Interviews plus an online survey

have gathered contemporary socio/psychological data on larger size women's clothing choices, shopping, body image and cathexis specific to this research.

Protocols have been established in body measurement and knitwear design for larger sizes by adapting traditional methods and embracing new technologies. Sophisticated digital knitting equipment has been core to the development of garments, which are based on manually acquired and 3D body scanned data. In order to achieve final garments, objective and subjective evaluation of prototypes have informed serial re-designing involving wearer participation. (Rasband and Liechty, p62-63; Watkins, p241)

This research concludes, as its contribution to new knowledge, that improving the fit of fashion knitwear for larger women by removing the fit-by-stretch factor (which up until now has been a major style and psychological drawback for these consumers), enhances their wearing experience, and entuses the wearer towards the garment. There are some indications that this engagement potentially encourages longevity of use, which may absorb the increased cost of customisation. The template library derived from the research offers a direct route into future industrial developments of the process, which includes scope to consider communication of data straight from body scanner to knitting machine. Response from the mass production knitwear industry has so far been positive and further work in this direction will be pursued.

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1.1 Introduction

The following paper is drawn from practice based research which forms part of a doctoral study into improving the fit of knitwear for larger sized women's body shape. The research is not focused on designing what is sometimes termed 'fast' fashion, the rapid turnover of high fashion styles on the catwalk and ultimately the high street; but on improving the fundamental fit of knitwear in its relationship to the underlying body shape, and wearer satisfaction with the resulting garment. One of the premises of the study is that the inherent stretch-to-fit property of knitting is not the solution to fit, and another is that the practise of

‘sizing-up’ when producing larger sizes does not provide a well fitting garment for bigger women.

1.2 “Extreme thinness is a fashion, a fashion set by the highest social classes”

So wrote Nancy Etcoff in, *Survival of the Prettiest*, her study of the science of beauty.

(Etcoff, p204) Fashion, (usually connected to celebrity and including Beth Ditto and the singer Adele (Hattersley, n.pag; Cosgrave, n.pag) becomes an exclusive, ‘closed shop’ when viewed through the eyes of larger sized women.(Clements, n.pag) The fashion world abhors fat and the ageing process, Caroline Evans in ‘Fashion at the Edge’ describes how the late British fashion designer Alexander McQueen, in his Spring/Summer 2001 catwalk show for Voss, employed a tableau mirroring an image found in fetish photography. The subject of the tableau was a voluptuously large naked woman reclining on a couch, whose bandaged head was covered by a pig mask. She had a breathing tube protruding from the bandages and was covered in moths (which could be seen to represent clothes moths which live by eating clothing). Evan’s translation of the tableau suggests that McQueen was using this and other elements of the show to challenge conventional images of beauty. She writes,

“In the staging of this show Mc Queen oscillated between beauty and horror, turning conventional ideas of beauty upside down. Although the fashion world may embrace polymorphous perversity when it comes to sex, it is narrowly prescriptive about body shape and size. Above all it does not tolerate fat, which with some honorable exceptions, is taboo.” (Evans, p94)

McQueen had a reputation for juxtaposing contrasts in his work, (see:

<http://www.alexandermcqueen.com>) but the question has to be asked whether other designers consider this discrepancy between the bodies they design their clothes for; catwalk models of exceptionally disparate height and weight proportions, and the actual body shapes of people who will wear the disseminated versions of these designs. That their diffusion ranges are unavailable in larger sizes, suggests not. With the exception of Anna Scholz, who really does design for larger women, fashion designers who design for large women are few and far between. Meanwhile the UK designer Julien Macdonald, who has an OBE for services to fashion, is reported as commenting on plus-size models, or indeed any size over a UK 8, as ‘a joke’.(Rawi, n.pag)

'Plus-size' models themselves are perpetuating the traditional 'hour-glass' figure shape, even the AmericanCristal Renn did not look like the average women of a UK size 18 (US 16, European 46) when she was modelling at this size, and model Hayley Morley, a UK size 12, is described in the press as 'voluptuous', when in reality a size 12 is below the now-established average female size. (Groskop, n.pag) Meanwhile the myth of the 'ideal' women's shape is maintained by designers who create their catwalk clothes in ever decreasing sizes. In 2009, Vogue editor Alexandra Schulman is reported as requesting that designers send larger sizes for the magazines photo shoots, because even the 'star' models could not comfortably fit into the sizes supplied.(Fisher, n.pag) Mark Fast, the UK designer chose to use larger sized models in his 2009 show, however the largest was a size 14, which still does not represent the average UK woman's size as established by a recent sizing survey. It is equally questionable as to whether the creative concept behind tight knitwear in combination with minimal supportive underwear was truly flattering to the body shape of the models.(Fisher, n.pag; Mower, n.pag) Within this discussion, the natural range of women's body shape must be taken into account; there are women at both ends of the spectrum of size and shape, plus all those inbetween, and they all require well fitting clothing.

One response to this problem with sizeism and ageism in fashion, has been the collaborative 2010 initiative *All Walks Beyond the Catwalk*. This was organised during London Fashion Week by Caryn Franklin (fashion writer and broadcaster), Debra Bourne (fashion consultant) and Erin O'Connor (model) to encourage diversity in the UK fashion industry.

(see:<http://allwalks.org>)

Nick Knight, the influential British fashion photographer addresses ageism in his 2009 London exhibition, *SHOWstudio: Fashion Revolution*, and also on his SHOWStudio website. Knight has a reputation for showcasing issues the fashion world chooses to ignore (Leitch, n.pag) including breast cancer and size, although a search of the SHOWstudio website failed to reveal any attention to larger size (see: <http://showstudio.com>). Knight however did photograph the disabled athlete Aimee Mullins for the magazine *Dazed & Confused* in 1998, and McQueen used her as a model in his Spring/Summer 1997 show. Evans discusses Knight's portrayal, recognising the similarity to images of dress-shop dummies, and observes that fashion has portrayed women as, "vamps, vampires, femmes fatales, dead, androgynous, threatening, seductive, vulnerable, anorexic, sexually deviant, deranged, complex and overbearing", - but the glaring omission from her list is, 'fat'. She further comments that the body in fashion is, 'disciplined and streamlined, a modernist body, in which the outer

discipline of the corset has given way to the inner disciplines of diet and exercise'. (Evans, p113,172) In other words, it requires strong will-power, plus a considerable investment of time and money (for a diet that does not centre round fat and carbohydrates) and for luxuries such as a gym or personal trainer. These options are unlikely to be attainable by the average woman wage earner, particularly mothers, or those on social benefits, and therefore the ideal remains unattainable. This is especially true in later life, when the body is undergoing the physiological changes of the ageing process.

1.2.1 “No woman can be too thin or too rich”, (the Duchess of Windsor)

Cultural variations in preference for body size have been identified by ethnologists Anderson, Crawford, Nadeau and Lindberg. Up to a forty-one percent variance was suggested, based on social and ecological variables. Anderson also observed that in American culture, women's increasing involvement in paid work correlated with an increased desire for thinness.

(Anderson et al., pp217,219) There is a considerable amount of research into social and cultural influences on, and preferences for, specific body size which it is not appropriate to include in this paper, but to acknowledge that differences exist is important when discussing fashionable body sizes.

Understanding of the 'fashion' body changes over time, and is influenced by social and cultural occurrences, and the proportions of 'fashionable' bodies in history change. We can deduce this from artist's choice of models for their nude studies in different periods. For example the fashionable body shapes we see in paintings by Rubens in the early 1600s, Ingres in the mid 1800s and Renoir towards the end of the nineteenth century, are not the same as the fashionable body shape of today. If we compare these body shapes to those of our own popular culture, we see a marked difference in overall shape, and specific proportions. These women have generous hips, rounded shoulders, stomach and thighs. Historically it would appear that larger size has not been a negative discriminatory factor in fashion, or beauty. Indeed in the Nineteenth century it was considered unattractive to be thin, especially for mature women and increased size was expected after childbirth. Once again art can tell us this. Stearns, in *Fat History*, points out that fashion added bustles and padded bosoms to increase body size, whilst at the same time cinching in the waist with corsetry. (Stearns, pp8,9) The historian Roberta Seid in *Never too Thin*, and Susan Bordo in *Reading the Slender Body*, both identify the late 1800s as when the negative attitude to larger size commenced and suggest that eating disorders subsequently proliferated. (Seid, p81);(Bordo, "Reading the Slender Body," p83) Stearns discusses improvements in sizing in clothing at the turn of the

twentieth century, and speculates that these may have affected the popular attitude to larger sizes, because standardisation made 'extreme sizes' difficult to find. (Stearns, p13)

The issue of popular perceptions of body size and shape were examined by Sypeck, Gray and Ahrens. They studied how fashion magazines portrayed the ideal of female beauty between 1964 to 2004, and found that a dramatic decrease in the body size of fashion models occurred between 1980 and 1990, and also cited earlier research that noted a similar trend after 1959. Their conclusion was that the increasingly thinner images in magazines combined with a dramatic rise in the number of full-body depictions suggest that an increasing cultural value is being placed on a thin ideal of women's shape in American society. They also suggest that this may contribute to the increase in disturbed eating patterns among American women. (Sypeck et al., pp342,346)

The psychological effect of a cultural pressure for an ideal body shape was examined in a recent American study by Roberts and Good. In their research they examined whether personality traits affected the dissatisfaction women experienced with their own body shape after viewing images of idealized body shapes. Findings suggest that neurotic women - those with somewhat elevated emotional instability, a not uncommon condition - were more susceptible to being influenced by the images than others. (Roberts and Good, p211) If it is accepted that American culture has a profound global influence, then this phenomenon can be taken as indicative of a global trend.

When the Duchess of Windsor observed that, 'No woman can be too slim or too rich', she was reflecting contemporary social and cultural belief. Anderson writes that Sobal and Stunkard associated female thinness with high status in industrialised societies (Anderson et al., p198), whilst in 2007 Emily Nussbaum reporting for the magazine *New York*, portrays extreme thinness as symbolising wealth, youth, and beauty. In her article on New York Fashion Week Nussbaum reports that clinically underweight top models can earn up to \$100,000 a week, and that the models 'globe trot' to capital city after capital city to tread the catwalks. (Nussbaum, n.pag) Whilst Nussbaum's report does not extoll the virtues of the job, but actually questions the lifestyle and demands made on what she describes as the 'beautiful freak' fashion models it nonetheless depicts a lifestyle that would superficially seem attractive to most young girls.

The reality of 'real' women's bodies is not that of the catwalk, average women can have up to 38% body fat by middle age (30% when younger) whereas models with as much as 22% less

than average body fat are the ideal for whom clothing is designed. (Wolf, p192) Meanwhile sample sizes for fashion shows are dwindling, Nussbaum in 2007 reported them as falling from a US 6 (UK 8, European 36), to a 4 (UK 6, European 34) and even a 2 (UK 4, European 32) which equates to a 82.5cm bust, 61cm waist and 87cm hips. (Nussbaum, n.pag)

It should not be ignored that at the edge of the economic exclusivity of fashion, there are 'democratic' designers such as Giles Deacon (British Designer of the Year 2006), who considers his label to be 'middle range' as he now aims to sell clothes at £500-£1,500. Although this figure clearly exceeds the purse of most high street shoppers, he also designs for UK high street outlets in the pursuit of a in his own belief in the 'democracy of design'. (Barber, n.pag)

It would appear that the elite fashion designers, with a very few exceptions, are deliberately excluding what is now found to be between twenty percent of women in France and potentially up to forty-nine percent of the female population in the UK. ("Alvanon-Ifth to Release French Body Measurements for Apparel Industry," n.pag; Allen, *Sizeuk Stats*, n.pag) This research has instead worked with real women, and designed garments specifically for the body shape of those over UK size 16.

1.3 Size UK

The UK population's body measurements had not been surveyed since the 1950s, when Kemsley carried out a manual survey on behalf of the British Joint Clothing Council. This situation was redressed in 2001-2002 when Size UK, a collaborative project between commercial and academic interests carried out a population size-survey using 3D body-scanning technology. The SizeUK survey has proved that a narrow waisted figure is no longer standard, and has established that the average woman in the UK is a size 16. (Allen et al.) The hour glass figure, beloved of cartoon artists and 1950s film directors is based on a hypothetical woman who no longer truly exists. Following this study, further body size and shape surveys have been carried out in the USA (2003-4), France (2006-8), China, Mexico, Brazil (2009) and Japan. ("I-Size: The International Morphological Data Portal," n.pag) (Allen, *News*, n.pag)

The findings of Size USA showed a similar trend, with a larger increase in waist girth and weight (6kg more than the UK average), despite the average American woman being 3cm shorter than her UK equivalent. (Wells et al., p422) The French survey, '*Campagne National de Mensuration*' which replaced data from the 1970s, found that twenty-six percent of the

adult population was overweight, with eight percent being classified as obese. The most popular dress size is a European 40 (UK 12, US 10), at twenty percent of reported purchases, closely followed by a European size 42 (UK 14, US 12) at nearly seventeen percent. The average French woman's height is 162.5 cm, which makes her half a centimetre shorter than her UK counterpart of 163cm, but taller than the average American woman of 160cm. ("Special Issue on Size," p2; Allen et al., n.pag)

Size UK was sponsored by a consortium of sixteen major UK retail companies, including amongst others: Tesco Stores, the Arcadia Group, and Marks & Spencer, which sought new sizing data for their production, and all of whom now own the data. The survey was carried out in collaboration with the London College of Fashion, University College London and Nottingham Trent University. Analysis of the results showed that, 'over 60% of UK shoppers had problems finding clothes that fit, and average female waist size had increased by 16.5cm since the 1950s', for this study the average woman was taken as in her mid-thirties. (Crawford; Wells et al., p422) In fact as well as the 16.5cm increase in waist size, women's hips showed an increase of up to 6cm and body weight was up to 3.3kg heavier than found in Kemsley's 1950s survey. (Allen et al., n.pag) It was also found that despite this increase in girths and weight, UK women are on average only 4cm taller than their 1950s counterparts. (Allen et al., n.pag; Wells et al., p422) In a further 2007 study into BMI (body mass index) in relation to body shape based on Size UK data, Wells, Trevelean and Cole found that the BMI (body mass index, which is a measure of body fat calculated from height and weight) of women is particularly associated with bust and hip size. They further found that there is as a significant difference in shape between the sexes in early adulthood, but that as women age their upper body girths, particularly the waist, increased so that male and female body shapes become more similar. It is interesting to note that their conclusion that across genders and age, BMI does not necessarily relate to body shape, and that waist measurements were widely varied for any given BMI. (Wells et al., p419) This presents a picture of a diverse range of female body shapes across the population, which in youth although possibly larger in bust and hip girths, may not have a proportionally larger waist despite having a higher amount of body fat for their height. However, as this population ages, their waist girth will generally increase in relation to overall body proportions, necessitating a re-working of apparel sizes in order to maintain clothing sales.

The WHR (waist-to-hip-ratio) as used by Wells to differentiate between body shape by sex and age and has been used in a number of studies, including those of Singh in 1995, and

Furnham in 1997, both of which looked at sexual attractiveness based on WHR. According to Etoff, a healthy pre-menopausal woman has a WHR that makes their waist between seven to eight tenths as large as their hips, a proportion that she considers to rarely be re-achieved naturally after pregnancy. (Etoff, pp190,191) Singh concluded that WHR plays an important role in female attractiveness and was probably more significant to attractiveness than overall body weight. (Singh and Young, p485) Furnham found that women with a high WHR (not a significant difference between waist and hip girth) were less attractive to men than those with a lower WHR (significant difference between waist and hip girth), but like Singh, he concluded that body shape was not viewed the same as weight. This conclusion was based on the finding that overweight women with a low WHR were actually considered to be more attractive by men than underweight women with a low WHR. (Furnham et al., p543)

These findings lead to question whether as the average woman becomes larger around the waist, and her WHR decreases, could she experience an increase in being perceived as 'attractive' by the opposite sex? It also lays foundations for a complete re-think of garment design to cater for a larger waisted population, with relationally different body proportions to those of the ideal body shape of the twentieth and early twentieth century. This re-evaluation of body shape is particularly crucial in view of the ageing demographic of many developed countries.

1.4 Clothes shopping

Recent studies show that 36% of the female population in the UK could be obese by 2020 (Press Association). Thus a significant amount of the female population falls into the plus size clothing market. Despite this trend, research has concluded that larger women experience dissatisfaction with clothing fit. (Chowdhary and Beale, p1; Kind and Hathcote, p323; Shim and Kotsiopoulos, p1038) Ageing changes body shape; these changes were catalogued during Professor Susan Ashdown's research into older women's clothing at Cornell University. Ashdown also found that ninety-two percent of older women have difficulty finding well-fitting clothes. Lang reports Ashdown as pointing out that, "Clothes are made for the upright stance of the 17- to 35-year-old and typically offer a poor fit for the different body proportions found among older women".(Lang, n.pag) This is however, not exclusive to aging; Abbot and Sapsford write that female teenagers over a size 14, "...find it difficult if not impossible to purchase the clothing that is seen as fashionable, and are thus...excluded from teenage fashion".(Abbott and Sapsford, p25)

Primary sources in this research also revealed that women encounter difficulty buying larger sized clothing at a price they can afford, especially in the UK. One participant explained that she had not always been larger, as a teenager in the 60s she was, "... the perfect shape, I was like a beanpole, flat, no shape, well I always had a little bit of a waist because I've been quite broad in my hips but I was skinny, oh it was lovely." Of her shopping experiences in the UK she said, "...it got to the point when I got to a size 20, a point I couldn't find clothes that I liked anymore". However of a 2006 shopping trip to her native Germany she said, "Its not like here (meaning the UK), here you have to look so hard to find something you like , and then its not in your size." she also commented on price, saying there were, "...really nice things for £20, and in my size, on the rail". Another participant also found that she could buy larger sizes in Germany, but in the UK shopped in large high street multiples and mail order catalogues in order to find her size.

In view of these observations, the persistence exhibited by designers and retailers to perpetuate the mythical 'ideal' woman appears self-defeating and damaging to the average woman's self esteem.

1.4.1 The economics of fashion

Rebecca Arnold in *Fashion, Desire and Anxiety*, suggests that a woman's socio-economic status rises she acquires the financial ability to achieve society's ideal body. (Arnold, p89) If this is indeed true, then the inverse situation is clear, that women who are on lower wages or benefits, will find it harder to achieve this. Arnold sees fashion in collusion with society's obsession with thinness, and describes a process of 'making and marketing' that is focused only on the smallest sizes. (Arnold, pp89-90) This reflects the earlier discussion on model size. To fit into designer's catwalk clothes, models have to be an ideal size and shape which is dictated by the designer's through these garment's size and fit. To stay in their profession, models must conform to this ideal even if it is unnatural for their personal figure, and through conforming to this ideal for employment reasons, sometimes at severe personal cost as described by Nussbaum, they collude with designers and perpetuate the ideal body shape. (Nussbaum, n.pag)

By using only thin women to model designer clothes, the fashion world and the media not only proliferate the idea that women must be thin to look good, but also reinforces the implicit understanding that they must also be economically successful in order to afford the clothes, or, even more damaging for the average women's self esteem, thin enough to have a rich man to buy them for them, thereby adding an additional sexual currency to thinness.

Arnold, Wolff , Etcoff, Bordo and Briscoe all discuss aspirational, physical transformation through elective plastic surgery. (Arnold, p90) (Wolf, p18) (Bordo, "Reading the Slender Body," p90; Bordo, *Unbearable Weight: Feminism, Western Culture and the Body*, p246; Briscoe, p2) Once again financial power is the enabling factor for this transformation. Briscoe writes about the body being the 'chosen canvas of the decade', in which the body's physical limits can be melted. (Briscoe, p2) Arnold, Bordo, and Briscoe view surgery as an expensive form of violence committed on the body, and they suggest that participation in the procedure causes the ideal body that participants seek to become even further removed from reality. The slightly earlier writing of Bordo is put into more current perspective by Briscoe who in 1997 wrote that cosmetic surgery is, '...as familiar in the 1990s to the British suburbanite as to your average Superstar'. (Bordo, "Reading the Slender Body," p84) However, this paper suggests that these operations still remain accessible only to a limited section of society, precluding low wage earners from the procedures even if they desire them. It further suggests that through designer's choiceful disregard for bigger sizes and the social mechanism of media imagery, economic access to healthy food and stringent exercise regimes, and the 'instant' fix of surgery, larger size, which often correlates with low income (*Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults the Evidence Report*, n.pag), is relegated to 'low fashion'. This research seeks to redress this situation by improving the fit of commercial knitwear for larger sizes available in the high street, not simply at designer prices.

1.5 "But I shall be sober in the morning" - body image and body cathexis

Differences between the closely related concepts of body image and body cathexis must be established to attempt to understand the complex ways in which we perceive our corporeal bodies. Susan Kaiser writes that, "The concept of body image refers to the mental picture one has of his or her body at any given moment in time. This picture may or may not be accurate or consistent with other's perceptions of that body", and she observes that it is, "...a vital component of the physical self". She differentiates between the two concepts by saying that body cathexis represents, '...the degree of satisfaction with the body, rather than the body per se'. (Kaiser, pp98,108) Jourard and Secord defined body cathexis as, "...the degree of satisfaction reported by a person with aspects of their own body". (Jourard and Secord, p243) Therefore the difference might be described as that of an overall self-invoked, self-image of our appearance that can change from moment to moment, against long held, self-attributed satisfaction with certain aspects of our body. Markee, who studied the difference between

clothed and unclothed body cathexis similarly agrees that body cathexis concerns satisfaction with parts of the body rather than the whole, and is integral to self esteem. (Markee et al., p1239)

Kaiser considers that clothing is a vehicle for raising self-image and esteem, because if you look good, or even just think you look good, then you feel that you matter. (Kaiser, p174) Markee's research found that amongst working women, clothing can elevate body cathexis, which in turn raises self esteem. (Markee et al., p1241-1242) LaBat and DeLong made similar connections between satisfaction with clothing and positive body cathexis. (LaBat and DeLong, p46) Therefore it is suggested that this link between feeling good in clothing and raised body cathexis (which in turn elevates self esteem), can be exploited through knitwear that fits well and is comfortable to wear.

The powerful prejudices experienced by larger sized women are described by one of Marcia Millman's interviewees in, *Such a Pretty Face*, as, '...the equivalent of being a homosexual'. (Millman, p13) Although she was writing about 1980s America, when this had stronger discriminatory connotations than today, we can nonetheless appreciate the power of the observation. Millman reinforces this prejudice by describing occurrences of 'fatism' in employment, and Wolf cites the dismissal of an airline stewardess for being overweight. (Millman, p93; Wolf, p33) As part of her argument, Millman suggests that low self esteem may indeed be engendered by 'shabby treatment', not precede it, (Millman, p94) and therefore be a product of prejudice rather than a personal response to body size or shape. Millman questions the absence of issues around 'fatism' amongst the American Women's Movement despite their focus on other standards of beauty, citing what small interest there was as centring on the social and psychological oppression of women, rather than promoting wider acceptance and the real social well being that could propagate from this. (Millman, pp93-94) Millman's discussions around the stigma of size brings to mind a conversation between Winston Churchill and Bessie Braddock. Ms Braddock commented, 'Mr Churchill, you are drunk', to which he replied, 'And you madam, are ugly. But I shall be sober tomorrow'. In a similar belief, fat people are generally considered to be able to be 'thin tomorrow', and if they do not avail themselves of this ability to transform (however much a misapprehension it may be) Millman suggests that they may be viewed by themselves and others as weak and undeserving of looking good or being loved. (Millman, p210)

Being fat can be painful, comments from salespeople in a before-and-after weight loss situation are recorded by Millman, and have been reflected in the online survey responses

elicited by this research, for example one respondent wrote, “As a child, having to shop for ‘special’ sizes was very painful, and made me feel different and flawed”(Respondent 167). (Millman, p214-215) Abbott and Sapsford write about teenager’s when clothes shopping; one commented that unless she tried on clothes with her peer group she felt excluded, and it was observed that a favourable male opinion (likely to be influenced by media images of thin women) was paramount to the successful outcomes of their shopping episodes.(Abbott and Sapsford, p29-30) This suggests high social and cultural value is placed on combinations of fashion and body size, a finding confirmed by Grixti in his 2005 study of teenage responses to media images of ‘ideal’ body types and appearances.(Grixti, p1) Whilst these are both studies of younger people, that of Webster in 2003 into older people’s body dissatisfaction, self-concept and self-esteem, found that in women these self perceptions did not alter with age. She did however suggest that older women may separate the concepts, and protect their self-esteem and self-concept by disassociating these from body dissatisfaction. (J. Webster and Tiggerman, p1)

Conclusions around body image and body cathexis discussed earlier, in conjunction with the findings of studies into cultural attitudes to and social impacts of larger body size, are important indicators to this research that an improved fit in knitwear may also enhance body cathexis, body image and feelings of self-esteem in larger and or older consumers.

1.6 The elderly body and fashion

It has already been seen that older people do not necessarily lose interest in the way they look; indeed they may even developing coping mechanisms to perpetuate high self-esteem. Interviews with the elderly have demonstrated that as women in particular age they feel an obligation to ‘make the best of themselves’. (Fairhurst in; Church Gibson, p81) Belleau, when looking at generational differences in attitudes to media and apparel found that older women were more accepting of error in appearances, and in general chose comfort above fashion. On the whole, they were also less influenced by the fashion media whilst being less happy with currently available apparel choices. (Belleau et al., pp107-110)

In response to market demands, the Japanese Takashimaya Department Store has developed a range of knitwear for the older female body shape, incorporating a wider, longer or larger front body. This research came to a similar independent conclusion based on experiments with disproportionate front and back garment panels, and lateral manipulation of side seam position. The Takashimaya knitted garments which they classify as ‘mid-price’, comprise approximately seventy percent of their Decoro clothing range, and are aimed at the 55-65

year old woman. Their spokesman commented that these targeted consumers do not follow fashion trends, but require good fit, comfort and classic styles, although within these parameters colours and fibre choices may change. ("Seamless Breaks into Takashimaya," p41) In contrast to this research's aims, Takashimaya have plans to move to complete garment production which will mean that alongside seamless comfort, they will be able to charge a higher price, thereby taking the 'comfort' fit out of the mid range market, attainable by many, into the high price market, attainable only by a few. In view of the successful Japanese initiative, and in conjunction with this research's knitting principles which could offer lower priced products, it is suggested that older European women may also appreciate the comfort and appearance of an improved fit in knitwear, especially in more classic styles. The findings in this research support this, with comfort and refined fit to their body shape being highly appreciated by participants during wearer evaluation.

1.7 Research methodology and methods

This study encompasses a number of areas including physiology, psychology, and cultural studies as well as the more obviously relevant ones of body shape, size, knitted textiles and knitwear design and manufacture. From within these disciplines a unique, mixed methodology emerged, including: designing a measurement system specific to large sized women and knitwear, visual evaluation, measurement analysis, deductive approaches to data, simple statistical analysis, semi structured interviewing, multiple choice questionnaires, and participatory feedback. Focussed oral histories were taken whilst discussing clothing preferences and retail experiences.

Because the intent has always been to use real bodies and analyse both body shape and clothing preference in order to satisfy the participant's needs in knitwear, visual methodologies including wrinkle analysis, postural reference, photographs, audio, video and drawing have been used to record and inform.(Rasband and Liechty, pp62,63; Watkins, pp267-277; Rose, p4) In response to the differences that were immediately discovered between participant's body shape (all of whom are over a UK size 16) and that of the 'standard' woman, it became obvious that a measurement system specific to larger body shape had to be developed. Traditional body landmarks used in anthropometric body measuring and that for apparel were re-evaluated and where necessary more appropriate ones established. (Simmons and Istook, pp18-26; Fan et al., p196) Methods were tested in a pilot study, as recommended by Yin, and subsequently refined for the main study which has now been completed.(Yin, p57)

Volunteers for the research were self-selecting following an electronic call for participants, and were then chosen through a series of interviews and questionnaires that established criteria for geographical and temporal availability, communication skills, and physical requirements pre-determined by the knitting system. Of the participants, the first was manually measured and her body shape analysed through the manufacture of a body-clone which facilitated fit, the second participant was manually measured, body cloned and latterly body-scanned, and the final participant was body-scanned to acquire shape and size data. Because some measurements are still not found satisfactorily by the scanner, manual measurements were taken for these. This process of progressively introducing three dimensional body scanning helped to establish which landmarks and dimensions should be extracted via the scanning. It also enabled the creation of personalised, independently formulated extraction parameters to be defined within the body-scanning software, which now comprise part of the outcomes of this study.

In addition to primary data from the participants, an online survey was designed to gather secondary data from a wider audience. Respondents were sought through flyers sent with online, plus-size clothing and knitting yarn retailer's deliveries and links posted on special interest websites such as Ample Knitters. A total of two hundred and ninety seven useable responses were received, and from this data, distributions of upper and lower body size have been extrapolated. (Figures 1 and 2) It is probably that as the survey was directed at a plus-size market, the responses will reflect this targeted demographic. The survey was partly designed to establish whether there was a disparity between upper and lower body sizes in individuals, which was achieved by asking the respondents to give the upper body size they choose when purchasing garments, and the same for lower body garments. Across upper body size amongst all respondents aged from 16 to 70, the largest single group of respondents (thirty-one percent) were found to be a size UK 24 or bigger, followed by nearly fifteen percent with a size 18 upper body. In lower body size, a similar proportion (thirty six percent) were found to be a size 24 or above, but the second largest group in the lower body size was in size 20, indicating a trans-generational difference between individual's upper and lower body sizes. (Figures 1 and 2)

In a second analysis, the older age group of 55-70 year olds was looked at in isolation. (Figures 3 and 4) The resulting charts illustrate that by far the largest proportion (thirty-two percent) of the respondents between the ages of 55 and 70 have an upper body size of UK 24 or above, with the next largest group of twenty-two percent having an upper body size of 18.

In the same age group thirty seven percent have a lower body size of over a UK size 24, whilst twenty-two percent of this total age group have lower body size of 20. This independently gathered and specifically targeted data enables validity and rigour in this study.

Upper body size 16- 70 years

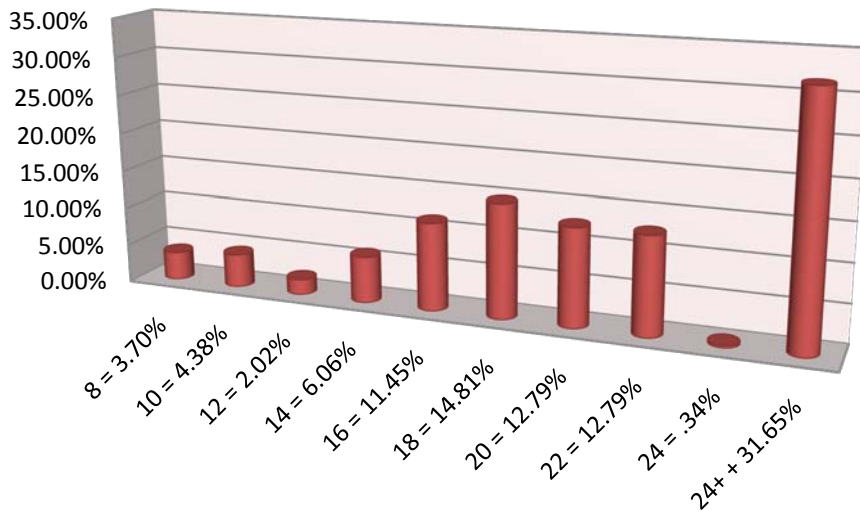


Figure 1 - Distribution of upper body size across all 16-70 year old female respondents to the online survey

Lower body 16-70 years

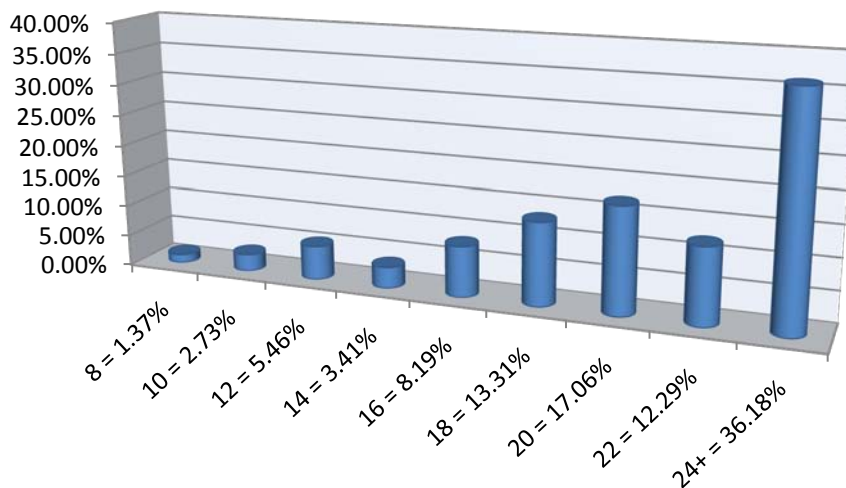


Figure 2 - Distribution of lower body size across all 16-70 year old female respondents to the online survey

Upper body size 55-70 years

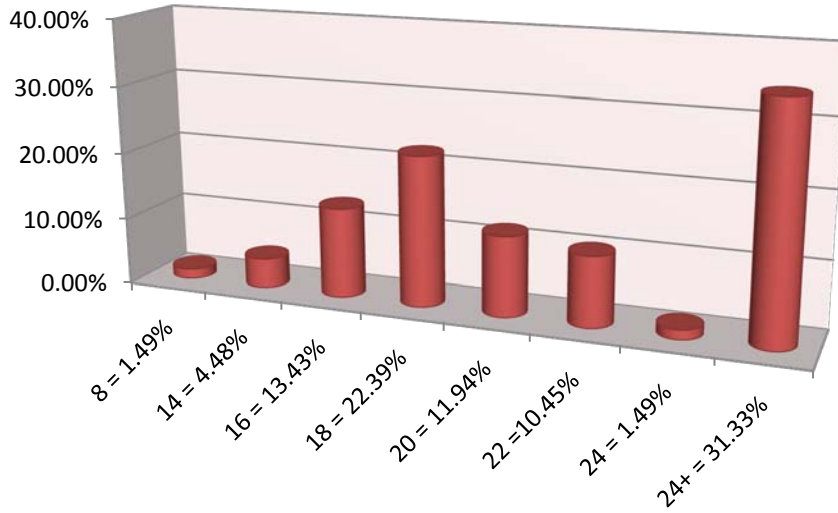


Figure 3- Distribution upper body size across all 55-70 year old female respondents to the online survey

Lower body size 55-70 years

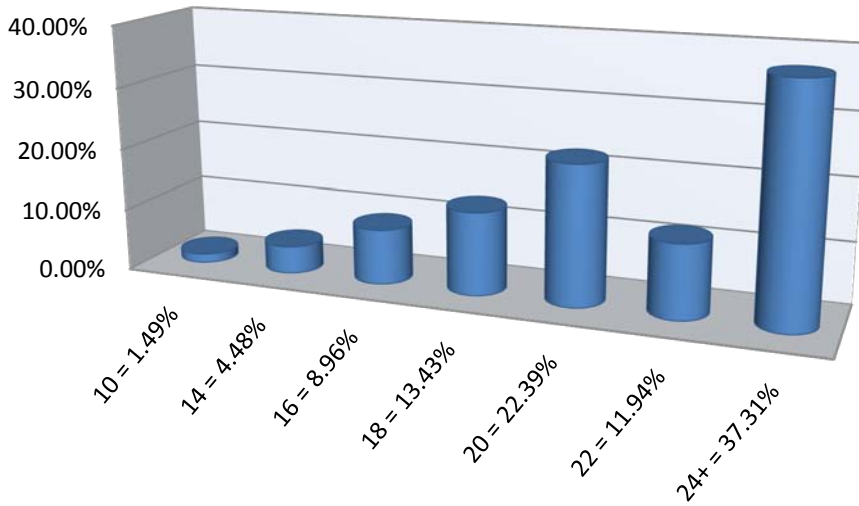


Figure 4 – Distribution of lower body size across all 55-70 year old respondents to the online survey

To augment manual measurement methods, three dimensional body-scanning from an NX12 scanner, with support from the American Textile Clothing Technology Corporation [TC]² has enabled analysis of the body shapes of participants and subsequent garment development. Shima Seiki UK generously provided technical support for the knitting system and proof of concept garments.

1.8 Body shape

Rather than assume that bodies are uniform and have waistline and bust line occurring at equally proportioned distances on the body, this research has, from the beginning, looked at real bodies and taken the information for garment development directly from these. When doing this it has been found that larger sized women tend to have a higher ‘waist’ line (for the purpose of this study, this is defined as the narrowest point of the torso between hip and bust, not necessarily where the participants wear their waistbands). This finding has been incorporated into the garment design, as have other pertinent definitions for larger body shape which have been established throughout analysis of particular body shapes.

Whilst it may not, feel ‘safe’ to articulate in public, “...this is too small”, or “...I am too big”; online there is an active and vocal community of women expressing themselves about clothing size, body shape and problems they encounter with clothing fit and availability. The online survey designed by this research has tapped into this phenomenon by including a text box for comments in the online survey which has provided anecdotal evidence about these problems. The heartfelt comment, “Just because I’m fat doesn’t mean I have arms like a gorilla!”, exemplifies one of the commonest problems; the incidence of relationally disproportionate body dimensions amongst larger women. Susan Ashdown when researching clothing size in the US, observed that, "Within each size category, it is assumed that the taller women are, the wider they are". (Land, n.pag) Yet it has been found by this research that bar some exceptions, grading-up sizes either manually - or more commonly now by computer software, continues without re-assessing proportions.

1.9 The possibilities of digital knitting technology

The digital revolution of the last twenty years has led to rapid developments in textile and fashion design and manufacture systems and methods. In the knitted textile and knitwear industry, computer aided design in combination with computer controlled manufacture have enabled individual needle selection, digitally controlled take-down (the pulling down of preceding stitches in order to enable the clean formation of the following ones), electronically

managed stitch size and yarn feed so that garment quality control can be precisely controlled. For the purpose of this research, the ability to select individual needles, particularly in conjunction with digital take down has enabled three-dimensional shaping to fit the curves of the larger body shape. By knitting with a Shima Seiki 102ff electronic knitting machine and SDS-One programming system, the garments have been developed and produced in an industrial context. It has been a premise of this research to work with the most popular model of knitting machine, so that the results will be widely adoptable. In addition, because the SES/SSG type flat-bed knitting machines are less expensive to purchase, programme and maintain than the complete garment systems, garments knitted using the Knit to Fit method developed by this research will offer the potential for better fitting knitwear at a more moderate price than those made on complete garment machines. Whilst it could be argued that complete garment technology is already being used in low price markets in the UK, the majority of these garments do not exploit the technology to its full potential, and consequently offer no obvious fit or comfort benefits beyond standard knitwear to the consumer, and are certainly not designed for an improved fit. (R. Webster, p10)

1.10 Findings so far

To date, wearer analysis has proved that women value the prototype garment's comfortable fit, which eliminates stitch distortion whilst reducing the drooping, folding and cling commonly found in larger women's knitwear (Myers McDevitt, 2004:246) The knitted garments visibly demonstrate refined relationships to an individual body shape. As hypothesized, the body shape and knitting relationships can be directly influenced by varying the value of wales and courses between areas, thus eliminating collision and reducing wrinkles, drooping hems and excess fabric folds. Responses during wearer trials have included, "...I don't feel like I'm wearing anything" and, "Can you make one for me to wear next?" , which indicate a high level of wearer satisfaction. Problems encountered have largely been related to the unexpected response to the three dimensional body scanning, which encouraged both latter participants to lose weight, thereby necessitating re-measuring, re-knitting and re-evaluation of garments.

1.11 Sustainability

This research concludes, as its contribution to new knowledge, that improving the fit of fashion knitwear for larger women by removing the fit-by-stretch factor (which up until now has been a major style and psychological drawback for these consumers), enhances their wearing experience, and entuses the wearer towards the garment. There are some indications

that this engagement potentially encourages longevity of use. Although the research project has produced customised garments, the principles behind these are transferable to a mass-customisation approach that embraces the concept of closer customer-manufacturer relationships, (Gray, p134) particularly in conjunction with three dimensional body-scanning, and online visualisation tools such as the pioneering My Virtual Model website. (<http://www.mvm.com>) When these are used in combination with design software such as the Shima Seiki SDS-One Apex system and the flexible knitting ability of the latest flat-bed machines possibilities for a new way of shopping that involves co-design via the internet may emerge. Tests of a similar concept by Shima Seiki in the form of their Shima Boutique in Wakayama, Japan and a temporary event in the Takashimaya Department Store's Yokohama and Tokyo stores have proven successful, although currently limited to high value products. (Shima Seiki Mfg., n.pag; Hunter, n.pag) In the case of the Tokyo store, it is interesting to note that in one week they received two hundred orders for custom-made knitwear, particularly in oversizes unavailable 'off the peg' which was worth five million Yen (approximately \$45,000). ("Seamless Breaks into Takashimaya," p41) Although this research is aimed towards more mass manufacture results, within the online survey, respondents were asked if they would consider buying custom-made clothing, and eighty-one percent replied that they might do so, whilst nine percent replied that they already did this. (See Figure 5) This finding has resonance with Takashimaya's experience with custom-made knitwear orders, and opens discussion about the possibilities of further ventures in this field.

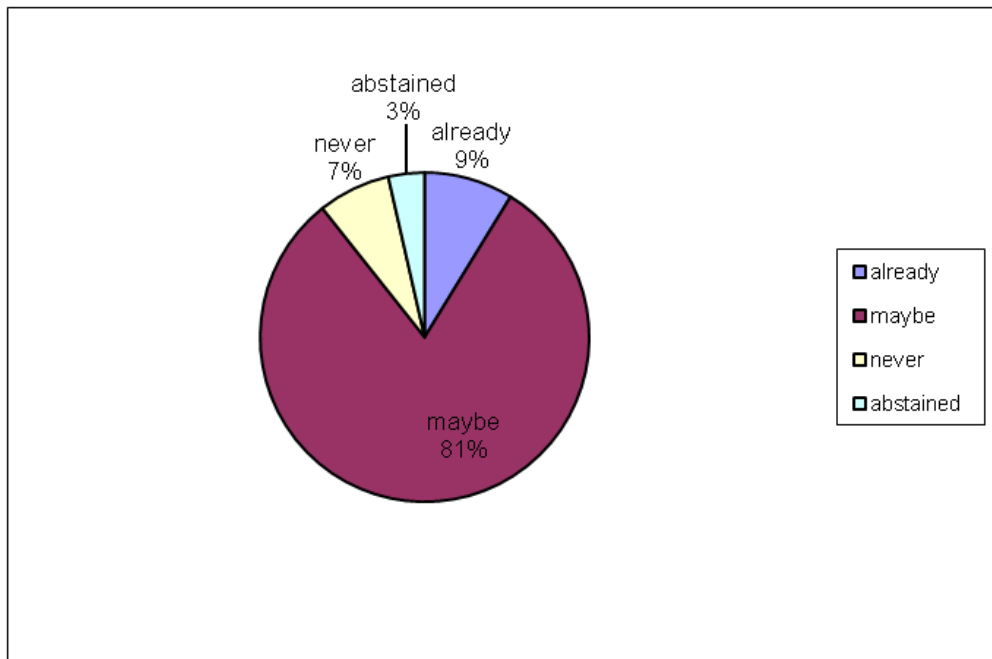


Figure 5 - Incidence of interest in custom clothing amongst 297 respondents sized 16-24+

The template library derived from the research offers a direct route into future industrial developments of the process. The aforementioned experimental ventures by Shima Seiki and the Takayashima Department Stores have indicated a need for a new approach to knitwear shape, and current technology offers scope to consider communication of data straight from body scanner to knitting machine. Response from the mass production knitwear industry has so far been positive, with Shima Seiki UK and TC2 both supporting this research, and further work in this direction will be pursued.

1.12 Future plans

Postdoctoral collaboration with retail and manufacturing is anticipated to produce commercial samples, and in the absence of many contemporary texts on industrial knitting, this work could possibly form a basis for publication

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