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WHAT IS YOUR TARGET MARKET'S SIZE AND SHAPE?

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Abstract: *The apparel industry needs to adopt a geographic segmentation strategy to better fit its target market. Early knowledge of body shapes and sizes of one's target market is one of the key ingredients to arrive at an efficient and shortened product cycle. This paper presents the results of geographical and demographic variables observed in the analysis of sizes and body shapes of women's lower bodies using the data generated by the "size USA" national survey conducted in the early 2000's and demonstrates how these findings may be used to better serve the consumer while improving the apparel supply chain.*

Keywords: apparel, target marketing, apparel fit, supply chain.

1. INTRODUCTION

Consumer expectations, volatility and seasonality have led the apparel industry to implement innovative Supply Chain Management (SCM) techniques and tools. In the 1980's, the industry developed a modified version of SCM known as Quick Response (QR). The innovativeness of this approach rest on its attempt at satisfying both final consumers' and channel members' expectations.

Although the industry has implemented various versions of QR, from the Zara *Quick Fashion* model to the Peerless Clothing *Quick Replenishment* model, consumers are still dissatisfied with the products offered and retailers still have to contend with high levels of product returns. A number of articles have been written on what QR is, how it can be implemented and the results to be expected from its implementation. Yet very little has been written on the impact that product design may have on its eventual success.

We demonstrated, in previous papers [1] [2], focusing on women's pants, that apparel manufacturers adapt their size specifications to their target market somewhat regardless of national standards or order initiator's measurement specifications. We confirmed that identically size labelled women pants often have different measurements. Finally, we also found that order initiators' tolerances are so generous as to allow for overlapping sizes thereby decreasing the fit identification value of existing size labels. The immediate consequences of these findings are consumer dissatisfaction and supply chain inefficiency.

These observations led us to hypothesize that product design, and more specifically sizing, is at the core of SCM efficacy and efficiency rests.

This article focuses on geographical and demographic variables observed in the analysis of sizes and body shapes of women's lower bodies using the data generated by the "*size USA*" national survey conducted in the early 2000's and demonstrates how these findings may be used to better serve the consumer while improving the apparel supply chain's performance.

2. SCM AND APPAREL VOLATILITY

The apparel industry is, by definition, highly volatile. Selling seasons are short [3] and ever shortening to the point where some have weekly style changes [4]; the number of styles and variety of product is high when compared to what may be found in other; demand is uncertain [6] [4] [7],. As Cho *et al* [8; p. 542] state: "The competitive pressure from markets and consumers has forced many firms to improve the quality of their products and to lower the cost of bringing them into the market."

In theory, QR is a strategy conceived to enable fashion retailers to rapidly respond to consumers' tastes and demands and thereby take advantage of early sales trends. Moreover they should also be able to adjust their orders and to maintain their inventories to a minimum. Fiorito *et al*. [9; p. 237) define QR as a "strategy where the manufacturer strives to provide products and services to its retail customers in exact quantities on a continuous basis with minimum lead times, resulting in minimum inventory levels throughout the pipeline".

QR has now been a strategy of choice in the apparel industry for more than 20 years yet results are, to say the least, mitigated. Hunter [10] and Jones [11] conclude in separate articles that there has been very little improvement in the apparel supply chain since the inception of QR. Fiorito [9] even goes as far as stating that the best QR results have been achieved without the use of a QR strategy.

Some authors suggest that the relative lack of success of the QR strategy rests on the fact that all apparel items are managed in the same manner although they are highly different. Sabath [12] suggests differentiating between volatile and non-volatile (i.e. a woman's blouse and a basic man's underwear); likewise for low and high volume items (i.e. an expensive winter coat versus black socks). Au [13] proposes to differentiate between new and standardized products.

Another important point that may impact the apparel industry's ability to truly take advantage of QR is the number of sizes currently offered. For example, a Canadian retailer wishing to carry one unit of every size of a garment would have more than 30 units in stock. This obviously forces a choice, to either target a narrow market or to reduce the selection, and renders the purchasing and inventory management extremely complex.

Christopher [6] advocates that a uniform application of the QR strategy may not be optimal and that organizations should evaluate the possibility of developing hybrid SCM models.

So when does QR become a viable SCM alternative? We propose that two factors are fundamental for QR to attain its full potentials: (1) a targeted marketing strategy, and (2) precise manufacturing specifications to support this strategy.

3. APPAREL SIZING

As stated by Carrier [14; p. 161] "In order to understand the apparel industry, we must first look at what it sells and who are its customers. What immediately comes to light is that this industry deals with a wide range of products, of highly varying prices, and targeted at a wide spectrum of population…Some manufacturers concentrate on an assortment of highly trendy items such as blouses, skirts, jackets for which fashion changes every season, and sometimes even more frequently in terms of design, textile and colour. Others deal in much less time dependant categories such underwear, socks, stockings and T-shirts. "

Price is another element of differentiation in the apparel industry; prices vary between items and within product lines. Winter coats rarely retail at less than a $100 whereas most men's underwear rarely exceeds a price of $40. On the other hand, one may buy a man's suit for $ 99 yet others sell for upwards of $ 5 000

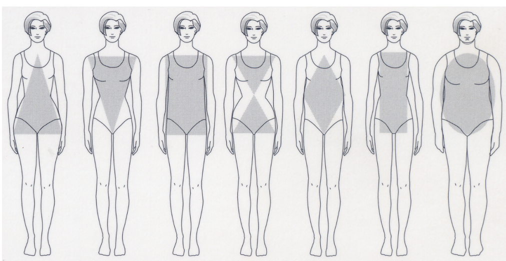
Everyone consumes apparel: all age groups, all social classes, all races and religions. Apparel is intended for work, leisure, vacations and special occasions. Consumers' expectations and behaviour differ when shopping for a work shirt, a ski jacket or a tuxedo.

The list of differentiation factors is endless. Yet one is probably more important than all the previously mentioned ones put together: garment fit. Regardless of the style, price or type of garment he or she may be looking at, for a consumer to be satisfied, he or she has to find a garment that fits properly: One of the approaches adopted to arrive at this fit has relied on the creation of standard sizing charts.

Measuring methods, standard sizes, grading systems, size labelling and apparel fit have been discussed for the past seven decades [15] [16] [17] [18] [19] [20]. For some, national surveys leading to the elaboration of size standards based on anthropometric data were the solution [18]. Nowadays more and more authors agree that standards originating in national surveys have not served their purpose; they generally argue that the spectrum of female body shapes and measurements is too wide [21] [22] [23]. Manufacturers therefore prefer grading their garments based on a body shape adapted to their target market [24].

Numerous articles dealing with female apparel market segmentation based on age, size, ethnicity, and a number of other factors have been written [25] [26] [27] [28]; yet body shapes have received little attention [29] [30] (figure 1). Rasband & Liechty [30] argue that an ideal figure does not exist but that characteristics such as height, bone size, weight and proportions between body areas are useful for shape determinations and fittings. Somewhat along the same line, Mullet & Chen [31], propose that two elements need to be considered when developing apparel: the intended wearer's body size (anthropometric measurements) and the garment size (key measurement points). In both cases, they add, measurement procedures are complex.

Figure 1 From "Fabulous Fit Speed Fitting and Alteration" Rasband & Liechty [30; cover page]



It therefore appears that arriving at size standards is complex. Fan *et al.* [32] state that today's challenge is to get accurate body measurements while Whitestone & Robinette [33] and Ashdown [15] underline that the need to identify proper statistical tools to arrive at precise measurements also is a challenge.

This challenge becomes all the more important in an environment where the lack of it risks creating confusion and dissatisfaction throughout the supply chain.

4. RESEARCH ON SIZING AND DEMOGRAPHY

We demonstrated in previous papers [2] that apparel order givers and manufacturers do not adhere to established national standards. A literature review enabled us to identify a number of causes for this situation ranging from standards obsolescence (based on a population survey conducted more than 60 years ago and updated irregularly for different purposes) to niche marketing (adapting sizes to please a specific group of consumer) or vanity sizing (using larger measurements than a given size calls for to appeal to the consumer's vanity). The ready-to-wear industry has clearly chosen not to respect size standards; on the other hand, it has not yet acquired the tools to offer *tailor-made* in the most price sensitive market segments. This has created a nightmarish situation: not only are there more than 30 different standard sizes in women's wear (in Canada) but the consumer can not even rely on the size label to identify a fitting garment and must therefore spend an undue amount of time finding the right one.

We contend that a viable choice exists between the *tailor-made* and imposed size standards extremes of the mass customization versus total standardization spectrum: allow order givers and manufacturers to size their products however they wish yet propose or impose a labelling system precisely reporting garments' specific measurements. This approach recognizes that order givers may target and fit specific consumer segments while ensuring the provision of pertinent information to the consumer. It also improves supply chain management by allowing distributors and retailers to order garments fitting their target market; on whatever criteria they may wish to segment this market.

Based on our research conducted on the data gathered by $[TC]^2$ in its "*Size USA*" [34] survey, we show that ethnicity could provide one possible starting point for the selection of specific targets and apparel sizing.

$[TC]^2$'s *Size USA, Let's Size Up America* survey consisted in body scanning 6 310 women in thirteen locations throughout the USA. The database is comprised of discrete variables (socio-demographic data) and continuous variables (key measurement points). Only selected variables were analyzed.

Women filled a 12-item questionnaire on:

- scan location (13 possibilities),

- ethnicity group (4 possibilities),
- income group (5 possibilities),
- age group (6 possibilities),
- lifestyle (4 possibilities),
- marital status (5 possibilities),
- educational level (5 possibilities),
- weight perception (4 possibilities),
- current employment (5 possibilities),
- clothing sizes (4 possibilities),
- stores to shop (14 possibilities**),**
- clothing types (16 possibilities).

We used socio-demographic variables to ascertain sample representativeness and to verify possible correlations with body measurements and silhouettes.

The $[TC]^2$ survey identifies more than 200 key measurement points (figure 2). As mentioned in the literature, body scanners can provide almost unlimited measurement data, the challenge rests in selecting significant and reliable variables (McKinnon & Istook, 2002; Fan *et al.*, 2004).

Numerous measurements dealt with the upper body and were therefore not pertinent for this study. All were eliminated the exception of bust girth and bust height which are widely cited in the literature and temporarily kept to ensure that they were truly irrelevant to lower body specifications. Insofar as lower body measurements were concerned, we opted to retain only those 34 points highlighted in the literature.

Figure 2 Body scan [34; p. 112]

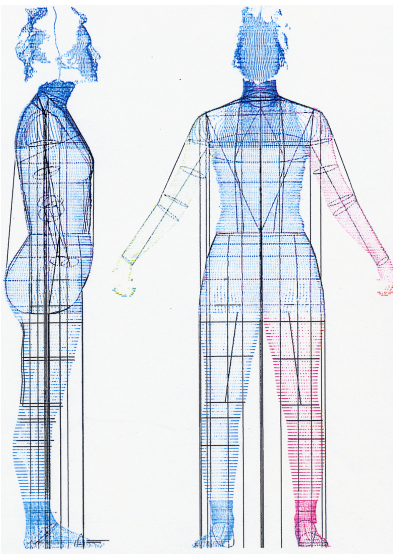


Table 1 Lower body, 34 key measurements retained

Key points	Key measurement points description	Average	Stand. Dev.
H	Total height in inches	63,91	2,81
K	Weight in pounds	155,64	38,61
tB	Bust girth	40,71	5,06
hB	Bust height	45,79	2,40
tT	Waist girth	34,33	5,45
hT	Waist height	39,37	2,36
tHH	High hip girth	40,23	5,64
hHHv	High hip height right side	36,11	2,26
hHHw	High hip height left side	37,32	2,15
tH	Hip girth	43,04	5,01
hH	Hip height	31,95	2,67
tHC	High thigh girth	24,54	2,94
tHCv	High thigh girth right side	24,44	2,92
tHCw	High thigh girth left side	24,30	2,91
hHCv	High thigh height right side	27,33	1,93
hHCw	High thigh height left side	27,33	1,93
tC	Thigh girth	20,13	2,49
tCv	Thigh girth right side	20,13	2,49
tCw	Thigh girth left side	20,08	2,50
hCv	Thigh height right side	22,96	1,49
hCw	Thigh height left side	22,97	1,48
tG	Knee girth	15,34	1,49
hG	Knee height	17,40	1,20
hGv	Knee height right side	17,40	1,20
hGw	Knee height left side	17,42	1,19
tM	Calf girth	14,98	1,57
tMv	Calf girth right side	14,97	1,55
tMw	Calf girth left side	8,99	0,77
tA	Ankle girth	10,78	2,83
hA	Ankle height	2,74	0,39
hAE	Ankle height right side	2,59	0,35
hAI	Ankle height left side	2,81	0,37
cF	Distance waist-crotch-waist	28,42	3,55
hF	Crotch height (inseam)	28,82	1,88

With the exception of the ankle measurement which presented a specific problem for some 300 women, all variables were either symmetrically distributed or slightly skewed to the right (considered normal since there is limit to how "small" a woman can be but not to how "blooming" she can be).

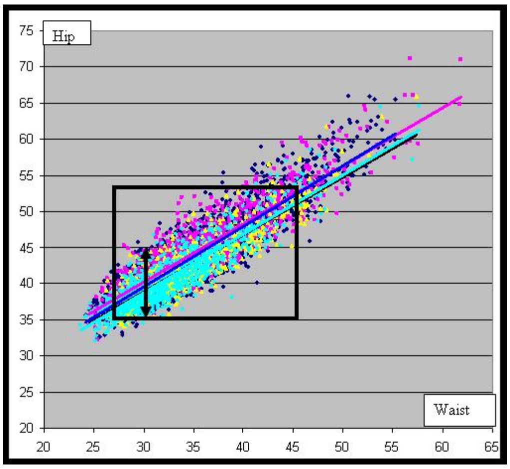
Some 212 women were eliminated from the initial database either because their data showed aberrant or unreliable values, such as a weight of 29 pounds for example. We therefore only confirmed that body scanning provided reliable data for close to 97 % of the subjects.

Circumference measurements analysis

Principal component and factor analyzes confirmed that we could retain the two measurements most frequently mentioned in anthropometric surveys and used in practice for sizing: waist and hip circumference.

We only retained subjects with measurements within the Canadian sizes 4 to 24 (i.e. waist between 27.5 and 45.5 inches and hips between 36.5 and 53.5 inches) which added up to 87,7 % of the original sample or 5615 individuals. In figure 3, these would be the subjects falling within the highlighted square. One may note that women's hips more or less exceed waist measurements by 5 to 15 inches.

Figure 3Waist/hip sample space, limited to pants measurements sizes 4 to 24 (color for ethnicities and slope: fuchsia for African-American women, Navy for Caucasian-American, and turquoise for Hispano-American)



Women with an important waist-hip variation (**A** silhouette) are located over the diagonal (black) line whereas women with a smaller waist-hip variation (**H** silhouette) fall below the diagonal. One can clearly see from this figure that Hispano-Americans are over represented below the diagonal whereas African-American women represent a high percentage above the diagonal.

Our objective being to group women based on silhouette and size (measurements), we performed a data clustering analysis. The data cloud slope (waist circumference - hip circumference) shows a proportional augmentation of the two dimensions according to the "general dimension" of each subject. The cloud gives the impression that abscissa and ordinate could be turned 45^{o}. Rotation of the axes enables one to determine the two principal directions of each subject (1) "general dimension[1]", (2) the variations in the population (**A, X** or **H** silhouette), (3) as well the lesser variations between extremes of a same class.

This approach assumes an *a priori* established number of clusters. Some authors suggest that one should use no less than 57 sizes to cover 80% of the female population; others try to dress the entire population with *small, medium* and *large* sizes or even try to fit them all within *one size fits all*. We opted to use eleven size groups as this is the most common number of sizes on the Canadian market (sizes 4 to 24, increments of 2).

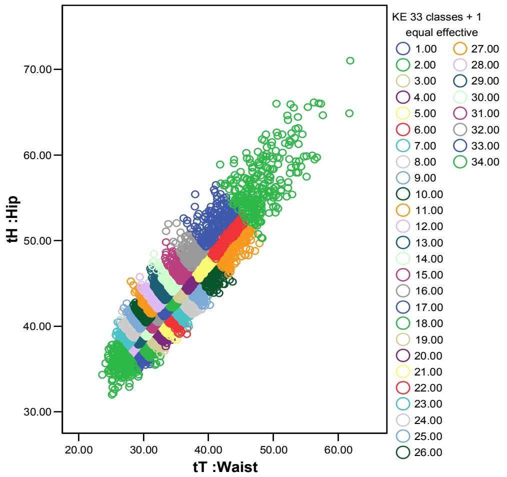
Our initial clustering results showed two silhouettes. Although the literature states that silhouettes can be divided into eight groups [30] we chose to work with three as we before [2] that manufacturers generally produce for **A, X** or **H** silhouette.

The data cloud can therefore be sliced vertically in eleven sections and broken down horizontally in three layers.

We tested both equal numbers and equal amplitude clustering. Figure 4 shows our results with equal numbers clustering. Both graphics use our Canadian retailer's specifications for sizes (S1 to S12, leaving us with 11 in-between classes).

[1] General dimension in this case should be interpreted as general size from smaller (underweight) to blooming sizes (obese).

Figure 4 Graphic representation of equal numbers with three silhouettes and eleven groups size. Number of subjects for each A, X and H class are listed to the right



KA 33 classes + 1 equal amplitude

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	118	1.9	1.9	1.9
	2.00	183	3.0	3.0	4.9
	3.00	221	3.6	3.6	8.5
	4.00	222	3.6	3.6	12.2
	5.00	227	3.7	3.7	15.9
	6.00	180	2.9	2.9	18.8
	7.00	142	2.3	2.3	21.2
	8.00	110	1.8	1.8	23.0
	9.00	85	1.4	1.4	24.3
	10.00	54	.9	.9	25.2
	11.00	44	.7	.7	26.0
	12.00	331	5.4	5.4	31.4
	13.00	438	7.2	7.2	38.5
	14.00	490	8.0	8.0	46.6
	15.00	398	6.5	6.5	53.1
	16.00	314	5.1	5.1	58.2
	17.00	286	4.7	4.7	62.9
	18.00	169	2.8	2.8	65.7
	19.00	139	2.3	2.3	67.9
	20.00	90	1.5	1.5	69.4
	21.00	65	1.1	1.1	70.5
	22.00	60	1.0	1.0	71.4
	23.00	67	1.1	1.1	72.5
	24.00	166	2.7	2.7	75.3
	25.00	171	2.8	2.8	78.1
	26.00	170	2.8	2.8	80.8
	27.00	143	2.3	2.3	83.2
	28.00	97	1.6	1.6	84.8
	29.00	72	1.2	1.2	85.9
	30.00	54	.9	.9	86.8
	31.00	39	.6	.6	87.5
	32.00	30	.5	.5	88.0
	33.00	30	.5	.5	88.4
	34.00	706	11.6	11.6	100.0
	Total	6111	100.0	100.0	

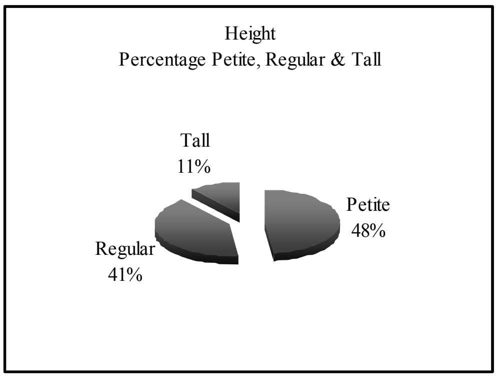
The classes along the diagonal cover a smaller graph area than those further away from the diagonal. From a producer's point of view, this means that the population is more densely distributed in this region and that it is therefore possible to satisfy a large number of consumers with a specific combination of waist-hip measurement, the measurement differences between adjoining clusters being small. As we move away from the diagonal, the population is distributed over larger areas: any given waist-hip combination of measurements will adequately fit a much smaller number of consumers, measurement differences between products targeting two adjoining clusters would need to be more important.

The table within figure 4 shows the number of subjects for each of the 33 clusters (11 sizes, 3 silhouettes). When the cloud of potential measurements is divided equally into 33 size-silhouette clusters, some clusters cover loosely distributed population while others cover denser areas; e.g. cluster 11 (**A** shape & blooming size) covers slightly less than 0,7 % of the population while cluster 14 (**X** shape & third size) covers close to 8 %. From a producer point of view, this means that any specific combination of waist-hip measurement would adequately fit a larger number or women in the more densely sections of the graph (around the diagonal).

It is of interest to note that, should this be the objective of the researcher, the average and upper-lower limits of each equal numbers clusters, or equal amplitude for that matter, could provide the basis to establish new size standards for the industry.

Although validating that women can be classified on three basic silhouettes, the number of classes necessary to cover the entire population is such that it can hardly lead to a functional size standardization system. The above data also clearly points to the fact that some population clusters would hardly be well fitted with a standardized product.

Figure 5 Women's height measurements descriptive statistics in [TC]2's survey



Most authors, as well as the Canadian retailer who contributed to our research agree on the following sizes and limits:

- *petite* refers to women smaller than 5'4";
- *regular* identifies women between 5'4" to 5'7";
- *tall* covers women taller than 5'7".

Figure 5 shows height measurements statistics from the [TC]^2 S*ize USA, Let's size up America* survey.

It shows that nearly 50% of [TC]^2's sample falls in the *petite* category while 11 % are taller than 5'7". Table 2 shows almost 70% of the Hispano-American and Asian-American and others are shorter than 5'4".

Table 2 Percentages of petite, regular and tall according to the Ethnicity

	Ethnicity			
	Caucasian-American	African-American	Hispano-American	Asian-American/ Others
Petite x < 5'4"	39%	37%	71%	68%
Regular 5'4" ≤ x ≤ 5'7"	47%	47%	25%	27%
Tall x > 5'7"	13,%	15%	3%	4%

Table 3 shows, as an example, how the women surveyed, once classified as *regular* and *tall,* as defined based on the Canadian standards should measure at the inseam.

Table 3 Example of inseam measurements for women identified as regular and tall per CS215-58

Siz. (regular)	8R	10R	12R	14R	16R	18R	20R	22R
Inseam in inch.	28-1/2	28-5/8	28-3/4	28-7/8	29	29-1/8	29-1/4	29-3/8
Siz. (tall)		10T	12T	14T	16T	18T	20T	
Inseam		30-7/8	31-1/8	31-1/4	31-3/8	31-1/2		

Although a relationship exists between total height and inseam, one cannot suggest any generalization to the effect that a *regular* or a *tall* would need an inseam of such or such a length. One can see in table 4, that more than 75% of Caucasian-American, African-American, Hispano-American and Asian-American women in the *regular* category need an inseam between 28.51 and 31.5; more than 15% of the Caucasian-American, Hispano-American and Asian-American women in the *regular* category need a shorter inseam between 27.01 and 28.5 compared to 3.26% for African-American and on the opposite close to 15% of African-American *regular* need an inseam of between 31.51 and 33 inch compared to less than 3% for Caucasian-American and Asian-American and a little more than 3% for Hispano-American. We also note that young *regular* women's inseam is longer than women's over 55 years old. Similar results were found in *petite* and *tall*.

Table 4 Summary of inseam measurements for regular by Ethnicity

	Ethnicity			
Inseam measurements	Caucasian American	African-American	Hispano-American	Asian-American/Others
x ≤ 24	0.00	0.00	0.00	0.00
24 <x≤25½	0.06	0.00	0.47	0.35
25½ <x≤27	0.57	0.77	1.90	2.09
27 <x≤28½	16.89	3.26	18.01	18.47
28½ <x≤30	49.34	34.17	50.24	50.17
30 <x≤31½	30.11	47.79	26.07	25.78
31½ <x≤33	2.97	13.24	3.32	2.79
33 <x≤ 34½	0.00	0.77	0.00	0.00
34½ <x≤36	0.06	0.00	0.00	0.00
36 <x	0.00	0.00	0.00	0.35
total	100	100	100	100

Table 5 Extraction of inseam measurements table for tall women by Ethnicity

	Ethnicity			
Inseam measurements	Caucasian American	African-American	Hispano-American	Asian-American/ Other
30.01 – 31.5	41.91	20.36	23.08	32.50
31.51 - 33	35.70	46.11	34.62	37.50

In Faust *et al.* [2] we presented our measurements on more than 800 pants of different styles taken at a large Canadian retailer. The pants styles identified as "*D*" and "*E*" came from the same manufacturer and their measurements (waist, high hip, hip, thigh girth, front and back rise) were highly similar.

Table 6shows the distance measures of similarity between these two styles.

Table 6 Distance measures of similarity between pants D and E

		1	1	1,5	1,5	2	2	3	3	4	4	5	5
		D- 6	E- 6	D- 8	E- 8	D- 10	E- 10	D- 12	E- 12	D- 14	E- 14	D- 16	E- 16
1	D- 6	0	0,1626	1,0075	0,9788	2,2628	2,5382	3,8648	3,6899	5,4423	5,9952	7,7051	8,0188
1	E- 6	0,163	0	1,107	1,0435	2,3466	2,6223	3,955	3,7703	5,5259	6,0802	7,7932	8,1063
2	D- 8	1,007	1,107	0	0,2624	1,2774	1,5392	2,8611	2,6894	4,4416	4,9907	6,7023	7,0132
2	E- 8	0,979	1,0435	0,2624	0	1,3227	1,5868	2,9237	2,7291	4,4876	5,0407	6,758	7,0685
2	D- 10	2,263	2,3466	1,2774	1,3227	0	0,3586	1,6296	1,4788	3,1879	3,7535	5,4522	5,7741
2	E- 10	2,538	2,6223	1,5392	1,5868	0,3586	0	1,3379	1,1634	2,9068	3,4595	5,1736	5,485
3	D- 12	3,865	3,955	2,8611	2,9237	1,6296	1,3379	0	0,3959	1,5924	2,142	3,8425	4,157
3	E- 12	3,69	3,7703	2,6894	2,7291	1,4788	1,1634	0,3959	0	1,7877	2,317	4,0524	4,3466
4	D- 14	5,442	5,5259	4,4416	4,4876	3,1879	2,9068	1,5924	1,7877	0	0,6106	2,2757	2,5963
4	E- 14	5,995	6,0802	4,9907	5,0407	3,7535	3,4595	2,142	2,317	0,6106	0	1,7519	2,0301
5	D- 16	7,705	7,7932	6,7023	6,758	5,4522	5,1736	3,8425	4,0524	2,2757	1,7519	0	0,4535
5	E- 16	8,019	8,1063	7,0132	7,0685	5,7741	5,485	4,157	4,3466	2,5963	2,0301	0,4535	0

The one important difference between these two pants was in the crotch height or inseam. Neither was labelled as either a *petite* or *tall.* Pants *D*'s inseam for sizes 6 to 16 varied from 31,05-inch to 31,43-inch whereas pants *E*'s inseam varied from 32,78-inch to 33,05-inch. Pants *E*'s inseam exceeded pants *D*'s inseam by at least one inch in every size.

The Canadian retailer who contributed to our research provided us with the list of every single purchase and return for both styles during a 4-month period. Our analysis showed that the return percentages were 7% to 31% higher for pants *E* than for pants *D*: the pants with the longer inseam (generally between 32 and 33-inch as opposed to 31-31,5 for pants *D*).

The data obtained from the $[TC]^2$ confirms this result as it shows that a 32-inch inseam is much too long for *petite*, long for regular women (especially in this case where the style is not really designed for African-American and fairly reasonable for *tall* women (see table 5).

These results clearly confirm that women of different ethnic origins vary in height and, for similar heights, need different inseam lengths for a fitting garment. On can see that the same type of analysis and observation may be made on age groups (table 7).

Table 7 Crotch height variations between age groups

Height Survey_ID Crotch_Height	Petite Age groups 18-25	26-35	36-45	46-55	56-65	66+
20-21	0,14%	0,00%	0,00%	0,00%	0,00%	0,00%
21-22	0,00%	0,15%	0,00%	0,00%	0,00%	0,00%
22-23	0,00%	0,31%	0,00%	0,18%	0,00%	0,65%
23-24	0,14%	0,46%	0,47%	0,53%	2,10%	1,29%
24-25	2,17%	2,61%	3,00%	2,85%	6,59%	3,23%
25-26	6,22%	7,37%	7,58%	11,03%	13,77%	11,61%
26-27	15,92%	18,74%	22,27%	25,62%	22,46%	22,58%
27-28	28,22%	29,65%	30,33%	29,18%	30,54%	32,26%
28-29	28,51%	28,11%	27,01%	22,95%	18,86%	18,71%
29-30	14,04%	10,14%	7,42%	6,23%	4,79%	9,03%
30-31	3,76%	2,30%	1,58%	1,25%	0,60%	0,65%
31-32	0,29%	0,00%	0,16%	0,18%	0,30%	0,00%
32-33	0,14%	0,15%	0,16%	0,00%	0,00%	0,00%
33-34	0,43%	0,00%	0,00%	0,00%	0,00%	0,00%
Total	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%

Height Survey_ID Crotch_Height	Regular Age groups 18-25	26-35	36-45	46-55	56-65	66+
24-25,5	0,00%	0,00%	0,36%	0,00%	0,45%	0,00%
25,5-27	0,45%	0,63%	1,46%	1,28%	0,00%	3,08%
27-28,5	8,86%	11,71%	15,88%	17,70%	26,82%	20,00%
28,5-30	41,59%	47,31%	47,81%	49,68%	49,09%	44,62%
30-31,5	39,94%	35,60%	30,84%	26,87%	21,82%	30,77%
31,5-33	8,56%	4,59%	3,65%	4,26%	1,82%	1,54%
33-34,5	0,45%	0,00%	0,00%	0,21%	0,00%	0,00%
34,5-36	0,15%	0,00%	0,00%	0,00%	0,00%	0,00%
>39	0,00%	0,16%	0,00%	0,00%	0,00%	0,00%
Total	**100,00%**	**100,00%**	**100,00%**	**100,00%**	**100,00%**	**100,00%**

Height Survey_ID Crotch_Height	Tall Age groups 18-25	26-35	36-45	46-55	56-65	66+
24-25,5	0,00%	0,61%	0,00%	0,00%	3,85%	0,00%
25,5-27	0,56%	2,42%	1,88%	0,90%	0,00%	0,00%
27-28,5	1,11%	1,82%	1,88%	0,90%	1,92%	0,00%
28,5-30	5,56%	11,52%	14,38%	11,71%	5,77%	6,25%
30-31,5	38,33%	32,12%	31,25%	35,14%	48,08%	37,50%
31,5-33	37,78%	38,18%	36,88%	40,54%	36,54%	50,00%
33-34,5	13,33%	11,52%	13,13%	9,91%	3,85%	6,25%
34,5-36	2,78%	1,82%	0,00%	0,90%	0,00%	0,00%
36-37,5	0,56%	0,00%	0,63%	0,00%	0,00%	0,00%
Total	**100,00%**	**100,00%**	**100,00%**	**100,00%**	**100,00%**	**100,00%**

CONCLUSION

This research first demonstrated that 3D body scanning is a relatively reliable source of body measurements. It also confirmed that, for the lower female body, some measurements were more important than others. It further established that body height measurements are not correlated to any body circumference measurement; although height and circumference measurements are generally highly correlated within themselves. Four conclusions stand out: (1) that although women vary in height, this measurement is not highly correlated with weight, (2) that the female body comes in three basic silhouettes: **A**, **H**, and **X**, (3) that waist and hips circumference measurements are initial key points in describing the female lower body and (4) that women of different ethnic origins cluster both in terms of body silhouette and in terms of height measurements.

In other words, it is possible for some in the apparel industry to adopt a marketing strategy targeted to a specific ethnic group while taking full advantage of an efficient QR or SCM strategy thereby reducing confusion within the channel and at the consumer level.

Our findings open a number of avenues for further research. The first should try to answer the question whether apparel manufacturers, distributors, and consumers would prefer this data to be used for the development of new size standards or only to provide better size label information, leaving the order givers entirely free to size their garments the way they chose.

The second two are somewhat parallel. One is that this same type of analysis should be conducted on the upper female body to determine if one can arrive at similar conclusions and, from these, at a full body label conveying all necessary information parsimoniously. A similar avenue would obviously be to perform the same type of research on the male body as well as on different age groups.

Finally, from a marketing point of view, that targeting women of specific origins could represent an initial step to mass customization in what Pine [35] labels as the easiest to start on the path to mass customization: marketing customized services over standardized products. "Completely standardized products can be customized before being offered to customers by people of marketing." [35; p.172].

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