

How Understanding Female Plus Size Body Shapes Throughout a Size Range Can Affect Apparel Grading and Design Attributes

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Significance of the Research

The Centers for Disease Control and Prevention (CDC), reported the prevalence of U.S. adult obesity at 39.8% of the population, which affects about 93.3 million (Hales, Carroll, Fryar & Ogden, 2017). Of those adults, 41% were estimated to be women (Hales, Carroll, Fryar & Ogden, 2017). This demographic represents a \$21.4 billion apparel industry (George-Parkin, 2019). Over the last five years, there has been an increased interest from apparel companies to manufacture products for this body type (George-Parkin, 2019). As there is a lack of accessible measurements and sizing standardization for plus sizes, companies have developed their own systems, often linearly grading from existing sample “core sizes” - often a size small 4/6 or medium 8/10. These sample size bodies typically have an hourglass shape, so the question for this research was – do plus size women really have hourglass body shapes?

Theoretical Framework

Plus sizes typically range from 16-30 in the U.S., although some companies may define their spectrums, by starting with a size 14. Some may also bookend their size range at a 24, 26, 28, 32 or 34. Aforementioned, most companies follow a linear grading protocol from a base sample size. Figure 1 presents a size run of body forms by Alvanon – the leading dress form maker for companies in the U.S.

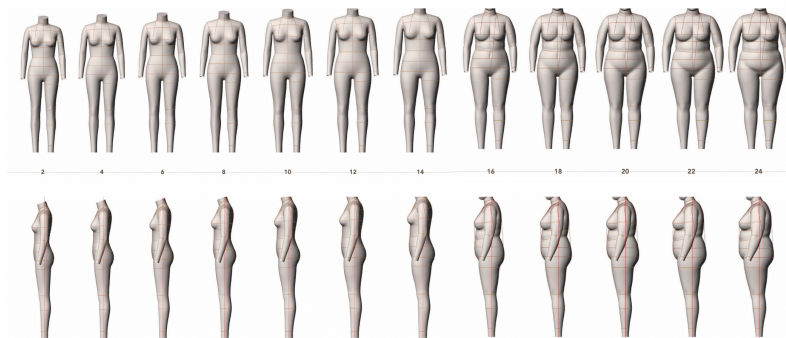


Figure 1. Size range of women’s dress forms manufactured by Alvanon (Alvanon, 2020).

With new 3D body scan data through studies like Size North America and companies investing in their own data capture, there was an opportunity to understand how the modern female plus size body changes throughout a size range and determine if it stayed an hourglass shape.

Methodology

The researchers partnered with a leading apparel company to analyze 3D body scans that were acquired by the company. Scans were classified into one of five height groups (Table 1); then bucketed into bust and hip size groups (Table 2) – as defined by the company. For this study only height group B (most common) and size 16, 20, 24 and 28 3D body scans were measured (with Anthroscan).

HEIGHT GROUPS
Height Group O: Under 5' 4"
Height Group A: 5' 4" to 5' 5.5"
Height Group B: 5' 6" to 5' 8.5"
Height Group C: 5' 9" to 6'
Height Group D: Over 6 feet

	SIZE GROUPS			
	16	20	24	28
BUST	43.75-45.25 in	47.00-49.25 in	51.75 to 54.25 in	56.75-59.25 in
HIP	47.25-48.75 in	50.20-52.45 in	55.25 to 57.75 in	60.25-62.75 in

Tables 1 and 2. Height and bust/hip size group measures.

Simmons, Istook & Devarajan (2004) identified nine body shapes (hourglass, bottom hourglass, top hourglass, spoon, triangle, inverted triangle, oval, diamond) using the Female Figure Identification Technique (FFIT). Mathematical formulas developed by Lee, Istook, Nam and Park (2007) using FFIT shape categories were modified to include plus size bodies and used to classify body shapes. Bust, waist hip, and high hip measures collected with Anthroscan were used to calculate the shapes.

BODY TYPE	MATHEMATICAL FORMULA
Hourglass	If (bust-hips) ≤ 1, then if (hips-bust) < 3.6, then if (bust-waist) ≥ 9 or (hips-waist) ≥ 10
Bottom Hourglass	If (hips-bust) ≥ 3.6 and (hips-bust) < 10, then if (hips-waist) ≥ 9, then if (high hip/waist) < 1.193
Top Hourglass	If (bust-hips) > 1 and (bust-hips) < 10, then if (bust-waist) ≥ 9
Spoon	If (hips-bust) > 2, then if (hips-waist) ≥ 7, then if (high hip/waist) ≥ 1.193
Triangle	If (hips-bust) ≥ 3.6, then if 0 ≤ (hips-waist) < 9, or if (bust-waist) < 0, then if (hips-waist) ≥ 0
Inverted Triangle	If (bust-hips) ≥ 3.6, then if (bust-waist) < 9, then if (hips-waist) ≥ 0
Rectangle	If (hips-bust) < 3.6, and (bust-hips) < 3.6, then if 0 ≤ (bust-waist) < 9 and 0 ≤ (hips-waist) < 10
Oval/Diamond	If (hips-waist) < 0

Table 3. Modified mathematical formulas for body shape categorization (adapted from Lee et al., 2007).

Results and Implications

One-hundred and seventy-three 3D female body scans were analyzed in this study using the modified FFIT formulas, for the bust and hip fit groups (Tables 4 and 5).

Height Group B - Bust	SIZES			
	16	20	24	28
Hourglass	0%	0%	0%	0%
Top Hourglass	0%	0%	0%	0%
Bottom Hourglass	7%	6%	0%	0%
Spoon	0%	0%	0%	0%
Triangle	53%	18%	25%	29%
Inverted Triangle	0%	0%	0%	0%
Rectangle	0%	41%	17%	14%
Oval/Diamond	13%	35%	58%	57%

Height Group B - Hip	SIZES			
	16	20	24	28
Hourglass	0%	0%	0%	0%
Top Hourglass	0%	0%	0%	0%
Bottom Hourglass	0%	13%	0%	0%
Spoon	0%	0%	0%	20%
Triangle	27%	33%	29%	80%
Inverted Triangle	0%	0%	0%	0%
Rectangle	45%	33%	14%	0%
Oval/Diamond	27%	20%	57%	0%

Tables 4 and 5. Plus size body shape categorization for bust and hip groups.

Results show that none of the plus bodies studied (16, 20, 24 or 28) were an hourglass or top hourglass shape and only a small percentage were a bottom hourglass shape. The findings demonstrated that apparel companies should not linearly grade patterns or assume the body continues to be an hourglass shape as it moves through a size range. Results also showed that triangle, oval and rectangle shapes are more prevalent for plus sizes. Because of the variability of these bodies, material placement zones (stretch versus non-stretch) and adjustment features are important considerations to enable fit for this emerging market.

References

- Alvanon. (2020). Alvaform Measurements & Specs. Retrieved from:
<https://alvanon.com/resources/alvaform-measurements-specs/>
- George-Parkin, H. (2019). 68% of American women wear a size 14 or above, Racked. Retrieved from:
<https://www.racked.com/2018/6/5/17380662/size-numbers-average-woman-plus-market>
- Hales, C. M., Carroll, M. D., Fryar, C. D., Ogden, C. L. (2017). Prevalence of obesity among adults and youth: United States 2015–2016, Data Brief No. 288.
- Lee, J. Y., Istook, C. L., Nam, Y. J., & Park, S. M. (2007). Comparison of body shape between USA and Korean women. *International Journal of Clothing Science and Technology*, 19(5), 374-391.
- Simmons, K., Istook, C. L., & Devarajan, P. (2004). Female figure identification technique (FFIT) for apparel. Part I: Describing female shapes. *Journal of Textile and Apparel, Technology and Management*, 4(1), 1-16.