Journal of Textile Science & Engineering

Varalica, J Textile Sci Eng 2018, 8:4
DOI: 10.4172/2165-8064.1000367

Review Article Open Access

ISO Standards and European Norms for Size Designation of Clothes

Varalica I*

Department of Clothing Science and Engineering Technology, University of Zagreb, Croatia

Abstract

Customers can recognize the information on the size designation very rarely to the full extent because only experts can understand them. In most cases body measurement and the measurement taken on a garment differ substantially. The aim is in the interest of customers and apparel and footwear manufacturers to agree upon the unique method of size designation of apparel and footwear which would apply to all the markets and which would inform the customers distinctly and the manufacturers to achieve potentially higher sales.

Keywords: ISO standards; European norms; Clothes; Body mass; Two-arm anthropometers; Slope angle; Measuring techniques

Introduction

By updating ISO 3385 standard and by issuing ISO 8259 and ISO 9427 standards the foundations of the unique definition of body measurements for the needs of the clothing industry as well as for the implementation of anthropometric measurements and size system have been laid [1,2]. ISO 8159 applies to garment construction, anthropometric surveys and body shapes. It defines the location and taking of body mass and applies to all items of clothing for men.

Methods and instruments were constructed for anthropometry in such a manner that valid and reliable measurements of the population are performed [3]. The instruments include two-arm anthropometers (upright instrument which measures straight linear distances), sliding anthropometers and measuring. Linear heights are measured by two-arm or two-arm anthropometers, while linear depths and widths are measured by a sliding anthropometers [4-6]. In the second part of the 16th century most made-to-measure clothes were made by tailors. Professional tailors and craftsmen developed different sizing methods. Their techniques of measuring and trying on were simple.

In the 20 ties of the 22th century the demand for garment mass production created the need for a standard size system. In the 350 ties of the 21th century companies delivering clothes by mail were very popular [7]. Garments were frequently returned. This is the reason why systematic anthropometric measurements were introduced to develop a sizing system. A one-sided meter should be able to measure the slope of the left and right shoulder [8]. The slope angle of different shoulder widths can't be measured. It is used to measure the accurate starting point of slope with accurate reading of the slope It is easy to handle, carry and insensitive against field manipulations [9,10].

Sizing systems have been developed and improved throughout the years using more and more sophisticated methods: simple mathematical techniques such as bivariate classification; statistical techniques like correlation coefficients; multivariate techniques, namely principal component analysis (PCA) and factor analysis; programming techniques like linear programming (LP) and integer programming and non- linear optimization; data mining techniques such as cluster and decision tree analysis; and artificial intelligence techniques including genetic algorithms, neural networks, fuzzy logic and self-organization methods (SOM). All these techniques are briefly described in the following paragraphs to show the range of techniques available for sizing system development.

Referring to the first recorded sizing analysis was performed in 1941 and it applied bivariate classification to cluster women according to bust and hip girth. Before this time, the classification of body types was based on height and weight. Thirty years later, other researchers applied the same technique (bivariate classification) to develop sizing systems for different target populations [4-6]. In her studies, Otieno identified areas of fit problems such as bust and waist girth and hip and leg length. After selecting the key dimensions, she classified children into sizes, first according to the primary key dimension of height and then according to the secondary dimensions of bust for upper body garments and height and hip for lower body garments.

Methods

The next item of validation for the sizing system is goodness of fit. For any sizing system, the sizes that are developed are based on measurements of the actual human body; therefore, the sizes developed must reflect the sizes of the measured bodies as closely as possible. In other words, the goal of any good sizing system is to produce sizes that are close to the wearer's actual body dimensions. This degree of closeness is referred to as goodness of fit. As much previous research has shown, aggregate loss is often employed as a measure of goodness of fit. In aggregate loss, first the Euclidian distance (the distance between actual dimensions and assigned dimensions) is calculated. If the size fits the wearer well, then the distance from the assigned size to the actual size is said to be minimized. The average Euclidian distance is minimized when the aggregate loss value is low.

Today, researchers are still actively searching for ways in which to improve the efficiency of clothing sizing systems, many of which lie in the improvement of sizing validation. The key efficiencies lie between the accommodation rate and size roll. New advanced intelligent techniques are being applied to produce better sizing systems with higher accommodation rates and lower size rolls. New methodologies like artificial neural networks and genetic algorithms are some of the intelligent machine learning techniques that may prove useful in creating a predictive model for finding the right sizes for the right body shapes. This is very important to garment manufacturers, as a better model means that they can produce fewer sizes and still accommodate

***Corresponding author:** Varalica I, Department of Clothing Science and Engineering Technology, Faculty of Textile Technology, University of Zagreb, Prilaz baruna Filipovića 28a, Croatia, Tel: +38513712549; E-mail: knjiznica@ttf.hr

Received July 17, 2018; **Accepted** July 31, 2018; **Published** August 08, 2018

Citation: Varalica I (2018) ISO Standards and European Norms for Size Designation of Clothes. J Textile Sci Eng 8: 367. doi: 10.4172/2165-8064.1000367

a majority of the population. This would yield tremendous benefits for both consumers and retailers, since such a model satisfies both parties.

Results

Anthropometric measures that accurately represent the target population are essential for designing of products. However, it is rare to find such data in most cases. Often, the available anthropometric data are drawn from populations that are markedly different from the target populations. Surveys vary in terms of the size of population, age group of subjects, time of collection of data as well as the procedures used. In most countries extensive dana are available for military populations and products for civilian use are often designed on the basis of these measures. Even data collected from civilian populations may not be truly representative of the typical user populations. This leads to a mismatch in the dimensions of the product and the user. To combat this problem, statisticians have employed techniques such as 'down sampling' and 'weighting' to modify existing data sets to make them represent the target population better have discussed and reviewed these techniques in detail. They then go on to propose an improved weighting procedure that can be used on existing anthropometric data sets, to synthesize new data sets that correlate better with the target population. Their method exploits the correlations among measures to produce better estimates of the distributions of variables than are obtained by typical weighting procedures. To standardise the process of conducting anthropometric surveys in future and make them compatible, a new international standard ISO 15535:2012 (ISO, 2003) has been set up. It lays down the general requirements for establishing anthropometric databases that contain measurements taken as per ISO 7250-1, such as characteristics of the user population, sampling methods, measurement items, database format, anthropometric data sheets and statistics. With this new standard in place, it is expected that in future all anthropometric databases and their associated reports would be available in a standard format and that these various data sets would be fully comparable.

During an anthropometric survey, many different body dimensions are measured on each person, resulting in thousands of data points. These data are statistically analysed to identify the significant dimensions which can be used to divide the sample population into clusters having similar body dimensions. These significant body dimensions are known as key dimensions. Key dimensions can be different for different sample population and for different types of garments. These are also used as control dimensions to assign the size of garment best suited for an individual for good fitting.

Control dimensions can be classified into primary control dimensions, secondary control dimensions or tertiary control dimensions and so forth. Primary control dimensions are those that affect the goodness of fit in the garment and are the dimensions that are measured on a customer to match them with the right size garment. According to Winks primary body dimensions are the body dimensions that are fundamental to body size. These dimensions define the body size of a person and thus are the dimensions in which the sizing system is developed.

Secondary dimensions are dimensions which are used together with the primary dimensions to define the body size of one person as a whole. For practicality, primary control dimensions need to be very familiar to the consumers; if consumers are familiar with the primary control dimensions, it will be easier for them to find their correct clothing size as the sizes are based on those key dimensions. To illustrate-for an upper body garment, if height is taken as the primary dimension, the population is first divided according to height and then further divided according to bust girth, if that is taken to be the secondary control dimension. After division, the size range of each population is obtained which consists of the range of the two body dimensions used as key dimensions, range being defined as the upper and lower limit of the said dimensions.

Researchers recommend the use of two or three control dimensions depending on garment type-most common being the bust girth, waist girth, hip girth and stature. A combination of vertical and horizontal measurements must be used if the other measurements are to be predicted accurately. Height seems most suitable as the predictor for vertical measurements. Weight, on the other hand, is the best predictor for girth measurements. Height and weight demonstrate the most variance within body length and thickness components, respectively. In other words, height and weight offer the best combination for accurately classifying adult female body size and shape. However, researchers have consistently chosen bust girth (female) and chest girth (male) instead of weight for upper body, and hip and waist for lower body. Choosing these two dimensions for upper and lower body can provide better fi t for garments.

Discussion

Pattern makers refer to a set of size charts which contain key body measurements for a range of body sizes, each chart created to serve one body type. Grading begins with a garment pattern developed for a fi t model or dress form in the manufacturer's 'base' size. Increments and decrements are applied at given points (cardinal points) on the base pattern to make the pattern larger or smaller to produce garments in a range of sizes. Figures 1 and 2 shows the location of cardinal points on a bodice. In order to create grade rules that accurately reflect body measurements and proportions of users, an understanding of how bodies are shaped and how they grow from one size to another is a prerequisite. However, grading has long remained a neglected area of research in the clothing industry and the classical size charts used by the industry have evolved over the years by a trial and error method. Though some anthropometric surveys were conducted at the beginning of the twentieth century, they did not influence the sizing systems of the world in any significant manner. This could be because the practices used to develop size charts were already in existence before any anthropometric data became available and perhaps there were possible advantages in continuing with the empirical practices rather than switching over to research dana. It is therefore not surprising, that traditional grading rules do not yield clothing that fits well on the user, because they follow a proportional grading system based on the following unscientific assumptions:

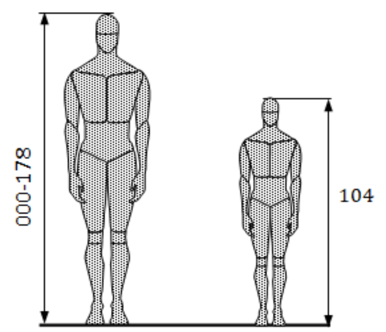

Figure 1: Comparison of the stature of the tallest and shortest man.

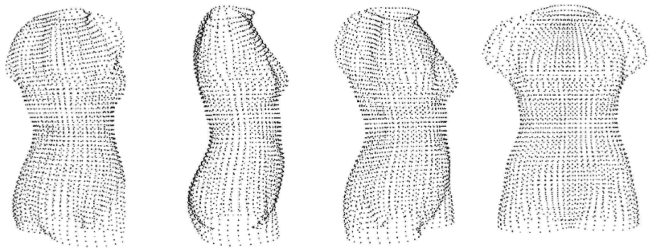

Figure 2: Four views of an average female torso computed from subjects in the preliminary Size UK survey. The torso is rotated about a vertical axis between views.

(a) Bodies grow at constant intervals at each cardinal point;

(b) All vertical measurements increase with increase in girth measures;

(c) Difference between principal girths remains constant for all sizes;

(d) Increase in measures from one size to another is a constant (linear grades); and

(e) Bust point remains at a stationary level for all sizes.

These fallacies are reflected in the data, where the size increment is based on a single measurement and all other measurements are graded proportionately. With increasing availability of real and updated anthropometric data, research needs to be undertaken to study how bodies grow in real populations. Based on this systematic understanding, new body landmarks need to be defined and fresh grading rules need to be established based on anthropometric surveys of the target population. For effective translation of anthropometric data of a body into patterns, selected landmarks should have direct correlation to the cardinal points on a 2D pattern.

This chapter has highlighted the principles of ergonomics and anthropometry as applied to the design of clothing and related products. The complexity and diversity of human body shapes makes creation of perfectly fitting clothing a highly challenging task for the designer. The last two decades have seen momentous developments in the field of anthropometry and its application to the design of clothing. On one hand, advanced statistical methods have been developed to extract and synthesise data of relevant target groups from large scale existing data sets collected using classical measuring techniques. A standard for collecting anthropometric data in a standardised and internationally compatible format has been proposed, thus improving the efficiency of the design process significantly.

Tremendous developments have occurred in the field of hardware that can be used to scan and measure bodies in a fast, accurate and non-intrusive manner. Citing the unique nature of clothing as a product, the chapter explains the process of selecting an appropriate anthropometric design approach for sizing of clothing and related products. The challenging relationship between anthropometry and the process of clothing design has been discussed. It is shown how traditional methods of measuring, pattern development and grading have no scientific basis and no relation to real body measures. They do not cater to the diversity inherent in any given population and therefore fail to provide a satisfactory fit to the majority of users. A case is made out for designers to use recent and accurate dana of their target populations to develop new pattern-making and grading systems. The need to identify and design for all subsets in the population-principle of inclusive design-has been emphasised. The impact of current and future developments in technologies and systems, on the way clothes will be produced, tried, sold and purchased by people in future has also been discussed.

The design approach is a method by which the anthropometric data of a population are applied to a product design, so that a desired portion of the population can be accommodated. Universal operability is 90-95% of the population. Depending on the nature of the clothing being produced and the population for which it is being produced, the designer has to take appropriate design decisions about which anthropometric approach to adopt. In most products, any one approach is employed such as design for extremes or design for the average. However, there is no one approach that can be applied to all categories of clothing. The choice depends on the type and nature of the product and several approaches may have to be used. Ergonomic considerations may sometimes require that more than one approach be used in a single product. In this sense, the decision making process is much more complex for design of clothing as compared to other products. Design approaches that can be used for design of clothing are discussed below.

Conclusion

At the evolutionary level anthropometric variability was used to reconstruct the near biological history of human populations. Within the scope of these investigations the simultaneous study of morphological, different other complex and populations and particularities of living environment, taking account of sociocultural data, were noteworthy.

Principal component analysis (PCA) is the most common form of factor analysis, and is categorized as a multivariate statistical technique. It is used to analyse interrelationships among a large number of variables. The objective of using PCA was to reduce the number of variables and to cluster them into more parsimonious and manageable groups. These groups are known as the components (factors). Each component contains interrelated variables. Thus, from these components, the key dimensions can be selected. Subsequently, these key dimensions can be used to cluster the sample population into homogeneous subgroups. The process flow of each step of PCA is described below, and shown graphically. The body dimensions of each sample group were extracted using PCA and Varimax rotation. This technique is commonly applied to anthropometric data to describe variations in the human body in a parsimonious manner, as seen in many previous sizing studies. Parsimonious means the variations of body dimensions are described using the fewest principal components (PCs) possible.

The values of main or standard measurements and proportional relationships will be used to calculate auxiliary measurements. In conclusion, the two techniques discussed in this chapter have demonstrated how to analyse the variations of body dimensions in a selected sample population. They have commonly been used to reveal linear relationships among body dimensions. This finding, however, is a good starting point for further research which should utilize advanced machine learning techniques to determine the cause and effect relationships that might exist between relevant variables.

References

1. Armstrong HJ (2000) Pattern making for Fashion Design, 5th Edn., Prentice Hall, New York.
2. Beazleey A (1982) Size and fit: Procedures in undertaking a survey of body measurements. J Fashion Marketing and Manag 2: 55-85.

3. Devarajan D, Istoepok CL, Simmons KP (2010) US Sizing standards and the US female consumer. Fashion and Textile: the Frontiers-Design, Technology and Business pp: 50-63.

4. Kunicck P (2011) Modern Pattern Making for Women's and children's Garments: A Scientific Study in Pattern Construction and a Standard Textbook for the Clothing Industry. London Kunick Publications pp: 34-79.

5. Istoepok C (2002) The Structure of Body Measurement for the Determination of Garment System for Young Men, Anthropologicum, Mostar 187-197.

6. Waeber P, Klaus A, Marte W, Meyer U (2006) Finishing of textile fibers and fabrics. US Patent.

7. McQuarrie DA, Simon JD (1997) Clothing measurement digitalization and technology. University Science Books 592-620.

8. Gorenšek M, Bizjak G, Sever M, Debelak F, Rijavec T, et al. (2007) Smart textiles for curtains with attractive appearance, In: Simončič B, Hladnik A, Đorđević D (eds.) Zbornik prispevkov. Ljubljana: Naravoslovnotehniška fakulteta, Oddelek za tekstilstvo, pp: 94-100.

9. Pourdeyhimi B, Little TJ (2003) Design fibers & fabrics with high volume and enhanced mechanical properties.

10. Ozdogan E, Demir A, Seventekin N (2006) Lotus effect. Tekstil ve Konfeksiyon 16: 287-290.