ANALYSIS OF BODY MEASUREMENTS USING A 3D CONTACTLESS SCANNING METHOD

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Abstract:

This research work concerns analysing the results of tests performed using apparatus for the contactless measurement of human body (Anthroscan 3D VITUS Smart). The applicability of measurement types in clothing design was the criterion of its selection. Traditional ways of measurements use an engaging and laborious manual method. However, 3D scanning of the human body surface can provide more measurements in a significantly shorter amount of time in comparison with the manual method. Moreover, new technologies of the 3D complete body scanning make possible to gain the 3D image of the human body surface. In this paper, we describe the analysis of the human body using a 3D scanner owned by the Textile Research Institute.

Key words:

Human body measurements, garment construction, contactless scanning method

Introduction

The measurements charactering body posture and the human silhouette are the basis for designing various products. The widest spectrum of measurement information concerns the clothing products covering the silhouette.

Different types of body structures are conditioned by genetic determination, but we inherit only a predisposition to the development of features. External environmental conditions such as climate, life mode, nutrition and physical activity also influence body structure. The features of body structures that are strongly related to genetic determination are mainly body size and silhouette.

Body structure is classified on the basis of various factors determining the ratios of certain body measurements to others. Pure types of body structure are rare; most often body structures have a combination of various types [1].

The problem of classifying different types also concerns the design of clothing products. Currently, clothing products are fit to the population on the basis of human body measurement tables. In addition to body structure types, silhouette and posture are also taken into consideration for construction purposes.

Methodology

Comparative tests were conducted on a group of 81 female students of the University of Lodz by taking measurements using the traditional manual method (anthropometrical method) and the scanning method using a 3D scanner (Anthroscan 3D VITUS Smart XXL; Human Solutions Company). This apparatus is equipped with four scanners located in the corners of a room and a computer system for recording over 100 body surface measurements. The built-in programme makes it possible to automatically scan different body positions (in standing and sitting positions) according to the standards:

- PN EN 13402-2:2004. Size Designation Of Clothes - Part 2: Primary And Secondary Dimensions,
- ISO 8559:1989. Garment construction and anthropometric surveys,
- PN EN ISO 7250:2005. Basic human body measurements for the technical design.

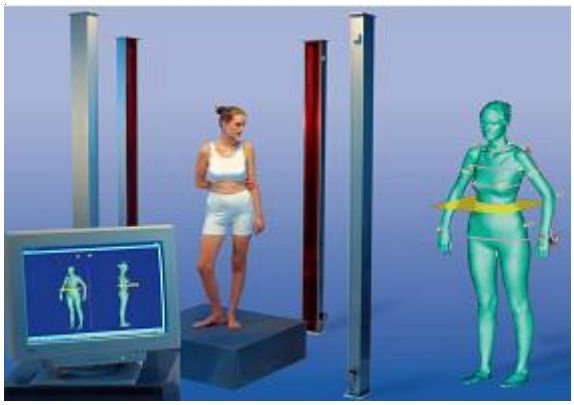


Figure 1. The cabin for untactile measuring [3].

For comparative tests, the body surface was measured in two positions according to the standards used in clothing: PN EN 13402-2:2004- Size Designation Of Clothes - Part 2: Primary And Secondary Dimensions [2].

Figure 2. Positions according to the standards used in clothing PN EN 13402-2:2004.

Silhouette measurements were taken to determine the quantity of particular types of silhouettes in a population group of young women on the basis of the Wanke method. This method systematises the various kinds and types of human body structure in respect to the similarities and differences of particular features. It came into being in the 1950s and is the first Polish typology conception. First, it concerned only men. However, this method can now typologically determine particular individuals and evaluate the somatic composition of a whole population or determined parts of a population on the basis of average arithmetical values. The following types of body structure can be determined:

I Type - long-trunk with weak structure, medium-broad pelvis, narrow shoulder, flat chest and low weight.
A Type - long-trunk with narrow shoulder, broad pelvis, round chest, medium weight.
V Type - short-trunk with broad shoulder, narrow pelvis, flat chest and big weight.
H Type - short-trunk with broad shoulder, broad pelvis, round chest, medium weight.

The evaluation of body structure is grounded on the body proportion determined by five indicators:

- Trunk height indicator (sst-sy/B-v) x 100,
- Shoulder width indicator (a-a/sst-sy) x 100,
- Pelvis-shoulder indicator (ic-ic/a-a) x 100,
- Chest indicator (xi-ths/thl-thl) x 100,
- Rohrer indicator body mass according to g/(B-v w cm)3 x 100 [4].

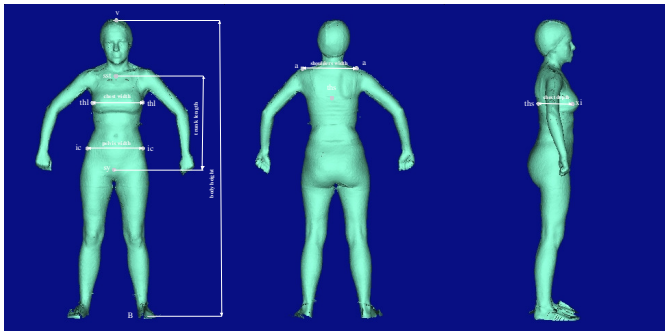
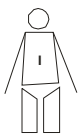
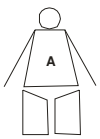


Figure 3. Anthropological points on the human body, own source.

Table 1. Indicators of Wanke's somatic elements (mean arithmetical values) for women.

Indicators				
$\frac{\text{Trunk length}}{\text{Body height}} \times 100$	31.6	31.8	28.4	28.3
$\frac{\text{Shoulder width}}{\text{Trunk length}} \times 100$	69.6	69.2	81.9	80.8
$\frac{\text{Pelvis width}}{\text{Shoulder width}} \times 100$	76.7	88.8	76.1	87.1
$\frac{\text{Chest depth}}{\text{Chest width}} \times 100$	75.4	77,7	61,8	77,6
Rohrer indicator $\frac{\text{Body mass(g)}}{\text{Body height3 (cm)}} \times 100$	1.3	1.8	1.3	1.8

For a population of women the somatic element symbol V from the men's typology is replaced by Y in the Kolasa method [4]. The mean values of particular indicators for all types of body structures are shown in Table 1.

Results

The analysed parameters were evaluated using the Wanke method and are presented in Figure 4.

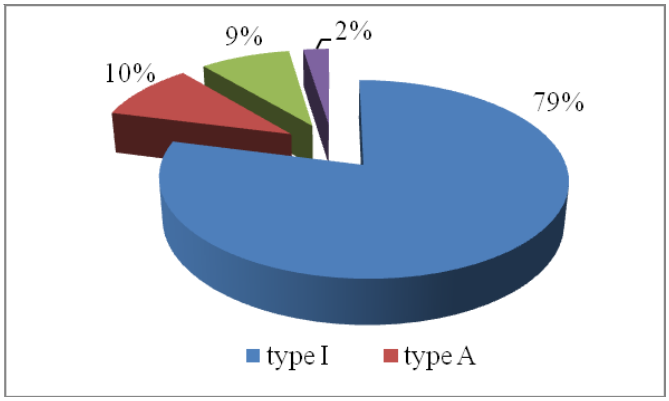


Figure 4. Percentage breakdown for silhouette types, own source.

The percentage breakdown for the analysed data stated that young women most often show the "I" type (79%). This means a slender silhouette with narrow shoulders and pelvis and low body mass in relation to body height and is compatible with the observed fact of the tendency to lose weight in the younger generation. Among young women, the "I" type occurs most often. The "A" type with broader hips is rather characteristic of women in their 40s, but in the tested group occurred in just 10% of women. Approximately one in 10 of the tested young women showed a "V" element - acknowledged as manlike, with broad shoulders and a narrow pelvis, flat chest and low body mass. The tests stated that women with a predisposition to sport possess this kind of structure. Only 2% of the sample had a body structure of the "H" type, which confirms the fact that "H" types are seldom found among young women.

Conclusion

Designers and clothes manufacturers demand knowledge concerning dozens of measurements with respect to sex and age. The body's proportions and measurements are correlated with its living conditions. During the past decade an improvement in living conditions had affected our appearance. The Wanke typology is grounded in bone measurements and mathematical calculations. The types of human body structure, as defined by this method, are defined as V(Y), A, H and I shapes. In young women the "I" type of body structure dominates, and only 20% possess another type of body structure. Homogeneous types of body structure are unique and usually we find a combination of various types. Understanding different types of body structures helps designers estimate the silhouette shape to match suitable clothing with respect to the rules on figure proportion balance.

Acknowledgments:

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References:

1. *Charzewski J., Piechaczek Henryk, £aska-Mierzejewska Teresa, Antropologia, AWF Warszawa, ISBN 83-87210-16-1, Warszawa 2004.*
2. *Anthroscan 3D Body Scanner Vitus XXL Technical Specification by Human Solution GmbH, July, 2008.*
3. *http://dl-designline.de/mode-nach-mass-massgescheidert/bodyscanner.htm*
4. *Malinowski Andrzej P., Æwiczenia z antropologii, Uniwersytet im. Adama Mickiewicza w Poznaniu, Poznañ 1989.*

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