Analysis of Body Features of Fashion Models Based on Untouched Measurement

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Abstract: Data of somatotype of 48 girl students aging from 17 to 20 who major in fashion show are measured using untouched 3D body scanner. Fashion show majors' 61 indexes which reflect those students' somatotypes are measured, and by analyzing and processing the data and principal component analysis, digital features are provided by analyzing the data and models' somatotypes, and the result of the research can be used in model selection. Meanwhile, based on somatotype esthetic theory, the research provides a reliable gist for model training in China. Besides, the research is of great importance to model training as well. It is practical and scientifically strict, thus is helpful for specific training for models individually. And due to the fact that differentiae of the model group are obviously revealed, the results can be used in holistic evaluation. And in the research, features of fashion models' bodily form are also analyzed in the paper.

Keywords: untouched measurement; fashion show; models; bodily form; feature analysis

Foreword:

Fashion, as a kind of art, involves many elements, and it can also be regarded as scientific. It has evolved during the process of human development from a culture of costume to a specific industry, and an independent artistic category. Being a manikin is the job of annotating the beauty of costumes by the carrier of the beauty of human body. Now, though it is inevitable to use untouched 3D-body-scanner in designing individual apparels, the scanner is barely used in the evaluation of somatotypes of models, the scanner is barely used in the evaluation of somatotypes of models. Besides, in recent years, in occasions like fashion model selection and manikin contests of every level, experiential estimation is the main factor, which means the evaluation is more or less subjective and ex parte. Hence, we need a series of more scientific data for evaluation. The analysis of features of the somatotype of manikins is theoretically solidly based, and provides a reference to self awareness of manikins, model selection for designer, as well as fashion designing and tailoring.

1. Respondents and Methods

1.1 Respondents

48 fashion majors, whose body heights vary from 172.1cm to 185cm, with the average being 175.8cm, and the standard deviation being 3.22cm, are chosen for this research.

1.2 Equipment

0Untouched 3D-Body-Scanner, made by Lectra Co. Ltd., France. The scanner is equipped with Vitus Smart 3D Body Scanning Software System and Scan WorX Digital Automatic Body Scanning Software, and the former can scan with laser beam a 3D area of 225×220×285(cm) with 8 to 10 seconds, and the latter software processes more than 500,000 spots of a human body, and the result is shown in a 3D image, and the system automatically measures a human body according to certain rules, and reflects dimensions of 97 body parts. This piece of equipment can also analyze sectional data of human body by intetactive measurements, and the data are used for further analysis.

1.3 Research Methods

In the research, 48 girl fashion majors aging from 17~20 are measure using untouched 3D body scanner, and after measuring body features are analyzed by selecting, comparing, and analyzing numbers.

2. 3D Measurement of Bodily Form

Based on anatomical theories, 61 features of human body are selected, which can reflect features of bodily form, they are body height, head height, neck height, neck-to-hip distance, neck-knee distance, waist-knee distance, side seam height, waist height, hip height, maximum hip girth height, crotch height, belly height, maximum belly circumference height, scapula height, breast height, neck from height, neck-vertical distance, neck front-to-vertical distance, scapula-vertical distance, waist-verticaldistance,hip-back-to-vertical-distance,hip-front-to-vertical-distance,breast-front-to-vertical-distance, breast-back-to-vertical-distance,belly-front-to-vertical-distance,belly-back-to-vertical-distance, mid-neck girth, neck girth, left side upper torso length, cross shoulder over neck, left shoulder width, shoulder width, left shoulder angle, right shoulder angle, breast width, bust point width, bust point to neck(both left and right), breast

girth, chest band, midriff girth, back width, back length, waist to high hip back, waist to hip back, crotch length, waist girth, waist to hip left, waist to hip right, high hip girth, hip girth, maximum hip girth, belly circumference, maximum belly circumference, arm length to neck back left, upper arm length left, upper arm length right, upper arm girth left, wrist girth left, inseam left, side seam left, left thigh girth, left knee girth, left ankle girth(Let's suppose human body is symmetrical.)

3.1 Data Analysis

After measuring via 3D body scanner, fashion models' body features can be inferred using SPSS software.

3.1.1 P-P Graph of Measuring

Drawing the P-P graph is a clear way to see if the sample data accord with certain rules. If they do, dots that represent correspondent data will form a straight line. The Graph 1 is the normal P-P plot of body height. Most dots approximately form a straight line, so they are of normal distribution.

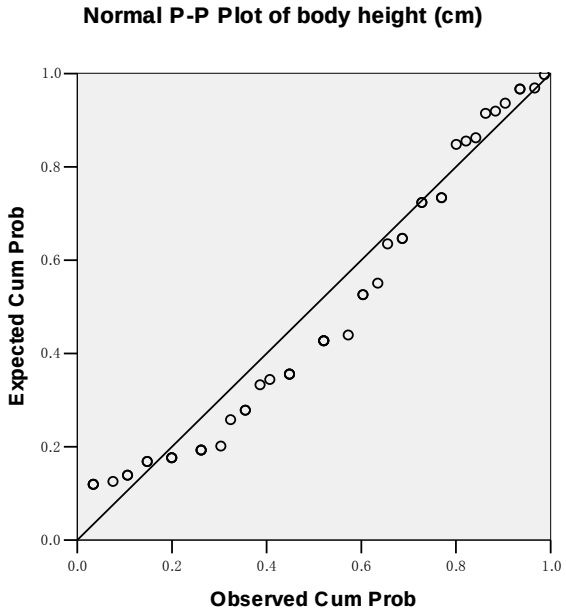

Fig.1

3.1.2 Analysis of Frequency of Models' Body Form Data

According to the law of massiveness, parameters of body parts are supposably of normal distribution. Frequencies of body height, breast girth, waist girth, and hip girth are analyzed next.

Statistics

		body height (cm)	breast girth (cm)	waist girth (cm)	hip girth (cm)
N	Valid	48	48	48	48
	Missing	0	0	0	0
Mean		175.890	82.273	62.581	88.885
Std. Deviation		3.2161	5.1255	3.1143	2.4959
Variance		10.343	26.271	9.699	6.229
Minimum		172.1	71.4	55.5	83.2
Maximum		185.0	95.7	70.3	94.8

Fig.2 some of the statistic information of body height, breast girth, waist girth, and hip girth

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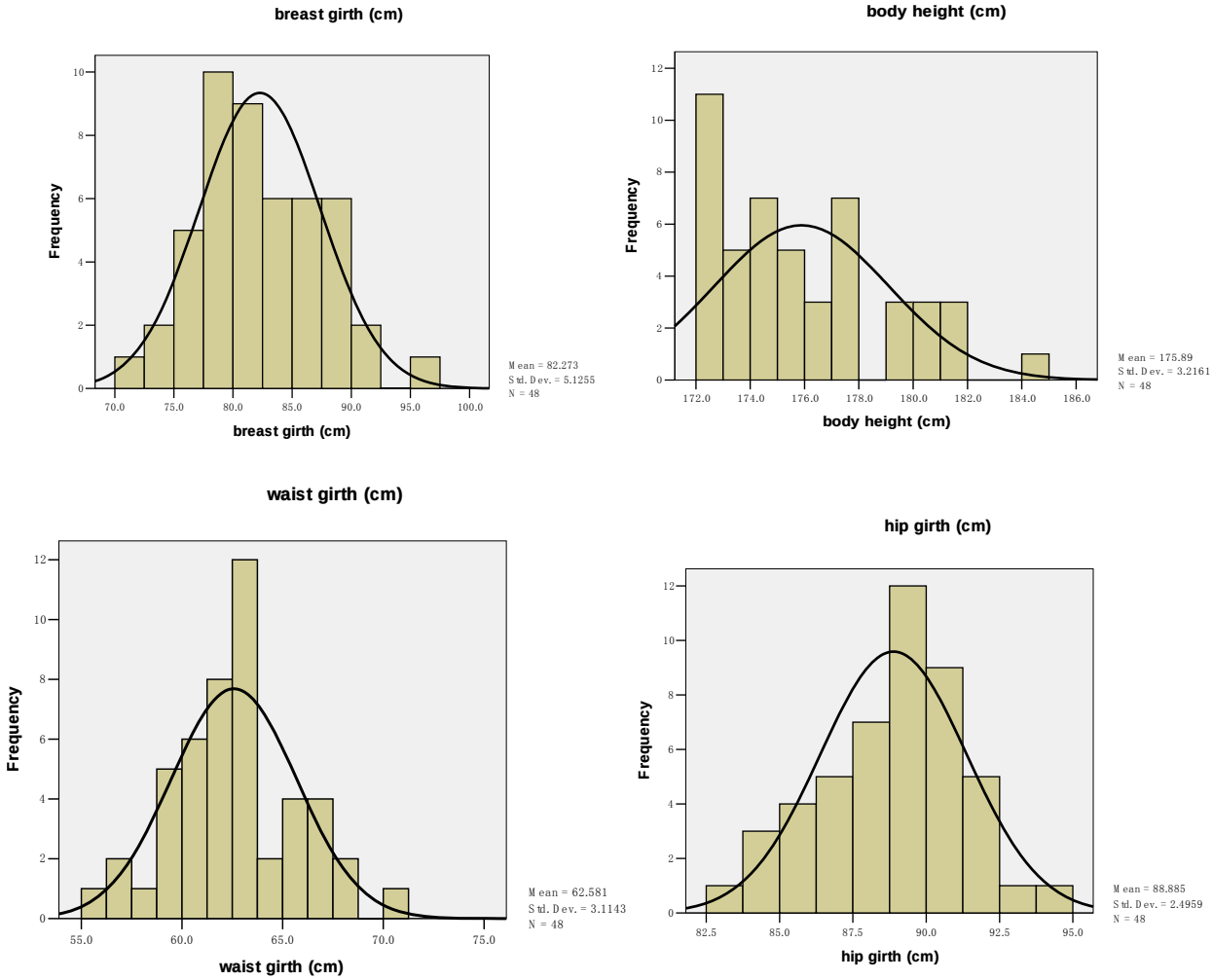

Fig.3 histogram of variants of body height, breast girth, waist girth, and hip girth

The Graph 3 are graphs of body height, breast girth, waist girth, and hip girth, with correspondent normal distribution curves on each. Manikins' body height are mostly 174.5cm to 177.5cm, breast girth are 87.5cm to 92.5cm. By observing the normal distribution curves we can find out that data of breast girth, hip girth, and waist girth are of normal distribution. A slight excursion happened in body height data, but they are supposably of normal distribution.

3.1.3 Principal Component Analysis

It is the case with most scientific researches of many fields that a lot of measurements are carried out to define certain variants that reflect features of something, data are collected for analysis to find out certain rules. A large sample with many variants offers scientific researches with abundant information, in the mean time, however, the work load of data collection is increased. More importantly, in most cases, there might be relativity among variants, which makes things more complicated. If we analyzed every single datum, the analysis could turn out insular. Blindly decrease research indexes may result in a loss of information, and therefore, the wrong judgment. So we need to find out a scientific and reasonable way to reduce information loss included in original research indexes and reasonably reduce research indexes. Because of the fact that there is relativity among variants, it is possible that we use less integrated indexes to cover information that exist in other variants.

In this research, principal component analysis about data of human body measurements is carried out to find out the influence of the size of every body part and the relativity.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %

1	16.568	22.696	22.696	16.568	22.696	22.696
2	11.989	16.423	39.120	11.989	16.423	39.120
3	7.399	10.135	49.255	7.399	10.135	49.255
4	5.895	8.075	57.330	5.895	8.075	57.330
5	4.325	5.925	63.255	4.325	5.925	63.255
6	3.237	4.435	67.689	3.237	4.435	67.689
7	3.130	4.287	71.976	3.130	4.287	71.976
8	2.814	3.854	75.831	2.814	3.854	75.831
9	2.200	3.014	78.845	2.200	3.014	78.845
10	1.872	2.565	81.409	1.872	2.565	81.409
11	1.787	2.448	83.858	1.787	2.448	83.858
12	1.603	2.196	86.054	1.603	2.196	86.054
13	1.573	2.155	88.209	1.573	2.155	88.209
14	1.493	2.045	90.254	1.493	2.045	90.254
15	1.162	1.592	91.846	1.162	1.592	91.846
16	.869	1.191	93.037	.869	1.191	93.037
17	.799	1.094	94.131	.799	1.094	94.131
18	.655	.897	95.028	.655	.897	95.028
19	.648	.888	95.915	.648	.888	95.915
20	.557	.763	96.678	.557	.763	96.678

Extraction Method: Principal Component Analysis.
Fig.4 statistic table of principal components(only first 20 items listed)

Table 4 is the table of variance factor of every component's common factors. The column of Components in the table is the sequence number of every main component. The Initial Eigenvalues column lists the eigenvalues of the relative matrices. "% of variance" column is the variance percentage of component explained. "Cumulative%" is the cumulative variance percentage of every component, listed from top to bottom. In the table we can see that the total variance the first 15 components take up 91.846%.

Extraction Sum of Loadings is the column about the sum of squared unspinned component load. The principle of component extraction is that the feature value is above 1, and 15 components are taken as a principal component.

By analyzing the principal component the two most important indexes to identify a good fashion show are: Index 1, body circumference, including breast girth, waist girth, hip girth, high hip girth, thigh girth, wrist girth, ankle girth etc. Index 2, heights and lengths, including body height, head height, leg length, arm length, torso length etc. Other indexes include features of main body parts and more detailed labels.

4. Body Form Analysis

As for fashion models, body form analysis for them is different from that for other people. Factors of time and fashion have an influence on it. The understanding of beauty and vogue influences people's view on models' body shape.

4.1 Head-Body Ratio

About a century ago, Polycletes referred that the best head-body ratio should be 1:8. For 20 centuries, both domestic and international models are becoming slimmer and taller. Especially, head-body ratio is exaggeratedly described in fashion comics, just to tell people a perfect body form. Thus, the head-body ratio is of great importance for body analysis of fashion models. The formula is: ratio=body height/head height. We can tell from Table 5 that 12.5% of the H-B ratio is above 7, most being above 6, and barely are there occasions the ratio is 8. So, most fashion models do not reach the most beautiful H-B ratio.

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Body height/head height	Frequency	Percent	Cumulative Percent
6.00——6.49	4	8.3%	8.3%
6.50——6.99	38	79.2%	87.5%
7.00——7.49	6	12.5%	100%

Fig.5

4.2 Ratio of Upper and Lower Body

It is generally believed that the ratio of the upper part of the waist line and the lower part is 1:1.618, which is the best form. From the table we can see that most ratios are close to the standard while there are a few exceptions.

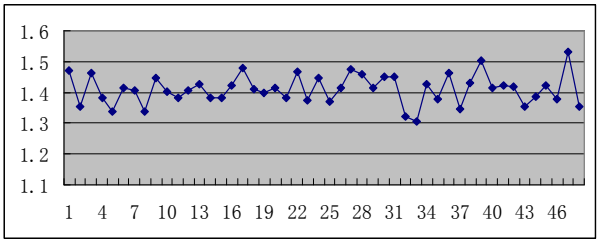

Fig.6

Conclusion

1) After the body shape analysis of 48 girl students, 3504 data are valid. And after data processing, comparing, selecting and analyzing, it is proved that the data of body height and vital statistics are of normal distribution, and body circumference is the first standard to value a model's body form, and heights and lengths are the second standard. Most models' head-body ratio is not close to the standard ratio 8. Most upper and lower body ratios are close to the standard while there are few exceptions.

2) Theoretically, body feature analysis of fashion show models is a necessary way of getting to know their body features. And use untouched 3D body scanner to evaluate body form and thus analyze and study bodily form can make up to many conventional short-comings, study body shape more objectively, and explore more features.

3) Practically, theories and methods of physical measurement have already been applied in selecting fashion models. Digital features are provided by analyzing the features of models' body form, and these digital features can be used as a standard of model selection, and can be seen as a reliable gist for model training in China as well.

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