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Proposals for Fashion Technology in the Standardization of Research Methods

- Centered on Scientific Approaches to Body Type Research Methods -

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Abstract

As a means of achieving fashion technology and scientification, this research on the standardization proposals of body type research methods has the following conclusions:

1. As human body displays different characteristics according to races, regions, sexes, and ages, clothing products (unlike other industrial goods) cannot be subject to global standardization. As a result, clothing size standardization can be desirably regionalized, for example, as Asian, European countries, etc.
2. In order to share human-body-concerned information among nations, programs for raw data exchange need to be urgently developed.
3. Top priority is databasing all raw data at home and abroad.
4. So that the findings of body type research can be practically applied to the concerned industry, industry-academy cooperation and information exchange are a must. While researchers have to heighten the precision of their studies, industrial partners ought to focus on the invaluable importance of academic research.
5. The scientific body type analysis, the basis of fashion technology, as well as the development of its application technology and software are ultimately and urgently required.

I. Introduction

1. Issues

1) Varied research methods on body types are highly likely to lead to disagreeable results.
2) Incorrect information on body types is also highly likely to be delivered in various conditions of measurement processes. Therefore, among the essential considerations are environmental conditions, sample selection, measurement equipment, measurement methods, measurement timing (season/AM/PM), mental/physical health conditions of subjects, clothing conditions, and equipment manipulation.
3) There is urgent necessity of distributing the databased raw data concerning body types at home and abroad, from region to region.
4) We witness great intellectual loss of

academic studies resulting from inactive industry-academy cooperation. Generally, the concerned industries lack interest in research stuff, while scholars get simple satisfaction by reading or publishing their papers.

5) There exist some problems in widely distributing 3D scanners developed by advanced scientific technology. Though they provide easy and quick information on three-dimensional human body shapes, they require high expenses and degrees of manipulation. That's why their generalization is rather difficult at this point.
6) We see some confusion of different clothing sizes in domestic and foreign fashion markets owing to the insufficient distribution of human body-concerned information.

2. Research Objectives

Today's fashion industry rightly serves as the index of a country's cultural level. Its realms are getting larger and larger following the courses of subclassification and scientification.

The scientific approaches to the fashion industry can be analyzed in three aspects: 1) material development and material choice, 2) goods production lines, 3) comfortableness to products and users. The first field is the development of functional, comfortable and new materials, the second is the scientification of production facilities, types and labor, and the third is a change into human-oriented thinking in production as well as the utilization of correct human body information.

The current clothing industry is witnessing rapid environmental changes owing to various standardization and the progress of the computer industry. All sorts of products are subject to rigid standardization, including the quality system of ISO 9000 and the environmental management of ISO 14000[1].

In the field of fashion, size standards and somatotype standardization are actively studied. Therefore, this research aims to discuss the standardization proposals of research methods for fashion technology. The discussion will be presented in the following order:

1) To analyze the current status of research methods on human body types and to suggest standardization proposals.
2) To suggest proposals to prevent the intellectual loss of academic research on body types and increase the trustworthiness and usability of academic research to the fashion industry by minimizing the regional errors of the final data.
3) To suggest the urgent necessity of databasing raw data appropriate for size specifications.

II. Research Methods

1. Comparison Ranges

The body type research methods in Korea and Japan were studied, while size systems and standardization were compared with a focus on Korea, Japan, the USA, and European countries.

2. Methods

Various body type research methods (such as measurement items, measurement methods and equipment, data gathering process, clothing size

system standards, and body type classification methods) were mutually compared and analyzed.

III. Present Status of Research Methods on Body Types

1. Measurement Items

Human body measurement is focused on precise description of the body. ISO 8559 (garment construction and anthropometric survey-body dimensions) suggests basic measurement items and methods for pattern design, clothing standards, and criterion procedures of human body measurement. This ISO is directly applied in each country to prevent any confusion regarding measurement items and methods. Nevertheless, it causes a few problems:

1. There may be some translational errors in delivering correct term usage and measurement methods.
2. Measurement items need to be compensated for the establishment of proper clothing standards.
3. Clear explanation is demanded about measurement base points and baselines for clothing design.

2. Measurement Methods & Equipment

At present, 1D information on somatotype measurements and 2D and 3D information on shapes are both used. In particular, computer-aided three-dimensional measurement analysis is favored in order to more correctly understand the circular human body shapes. But the 3D shapes on the computer requires ultrahigh precision of the equipment and precise verification of the final data.

1. 1D Direct Method: This simple R.Martin method is conveniently and widely used around the world, though errors may occur according to a measurer's manipulation skills.
2. 2D Methods: Sliding gauge represents direct measurement, whereas photography and silhouetter photography belong to indirect measurement.
3. 3D Methods: Direct measurement includes replica, adhesive tape, paper replacement, and tight fitting. Indirectly, there are Moir photography and 3D scanning. However, 3D scanners by way of laser beams and the computer demand diverse software and are too expensive to be generally distributed.

3. Value of Comparison According to Different Measurement Methods

Based on R.Martin method, sliding gauge, replica, and 3D scanning were compared so as to examine errors resulting from different measurement methods. Sliding gauge measurements were produced from the Human Engineering Lab at Dong-A University, while the other two were derived from preceding reports. The results are shown in <Table 2>.

In the case of 3D scanning, the error range was 0.1~0.5cm to produce comparatively correct measurement. Sliding gauge measurement values were a little smaller than Martin method measurements, which were probably the errors by the measurement rod pressing the measurement areas, especially the girth areas.

<Table 1> Scanner Models for Human Body Measurement

Nation	Model	Company	Application	Characteristics
USA	3D Whole Body Scanner	Cyberware (www.cyberware.com)	Fashion design, animation, computer graphics, etc. Automatic body measurement (with digi-size program)	Easily exchangeable
	Body Scanner	Textile Clothing Technology Corporation (www.tc2.com)	Automatic body measurement	Easy to pattern
Japan	Body Line (BL) Scanner	Hamamatsu Photonic System (www.hamamatsu.com)	Automatic body measurement	Automatic measurement for ISO standards
Germany	VITUS Pro	Vitronic (www.vitus.de)	Automatic body measurement	Easy for M to M approach
	VITUS Smart		Automatic body measurement	Usable for compact, small shops
	PEDUS		Automatic foot measurement	Custom order shoes possible
Canada	CANFIT-PLUS™ Yeti™	Vorum (www.vorum.com)	Automatic foot measurement	Custom order shoes possible

<Table 2> Value of Comparison According to Different Measurement Methods

(unit: cm)

Item		Sliding Gauge: Martin Method*	Replica: Martin Method**	3D: Martin Method***
Bust	Girth	-0.6	+1.3	+0.5
	Breadth	+0.1	+1.4	+0.5
	Depth	0	+0.7	+0.3
Waist	Girth	-1.2	+1.0	-0.3
	Breadth	-0.3	-0.9	+0.4
	Depth	-0.3	-2.8	+0.1
Hip	Girth	-1.3	-1.1	+0.2
	Breadth	-0.4	+1.5	+0.5
	Depth	-0.3	+2.4	+0.2

*: Human Engineering Lab, Dong-A University

**: Shim Kyu-nam (1999)

***: Kim Hye-gyong et al (2000)

※ Measurement error (ISO): ±0.5cm, ±1%

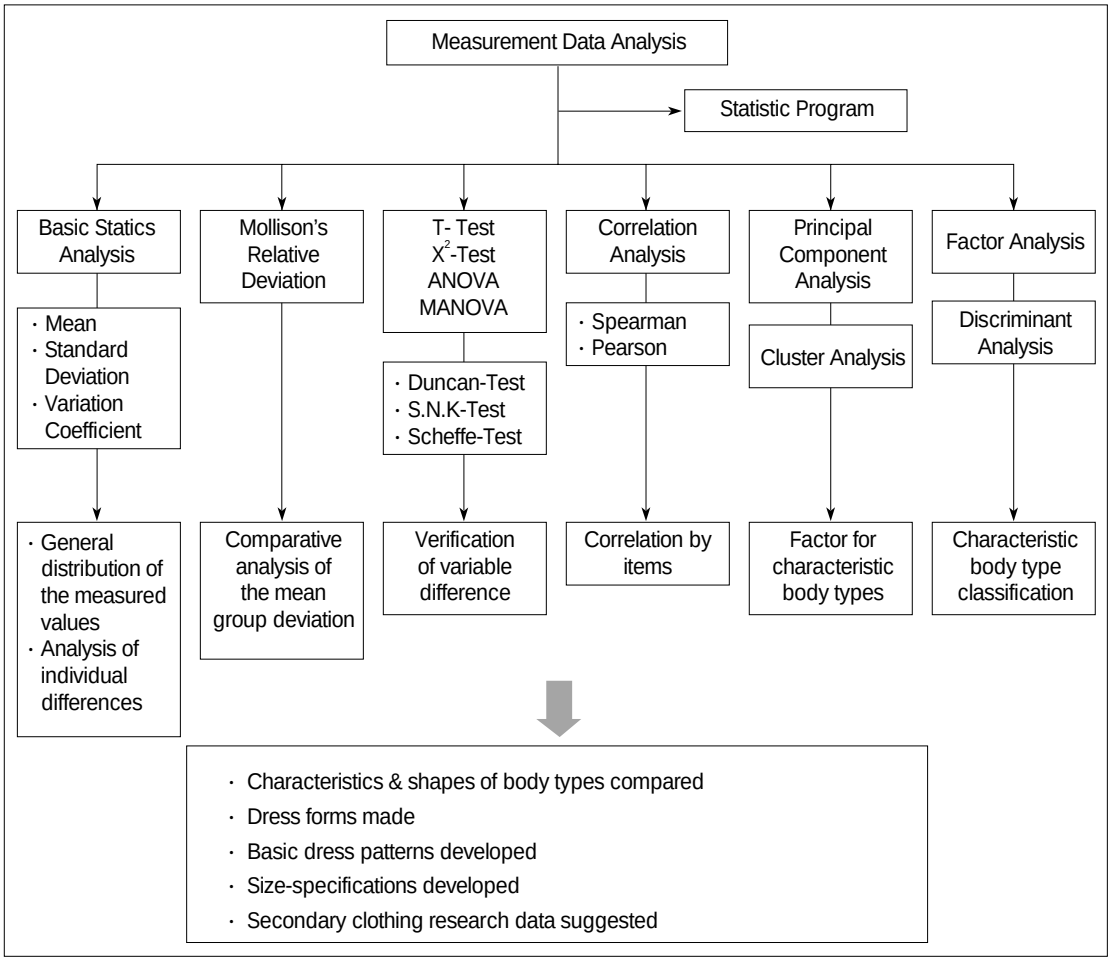
Replica measurements revealed the greatest errors, coming from the process of detaching and drying. Then, experimental results and errors should be considered according to research objectives.

4. Measurement Data Analysis Process

As seen in <Fig. 1>, a typical data processing method shows no distinct differences from country to country. Comparatively, research on somatotype characteristics is active in Korea and Japan, where various methods of statistic analysis are employed.

5. Comparison of Each Country's Human Body Measurement Methods & Clothing Size Specifications

Based on ISO systems (1991), each country makes its own sizing systems regarding body types and height.



<Fig. 1> Statistical Treatment Methods According to Measurement Data

<Table 3> Comparison of Each Country's Human Body Measurement Methods & Clothing Size Specifications

Division	ISO	KSA(Korea)	JSA(Japan)	AFNOR(France)
Body Measurement for Clothes	ISO 8559 ISO 7250	KS A 7003 KS A 7004	JIS L 0111 JIS L 0112 JIS L 0215	NF G 03-001
Sizing Systems for Men's and Boy's Garments	ISO 3636	KS K 0050	JIS L 4004 (Men's) JIS L 4002 (Boy's)	NF G 03-003
Sizing Systems for Women's and Girl's Garments	ISO 3637	KS K 0051	JIS L 4005 (Women's) JIS L 4003 (Girl's)	NF G 03-002

6. Body Type Classification Methods for Size Specifications

Based on ISO, each country develops a different clothing size system by way of drop values of height, chest girth and hip girth. These size specifications and somatotype classification methods vary. <Table 4> shows the body type classification methods for size specification.

<Table 4> Body Type Classification Methods for Size Specifications

Division	Body Type	Drop Value
ISO	A (large hip)	12cm
	M (large hip)	6cm
	H (small hip)	0cm
Germany	Large hip	8~14cm
	Medium hip	2~8cm
	Small hip	2~-4cm
Japan	A (medium hip)	Hip girth: about 91cm
	Y (small hip)	Type A: -4cm(hip)
	AB (large hip)	Type A: +4cm(hip)
	B (extra large hip)	Type A: +8cm(hip)
Korea	N (medium hip)	6cm
	A (large hip)	12cm
	H (small hip)	0cm
France	F (large hip)	10cm
	N (medium hip)	4cm
	M (small hip)	2cm

7. Comparison of Women's Minimal, Maximal Values in Basic Sizes

<Table 5> represents the comparison of women's minimal and maximal values in basic sizes of clothing specifications, such as bust, hip, waist, and height.

<Table 5> Comparison of Women's Minimal, Maximal Values in Basic Sizes

(unit: cm)

Division		ISO	Korea	Japan	France	Germany	USA
Bust		80-116	70-106	74-104	80-128	76-146	76-148
Hip		87-126	78-104	81-105	78-130	86-150	86-158
Waist		63-104	58-93	58-92	57-101	59-130	61-132
Height	Tall	172-179	165-175	162-170	164-172	172-180	170-180
	Regular	164-171	155-165	154-162	156-164	164-172	160-170
	Petite	155-163	145-155	146-154	148-156	156-164	150-160
	Petite Petite			138-145			

Source: Comparison on sizing systems of adult outwears, Lee Young-Suk, 1999

As each country holds different somatotype characteristics, the work of standardizing body type classification will be difficult. Therefore, somatotype standardization should reflect racial or regional differences.

Ⅳ. Standardization Proposals for Body Type Research Methods

1. Proposals for standardizing measurement methods according to research objectives

<Table 6> suggests the standardization proposals of measurement methods according to research goals.

Best results are produced when more than two measurement methods on the table are applied.

2. Proposals for the Exchangeability of Each Country's Clothing Sizes

As we have seen so far, owing to the different body size specifications and body type characteristics from country to country, standardization by way of ISO speculations is impossible. Henceforth, regional size standardization is necessary, including Asian and European countries. Also, exchangeability of clothing goods' sizes should be promoted. <Table 7> stands for a corresponding size table of clothing products.

3. Proposals for 3D Scanners' Practicalization & Utilization

1) Operation should be convenient and price should be low and reasonable.
2) In body type analysis, 3D scanners should be accompanied with programs to verify the data and equipment precision.

<Table 6> Proposals for Standardizing Measurement Methods According to Research Objectives

Measurement Method \ Research Objective		Body Type Characteristics	Basic Pattern Development	Dress Form	Clothing Size System
1D	Martin Measurement Values	◎	◎	◎	◎
	Body Indices	◎	○	○	◎
2D	Body Surface Angles	◎	△	◎	△
	Sliding Gauge	◎	○	○	△
	Photography & Silhouetter Photography	◎	○	◎	△
3D	Sliding Gauge Sectional Views	◎	○	○	△
	Replica	○	◎	○	△
	Tight Fitting	△	◎	△	△
	3D Scanning	◎	○	○	○

◎: Absolutely Necessary ○: Necessary △: For reference

<Table 7> Correspondence Clothing Sizes of Each Country

Korea	Japan	Italy	France	UK	Germany	Spain	Switzerland	USA	Canada
82-90(N)-160	9AR (83-91-158)	40	38	32	36	30	36	10	10
85-92(N)-160	11AR (86-93-158)								
88-94(N)-160	13AR (89-95-158)	42	40	34	38	32	38	12	12
91-96(N)-160	15AR (92-97-158)								
94-98(N)-160	17AR (95-99-158)	44	42	36	40	34	40	14	14
		46	44	38	42	36	42	16	16
		48	46	40	44	38	44	18	18
		50	48	42	46	40	46	20	20

Korea, Japan: Standards at medium hip & regular height

3) In order to introduce 3D scanner results into the fashion industry, software should be consistently developed.

V. Conclusions

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3. Top priority is databasing all raw data at home and abroad.
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5. The scientific body type analysis, the basis of fashion technology, as well as the development of its application technology and software are ultimately and urgently required.

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