In Search of the Right Trouser Pattern

- Comparison study of four different pattern making methods focused on different body shapes and movements

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Abstract

Clothing fit is one of the main factors to be considered in pattern making. Various pattern making and fit evaluation methods have been used by the clothing industry. This study is a comparison of four pattern making methods which are known as ESMOD, Bunka, Aldrich, and Armstrong methods through evaluating specific movements. Two subjects having Hourglass and Bottom hourglass body type respectively were used but they had similar body measurements data. Two subjects and eighteen experts who had a pattern making background examined the fit of experimental garments. To analyse the results of the fit evaluation, SPSS 11.0 was used and Kendall's coefficient of concordance was conducted for verification of the level of significance between the rank-match of the responses and the questionnaires.

Index Terms - Clothing fit, Clothing comfort, Fit preference, Fit evaluation

I. INTRODUCTION

To have professional pattern making skill for unspecified customers' satisfaction can be a valuable strength in the clothing industry. In modern society, the number of females choosing to wear trousers has increased through the result of flourishing women's life in society. Proper trousers should have functional perspectives, physical comfort, movement adjustability, and satisfactory design.

It has been defined that fit preference is how customers desire a particular clothing to match to their body shape [8] and it has been mentioned that clothing fit is affects the loyalty of consumers to clothing companies considerably. For this reason, more clothing companies have been concentrating on considering their customers' fit requirements. Reference [2] mentions clothing companies should analyse body shapes of customers and manufacture proper clothing to satisfy their fit preference. Reference [3] states that well-fitted clothing should hang well on the body without causing fabric contortions, and should have good proportions, and compression. In addition, they mention sufficient ease for movement is necessary for well-fitted clothing and gave the bad example of a constricted crotch on the lower body. In the clothing industry, fit analysis is normally managed using a sample fitting model in their size system [4] through a sensory test by manufacturers and researchers.

In this sense, it is necessary to understand body shapes and to develop enhanced trousers pattern blocks which can reflect the specific characteristics of different pattern making methods.

II. METHODS

In this study, to compare the four different trousers' pattern making methods, with a focus on movements, subjects and pattern making analysis, garment production and evaluating each garment were conducted in consecutive order. First, body sizes of selected subjects designated as subject A and B were measured by a 3D body scanner, [TC] ². BMI (Body Mass Index) and 'Female figure identification technique (FFIT) for apparel©' developed by [6] were used to classify the subjects' body type and shape. Second, four pattern making methods were selected ([1],[3],[5],[7]) and these methods were referred to as ESMOD, Bunka, Aldrich, and Armstrong. Next, trouser patterns were developed by using the YUKA apparel CAD system (SuperALPHA:Plus) and pattern data were saved as DXF file format. Four types of experimental garments for each subject were developed. 100% cotton muslin tested by KES system was used to make the experimental garments with 1cm seam allowance and a concealed zipper on the side seam. Then, each experimental garment was photographed using specific postures (Fig 1).

Assessments were carried out by subjects and experts to find out the suitability of each body part through a wearer test and appearance evaluations. The movements for examination were 'stepping at walking pace', 'sitting 90°', 'stooping 90°', 'climbing the stairs', and 'squatting on hams'. The examined areas to judge sufficient ease were waist, belly, hip, crotch, thigh, and calf. Evaluations were made on a five-point scale with each response ranging from "very good=5", "good=4", "neutral=3", "bad=2", and "very bad=1". SPSS 11.0 was used to analyse the result of the fit evaluations.

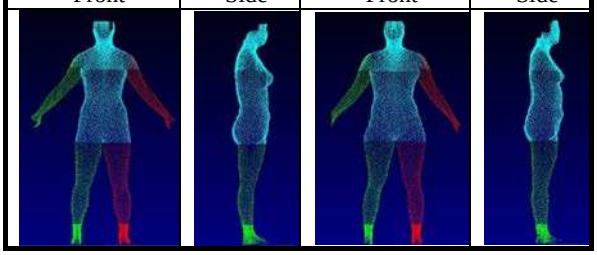
Movement 1	Movement2	Movement 3	Movement4	Movement 5
				
Stepping at walking pace	Sitting 90°	Stooping 90°	Climbing the stairs	Squatting on hams
Walking step - 30cm	Upright posture	Bending forward with 90°	Height of stairs - 20cm	Sitting on floor

(Fig 1) Movements for examinations (Reproduced from [8])

III. RESULTS AND FINDINGS

A. Findings of subjects

(Fig 2) describes each subject's body scanned data by using a [TC]² body scanner. Each subjects' significant body sizes for trousers were collected to developed experimental garments and two subjects were divided by BMI and FFIT© (Table 1). The Two subjects were found to have similar body sizes as regards their height and weight with similar BMI. However, there was a substantial hip size difference (8cm) which is almost two size's grading interval and this was useful for comparison in this study.

Subject A		Subject B	
Front	Side	Front	Side
			

(Fig 2) Body scanned data of two subjects

	Subject A	Subject B
Waist (Front)	75.9 cm	81.4 cm
Hip	101.9 cm	110 cm
Hip length	23.7 cm	24.6 cm
Crotch length	34.15 cm	41.2 cm
Height	167.7 cm	168 cm
Weight	68 kg	69.2 kg
BMI	24.18	24.52
Body shape	Hourglass	Bottom Hourglass

(Table 1)Major sizes to make trousers

B. Experimental garments development

Four experimental garments were developed using four pattern methods' (ESMOD, Bunka, Aldrich, and Armstrong) for each subject. The two subjects were photographed when they posed for a picture taking up the five movement poses (Fig.3) and (Fig.4) show each subject′s movement postures, and these are represented as ESMOD- Bunka- Aldrich- Armstrong in order.

C. Experts' examinations

Appearance examinations were evaluated by 18 experts who had background knowledge about pattern making. The experts examined the photos of the two subjects wearing the experimental trousers and in the five postures. These movements were judged by examiners by ranking from the first to the last among the four pattern making methods and these were numbered from 1 to 5. The examined body parts were waist, abdomen, hip, crotch, thigh, and calf. (Table 3) shows the results of the movement examinations by experts.

D. Subjects' evaluations

The two subjects evaluated the range of comfort on each body part when they posed in the five different postures. All answers were received when a photographer took each picture by the researchers. Overall satisfaction was examined and sufficient amount of ease around the waist, abdomen, hip, crotch, thigh, calf area were evaluated respectively employing a five point scale.

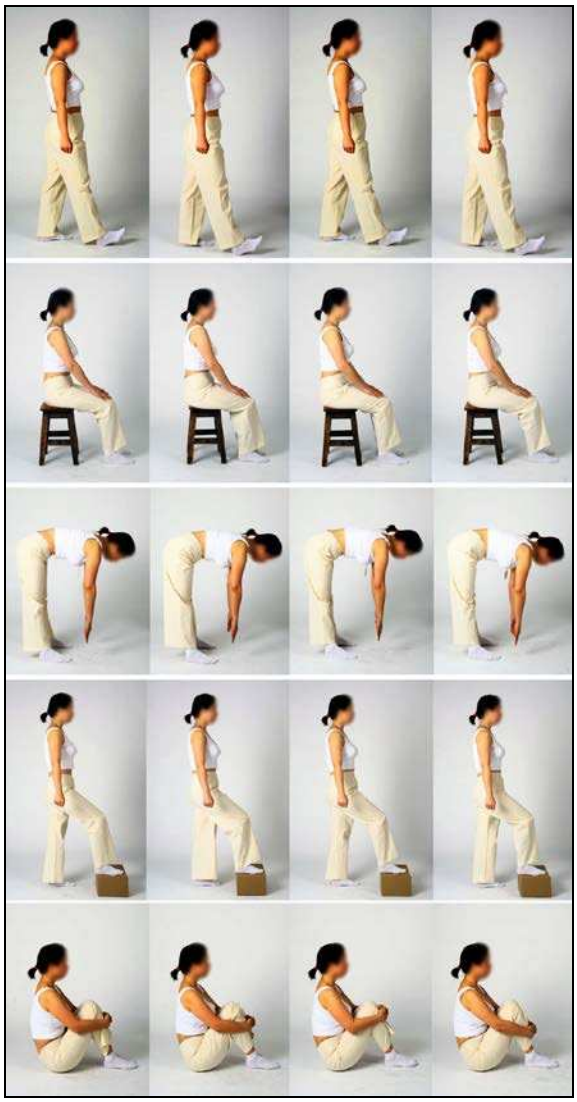
IV. ANALYSIS

A. Analysis of Experts' examinations

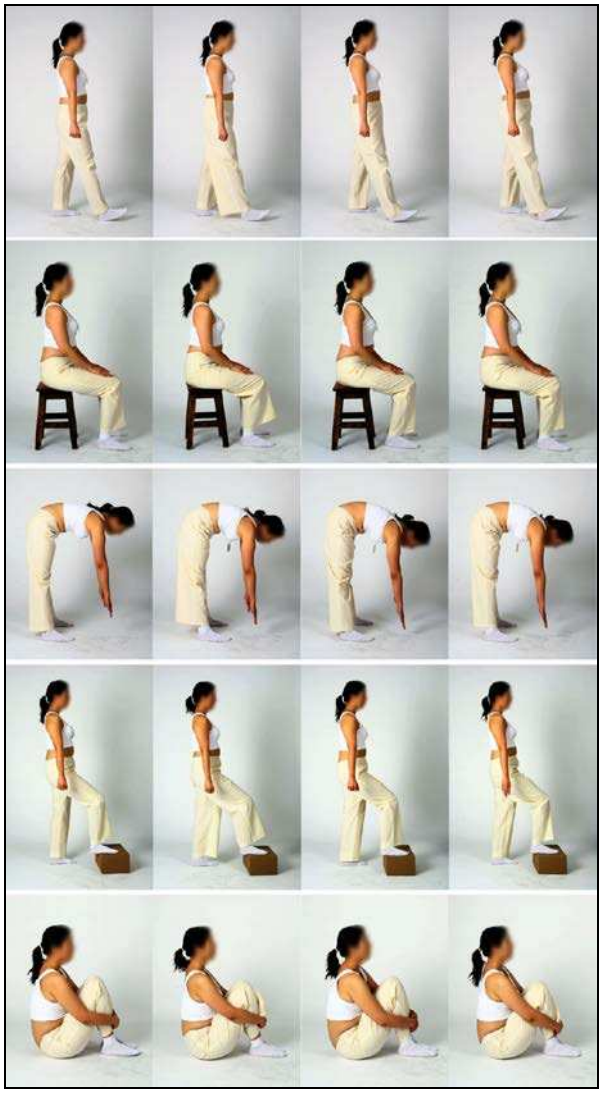
The results of the two subjects' evaluation by the expert group are shown in Table 2. For subject A it was determined that the Aldrich method received the most predominant choices in five movements, followed by ESMOD and Bunka.

Depending on the evaluated data, it is shown which method was found to be the most comfortable for the five movements for Subject B. The results were the same results as Subject A's; Aldrich – Bunka – ESMOD – Armstrong in order.

Kendall′s coefficient of concordance was conducted for verification of the level of significance between the rank-match of the responses and the questionnaires (Table 7). According to the p-value for each movement′s results, this experiment′s results are said to be statistically significant if these are assumed at a 0.1% level of significance



(Fig.1) Five movements - Subject A



(Fig.2) Five movements - Subject B

Subject A	Movement 1	Movement 2	Movement 3	Movement 4	Movement 5	mean	SD
ESMOD	2.75	2.06	2.25	2.06	2.38	2.4	0.38
Bunka	2.63	1.47	2.63	2.75	2.88	2.47	**0.56**
Aldrich	2.25	3.53	2.94	3.06	2.75	2.9	0.46
Armstrong	2.38	2.94	2.19	2.13	2.00	2.3	0.36
Subject B	Movement 1	Movement 2	Movement 3	Movement 4	Movement 5	mean	SD
ESMOD	2.44	2.44	2.31	2.13	2.56	2.37	0.16
Bunka	2.56	2.50	2.44	2.81	2.63	2.58	0.14
Aldrich	2.38	2.56	2.94	2.88	2.63	2.67	**0.23**
Armstrong	2.63	2.50	2.31	2.19	2.19	2.36	0.19

(Table 2) Results of experts' examination

Ranking	Movement 1	Movement 2	Movement 3	Movement 4	Movement 5	mean
1	ESMOD	Aldrich	Aldrich	Aldrich	Bunka	Aldrich
2	Bunka	Bunka	Bunka	Bunka	Aldrich	Bunka
3	Armstrong	ESMOD	ESMOD	Armstrong	ESMOD	ESMOD
4	Aldrich	Armstrong	Armstrong	ESMOD	Armstrong	Armstrong

(Table 3) Result of Subject A's examination

B. Analysis of subjects' evaluations

Four pattern systems' basic trousers were generally examined comfortable because these trousers had suitable ease on each body part. It was found that there were not significant differences in crotch, thigh, and calf. However, there was slight increase of dissatisfaction when subjects changed poses. According to (Table 6), it can be seen that these amount of discomfort by and large increased from standing to squatting.

(Table 7) represents which pattern's method was preferred by the two during each movement. Overall, Subject A selected the Bunka method, but generally the Aldrich method was chosen by Subject B.

Ranking	Movement 1	Movement 2	Movement 3	Movement 4	Movement 5	mean
1	Armstrong	Aldrich	Aldrich	Aldrich	Aldrich / Bunka	Aldrich
2	Bunka	Armstrong / Bunka	Bunka	Bunka	ESMOD	Bunka
3	ESMOD	ESMOD	Armstrong / ESMOD	Armstrong	Armstrong	ESMOD
4	Aldrich	·	·	ESMOD	·	Armstrong

(Table 4) Result of Subject B's examination

	Subject A					Subject B				
	Movement 1	Movement 2	Movement 3	Movement 4	Movement 5	Movement 1	Movement 2	Movement 3	Movement 4	Movement 5
W^a of Kendall	0.3	0.52	0.07	0.14	0.09	0.008	0.002	0.053	0.095	0.027
chi-square	1.5	25.03	3.52	6.82	4.50	0.375	0.075	2.550	4.575	1.275
Degree of freedom	3	3	3	3	3	3	3	3	3	3
p-value	0.68**	0	0.31 *	0.07*	0.21*	0.94**	0.99**	0.466*	0.20*	0.73**

(Table 5) Results of Kendall's W testing - movement examinations

Subject A	Movement 1	Movement 2	Movement 3	Movement 4	Movement 5
ESMOD	4.85	4.14	4.28	4.28	4
Bunka	5	4.85	5	5	4.85
Aldrich	5	4.57	4.57	5	4.57
Armstrong	4.85	4.28	4.57	5	4.28
mean	4.92	4.46	4.60	4.82	4.42
Subject B	**Movement 1**	**Movement 2**	**Movement 3**	**Movement 4**	**Movement 5**
ESMOD	4.28	3.42	4.28	4.14	3.57
Bunka	4.85	4.28	4.57	4.57	4.42
Aldrich	5	4.85	5	4.85	4.85
Armstrong	5	4.42	5	4.85	4.42
mean	4.78	4.24	4.71	4.60	4.31

(Table 6) Differences of each movement's results

Movements		Subject A	Subject B
Movement 1	Stepping a walking pace	Bunka/ ALDRICH	Aldrich / Armstrong
Movement 2	Sitting 90°	Bunka	Aldrich
Movement 3	Stooping 90°	Bunka	Aldrich / Armstrong
Movement 4	Climbing the stairs	Bunka/ Aldrich / Armstrong	Aldrich / Armstrong
Movement 5	Squatting on hams	Bunka	Aldrich / Armstrong
Overall		Bunka	Aldrich

(Table 7) Results of Subjects' evaluations

V. CONCLUSION

It was determined that the Aldrich method received the most predominant choices in the five movement types, and the following ranks (in order of the experts' judgment) were Bunka, ESMOD and Armstrong for the case of the two subjects in the experts' examinations. In addition, Subject A selected the Bunka method generally when the Aldrich method was chosen by Subject B. However, clothing comfort and fit preferences can be defined individually and differently thus it can be affected to the fit evaluations. In addition, it is suggested more participants for subjects and survey for reliable results in any future survey.

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