Method of historical pattern analyzing

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Abstract. Simulation of historical costume requires digitalization of pattern block. This research developed the method of reconstruction of historical men’s coat by parameterized pattern blocks and CAD. The method includes three steps. Firstly, to collect the information about historical body measurements, drafting systems of patterns, clothing construction, methods of production and shaping, etc. Second step is the digitalization of patterns. Thirdly, to extract the body measurements and the ease allowance from pattern blocks. Fourthly, the calculation of shaping techniques values. Finally step includes the virtual reconstruction of costume. The database containing the historical pattern blocks, the manuals of drafting methods, the parameters of pattern, the body measurements, the eases of 47 historical men’s coat, and the values of shaping methods was established. Data base allows to calculate hided body measurements from patterns and to reconstruct of historical men’s coat with high accuracy in virtual reality.

1. Introduction
Since the middle of the XIX century, the tailors published a huge number of pattern manuals including method of measuring, body measurements, method of drafting, images of scale sown at the same proportion patterns, and cutting table of proportions. The pattern blocks are the resources to find the body measurements, on the one side, and the methods of coat shaping, on the other side [1,2]. However, the both mentioned indexes couldn’t be measured directly. To parameterize the historical patterns, modern CAD technology is needed. Several groups of indexes should be measured, such as length, widths, ease allowances, etc., it helps to reconstruct historical coats in 3D.

2. Experiment
2.1. Initial database collected
Based on the pattern drafting methods published from 1891 to 1913 [3-10], 47 pattern blocks (P1,P2…P47) of men’s coats (17 cutaway, 11 dress and 19 frock coats) has been drawn for parameterization. According to the explanation of pattern drafting methods, the following original information has been collected:
• the measures (sizing system, method of measuring, content and condition of body dimensions measuring, body measurements);
• pattern blocks;
• procedure of pattern drafting;
• full algorithm of pattern block drafting;
• methods of clothing shaping designing during pattern block drafting and its manufacturing.

2.2. Parameterization of pattern block
After drafting a patterns in 1:1 scale in CAD, three groups of parameters were chosen for measuring.
1. For finding out the relationship between pattern block parameters, body measurements and ease allowance in accordance with the full algorithm of pattern block drafting: depth of arm scye /A-B/, back length /A-C/, back width /B-M/, and position of fashion waist /A-D/, etc. (Figure 1).

![Figure 1](image1.png)

**Figure 1.** Diagrams of men’s coat: cutaway coat (a), dress coat (b), frock coat (c).

2. For determine the body measurements (chest girth and waist girth) of the wearer: /B1+B1+B3/, /W1+W2+W3/ (Figure 2);

3. For calculating the deformation of sewing edge under heat-moisture treatment: the length of each pair of seam lines (a & b, c & e1, r1 & r2, etc.) (Figure 2).

![Figure 2](image2.png)

**Figure 2.** Scheme of pattern blocks of men’s coat measurements: cutaway coat (a), dress coat(b), frock coat (c), sleeve (d).
3. Results and discussion

3.1. Exploration for 1st groups of parameters
Based on the initial database, the body measurements and full algorithm of pattern block drafting have been collected. After combined with the 1st group of parameters, the relationships which were existed between the parameters of historical pattern block, the ease allowances and the body measurements of real wearer were developed. The equations in Table 1 related to three style of coats P1 to P23, P29 to P47 from manuals [4, 5, 7-10]. The abbreviations are: CG is the chest girth, WG is the waist girth, H is the height.

Table 1. Relationship between pattern block parameters, body measurements and ease allowance, cm.

| Item  | Measurement                        | Relations         | Item  | Measurement                        | Relations         |
|-------|-----------------------------------|-------------------|-------|-----------------------------------|-------------------|
| AB    | Depth of scye + ease             | CG/6 + 8.89       | BK    | Blade width + ease                | Blade width + ease |
| AC    | Position of natural waist (back length) | H/4 + 0.64      | BM    | (Blade width + ease) /2 + ease    | (Blade width + ease) /2 + 3.18 |
| AD    | Position of fashion waist        | H/4 + 3.81       | B~2   | -                                 | CG/4              |
| AE    | Full length                      | -                 | BH    | -                                 | CG/2              |
| AR    | -                                 | CG/24 + 3.81      | HI    | Ease                              | 5.72              |
| SR    | Depth of neckline                | CG/16 – 1.63      | GC    | CG/32 + ease                      | CG/32 + 3.18      |
| BW+K  | Over shoulder distance + ease    | Over shoulder + 2.54 | 4~5   | -                                 | WG/4              |

Owing to the variance of the styles of men’s coat, the ease allowances on chest and waist widths of several patterns were different. The ease to chest width of P24 to P26, namely item HI in Table 1, was 0.64 cm larger than the others’ [6]. The ease to chest and waist width of P27, P28, namely item HI and 4~5, were 1.91 cm and 2.54 cm larger than the others’, respectively [3].

3.2. Exploration for 2nd groups of parameters
In pattern manuals, the major body measurements corresponding to the parameters of pattern block, could be get together, such as chest girth, waist girth, height, etc. The chest and waist girths of the historical wearers were collected, and the chest and waist widths of patterns were measured in CAD (/B1+B1+B3/, /W1+W2+W3/ in Figure 2). These data help to find the appropriate wearer body measurements for the XIX century patterns or real prototypes without sufficient initial information in next way:
1. Determine the coat style of pattern or real prototype;
2. Measure the length of natural waist and fashion waist of the pattern or real prototype, calculate the wearer’s height according to the relations in Table 1;
3. Find the same coat style of 2nd group’s parameters Table 1, determine the wearer’s chest girth and waist girth according to the chest and waist widths of the patterns.

3.3. Exploration for 3rd groups of parameters
The differences between each pair of sewing seam lines (a & b, c & e1, r1 & r2, etc.) were calculated. These results will be useful for analyzing and adjusting pattern, matching the length of each paired suture line by making darts. For example, the seam line which is longer should be deforming by making dart to shorten in virtual reconstruction.
3.4. Virtual try-on
The pattern block of frock coat was selected for virtual reconstruction in software CLO3D 6.0 as an example of results application. According to the database of body measurements and methods of pattern block drafting, the men’s suit that combined shirt [11], drawers [12], trouser, waistcoat and coat has been chosen because all of them had the same anthropometric measures, cm: height 167.6, chest 91.4, waist girth 81.3, hip girth 94 [8].

In accordance with the historical database including structure, textile materials, method of shaping developed in previous research [13,14], the digital twin of men's frock coat was simulated.

Figure 3 shows the pattern blocks of shell and lining fabrics of each garments, and paddings from which the full suit was combined.

![Pattern block of five garments of the suit](image)

**Figure 3.** Pattern block of five garments of the suit: shell (a), lining of waistcoat and coat (b), padding of coat (c).

Men’s suit with modified frock coat which was adjusting the suture lines by making darts was simulated as shown in Figure 4.
**Figure 4.** Virtual reconstruction of full men’s suit layer by layer, shirt + drawers (a); shirt + drawers + waistcoat + trousers (b), shirt + drawers + waistcoat + trousers + coat (c), full suit (d).

To prove the higher precision of modified frock coat, the silhouettes of frock coats which have been reconstructed in two ways were compared.

**Figure 5.** Silhouettes of frock coat in two ways: initial image (a) [15], original coat without adjusting the suture lines (b), modified coat (c).

The selected photo of real XIX century men’ coat which exhibited the similar style of as the reconstructed virtual ones as shown in Figure 5 (a). For the consistency between real and virtual situations, the avatar adapted to the same posture was investigated from the same perspective as the photo. Compared to the original coat (Figure 5 (b)), the modified coat (Figure 5 (c)) shown higher consistency: the collar fitted more closely to the neck, the seam between upper forepart and skirt of the coat were smoother, the hem fitted more closely to the body. Thus the new approach proved to be effective.
4. Conclusion

Thanks to the digitalization and CAD technology, the analyses of historical men’s pattern blocks could be developed. Meanwhile, combining the source and style of patterns, the database of historical men’s coat patterns has been built. This method can be used for virtual reconstruction of historical men costume complex but also for designing modern garments with historical elements.

References

[1] Kuzmichev V E, Moskvin A and Moskvina M 2018 Virtual reconstruction of historical men’s suit *Autex Research Journal* vol 18 no 3
[2] Kuzmichev V E, Moskvin A, Surzhenko E and Moskvina M 2016 Computer reconstruction of 19th century trousers *International Journal of Clothing Science and Technology* 29 (4) pp 594-606
[3] Arvidson P 1892 *The Arvidson coat and vest system* (Kalamazoo: Published by the author)
[4] Holmes N 1894 *The Holmes cutter A practical system for garment cutting that is based on selfvarying principles for block patterns* (Chicago: Published by the author)
[5] Selden S G 1895 *The American coat, vest and trousers system* (New York: JNO.J. Mitchell Co)
[6] Schulman L 1904 *Schulman’s system of garment cutting, coat and vest measure and adjustable trouser system* (New York: Published by the author)
[7] Jno J M Co 1906 *The new standard coat system* (New York: JNO.J. Mitchell Co)
[8] Gibson L 1913 *International Cutting System* (Washington, D. C.: Published by the author)
[9] Streiff E L 1913 *Streiff’s system of garment cutting* (Detroit: Printed by A W Brookes)
[10] Streiff E L 1920 *Streiff’s ideal system of garment cutting* (Detroit: Published by the author)
[11] Vincent W D F 1898 *The Cutter’s Practical Guide to Cutting and Making Shirts, Undergarments, Collars, and Specialite Clothing for Various Occupations* (London: The J. Williamson company limited)
[12] Half of drawers pattern piece: gentleman’s drawers, 1907 – The ladies treasury of costume and fashion [https://www.pinterest.com/pin/553028029212603540/](https://www.pinterest.com/pin/553028029212603540/) (2020, accessed 2 October 2020)
[13] Zhang S C and Kuzmichev V E 2019 Retrospective Analysis of European Men’s Suit from 1850s to 1920s for Virtual Reconstruction *DEStech Transactions on Social Science, Education and Human Science aems* pp 239-243
[14] Zhang S C and Kuzmichev V E 2020 A method of selection the textile materials for virtual reconstruction *IOP Conference Series: Materials Science and Engineering* 811(1): 012008
[15] The Metropolitan Museum of Art Suit [https://www.pinterest.com/pin/369928556873397463/](https://www.pinterest.com/pin/369928556873397463/) (2020, accessed 2 October 2020)