

# Study on the influencing factors of fitness between shawl collar and face shape

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**Abstract.** In order to improve the fit degree of the shawl collar and the human face type, the combination method such as eye tracker experiment, questionnaire survey and virtual fitting evaluation were used to analyze the influencing factors of the effect on different face type wearing shawl collar. The result of eye tracker test and the verification evaluation showed that the main factors affecting the fit of the face type and the shawl collar were the aspect ratio of the frontal projection of the neck shape, the width of the collar, and the height of the lapel point. When the shape of the shawl collar was more prominent in the whole garment, the curvature of the shawl collar outer contour affected the shape of the garment significantly.

## 1. Introduction

When we choose clothes, the proper matching of face and collar is very important. The research of face shape mainly focused on the field of anthropometry and image research, including the simple classification of face shape by observing, the extraction of features recognition and classification of face shape by various algorithms. The research and application of human neck features mainly focused on the establishment of collar specifications series [1], the formulation of model specifications [2], and the study of neck characteristic factors. However, during the fashion design, the matching of face, neck and collar mainly depended on the designer's subjective experience and implicit rules, and it could not be quantified and accurately expressed. And few studies have been done on the related factors between collar type and specific face type.

In this paper, the factors influencing the fitness between face shape and collar were studied. Eye tracker experiment and questionnaire were used to collect the change of the participants' attention on the matching of different face shape and parameters. The virtual fitting software was used to construct a verification and evaluation experiment, which verifies the influence of different parameters on the face shape fitness of collar.

## 2. Experiment

### 2.1 The samples and classification

According to the face classification method, human face contour was divided into five categories. Twenty-seven female subjects were randomly selected from the university. The subjects' image collection and face measurement were taken and shown in Fig. 1. With the collection of the image for facial feature point measurement and registration of measurement results, the image and the actual size were converted. According to the classification method mentioned, the face shape data of 25 students met the value range given by the above classification method [3], the accuracy rate was about 92.6%. In the valid sample images, there were 3 long faces, 7 egg-shaped faces, 5 round faces, 3 square faces and 7 heart-shaped faces.

By collecting 108 neck-shaped front projection photos and corresponding physical measurement data, front projection of the neck shape was divided into three types: slender, normal and wide type.



Fig. 1 The samples of face collection

The height of the shawl collar is normally set to 2cm [4]. So, the height of the shawl collar in this experiment was set at 2cm. The width of collar, height of the lapel and curvature of the outer contour were chosen as the parameters as to study the influence of the fit on the front shape of face and collar. The specific parameters of collar were shown in table 1, table 2 and table 3.

Table 1 Classification index of shawl collar width

Level of collar width	Distance from collar edge to neck point (mm)	Collar width in neck point(mm)
1	20	41
2	30	50
3	40	60
4	50	69
5	60	79

Table 2 Classification index of height of lapel point

Level of lapel height	Vertical dimension lapel point to bust line(mm)	Vertical dimension lapel point to shoulder point(mm)
1	0	223
2	50	273
3	100	323
4	150	373
5	200	423

Table 3 Classification index of outer contour curvature

Level of outer contour curvature	Curvature	Inverse of curvature (1/mm)
1	1/50	500
2	1/60	600
3	1/70	700
4	1/80	800
5	1/90	900

## 2.2 Experimental procedure

There were five factors including face shape, ratio of neck length to neck width, height of lapel collar, width of the collar and the curvature of the outer contour in the experiment, and each parameter had different levels. So, 25 samples were determined by orthogonal design and the 25 type collars were drawn by the CAD software. Twenty-five experimental samples were divided into five categories according to the face type, the experimental samples of the same category were randomly arranged, and two different arrangements were taken as the final experimental samples for the experiment. The experimental samples of the same size were drawn by CorelDraw X4, as shown in Figure 2.

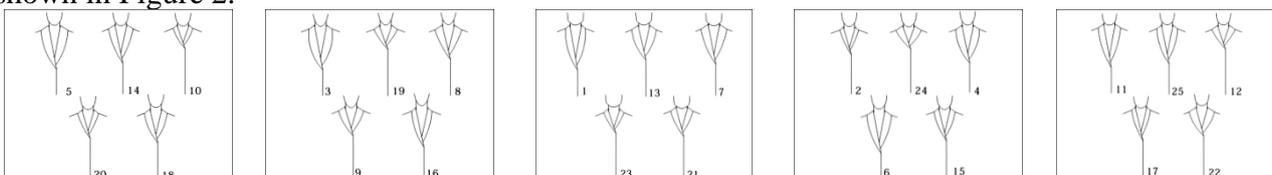


Figure 2 The experimental samples

### 2.2.1 Eye tracker experiment

In this experiment, 37 female subjects joined eye tracker experiment using Eye Link from Canada. This eye tracker was connected with a computer installed with EXPERIMENT BUILDER and

DATA VIEWER software and a main test machine recording the experiment process for eye movement.

According to the experimental procedure, the subjects had the experiment one by one. After completing the eye tracker and the questionnaire, the subjects were asked to compare the coordination of five patterns with different collar types under the same face type, and to choose the most suitable face type and shawl collar type.

### 2.2.2 Verification experiment procedure

In order to verify the results of the face and collar fitting, a virtual model was built on the 3D fitting software. The face and neck size of the virtual model were adjusted to the same size as the subjects, the verification sample image was taken based on the ear-eye horizon level. The CorelDraw X4 was used to process the details, and five different samples of the same face were arranged.

After finishing the display of virtual fitting, the subjects carried out eye tracker experiment of the same process after full rest. Based on the data of eye tracker experiment and the results of heat map, the difference of subjects' attention to different front projection forms of neck and different collar models of the same face type can be judged, so as to verify and evaluate the effectiveness of the experimental results of the face shape adaptation eye tracker.

## 3. Results and discussion

### 3.1 The results of eye tracker

According to the comprehensive analysis of the variance factors on the fixation time and times of the region of interest, we knew there were three factors, such as ratio of front projection of neck shape, the width of collar face and the height of the turning point had significant influence, but the curvature of the collar contour outside had little influence on the experimental results.

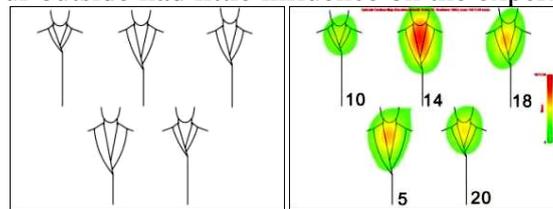


Figure3 The egg-shaped samples and the heat point

As shown in figure 3, taking egg-shaped face for an example, the subjects paid more attention to combination #14 than other combinations, followed by combination #18 and combination #5, which were close and relatively high in attention. The mean value statistics of the experimental results of egg-shaped face were shown in table 4.

According to the data analysis of the eye tracker, the subjects paid more attention to the matching of shawl collar and egg-shaped face with turning point from 10cm below chest line to waist line, and the collar width from 6cm to 7.9cm. However, people with egg-shaped faces with short and thick necks paid less attention to the combination with inverted point, which was near bust line and had a narrow lapel collar width with 4.1cm to 5cm. In addition, people with egg-shaped faces and short, thick necks would get more attention if they were fit with lower lapel point collars.

Table 4 The mean value statistics of the experimental results of egg-shaped face

Code	Ratio of the front projection of neck (%)	Height from turning point to shoulder (mm)	Width of the shawl collar (mm)	Inverse of outer contour curvature (1/mm)	Average fixation time interest (ms)	Proportion of average fixation time (%)	Average number of fixation
#10	5	223	41	500	792.27	9.56	2.82
#14	5	373	69	900	2359.92	28.98	7.68
#18	33	323	60	600	1694.51	20.85	5.51
#5	18	423	79	700	1623.99	19.09	5.34
#20	18	273	50	800	1348.51	17.04	4.21

### 3.2 The result of the questionnaire

Among the 37 subjects, 15 subjects thought that the combination #14 shawl collar was the best match for egg-shaped face, followed by #5 and #18, few subjects chose #20, and no one thought that #10 matched egg shaped face. Therefore, it could be concluded that most of the subjects think that people with egg-shaped face, wide neck and normal neck were more suitable to wear the shawl collar with lapel point 15cm below the bust line, and the width of the collar is 6.9cm. If the egg shaped face and neck are not long enough, it is not suitable to wear shawl collar with a high Lapel point and a small collar width. The results of eye tracker experiment and questionnaire were shown in table5.

Table 5 Results of eye tracker and questionnaire

Face shape	Lapel point	Collar width	Characteristic	Suitable
Egg-shaped face	15cm below bust line to waist line	about 6.9cm	Egg-shaped face was not suitable for the lapel point near the bust line and the narrow collar face such as the 4.1cm to 5cm width.	
Square face	Under the bust line 5cm to 10cm	about 6.9cm	Long neck people were suitable for high lapel point collar; short neck people were not suitable for low lapel point and wide collar.	
Heart-shaped face	Near waist line	about 5cm	People with heart-shaped face were not suitable for collar with lapel point near waist line and the 6cm collar width.	
Round face	15cm below bust line to waist line	about 7.9cm	People with round face were not suitable for the too high lapel point collar.	
Long face	10cm below bust line to waist line	5cm to 6.9cm	People with long face were not suitable for the too high lapel point and too wide collar.	

### 3.3 The result of the verification experiment

In the verification experiment, the four factors as ratio of length to width of the front projection of the neck shape, the height of the lapel point of shawl collar, the width of the collar surface and the curvature of the contour line had a significant effect on the experimental results. The results were different from those of the face matching eye tracker. Because the verification experiment included the attractive factors such as facial features, hair style and skin color, as well as the shadow effect around the shawl collar, which was compared with the white suit body, so the subjects paid more attention to the curvature of the outer contour line and the shape of the shawl collar.

Through the analysis of the results of the two experiments, we knew that the length width ratio of the front projection of the neck shape, the height of the lapel point of collar and the width of the collar surface all had significant effects on the observation results of the subjects.

## 4. Conclusion

According to the eye tracker experiment and verification experiment, the length width ratio of the front projection of the neck shape, the width of the collar and the height of the turning point were main factors that affected the fitness of the face and the shawl collar. If shape of shawl collar was more prominent in the whole garment, curvature of outer contour line of collar also significantly affected the dressing effect of the collar. Through the analysis of the experimental results, it was concluded that egg-shaped people were more suitable to wear shawl collar with lapel point 15 cm below bust line and the collar width about 6.9 cm. For the square face people, the collar with lapel point at 5-10cm below bust line and 6.9cm collar width were much more suitable. For heart-shaped face, the lapel point near the waist line and 5cm width was more suitable. The wide collar with a round face and a lapel point 15cm below bust line and a collar width of 7.9cm was more beautiful. People with long faces were suggested to wear a collar with a lapel point 10cm below bust line and collar width of 5-6.9cm.

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