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TR－H－114

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1994. 12. 22

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Abstract

This article presents two studies investigating the relationships between physical measurements and psychological judgments of human faces. The first study was concerned with the gender classification and the second with the femininity-masculinity judgment of male and female faces. A variety of physical measurements were taken on 36 male and 36 female faces and subjected to discriminant analysis. One group of subjects was asked to classify each face as male or female and another group to rate each face on a femininity-masculinity scale. While female faces were in general more accurately classified by the discriminant analysis than were male faces, male faces were in turn more accurately classified by the subjects. Multiple regression analysis indicated that the femininity-masculinity rating for female faces was less accountable than that for male faces, suggesting that the femininity-masculinity judgment of female faces depends on non-spatial factors to a larger degree.

In this paper, we report two studies which investigated the relationships between physical measurements and psychological judgments of Japanese male and female faces. The first study was concerned with the gender classification and the second with the femininity-masculinity judgment of those faces.

Enlow (1982) discussed gender differences of human faces from the viewpoint of evolution and suggested that the important gender cues of the human face are the nose and nasopharynx, which are generally larger for male than female faces. Bruce and her colleagues (e.g., Roberts & Bruce, 1988; Bruce et al., 1993) showed that the nose, eyebrows and skin texture provide important gender information for Caucasian faces, whereas Yamaguchi, Hirukawa and Kanazawa (1994) reported that for Japanese faces the eyebrows play an important role in gender classification. Recently, Burton et. al. (1994) have reported a measurement study that investigated the relationships between the physical measurements of Caucasian faces and the gender classification of those faces performed by discriminant analysis and by human subjects. For this study, they took more than 50 measurement points on each of 200 faces.

The gender-classification studies cited above typically involved whole faces which include external features (e.g., hair, face outline) as well as internal features (e.g., eyes, nose). It might be that external features serve as gender cues so effectively that they help to make accurate gender classification, virtually independently of other gender cues. In the present study, therefore, we used faces from which the influence of hair and face outline was eliminated as much as possible. This allowed us to examine the relative importance of internal features for gender classification, almost independent of external cues. Thus, the main objective of the first study was to examine the extent to which the gender classification of the face could be accounted for by the physical characteristics of the central region of the face (i.e., internal features).

Most research concerned with the gender differences of human faces have used a "binary" (male or female) classification task. In our everyday lives, however, judging the degree of masculinity or femininity of the face seems more relevant than simply distinguishing between male and female faces. In this paper, we seek to clarify those physical characteristics that might determine the femininity or masculinity of the face.

Recently, averaged and hyper faces have been introduced in the study of gender differences between human faces (Benson & Perrett, 1991, 1992, 1993; Yamaguchi, Hirukawa & Kanazawa, 1994), with the hyper faces made by exaggerating differences between male averaged and female averaged faces. One relevant question here is whether hyper-male and hyper-female faces actually correspond to the psychological impressions of the masculinity and femininity of the face. Benson and Perrett (1992) indicated that a hyper male face tended to be rated more masculine than an averaged male face and a hyper female face more feminine than an averaged female face. Yamaguchi et al. (1994) tested to see whether hyper faces might exert facilitatory effects on gender classification. Their results indicated that hyper faces did not have any sizable advantage over averaged faces which themselves seemed to contain sufficient information to allow accurate gender classification. Since Yamaguchi et al. did not measure the femininity or masculinity of the faces, however, it still remains to be seen whether or not masculinity-femininity rating might be different between averaged and hyper faces.

In previous studies, hyper faces were made by exaggerating whole differences and the relative importance, if any, of different parts of the face have not been taken into account . It seems reasonable to expect, however, that the effect of exaggeration might be different from one facial region to another, depending on its importance in a given face processing task. The exaggeration of whole differences might more or less obscure the relative saliency of the important aspects of the face, thus making hyper faces less hyper than otherwise. The purpose of the second study was to clarify those physical characteristics which are important for masculinity-femininity judgment of the face so that more genuine hyper faces might be generated.

Study 1

The purpose of Study 1 was to examine the correspondence between the gender classification performance by human subjects and the physical discriminability tested by discriminant analysis.

Experiment 1

An experiment was conducted to obtain human performance data on the gender classification of faces, which was to be compared with data from a discriminant analysis applied to the same faces.

Method

Stimulus: 36 male and 36 female faces were used in this experiment. Both the males and the females were in their 20's.

We trimmed the corners of all faces in order to exclude hair and face outline , and used black and white colors to reduce the effects of skin color and lipstick color. The portion of the face that was trimmed was normalized across the faces by equating the vertical length between the mouth center and the line connecting the center of the two eyes. (See Figure 1.)

Subjects: The subjects were 11 male and 13 female undergraduate students. All subjects were Japanese and their average age was 19 years old.

Procedure: The subjects were asked to classify each face as male or female. They responded by pressing either one of the two keys assigned on the keyboard. All of the faces were 128X128 pixels in size and were shown on a computer monitor screen, one at a time in random order. This experiment was controlled by the Super Lab program running on a Macintosh computer.

Results

The subjects' percent correct and reaction time results in the gender classification task are shown in Table 1. The subjects had means of 85.4% accuracy for female faces and 91.8 % accuracy for male faces. This level of performance is roughly equivalent to that of previous studies (Bruce et al, 1987; Burton et al, 1993), despite the fact that only the internal features were available to the subjects in the present experiment.

Analysis 1

Discriminant analysis was applied to the physical measurements of the male and female faces used above in order to estimate the physical discriminability of these faces.

Physical Measurements

All measurement points are shown in Figure 2. These points were identified manually on each face by using a measurement tool developed on a Silicon Graphics system.

We defined three types of measurements. The first type was facial parts containing the length, area, curve, and/or tilt measurements of the individual facial parts (see Table 2). The second was configurations containing the lengths and areas defined by the measurement points of at least two different facial parts (Table 4). The third was the ratios of one length to another (see Figure 3). These are shown in Tables 5 and 6. All such measurements for each face were then automatically calculated based on the previously identified measurement points. It should be noted that all the values were standardized in such a way that they were taken as relative values to the baseline unit which was defined to be the length of the perpendicular line from the line between the center of both eyes to the center of the mouth (Fig. 4).

Facial parts

We defined facial parts as shown in Table 2. The length and area of each part were calculated. For the eyes and eyebrows, the curves and angles of these parts were additionally calculated. For the curve measurement of the eyebrows, the point on the top edge of the widest area was connected with both end points and its inner angle was calculated. The scheme for calculating the curve , tilt and the ratio of the top edge position to the width of the eyebrows (BROW-P) is illustrated in Figure 5. The method for calculating MOUTH-R is shown in Figure 6.

Configurations

We defined three types of facial configurations as shown in Table 4 for which the lengths and areas were calculated.

Ratios

Tables 3, 5 and 6 show the numerator and denominator of the ratios. The ratios were calculated between parallel directions and between cross directions of two lengths.

Analysis

In order to examine the differences between male and female faces, the measurement data were subjected to discriminant analysis. The independent variable was the sex of the face and the dependent variables were those facial characteristics divided into four groups:

1. Facial Parts (including the horizontal /vertical ratios of the same parts)
2. Configuration 1 (distances and areas between parts)
3. Configuration 2 (same directional ratios of lengths)
4. Configuration 3 (horizontal /vertical ratios of lengths)

Results

The results of the stepwise discriminant analysis are shown in Tables 7, 8, 9 and 10. Nine out of 32 variables were selected as significant (α=0.15) for Facial Parts, five out of 16 variables for Configuration 1, four out of 29 variables for Configuration 2 , and four out of 32 variables for Configuration 3.

The total hit rates of the selected variables of Facial Parts were 80.6% for male faces and 86.1% for female faces. For Configuration 1, the hit rates were 80.6% for male faces and 69.4% for female faces. For Configuration 2, the hit rates were 77.8% for male faces and 86.1% for female faces, and for Configuration 3, the hit rate was 80.6% for both male and female faces.

Discussion

The effective facial measurements were found to be EYE-H-l, RS10 and RC6. It is interesting that all of these measurements include the height of the eyes. Furthermore, the RS10 and RC6 ratio measurements (the ratio of the height of the eyes to the nose width or the distance between eye and mouth) led to more accurate classification of female faces than the height of the eyes itself. For male faces, however, this tendency was reversed. The height of the eyes itself led to more accurate classification of male faces than when the height of the eyes was used in connection with other measurements. It was also found that the correct classification of female faces was low with the items in Configuration 1 than with those in Facial Parts.

The discriminant analysis results showed that with Facial Parts and Configuration 2 female faces were more accurately classified than male faces, whereas with Configuration 1 male faces were more accurately classified than female faces. The human performance data showed that male faces were more accurately classified than female faces. One implication of this pattern of results is that the human performance on gender classification might not depend as much on the individual facial parts and the ratios between lengths (Configurations 2) as on the lengths and areas between parts (Configuration 1).

Study 2

As stated before, the purpose of this study was to clarify a set of physical measurements by which the femininity-masculinity judgment of the face might be satisfactorily accounted for.

Experiment 2

An experiment was conducted to obtain subjects' rating data on a femininity-masculinity scale to be subjected to multiple regression analysis.

Stimulus: The stimuli were the same as those in Experiment 1.

Subjects: The subjects were 19 male and 21 female undergraduate students. They were all Japanese and their average age was 19 years old.

Procedure: All faces were shown by a slide projector. They were black and white in color. Each slide was shown for 10 seconds during which time the subjects rated the face on a seven-point femininity-masculinity scale; 1 for most feminine and 7 for most masculine.

The subjects first rated all the female faces, and then all the male faces. Prior to each rating session, they were informed of the sex of the faces they were about to rate.

Analysis 2

The subjects' rating scores and the physical measurements of the faces were subjected to multiple regression analysis to identify a set of physical measurements that could best account for the femininity-masculinity rating.

Measurement

The physical measurements used were the same as those in Analysis 1.

Analysis

We applied stepwise multiple regression analysis to identify a set of significant physical measurements that could account for the femininity-masculinity judgment. The independent variable was the average rating scores and the dependent variables were the facial characteristics that were divided into four groups as in Analysis 1.

1. Facial Parts (including the horizontal/vertical ratios of the same parts)
2. Configuration 1 (distances and areas between parts)
3. Configuration 2 (same directional ratios of lengths)
4. Configuration 3 (horizontal/vertical ratios of lengths)

Those variables retained in the stepwise multiple regression analyses on Configurations 1, 2, and 3 were then collected and subjected to further stepwise multiple regression analysis.

5. Selected configurations

Finally, those retained in Facial Parts and in the combined selected configurations above were subjected to stepwise multiple regression analysis.

6. Selected variables

Results

The results of the multiple regression analyses are shown in Tables 11-22.

Male face

The results for male faces are shown in Tables 11-16. Three out of 32 variables were selected as significant (α=0.15) for Facial Parts, five out of 16 variables for Configuration 1, seven out of 29 variables for Configuration 2, and four out of 32 variables for Configuration 3.

In Facial Parts, the positions of BROW-r and MOUTH-R were identified as significant factors in rating the masculinity or femininity of male faces. BROW=EYE-H-l, EYE=MOUTH-L, RS4, RS11, RS5, RS7, RS2, RC3 , RC9, and RC10 were also identified as important factors for such judgments.

Female face

The results for female faces are shown in Tables 17-22. Five out of 32 variables were selected as significant (α=0.15) for Facial Parts, two out of 16 variables for Configuration 1, one out of 29 variables for Configuration 2, and four out of 32 variables for Configuration 3.

The facial parts such as EYE-A-r, MOUTH-R, BROW-R-r, and EYE-C-l, and the configurations such as EYE=MOUTH -L-l and CHEEK-A-l, RS9, RC5, and RC11 were found to be significant factors in rating the masculinity or femininity of female faces.

Discussion

The results of the multiple regression analyses suggest that the masculine male face seems to be characterized by:

1) eyebrows whose curved point is positioned toward the outer end,

2) a thicker bottom lip,

3) a shorter distance between eyebrow and eye,

4) a wider distance between eye and mouth,

5) a larger ratio of the eye width to the distance between eyes,

6) a larger ratio of the nose length to the mouth length, and

7) a larger ratio of the eye height to the eyebrow height.

On the other hand, the feminine female face seems to be characterized by :

1) larger eyes,

2) a thicker bottom lip,

3) eyebrows whose edge is tilted downward,

4) a wider cheek area,

5) a larger ratio of the distance between eye and mouth to the distance between eyes,

6) a larger ratio of the nose width to the eye height, and

7) a larger ratio of the mouth height to the eye height.

The physical measurements retained as significant by the multiple regression analyses were different between male and female faces, indicating that subjects' judgment of the femininity and masculinity of the face is different between male and female faces.

General Discussion

The hit rates of the discriminant analyses in the present study were lower than those in the Burton et al. (1993) study. This might be due to the lack of three-dimensional as well as external feature (e.g., face outline) measurements in our study. Also, our subjects were outperformed by Burton et al.'s subjects in the gender classification task, indicating that the external features provide significant gender information. Preliminary results of the gender classification task for whole faces indicate that our subjects might still be outperformed by Burton et al.'s subjects. It might be the case that Japanese male and female faces are physically less discriminable than their Caucasian counterparts.

It seems clear that the eyes and eyebrows are discriminable between male and female faces and that they play an important role in determining the femininity and masculinity of the face.

The total variance accounted for by the multiple regression model was lower for female faces (R^2=0.56) than for male faces (R^2=0.85). This indicates that the femininity-masculinity judgment of the female face might depend to a substantial degree on some other factors than those physical measurements captured in the present study. It is possible that at least some of them are not measurable as spatial factors. For example, the femininity-masculinity judgment of the female face could be substantially influenced by the apparent fairness and/or fineness of the facial skin.

The results of the multiple regression analyses indicate that female faces with larger eyes, a shorter distance between the eye and mouth, and a longer distance between eyes would be judged more feminine than other female faces. These facial characteristics in fact point to the "baby schema" (Mark et al., 1988). In contrast, the masculine male faces tend to have a shorter distance between the eye and eyebrow and a longer distance between the eye and mouth. These facial characteristics are like those of adult-like faces. One implication of these results is that the femininity of the face might be rated in reference to the baby schema and the masculinity to the adult -like face.

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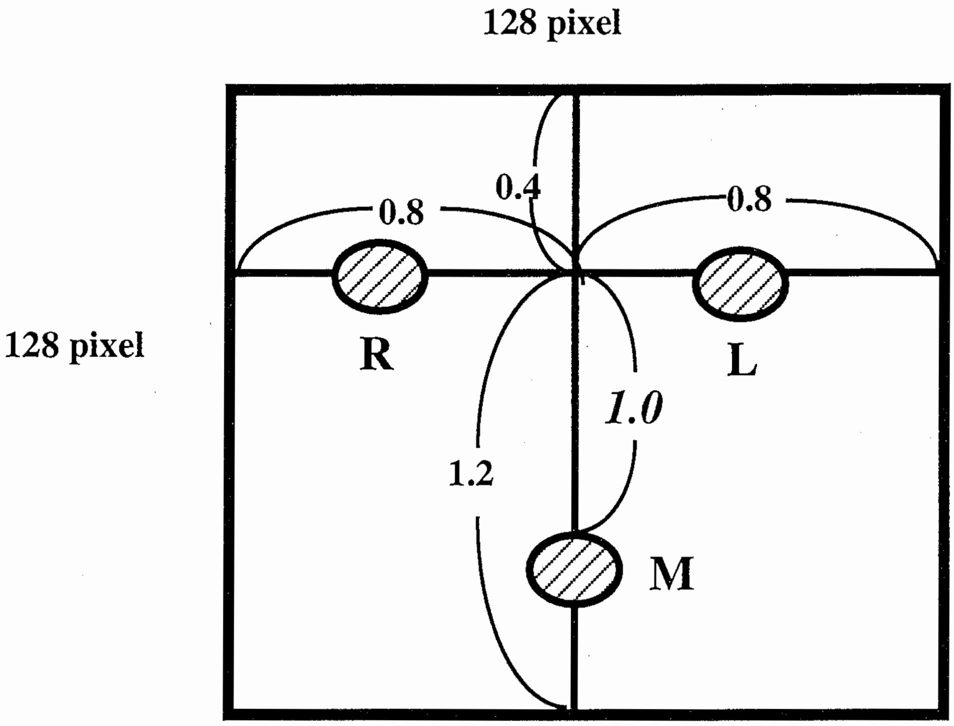


R= right eye L= left eye M = mouth

Fig. 1 Ratios for trimming the faces

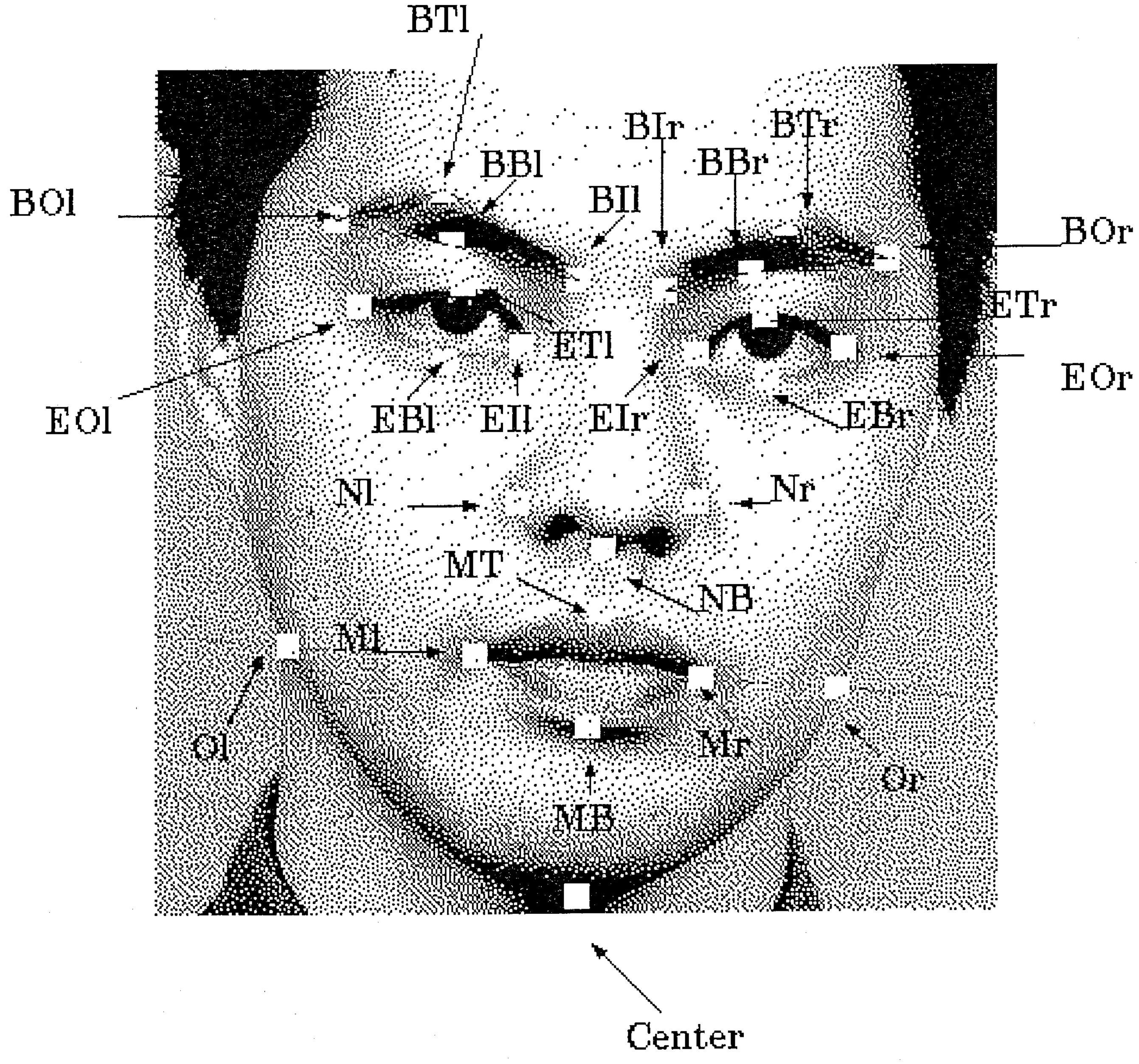


Fig. 2 Measurement points in our study

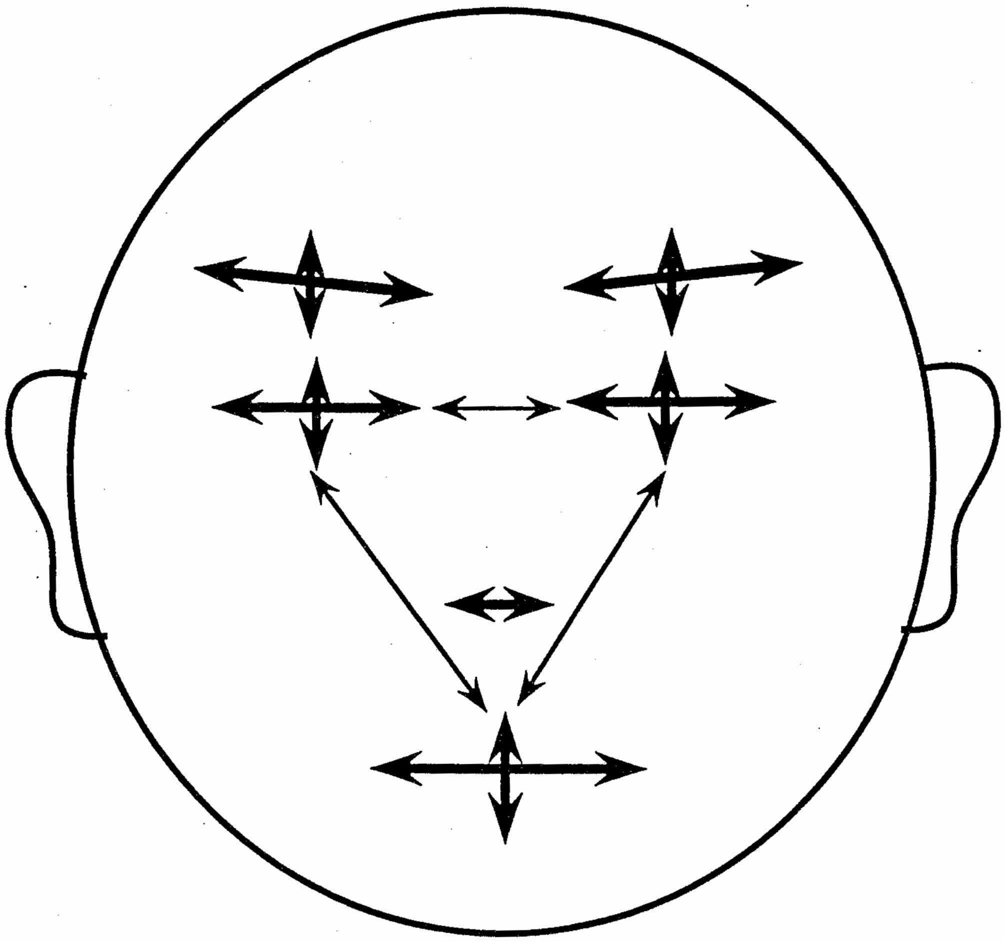


Fig. 3 Ratios of lengths calculated

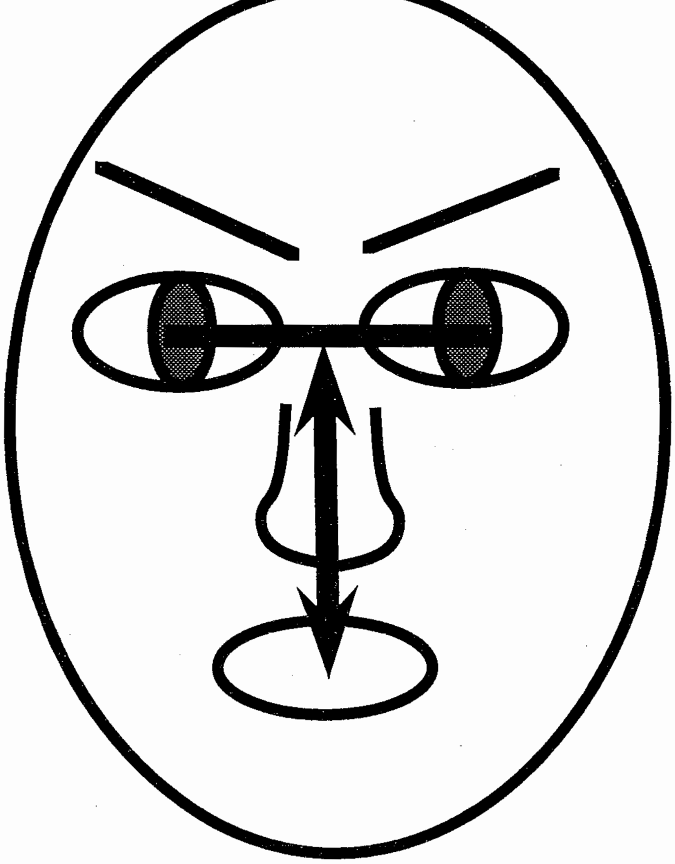


Fig. 4 Line for standarzing the measurement

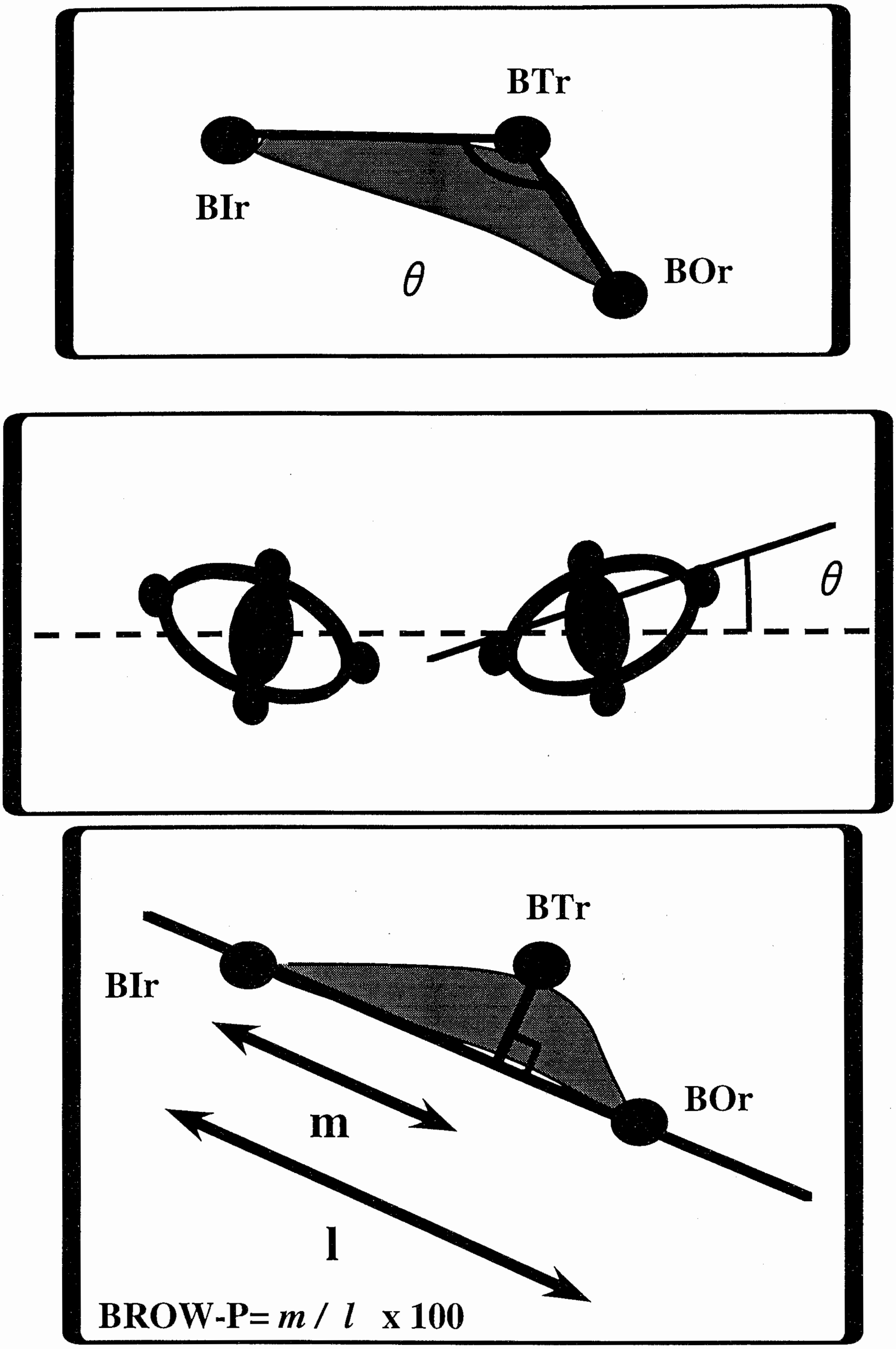
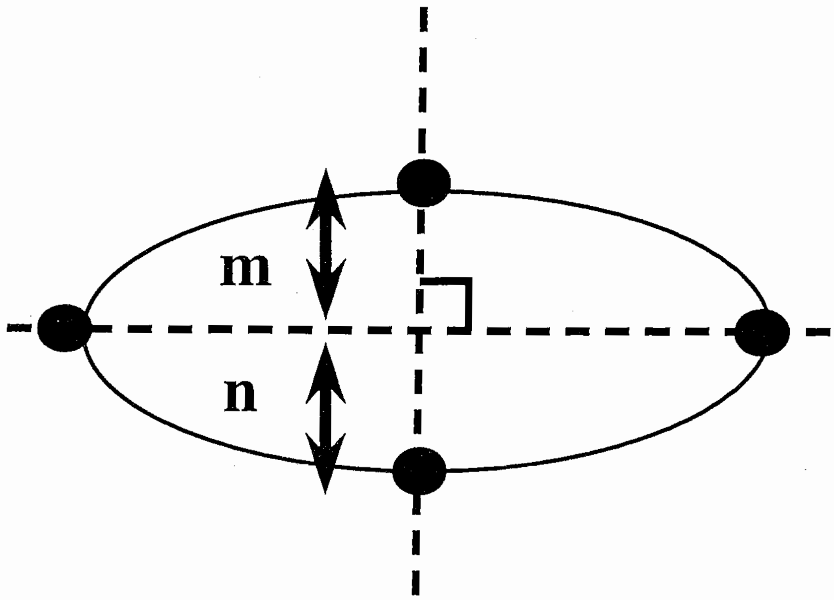


Fig. 5 Method for calculating curves, angles, and positions on the top of brows.



MOUTH-R = m / (m+n) x 100

Fig. 6 Method for calculating MOUTH-R

Table 1. Percentage correct and reaction time in judging male faces and female faces

	Male Face		Famale Face	
	percent correct	reaction time	percent correct	reaction time
Male subjects	88.64	860.14	85.75	888.17
Female subjects	94.44	730.90	85.05	818.16

Table 2. Variables used in Facial Parts

	Code name	Parts between			
Length					
	BROW-H-r	BTr		BBr	
	BROW-H-l	BTl		BBl	
	BROW-W-r	BIr		BOr	
	BROW-W-l	BIl		BOl	
	EYE-H-r	ETr		EBr	
	EYE-H-l	ETl		EBl	
	EYE-W-r	EIr		EOr	
	EYE-W-l	EIl		EOl	
	NOSE-W	Nl		Nr	
	MOUTH-H	MT		MB	
	MOUTH-W	Mr		Ml	
Area					
	BROW-A-r	BIr	BTr	BOr	BBr
	BROW-A-l	BIl	BTl	BOl	BBl
	EYE-A-r	EIr	ETr	EOr	EBr
	EYE-A-l	EIl	ETl	EOl	EBl
	MOUTH-A	Ml	MT	Mr	MB
Others					
	BROW-C-r		BIr	BTr	BOr
	BROW-C-l		BIr	BTr	BOr
	EYE-C-r		EIr	ETr	EOr
	EYE-C-l		EIl	ETl	EOl
	BROW-T-r		BIr	BOr	
	BROW-T-l		BIr	BOr	
	EYE-T-r		EIr	EOr	
	EYE-T-l		EIl	EOl	
	BROW-P-r *				
	BROW-P-l *				
	MOUTH-R *				

Table 3. The variables used in Facial Parts (ratios)

Code name	Numerator	Denominator
BROW-R-r	BROW-H-r	BROW-Wr
BROW-R-l	BROW-H-l	BROW-W-l
EYE-R-r	EYE-H-r	EYE-W-r
EYE-R-l	EYE-H-l	EYE-W-l
MOUTH-R2	MOUTH-H	MOUTH-W

Table. 4. The variables used in Configuration 1

Code name	Parts between					
Length						
BROW=BROW-L		BIl	BIr			
EYE=EYE-L		EIl	EIr			
BROW=EYE-L-r		BBr	ETr			
BROW=EYE-L-l		BBl	ETl			
EYE=MOUTH-L-r		EBl	MT			
EYE=MOUTH-L-l		EBr	MT			
NOSE=MOUTH-L		NB	MT			
Area						
BROW=EYE-A-l	BOl	BBl	BIl	EIl	ETl	EOl
BROW=EYE-A-r	BOlr	BBr	BIr	EIr	ETr	EOr
EYES=BROWS-A	BIl	EIl	EIr	BIr		
BROWS=MOUTH-A	BOl	BOr	Mr	Ml		
EYES=MOUTH-A	EOl	EOr	Mr	Ml		
BROWS=NOSE-A	BOl	BOr	Nr	Nl		
EYES=NOSE-A	EOl	EOr	Nr	Nl		
CHEEK-A-r	EOr	EBr	EIr	Nr	Or	
CHEEK-A-l	EOl	EBl	EIl	Nl	Ol	

Table 5. The variables used in Configuration 2

	Numerator	Denominator
	EYE-W-r	BROW-W-r
	NOSE-W	BROW-W-r
RS1	BROW-W-r	MOUTH-W
	EYE=EYE-L	BROW-W-r
	EYE-W-l	BROW-W-l
	BROW-W-l	NOSE-W
RS2	BROW-W-l	MOUTH-W
	EYE=EYE-L	BROW-W-l
RS3	NOSE-W	EYE-W-r
	EYE-W-r	MOUTH-W
	EYE-W-r	EYE=EYE-L
	EYE-W-l	NOSE-W
	EYE-W-l	MOUTH-W
RS4	EYE-W-l	EYE=EYE-L
RS5	NOSE-W	MOUTH-W
RS6	EYE=EYE-L	NOSE-W
	MOUTH-W	EYE-W
	BROW-H-r	EYE-H-r
	BROW-H-r	MOUTH-H
	BROW-H-r	EYE=MOUTH-L-r
RS7	BROW-H-l	EYE-H-l
	BROW-H-l	MOUTH-H
RS8	BROW-H-l	EYE=MOUTH-L-l
RS9	EYE-H-r	MOUTH-H
	EYE-H-r	EYE=MOUTH-L-r
	EYE-H-l	MOUTH-H
RS10	EYE-H-l	EYE=MOUTH-L-l
	MOUTH-H	EYE=MOUTH-L-r
RS11	MOUTH-H	EYE=MOUTH-L-l

Table 6. The variables used in Configuration 3

	Numerator	Denominator
	EYE-H-r	BROW-W-r
	MOUTH-H	BROW-W-r
RC1	BROW-W-r	EYE=MOUTH-L-r
	EYE-H-l	BROW-W-l
	MOUTH-H	BROW-W-l
	BROW-W-l	EYE=MOUTH-L-l
	BROW-H-r	EYE-W-r
RC2	MOUTH-H	EYE-W-r
	EYE-W-r	EYE=MOUTH-L-r
	BROW-H-l	EYE-W-l
RC3	MOUTH-H	EYE-W-l
	EYE-W-l	EYE=MOUTH-L-l
	BROW-H-r	NOSE-W
RC4	BROW-H-l	NOSE-W
RC5	EYE-H-r	NOSE-W
RC6	EYE-H-l	NOSE-W
	MOUTH-H	NOSE-W
RC7	NOSE-W	EYE=MOUTH-L-r
	NOSE-W	EYE=MOUTH-L-l
	BROW-H-r	MOUTH-W
	BROW-H-l	MOUTH-W
	EYE-H-r	MOUTH-W
RC8	EYE-H-l	MOUTH-W
RC9	MOUTH-W	EYE=MOUTH-L-r
RC10	MOUTH-W	EYE=MOUTH-L-l
	BROW-H-r	EYE=EYE-L
	BROW-H-l	EYE=EYE-L
	EYE-H-r	EYE=EYE-L
	EYE-H-l	EYE=EYE-L
RC11	EYE=EYE-L	EYE=MOUTH-L-r
	EYE=EYE-L	EYE=MOUTH-L-l
	MOUTH-H	EYE=EYE-L

Table 7. Results of discriminant analysis in Facial Parts

Value	Wilks' Lambda	Hit Rate	
BROW-H-l	.55	58.33	male
		86.11	female
EYE-H-l	.50	83.33	male
		75.00	female
BROW-W-r	.47	63.89	male
		58.33	female
BROW-A-l	.43	61.11	male
		72.22	female
BROW-A-r	.41	52.78	male
		75.00	female
EYE-T-r	.41	50.00	male
		50.00	female
EYE-C-r	.40	72.22	male
		77.78	female
EYE-W-r	.39	47.22	male
		36.11	female
EYE-H-r	.37	72.22	male
		66.67	female
Total		80.56	male
		86.11	female

Table 8. Results of discriminant analysis in Configuration 1

Value	Wilks' Lambda	Hit Rate	
EYES=BROWS-A	.91	80.56	male
		52.78	female
NOSE=MOUTH-L	.85	55.56	male
		55.56	female
BROWS=NOSE-A	.79	77.78	male
		47.22	female
CHEEK-A-r	.74	55.56	male
		52.78	female
EYES=NOSE-A	.72	66.67	male
		38.89	female
Total		80.56	male
		69.44	female

Table 9. Results of discriminant analysis in Configuration 2

Value	Wilks' Lambda	Hit Rate	
(RS10) EYE=MOUTH-L-l/EYE-H-l	.73	66.67	male
		80.56	female
(RS8) EYE=MOUTH-L-l/BROW-H-l	.51	75.00	male
		66.67	female
(RS6)NOSE-W/EYE=EYE-L	.46	50.00	male
		66.67	female
(RS1)MOUTH-W/BROW-W-r	.44	63.89	male
		44.44	female
Total		77.78	male
		86.11	female

Table 10. Results of discriminant analysis in Configuration 3

Value	Wilks' Lambda	Hit Rate	
(RC6) NOSE-W/EYE-H-l	.62	77.78	male
		80.56	female
(RC4) NOSE-W/BROW-H-l	.49	75.00	male
		66.67	female
(RC1) EYE=MOUTH-L-r/BROW-W-r	.46	72.22	male
		55.56	female
(RC11) EYE=MOUTH-L-r/EYE=EYE-L	.44	50.00	male
		50.00	female
Total		80.56	male
		80.56	female

Table 11. Results of multiple regression analysis in Facial Parts of male faces

Variable	R^2	Parameter Estimate	F value
BROW-P-r	0.28	-0.035	13.20**
MOUTH-R	0.38	0.051	5.44*
BROW-A-l	0.44	-0.0026	3.00
		*p<.05	**p<.01

Table 12. Results of multiple regression analysis in Configuration 1 for male faces

Variable	R^2	Parameter Estimate	F value
BROW=EYE-H-l	0.37	0.10	20.34**
EYE=MOUTH-L	0.46	-0.10	5.28*
BROWS=MOUTH-A	0.52	0.00042	3.95
EYES=BROWS-A	0.58	0.0010	4.12
EYE=EYE-L	0.62	0.041	3.11
		*p<.05	**p<.01

Table 13. Results of multiple regression analysis in Configuration 2 for male faces

Variable	R^2	Parameter Estimate	Fvalue
(RS4) EYE=EYE-L/EYE-W-l	0.12	4.78	4.55*
(RS11) EYE=MOUTH-L-l/MOUTH-H	0.26	-0.50	6.51*
(RS5) MOUTH-W/NOSE-W	0.38	-5.61	5.83*
(RS7) EYE-H-l/BROW-H-l	0.45	1.44	4.37*
(RS2) MOUTH-W/BROW-W-l	0.52	2.69	3.76
(RS3) EYE-W-r/NOSE-W	0.57	-3.22	3.46
(RS8)EYE=MOUTH-L-l/BROW-H-l	0.60	-0.18	2.29
		*p<.05	**p<.01

Table 14. Results of multiple regression analysis in Configuration 3 for male faces

Variable	R^2	Parameter Estimate	Fvalue
(RC3) EYE-W-l/MOUTH-H	0.17	-1.63	6.88*
(RC9) EYE=MOUTH-L-r/MOUTH-W	0.28	7.94	5.33*
(RC10) EYE=MOUTH-L-l/MOUTH-W	0.37	-5.69	4.37*
(RC7) EYE=MOUTH-L-r/NOSE-W	0.42	-1.67	2.45
		*p<.05	**p<.01

Table 15. Results of multiple regression analysis in all Configurations for male faces

Variable	R^2	Parameter Estimate	F value
BROW=EYE-H-l	0.37	0.087	20.34**
(RS5) MOUTH-W/NOSE-W	0.46	-2.25	5.46*
EYE=MOUTH-L	0.55	-0.077	6.27*
(RS4) EYE=EYE-L/EYE-W-l	0.60	3.01	4.05*
(RS7) EYE-H-l/BROW-H-l	0.64	0.67	3.27
EYES=BROWS-A	0.68	0.00090	3.40
EYE=EYE-L	0.70	-0.056	2.27

*p<.05 **p<.01

Table 16. Results of multiple regression analysis in all variables for male faces

Variable	R^2	Parameter Estimate	Fvalue
BROW=EYE-H-l	0.37	0.10	20.34**
BROW-P-r	0.57	-0.034	14.68**
(RS5) MOUTH-W/NOSE-W	0.63	-2.084	5.78*
EYES=BROWS-A	0.67	0.00068	3.10
(RS7) EYE-H-l/BROW-H-l	0.70	1.64	3.54
(RC3) EYE-W-l/MOUTH-H	0.73	-2.21	3.57
(RS11) EYE=MOUTH-L-l/MOUTH-H	0.76	0.89	2.54
(RS8) EYE=MOUTH-L-l/BROW-H-l	0.79	-0.21	4.01

*p<.05 **p<.01

Table 17. Results of multiple regression analysis in Facial Parts for female faces

Variable	R^2	Parameter Estimate	F value
EYE-A-r	0.11	0.0033	4.29*
MOUTH-R	0.21	-0.035	3.99*
BROW-T-r	0.31	-0.046	4.91*
EYE-C-l	0.47	0.051	5.07*
EYE-C-r	0.37	-0.035	3.05

*p<.05 **p<.01

Table 18. Results of multiple regression analysis in Configuration 1 for female faces

Variable	R^2	Parameter Estimate	F value
EYE=MOUTH-L-l	0.14	0.089	5.61*
CHEEK-A-l	0.21	0.00041	2.88

*p<.05 **p<.01

Table 19. Results of multiple regression analysis in Configuration 2 for female faces

Variable	R^2	Parameter Estimate	Fvalue
(RS9) MOUTH-H/EYE-H-r	0.161	-1.15	6.52*

*p<.05 **p<.01

Table 20. Results of multiple regression analysis in Configuration 3 for female faces

Variable	R^2	Parameter Estimate	Fvalue
(RC5) NOSE-W/EYE-H-r	0.13	-1.17	4.96*
(RC2) EYE-W-r/MOUTH-H	0.20	1.22	2.77
(RC11) EYE=MOUTH-L-r/EYE=EYE-L	0.25	-1.43	2.26
(RC8)MOUTH-W/EYE-H-l	0.31	0.77	2.71

*p<.05 **p<.01

Table 21. Results of multiple regression analysis in all Configurations for female faces

Variable	R^2	Parameter Estimate	F value
(RS9) MOUTH-H/EYE-H-r	0.16	-1.14	6.52*
CHEEK-A-l	0.24	0.00044	3.55

*p<.05 **p<.01

Table 22. Results of multiple regression analysis in all variables for female faces

Variable	R^2	Parameter Estimate	Fvalue
(RS9) MOUTH-H/EYE-H-r	0.16	-1.73	6.52*
EYE-C-l	0.26	0.044	4.38*
(RC11) EYE=MOUTH-L-r/EYE=EYE-L	0.33	-1.29	3.26
MOUTH-R	0.43	-0.036	5.27*
CHEEK-A-l	0.50	0.00049	4.36*

*p<.05 **p<.01