5.2 PILOT STUDY

5.2.1 SELECTION OF SUBJECTS FOR PILOT STUDY

Slides were made from the black and white negatives of the 44 subjects. There was a large variety of profiles, with a wide range in the different facial profile components (ie. profile form; profile flow; total facial convexity; nasofacial angle; nasolabial angle; nose prominence; upper and lower lip protrusion; sulcus depth of upper and lower lips; anterior vertical proportions).

To eliminate the author's bias in the selection of a subgroup of 22 profiles for the pilot study, the following procedures were taken :

1. 10 judges (5 Chinese and 5 Caucasians) were individually shown all 44 slides laid out on a large light-viewing box. Each judge was asked to rank the slides from 1 to 44, in order of preference from the most attractive profile (given a score of 1) to the least attractive profile (given a score of 44). No time limit was set.
2. The ten scores for each slide were totalled, and then all 44 slides were ranked in ascending order of total score, from the most to the least attractive profile.
3. Every second profile from this ordered ranking of the 44 subjects was selected for the pilot study.

5.2.2 PILOT STUDY METHOD

The pilot study was undertaken to check the survey method :

- the format of the judges' questionnaire,
- clarity of the instructions given to the judges,

- duration of time given for the responses,
- suitability of slides selected.

The 22 profiles selected for the pilot study were randomised and shown to 10 judges for a trial run.

The general principles of Likert's attitude scale were employed (Likert 1932; Edwards 1957; Kidder & Judd 1986; Mok 1990). The profile attractiveness of each subject was gauged on a scale of 1 to 7 (Likert 7-point scale), with 1 as very unattractive and 7 as very attractive (Appendix B).

To check for reliability and consistency of the judges, 2 profiles (representing approximately 10% of the sample size) were duplicated and randomly shown with the other slides, without forewarning the judges.

The following instructions were given to the judges :

1. Each slide will be shown for 15 seconds.
2. Rate each profile by circling a number on the 7-point Likert scale corresponding to preference.
3. Write comments on the profile in the right hand column adjacent to the slide number.
4. If the subject is recognised as a friend or patient, indicate this on the left hand side of the questionnaire, adjacent to the slide number.

The data collected from the pilot study were analysed. The mean score for each profile was calculated and plotted along the 7-point Likert

scale. The results were as follows :

1. Mean scores ranged from 2.1 to 5.3.
2. Most of the preference scores for the profiles were concentrated in the middle range (between 3 to 4).
3. Most of the preference scores were skewed towards the unattractive end.
4. The reliability of the judges' scores was found to be moderate.

5.3 PROFILE PREFERENCE STUDY

5.3.1 SURVEY STUDY METHOD

To improve the spread of profile selection on the 7-point Likert preference scale, 6 profiles were removed from the group concentrated in the middle range, ie. between 3 to 4 on the scale. They were substituted with 5 "more attractive" profiles, as rated by judges in the original set of 44 slides.

To check the reliability and consistency of the judges, 3 profiles were duplicated (representing 14% of the sample size). One was taken from the "more attractive" profiles, one from the "average" profiles, and another from the "less attractive" profiles.

Thus, 25 slides (including 3 duplicates) were selected for the final profile preference study, and shown to 4 groups of judges :

1. Chinese public - Chinese volunteers recruited from church groups and family social gatherings.
2. Caucasian public - volunteers of European-extraction, recruited from church groups and family social gatherings.

3. Chinese orthodontists, including graduate orthodontic students (NB. The Chinese orthodontist group consisted of mainly overseas graduate orthodontic students, of whom 2 were part-Chinese.)
4. Caucasian orthodontists, including graduate orthodontic students.

The instructions given to the judges were similar to that given for the pilot study, except that the time was increased to 20 seconds per slide.

5.3.2 DETAILS ON THE SAMPLE OF JUDGES

1. Type of Subjects

	Frequency	%
Chinese public	113	55.7
Caucasian public	40	19.7
Chinese orthodontist	13	6.4
Caucasian orthodontist	37	18.2
Total	203	

2. Gender of respondent

Overall (N = 203)		
Male	117	57.6
Female	86	42.4
Chinese public (N = 113)		
Male	55	48.7
Female	58	51.3
Caucasian public (N = 40)		
Male	23	57.5
Female	17	42.5
Chinese orthodontist (N = 13)		
Male	6	46.2
Female	7	53.8

Caucasian orthodontist (N = 37)		
Male	33	89.2
Female	4	10.8

3. Country of Birth

Overall (N = 203)		
Australian-born	86	42.4
Other	117	57.6
Chinese public (N = 113)		
Australian-born	26	23.0
Other	87	77.0
Caucasian public (N = 40)		
Australian-born	32	80.0
Other	8	20.0
Chinese orthodontist (N = 13)		
Australian-born	0	0
* Other	13	100
Caucasian orthodontist (N = 40)		
Australian-born	28	75.7
Other	9	24.3

* Mainly from South-East Asia (Malaysia, Singapore, Hong Kong, Taiwan, Indonesia and Vietnam) and China.

4. Length of living in Australia (if Australia is not country of birth)

(Refer to Table 5.1)

5. Age Group (Refer to Table 5.2)

		Years
Overall,	Average age	34.06
	SE mean	1.07
	Median age	31.00
	Maximum age	83
	Minimum age	9

Table 5.1 Length of stay in Australia for sample of judges not Australian-born.

Years	CHINESE PUBLIC Freq	%	CAUCASIAN PUBLIC Freq	%	CHINESE ORTHOD Freq	%	CAUCASIAN ORTHOD Freq	%	OVERALL Freq	%
1-5	26	29.9	0	0.0	9	69.2	1	11.1	36	30.8
6-10	14	16.1	1	12.5	1	7.7	1	11.1	17	14.5
11-15	28	32.2	1	12.5	0	0.0	1	11.1	30	25.6
> 16	19	21.8	6	75.0	3	23.1	6	66.7	34	29.1
Total	87	100.0	8	100.0	13	100.0	9	100.0	117	100.0

Table 5.2 Age grouping for sample of judges.

Age	CHINESE PUBLIC Freq	%	CAUCASIAN PUBLIC Freq	%	CHINESE ORTHOD Freq	%	CAUCASIAN ORTHOD Freq	%	OVERALL Freq	%
< 16	5	4.4	4	10.0	0	0	0	0	9	4.4
16 - 20	18	15.9	8	20.0	0	0	0	0	26	12.8
21 - 25	26	23.0	9	22.5	0	0	0	0	35	17.2
26 - 30	15	13.3	3	7.5	4	30.8	4	10.8	26	12.8
31 - 35	9	8.0	4	10.0	7	53.8	11	29.7	31	15.3
36 - 40	4	3.5	4	10.0	1	7.7	8	21.6	17	8.4
41 - 45	9	8.0	2	5.0	1	7.7	7	19.0	19	9.4
46 - 50	5	4.4	3	7.5	0	0	2	5.4	10	4.9
51 - 55	7	6.2	1	2.5	0	0	3	8.1	11	5.4
56 - 60	3	2.7	1	2.5	0	0	1	2.7	5	2.5
61 - 65	3	2.7	0	0.0	0	0	0	0	3	1.5
66 - 70	4	3.5	0	0.0	0	0	1	2.7	5	2.5
71 - 75	1	0.9	1	2.5	0	0	0	0	2	1.0
> 75	4	3.5	0	0.0	0	0	0	0	4	2.0
Total	113	100.0	40	100.0	13	100.0	37	100.0	203	100.0

5.4 TRACING AND DIGITIZING OF PHOTOGRAPHS

Black and white photographic prints were made of the 22 profiles selected. The photographs were enlarged to life size (1:1) with the 5 centimetre ruler scale as reference and the plumb line taken as the true vertical.

All the photographs were traced with a 0.3 mm HB mechanical pencil onto 0.003" matte acetate orthodontic tracing paper. All tracings were completed within the same day, so that systematic errors were minimised (Houston 1983).

Tracings were digitized on a Hipad Digitizing Pad by Houston Instruments, connected to a NEC personal computer. The soft tissue digitizing programme was written by Dr. Hilton Wasilewsky, senior tutor, Orthodontic Department, University of Sydney. Data were stored into the NEC hard disk.

The digitizing procedure was as follows :

1. Before digitizing the photographs, 13 facial points (section 3.5) were marked on each tracing.
2. The tracing was secured on top of the white screen of the digitizing pad with tape.
3. The computerised digitizing program was loaded into the NEC computer and digitizing instructions were performed following the screen prompts. The 5 cm reference ruler recorded on the photograph was also digitized to correct for any error in photographic enlargement.
4. The processed data were stored.

5. The above procedures were repeated for each new tracing.

In order to assess the accuracy of tracing, locating landmarks and digitizing, 10 photographs were selected randomly, retraced and redigitized on a separate occasion 1 week later.

5.5 REFERENCE POINTS

Soft tissue nasion (Na') : The most concave point at the root of the nose in the midsagittal plane in relation to a line perpendicular to the true vertical (modified from Larrabee at al 1985).

Pronasale (Prn) : The most prominent point on the midsagittal plane of the nose in relation to a line perpendicular to the true vertical (modified from Larrabee et al 1985)

Columella point (Cm) : The most anterior point on the columella of the nose (Legan and Burstone 1980)

Subnasale (Sn) : The point at which the nasal septum merges with the upper cutaneous lip in the midsagittal plane (Legan and Burstone 1980).

Superior labial sulcus (A') : The deepest point on the upper lip as determined by a line drawn from subnasale and tangent to the upper lip (modified from Burstone 1959).

Labrale superius (Ls) : The most anterior point on the convexity of the upper lip in relation to a line perpendicular to the true vertical (modified from Larrabee et al 1985).

Stomion superius (Stm_S) : The lowermost point on the vermilion of the upper lip (Legan and Burstone 1980).

Stomion (Stm) : The junction in the midline of the upper and lower lip (Burstone 1959).

Stomion inferius (Stm_I) : The uppermost point on the vermilion of the lower lip (Legan and Burstone 1980)

Labrale inferius (Li) : The most anterior point on the convexity of the lower lip in relation to a line perpendicular to the true vertical (modified from Larrabee et al 1985).

Inferior labial sulcus (B') : The most concave point in relation to a line joining the tangent of the lower lip to soft tissue pogonion (modified from Burstone 1959).

Soft tissue pogonion (Pog') : The most anterior point on the contour of the soft tissue chin in relation to a line drawn perpendicular to the true vertical (modified from Larrabee et al 1985).

Soft tissue menton (Me') : The lowest point on the contour of the soft tissue chin in relation to a line drawn perpendicular to the true vertical (modified from Larrabee at al 1985).

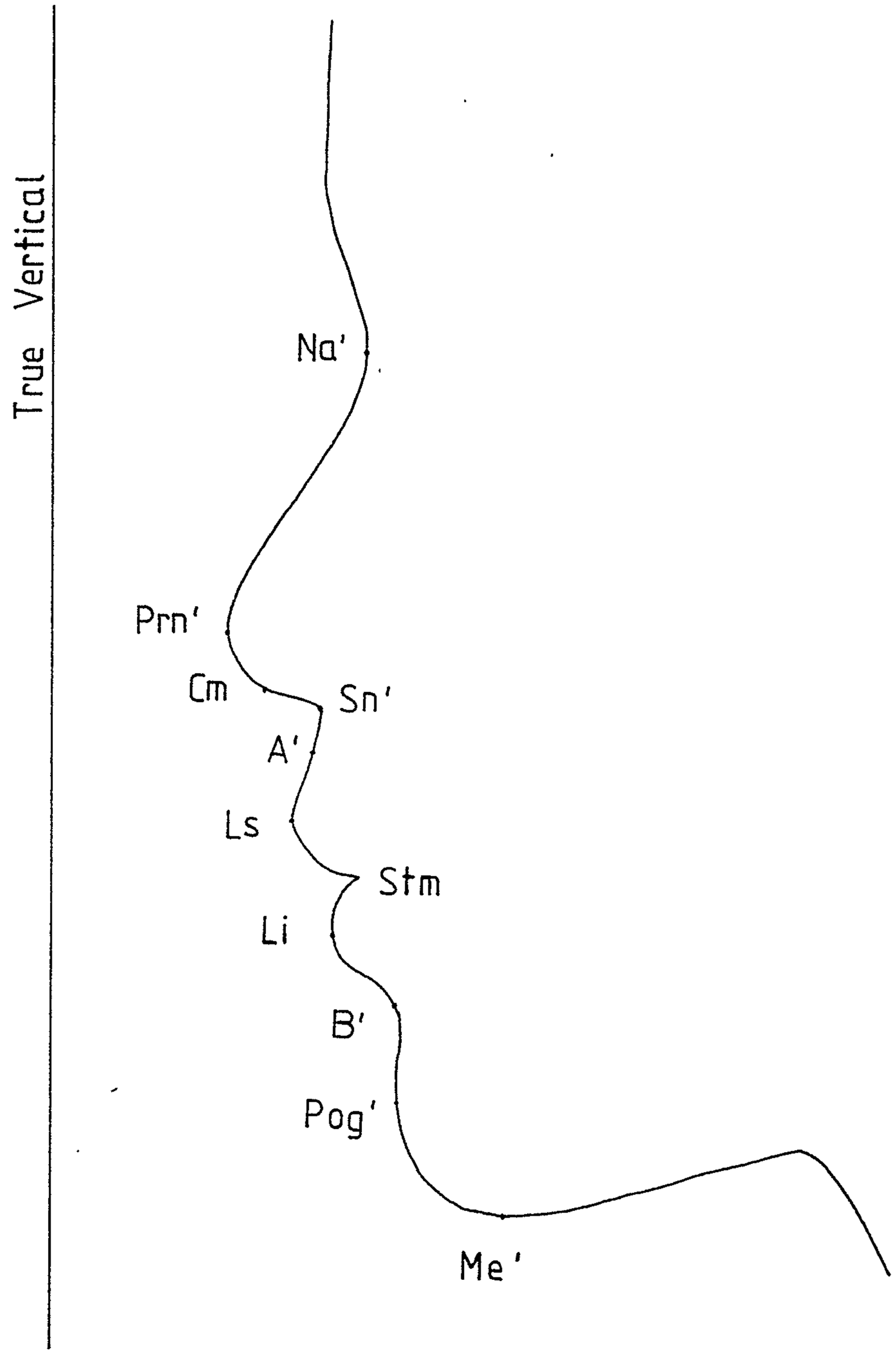


Fig 5.4 Profile tracing with soft tissue landmarks.

5.6 VARIABLES USED FOR SOFT TISSUE PROFILE ANALYSIS

A. Overall Profile Assessment

Linear	1.	Na'/Sn perp.*	(Soft tissue nasion position)
	2.	Pog'/Sn perp.*	(Chin position)
Angular	3.	Na'-Sn-Pog'	(Facial contour angle)
	4.	Na'-Prn-Pog'	(Overall facial angle)

B. Nasal Measurements

Angular	5.	Prn-Na'-Pog'	(Nasofacial angle)
Linear	6.	Prn/Sn perp.*	(Nose prominence)

C. Relationship of nose to upper lip

Angular	7.	Cm-Sn-Ls	(Nasolabial angle)

D. Upper Lip Measurements

Linear	8.	Ls/Sn perp.*	(Upper lip protrusion)
	9.	Upper lip / E plane	
	10.	Upper lip / Sn-Pog' plane	
Angular	11.	Upper lip-Pog'-Na'	(H-angle)
Linear	12.	A' / Sn-Upper lip	(Upper lip curl)

E. Lower Lip Measurements

Linear	13.	Li/Sn perp.*	(Lower lip protrusion)
	14.	Lower lip / E plane	
	15.	Lower lip / Sn-Pog' plane	
	16.	Lower lip / H line	
	17.	B' / lower lip-Pog'	(Lower lip curl)

F. Vertical Facial Proportions

Ratio : 18. Na'-Sn : Na'-Me' (Midfacial to total face height)

19. Sn-Stm : Stm-Me' (Vertical lip - chin ratio)

* Sn perp. is the plane through subnasale, perpendicular to the True Horizontal.

5.7 STATISTICAL EVALUATIONS

Formulae Used in the statistical analyses :

N	Number of observations	
$\bar{x}$	Mean	$\frac{\Sigma x}{N}$
S^2	Variance	$\frac{\Sigma(x-\bar{x})^2}{N-1}$
S	Standard deviation	$\sqrt{\frac{\Sigma(x-\bar{x})^2}{N-1}}$
SE(m)	Standard error of the mean	$\frac{S}{\sqrt{N}}$
X_i	i^{th} independent variable	
Y	Dependent variable (degree of attractiveness)	

$\hat{Y}$ Estimated value of dependent variable

The regression relationship between Y and X_i's are :

$$\hat{Y} = b_0 + b_1X_1 + b_2X_2 + \ldots\ldots\ldots\ldots + b_kX_k$$

where $b_0, b_1, \ldots\ldots\ldots b_k$ are regression coefficients.

r Zero order Pearson Product-Moment Correlation coefficient

$$r = \frac{\Sigma(X-\bar{X})(Y-\bar{Y})}{\sqrt{\Sigma(X-\bar{X})^2}\sqrt{\Sigma(Y-\bar{Y})^2}}$$

R^2 Coefficient of determination

$$R^2 = \frac{\Sigma(\hat{Y}-\bar{Y})^2}{\Sigma(Y-\bar{Y})^2}$$

$$= \frac{\text{variation in Y explained by the Xi 's in the equation}}{\text{total variation in Y}}$$

P Number of concordant pairs in using duplicate slides

Q Number of disconcordant pairs in using duplicate slides

T_1 Number of ties on the row variables

T_2 Number of ties on the column variables

Tb Kendall's Tau-b $\dfrac{P - Q}{\sqrt{\frac{1}{2}(N^2 - \Sigma T_1^2)\frac{1}{2}(N^2 - \Sigma T_2^2)}}$

(Nie et al 1975)

To check the error of method, Paired Student's t-test is calculated by :

Z Number of slides sampled for checking error of method.

D Difference between two measures (X_1, X_2) of a profile variable.

$\bar{D}$ Mean difference between two measures across sample of slides. $\dfrac{\Sigma D}{Z}$

df Degree of freedom $Z - 1$

S Standard deviation $\sqrt{\dfrac{\Sigma(D - \bar{D})^2}{Z - 1}}$

$S_{\bar{D}}$ Standard error of mean difference $\sqrt{\dfrac{S_1^2 + S_2^2 - 2cov(X_1X_2)}{Z}}$

t t-statistic $t = \dfrac{\bar{D} - 0}{S_D}$

t has $2Z - 2$ degrees of freedom.

CHAPTER 6 : RESULTS

6.1 ERRORS OF THE METHOD

The errors of the method were investigated for :

1. Reliability of the author's measurements, and
2. Reliability of the judges' ratings for the profiles.

6.1.1 RELIABILITY OF MEASUREMENTS

Ten photographs were randomly selected, retraced and redigitised on a separate occasion 1 week later. Paired Student's t-test was computed for each of the profile variables measured to test the null hypothesis that there was no difference between the two sets of measurements. The various formulae and their use in error determination have been discussed previously (refer to Section 5.7).

The results, showing the mean difference, standard error of the mean difference, standard deviation, t-test value and the probability for each of the 19 profile variables measured, are listed in Table 6.1. The degrees of freedom are 9. From the probability computed, only the upper lip to E-plane measurement is significantly different (p=0.003). The upper lip to Sn-Pog' plane is close to being significant (p=0.053). This indicates that the tracing, locating the reference points, and the digitising method is very reliable, except for the upper lip to E-plane measurement.

Table 6.1 Results of double determinations on 10 photographs.

PROFILE VARIABLE	D	$S_{\bar{D}}$	S	t	df	p(2 tail)
1. Na/Sn perp	-0.0500	0.131	0.414	-0.38	9	0.712
2. Pog/Sn perp	0.1100	0.196	0.621	0.56	9	0.589
3. Na-Sn-Pog	0.1000	0.275	0.869	0.36	9	0.724
4. Na-Prn-Pog	-0.0200	0.276	0.872	-0.07	9	0.944
5. Prn-Na-Pog	0.1400	0.200	0.631	0.70	9	0.501
6. Prn/Sn perp	0.0000	0.151	0.476	0.00	9	1.000
7. Cm-Sn-Ls	-0.8400	1.206	3.813	-0.70	9	0.504
8. Ls/Sn perp	-0.0800	0.085	0.270	-0.94	9	0.373
9. U. lip/E-plane	-0.3200	0.081	0.257	-3.93	9	0.003 *
10. U. lip/Sn-Pog	-0.2200	0.099	0.312	-2.23	9	0.053
11. H-Angle	-0.1500	0.076	0.242	-1.96	9	0.081
12. A'/Sn-U. lip	0.0100	0.098	0.311	0.10	9	0.921
13. Li/Sn perp	0.0500	0.117	0.369	0.43	9	0.678
14. L. lip/E-plane	0.0500	0.159	0.502	0.32	9	0.760
15. L. lip/Sn-Pog	-0.1400	0.108	0.341	-1.30	9	0.226
16. L. lip/H-line	-0.1000	0.100	0.316	-1.00	9	0.343
17. B'/L. lip-Pog	0.1100	0.166	0.526	0.66	9	0.525
18. Na-Sn : Na-Me	-0.2400	0.210	0.664	-1.14	9	0.282
19. Sn-Stm : Stm-Me	0.4300	0.574	1.816	0.75	9	0.473

* Result is significantly different.

Table 6.2 Correlation between the duplicate slides (ie. Rater Reliability)

JUDGES	SLIDES	CORRELATION	
OVERALL	S3 with S19	0.6495	
	S4 with S17	0.6118	
	S7 with S21	0.6264	
CHINESE PUBLIC	S3 with S19	0.5532	n=113
	S4 with S17	0.5210	
	S7 with S21	0.6408	
CAUCASIAN PUBLIC	S3 with S19	0.6119	n=40
	S4 with S17	0.7067	
	S7 with S21	0.4681	
CHINESE ORTHODONTIST	S3 with S19	0.5401	n=13
	S4 with S17	0.7757	
	S7 with S21	0.8647	
CAUCASIAN ORTHODONTIST	S3 with S19	0.7904	n=37
	S4 with S17	0.6586	
	S7 with S21	0.6338	

6.1.2 RATERS' RELIABILITY

The consistency of the judges was evaluated by showing three sets of duplicate slides, amongst the 25 slides. The duplicates were :

slide number 3 and slide number 19,
slide number 4 and slide number 17, and
slide number 7 and slide number 21.

The Pearson Product-Moment Correlation coefficient (r) was calculated between the first and second observations of the duplicate slides, made by the 4 groups of judges (Table 6.2). The correlation coefficients computed for the judges' ratings indicate moderate-to-high correlation between the three sets of slides (r = 0.5210 to 0.7904).

Cross-tabulation was computed for each pair of slides (Table 6.3 a to Table 6.3 c). The rows indicate the ratings of attractiveness on the slide seen during the first observation, and the columns indicate the ratings of attractiveness on the duplicate slide. The $(i, j)^{th}$ cell entry represents the frequency of judges giving a rating of "i" to the first slide, and a rating of "j" to the duplicate slide (where "i" = 1 to 7; "j" = 1 to 7). The diagonal entries (in **bold** type) represent a consistency in attractiveness ratings for the duplicate slides. Entries below the diagonal represent those situations where the duplicated slide was perceived as less attractive during the second observation; entries above the diagonal represent those situations where the duplicated slide was rated as more attractive during the second observation. Thus if more entries lie on the diagonal, it means the judges' ratings are reproducible. This reliability is measured by computing Kendall's tau b (T_b). When all the entries fall along the

diagonal, Kendall's tau b takes on a value of +1. When all the entries are off the major diagonal, Kendall's tau b takes on a value of 0.

Tables 6.3 (a to c), indicate that the raters' reliability for the 3 sets of slides are moderate, with the percentage of agreement, ranging from 45.3% to 60.9%. Slide number 4 with slide number 17 show the most percentage of agreement (60.9%).

Table 6.3 (a) Cross-tabulation of ratings on slide #3 with slide #19

		Ratings on Slide # 19							
	Frequency	1	2	3	4	5	6	7	Row total
	1	**0**	0	0	1	0	0	0	1
Ratings	2	0	**1**	4	3	0	0	0	8
on	3	0	0	**13**	14	9	1	0	37
Slide # 3	4	0	0	11	**39**	20	4	0	74
	5	0	0	1	11	**20**	12	3	47
	6	0	0	0	2	9	**20**	2	33
	7	0	0	0	0	0	1	**2**	3
	Column total	0	1	29	70	58	38	7	203

Kendall's tau-b = 0.5585

Percentage of agreement = 46.8%

Table 6.3 (b) Cross-tabulation of ratings on slide #4 with slide #17

		Ratings on Slide # 17							
	Frequency	1	2	3	4	5	6	7	Row total
	1	**37**	25	2	0	0	0	0	64
Ratings	2	13	**65**	23	0	0	0	0	101
on	3	1	10	**17**	2	0	0	0	30
Slide # 4	4	1	0	2	**4**	0	0	0	7
	5	0	0	0	0	**0**	0	0	0
	6	0	0	0	0	0	**0**	0	0
	7	0	0	0	0	0	0	**0**	0
Column total		52	100	44	6	0	0	0	202

Kendall's tau-b = 0.55113

Percentage of agreement = 60.9%

Table 6.3 (c) Cross-tabulation of ratings on slide #7 with slide #21

		Ratings on Slide # 21							
	Frequency	1	2	3	4	5	6	7	Row total
	1	**1**	1	0	0	0	0	0	2
Ratings	2	1	**5**	8	6	1	0	0	21
on	3	1	7	**28**	20	9	0	0	65
Slide # 7	4	0	0	13	**39**	11	5	0	68
	5	1	0	3	10	**15**	9	0	38
	6	0	0	0	0	1	**4**	4	9
	7	0	0	0	0	0	0	**0**	0
Column total		4	13	52	75	37	18	4	203

Kendall's tau-b = 0.5211

Percentage of agreement = 45.3%

6.2 PROFILE PREFERENCE STUDY

The percentage distribution for each slide, as rated on the 7-point Likert scale by all the judges, is presented in Table 6.4. For each of the slides, the mean score, the standard error, the minimum and maximum scores and the number of valid responses (n) have been tabulated. If the judges indicated that they recognised the subject as a friend, relative or patient, then the score for that particular subject was discarded.

For each of the 4 groups of judges, ie. the Chinese public, the Caucasian public, the Chinese orthodontist and the Caucasian orthodontist, the total score for each slide was calculated and the mean value obtained. The slides were then arranged in descending order of attractiveness (Table 6.5).

Table 6.4: Percentage distribution of ratings and descriptive statistics for each slide

Attractiveness Scale

Slide	1	2	3	4	5	6	7	Mean	SE	Min	Max	n
#1	0.5	3.9	15.8	41.4	27.6	8.9	2.0	4.261	0.074	1	7	203
#2	4.4	24.1	42.9	22.7	4.9	1.0	0.0	3.025	0.068	1	6	203
#3	0.5	3.9	18.2	36.5	23.2	16.3	1.5	4.325	0.080	1	7	203
#4	31.7	50.0	14.9	3.5	0.0	0.0	0.0	1.901	0.054	1	4	202
#5	3.9	17.2	37.4	33.0	4.4	3.9	0.0	3.286	0.074	1	6	203
#6	0.5	2.0	7.9	38.9	31.5	15.8	3.4	4.601	0.074	1	7	203
#7	1.0	10.3	32.0	33.5	18.7	4.4	0.0	3.719	0.074	1	6	203
#8	1.0	2.5	16.7	41.9	25.6	7.9	4.4	4.300	0.078	1	7	203
#9	11.8	37.9	38.9	10.8	0.5	0.0	0.0	2.502	0.060	1	5	203
#10	3.5	19.7	47.0	21.2	6.1	2.0	0.5	3.146	0.072	1	7	198
#11	0.5	5.4	12.9	33.7	24.8	18.3	4.5	4.495	0.087	1	7	202
#12	1.5	2.5	16.3	29.1	29.1	19.7	2.0	4.488	0.084	1	7	203
#13	0.0	2.0	10.8	37.4	30.0	16.3	3.4	4.581	0.074	2	7	203
#14	37.9	48.8	11.3	1.5	0.0	0.0	0.5	1.788	0.056	1	7	203
#15	3.4	26.6	38.4	25.6	4.4	1.5	0.0	3.054	0.069	1	6	203
#16	1.0	4.4	23.6	43.3	17.2	8.9	1.5	4.039	0.076	1	7	203
#17	25.6	49.3	21.7	3.0	0.0	0.0	0.0	2.020	0.054	1	4	202
#18	0.5	3.0	17.7	34.5	29.6	12.3	2.5	4.365	0.078	1	7	203
#19	0.0	0.5	14.3	34.5	28.6	18.7	3.4	4.611	0.075	2	7	203
#20	7.9	28.1	42.9	16.7	3.9	0.5	0.0	2.823	0.068	1	6	203
#21	2.0	6.4	25.6	36.9	18.2	8.9	2.0	3.975	0.083	1	7	203
#22	34.5	47.3	15.3	2.5	0.0	0.5	0.0	1.877	0.057	1	6	203
#23	14.8	30.0	34.0	18.2	2.5	0.5	0.0	2.650	0.074	1	6	203
#24	0.5	10.4	15.3	35.6	25.2	9.4	3.5	4.168	0.087	1	7	202
#25	1.5	6.9	25.1	44.3	13.8	6.9	1.5	3.887	0.077	1	7	203

Table 6.5 Slides ordered by descending attractiveness for each group of judges

Rank	Chinese Public		Caucasian Public		Chinese Orthod		Caucasian Orthod	
Order	Slide #	Mean	Slide #	Mean	Slide #	Mean	Slide #	Mean
1	13	4.504	6	4.850	1	5.615	**19***	5.162
2	12	4.469	**19***	4.750	**19***	5.154	6	5.081
3	8	4.434	**3***	4.725	12	5.077	13	4.892
4	18	4.425	13	4.475	8	4.923	**3***	4.784
5	11	4.398	11	4.450	**3***	4.846	11	4.750
6	24	4.348	18	4.275	6 }	4.769	12	4.595
7	6	4.336	12	4.250	11 }	4.769	**21***	4.432
8	**19***	4.319	8	4.050	13 }	4.692	18	4.297
9	1	4.283	**21***	4.025	16 }	4.692	16	4.270
10	**3***	3.973	16	3.950	**21***	4.385	24	4.162
11	16	3.920	1	3.925	18	4.308	1	4.081
12	25	3.858	**7***	3.875	25	4.231	25	4.054
13	**21***	3.761	24	3.750	**7***	4.000	**7*** }	3.946
14	**7***	3.558	25	3.700	24	3.923	8 }	3.946
15	5	3.150	5	3.325	5	3.769	5	3.486
16	10	3.093	10	3.225	15	3.692	10	3.135
17	15	3.088	2	3.150	2	3.538	15	2.919
18	2	2.965	15	2.875	10	3.385	2	2.892
19	20	2.796	20	2.750	23	3.308	20	2.865
20	23	2.584	9	2.700	20	3.154	23	2.757
21	9	2.354	23	2.525	9	3.000	9	2.568
22	**17***	1.912	**4*** }	2.300	22	2.385	**17***	1.972
23	22	1.832	**17*** }	2.300	**17***	2.231	22	1.703
24	**4***	1.823	22	2.000	14	2.154	**4***	1.694
25	14	1.814	14	1.775	**4***	1.923	14	1.595

NB. 3 sets of duplicate slides are used to check for rater reliability :

* Slides # 3 and # 19 ;
* Slides # 4 and # 17 ;
* Slides # 7 and # 21.

6.2.1 PERCENTAGE AGREEMENT OF PROFILES AMONGST THE JUDGES

The profiles that are "universally" agreed to be either "more attractive" or "less attractive" by all 4 groups of judges can be counted and expressed in terms of percentage of agreement.

As shown in Table 6.5, the 4 groups of judges did not agree on their preference for the single most attractive profile. However, the percentage of agreement increased when the six or seven most attractive profiles (excluding the duplicate slides) were taken as a group and compared across the 4 groups (Table 6.6).

However, as demonstrated in Table 6.5, the percentage of agreement on the choice of the 6 least attractive profiles in the sample was 100% across all 4 groups of judges. Note that the slides ordered by descending attractiveness from number 15 to 25 (ie. the10 least attractive profiles) were ranked identically by both the Chinese public and the Caucasian orthodontist groups.

Table 6.6 Percentage of agreement for the 6 and 7 most attractive profiles.

	Caucasian Public		Chinese Orthod		Caucasian Orthod	
	6 best	7 best	6 best	7 best	6 best	7 best
Chinese Public	66.7% (4)	85.7% (6)	50.0% (3)	71.4% (5)	50.0% (3)	71.4% (5)
Caucasian Public			66.7% (4)	85.7% (6)	83.3% (5)	85.7% (6)
Chinese Orthod					66.7% (4)	85.7% (6)

NB. The numbers enclosed in brackets indicate the number of profiles that were common choices between the corresponding groups of judges.

6.2.2 ANALYSIS OF VARIANCE OF THE RATINGS

A 2 x 2 analysis of variance of the ratings was performed to evaluate any significant differences among the 4 groups of judges in their ratings of the 25 slides. The results of ANOVA for the 25 slides are shown in Table 6.7. The main effects evaluated are "race" (the Chinese and the Caucasians) and "profession" (the public and the orthodontists). 16 out of 25 slides show significant differences in attractive ratings as either :

- significant "race" x "profession" interaction effect, or
- significant "profession" effect, or
- significant "race" effect.

(See Appendix E, for examples of derivation of ANOVA results from computer printout.)

a. Interaction effect

Seven slides (slide numbers 1, 2, 3, 4, 9, 17 and 22) show significant interaction effects. These interactions are illustrated graphically in Fig. 6.1 to Fig. 6.7 for the respective slides.
(NB. All the graphic representations compare the mean attractiveness ratings for the 4 groups of judges.)

With only one exception (slide number 24), the Chinese orthodontist group gave higher attractiveness ratings than the Chinese public group. The Caucasian orthodontist group gave lower ratings than the Caucasian public group for 5 slides (slide numbers 2, 4, 9, 17 and 22) with a significant interaction effect. However, with slide numbers 1 and 3, both orthodontist groups (especially, the Chinese orthodontist group) gave higher ratings than the two public groups.

b. Main effect (Profession)

Five slides (slide numbers 12, 16, 19, 21 and 23) show significant "profession" (ie. the orthodontist and the public) main effects. These are represented graphically in Fig 6.8 to Fig. 6.12 respectively.

In these five cases, the two orthodontist groups gave higher attractiveness ratings than the two public groups.

c. Main effect (Race)

Five slides (slide number 6, 8, 15, 19 and 24) show significant "race" (Chinese and Caucasian) main effects. These are illustrated in Fig. 6.10, and Fig. 6.13 to Fig. 6.16.

The two Chinese groups on the average gave significantly higher ratings to slide number 8, 15 and 24 than their two Caucasian counterparts. On the other hand, slide number 6 and 19 were rated significantly lower by the Chinese groups than by the Caucasian groups.

Table 6.7 ANOVA results comparing the interaction and main effects of the 4 groups of judges, and their average ratings for each slide.

* $p < 0.05$

** $p < 0.01$

SLIDE No.	INTERACTION F	INTERACTION Prob	MAIN (Profes) F	MAIN (Profes) Prob	MAIN (Race) F	MAIN (Race) Prob	AVERAGE RATINGS Chinese Public	Caucasian Public	Chinese Orthodon	Caucasian Orthodon	
1	**9.45**	**0.002****	**13.12**	**0.000****	**16.32**	**0.000****	4.283	3.925	5.615	4.081	
2	**4.82**	**0.029***	0.28	0.597	0.001	0.974	2.965	3.150	3.538	2.892	
3	**4.16**	**0.043***	3.50	0.063	**10.19**	**0.002****	3.973	4.725	4.846	4.784	
4	**6.39**	**0.012***	**6.17**	**0.014***	**6.45**	**0.012***	1.823	2.300	1.923	1.694	
5	1.14	0.286	3.65	0.057	0.19	0.663					
6	0.351	0.554	2.98	0.086	**8.69**	**0.004****	4.336	4.850	4.769	5.081	Chinese < Caucasian
7	0.95	0.332	1.27	0.260	1.90	0.170					
8	2.25	0.136	0.41	0.525	**8.67**	**0.004****	4.434	4.050	4.923	3.946	Chinese > Caucasian
9	**6.59**	**0.011***	1.27	0.261	1.67	0.198	2.354	2.700	3.000	2.568	
10	1.01	0.317	0.09	0.770	0.05	0.819					
11	0.02	0.878	2.13	0.146	0.03	0.862					
12	0.39	0.535	**4.16**	**0.043***	2.27	0.134	4.469	4.250	5.077	4.595	Public < Orthodontist
13	0.42	0.518	3.28	0.072	0.04	0.847					
14	2.92	0.089	0.04	0.846	1.64	0.202					
15	2.17	0.142	2.40	0.123	**4.87**	**0.028***	3.088	2.875	3.692	2.919	Chinese > Caucasian

Table 6.7 Results of ANOVA (continued)

SLIDE	INTERACTION		MAIN (Profes)		MAIN (Race)		AVERAGE RATINGS				
	F	Prob	F	Prob	F	Prob	Chinese Public	Caucasian Public	Chinese Orthodon	Caucasian Orthodon	
16	1.103	0.295	**7.13**	**0.008****	0.18	0.673	3.920	3.950	4.692	4.270	Public < Orthodontist
17	**5.212**	**0.023***	0.35	0.555	3.58	0.060	1.912	2.300	2.231	1.972	
18	0.25	0.621	0.00	0.965	0.32	0.571					{ Chinese < Caucasian
19	1.22	0.270	**9.83**	**0.002****	**4.10**	**0.044***	4.319	4.750	5.154	5.162	{ Public < Orthodontist
20	0.28	0.596	1.88	0.171	0.36	0.547					
21	0.25	0.615	**5.44**	**0.021***	1.30	0.257	3.761	4.025	4.385	4.432	Public < Orthodontist
22	**8.10**	**0.005****	0.03	0.869	0.10	0.757	1.832	2.000	2.385	1.703	
23	1.64	0.202	**4.99**	**0.027***	1.13	0.288	2.584	2.525	3.308	2.757	Public < Orthodontist
24	3.39	0.067	0.19	0.663	**4.01**	**0.047***	4.348	3.750	3.923	4.162	Chinese > Caucasian
25	0.002	0.962	3.35	0.069	0.85	0.357					

* Prob < 0.05

** Prob < 0.01 very significant

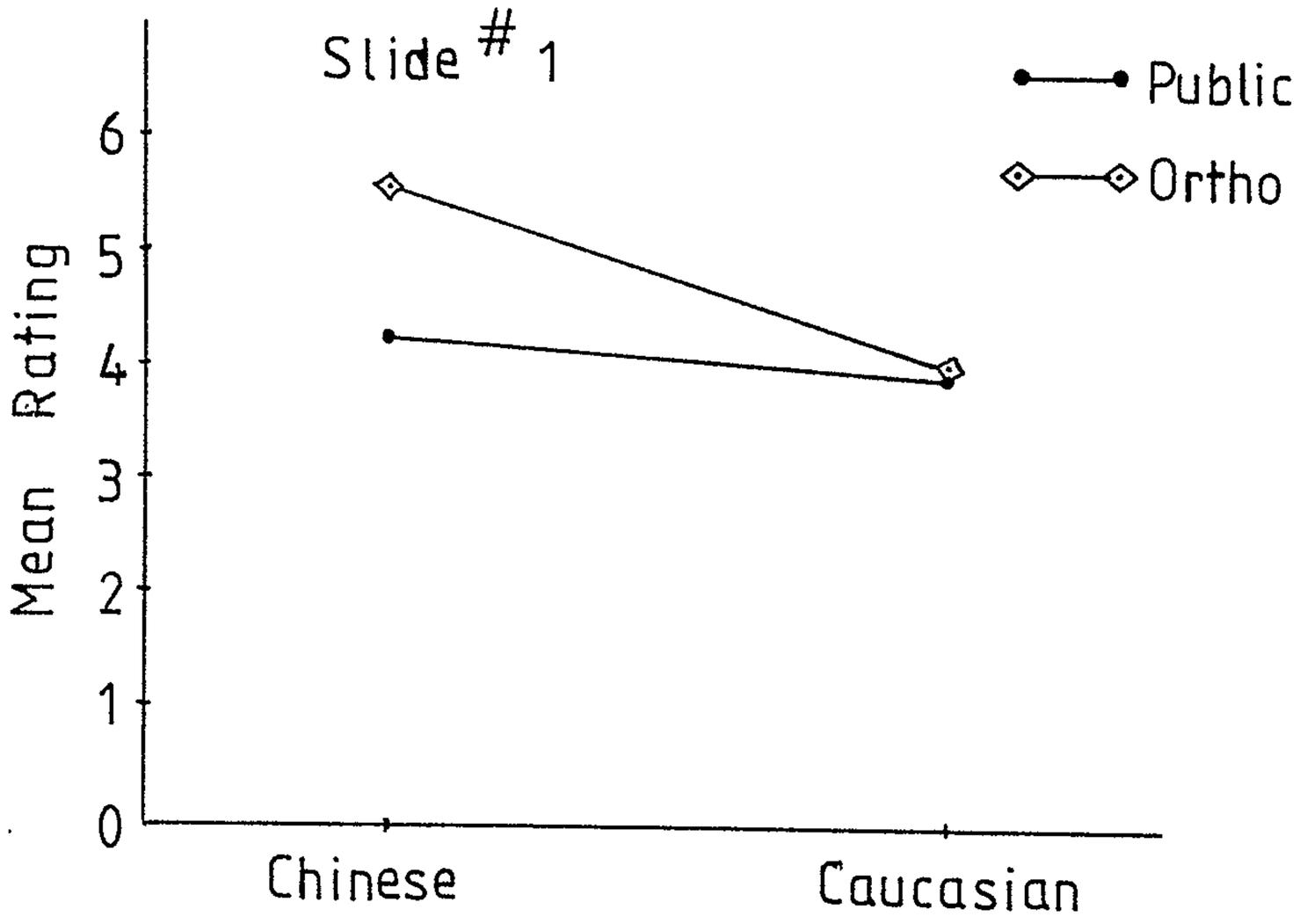


Fig 6.1 Slide #1 shows an interaction effect : the orthodontist groups (especially the Chinese orthodontists) gave higher ratings than the public groups.

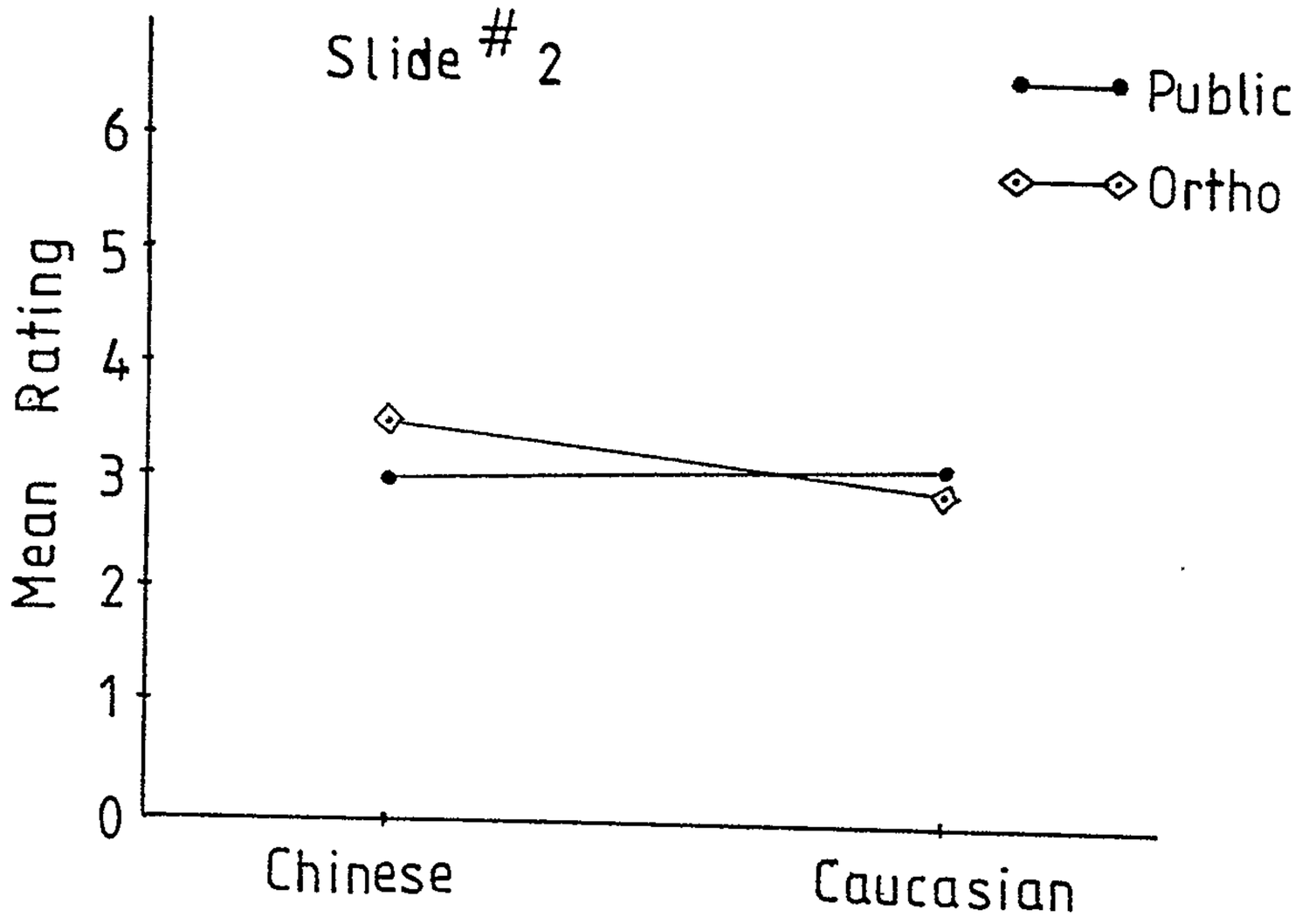


Fig 6.2 Slide #2 shows an interaction effect : the Chinese orthodontists gave a higher rating than the Chinese public; the Caucasian orthodontists gave a lower rating than the Caucasian public.

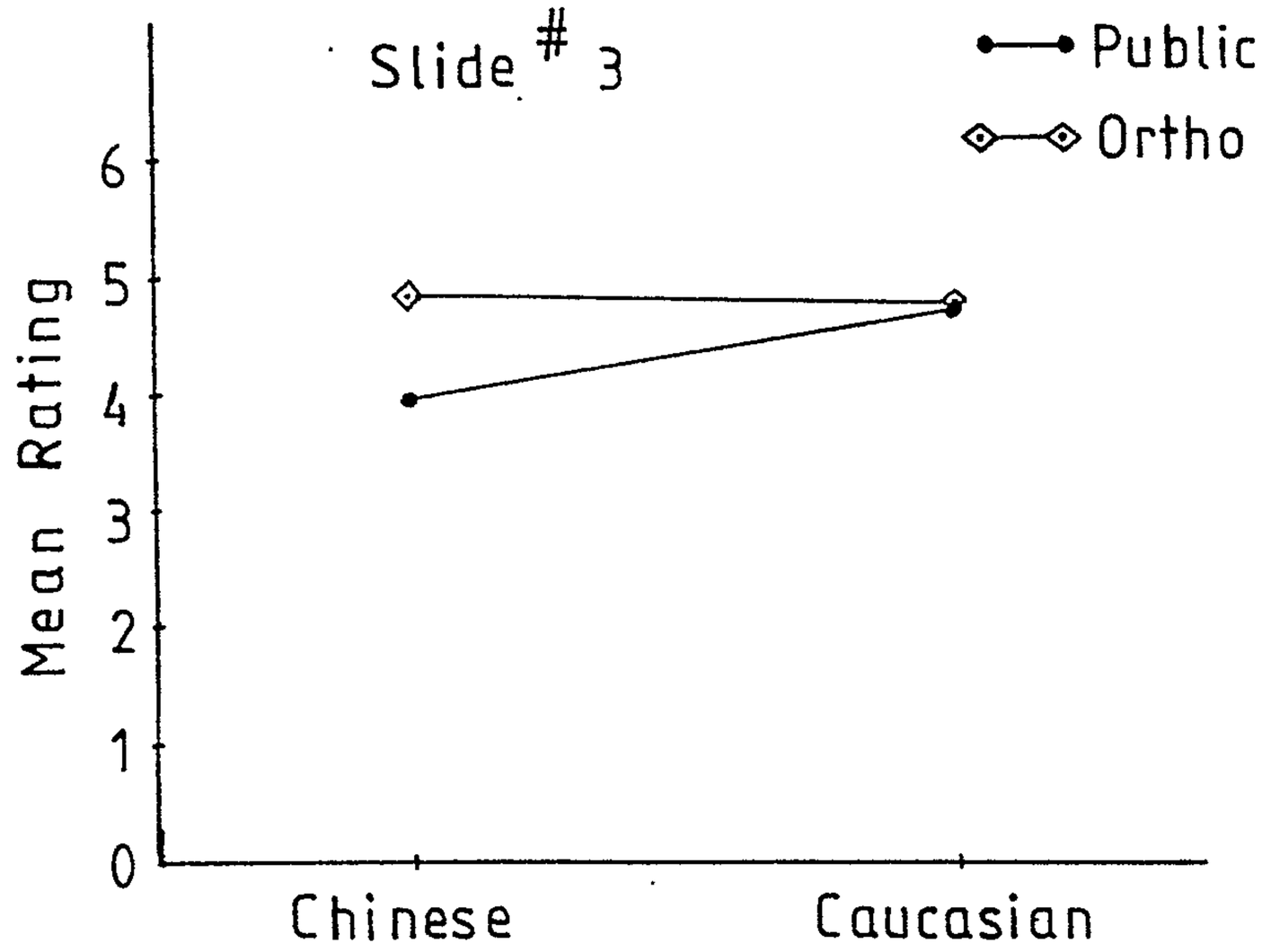


Fig 6.3 Slide #3 shows an interaction effect : the public groups (especially the Chinese public) gave lower ratings than the orthodontist groups.

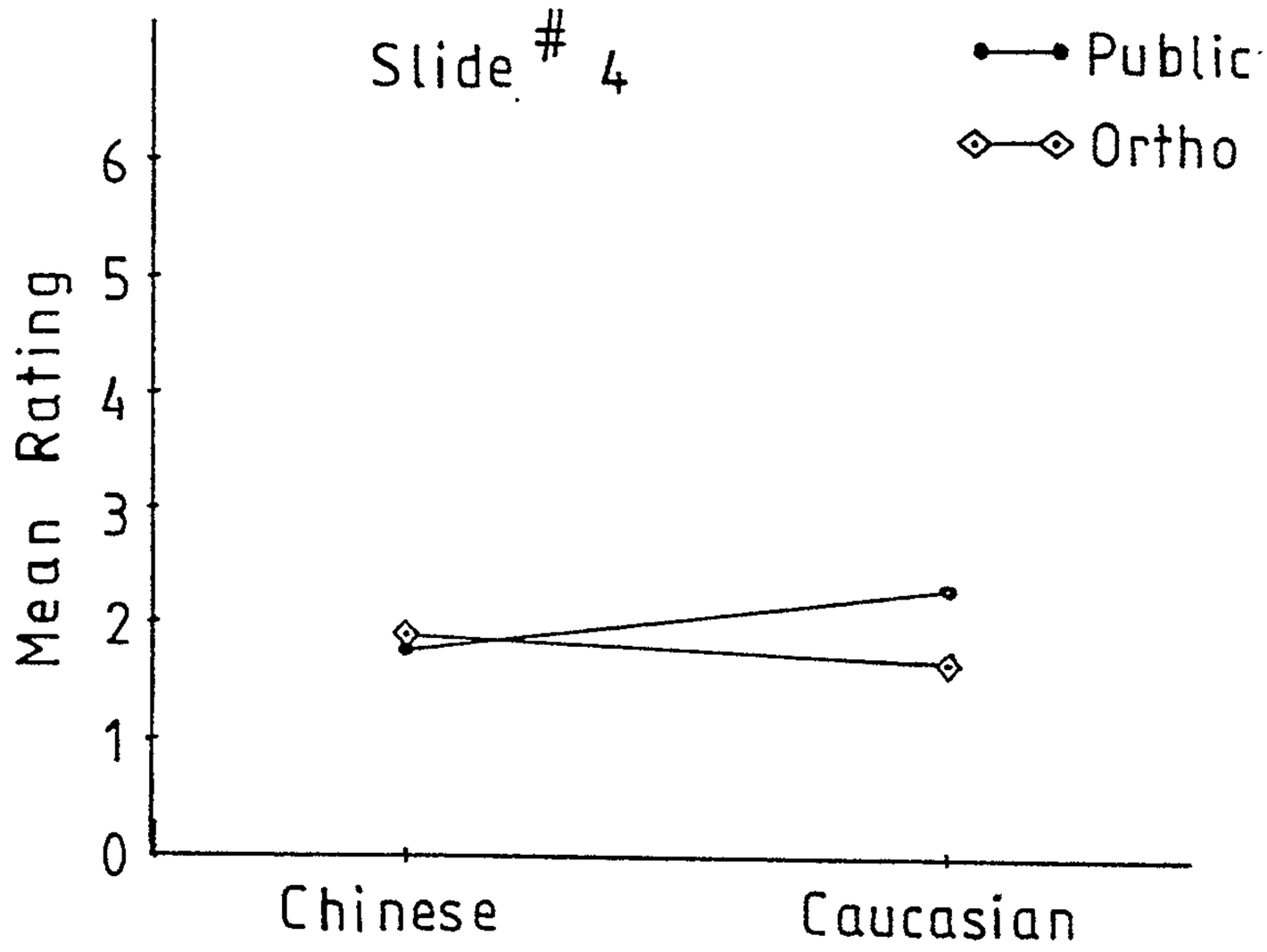


Fig 6.4 Slide #4 shows an interaction effect : the Chinese orthodontists gave a higher rating than the Chinese public; the Caucasian orthodontists gave a lower rating than the Caucasian public.

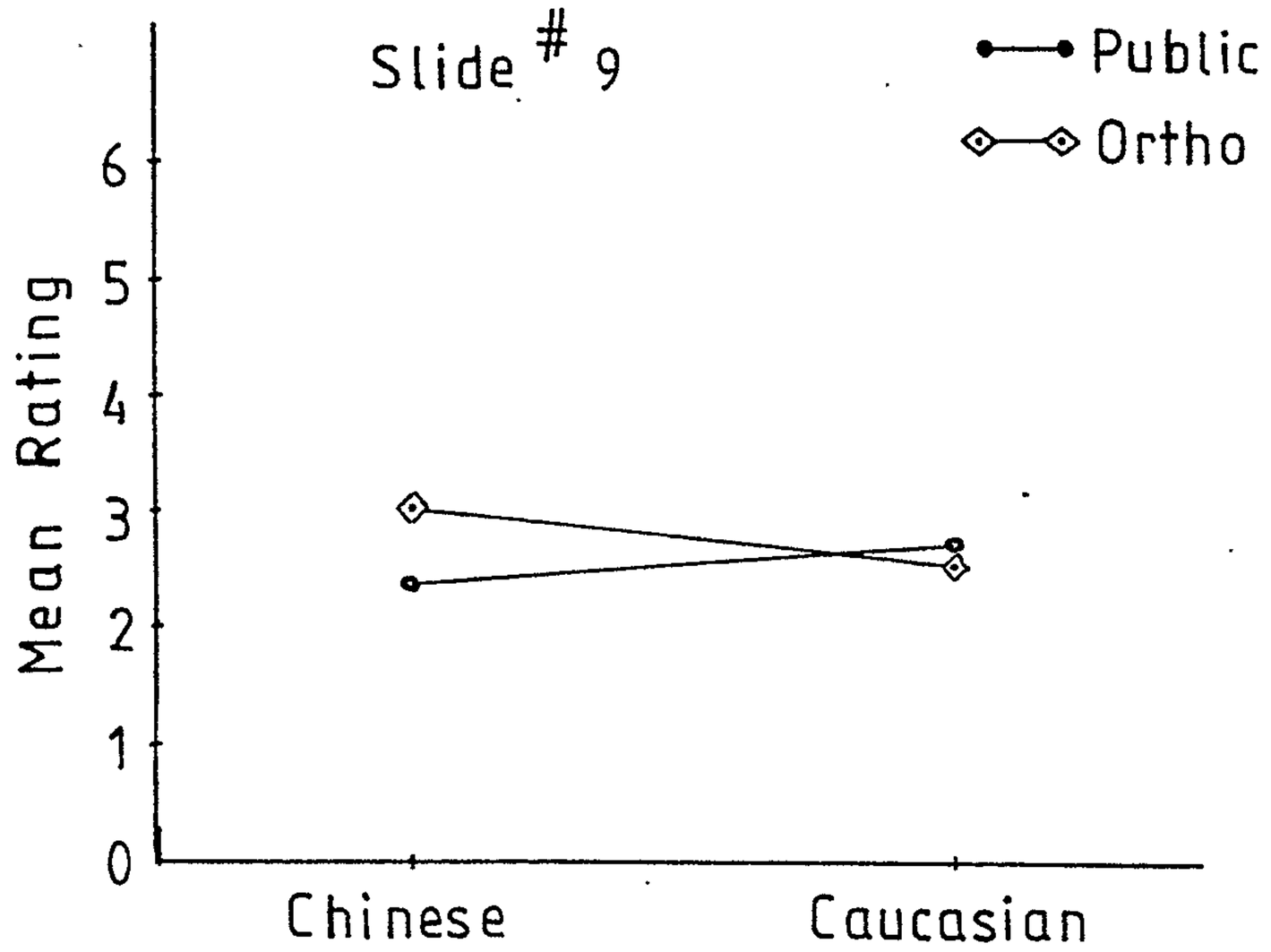


Fig 6.5 Slide #9 shows an interaction effect : the Chinese orthodontists gave a higher rating than the Chinese public; the Caucasian orthodontists gave a lower rating than the Caucasian public.

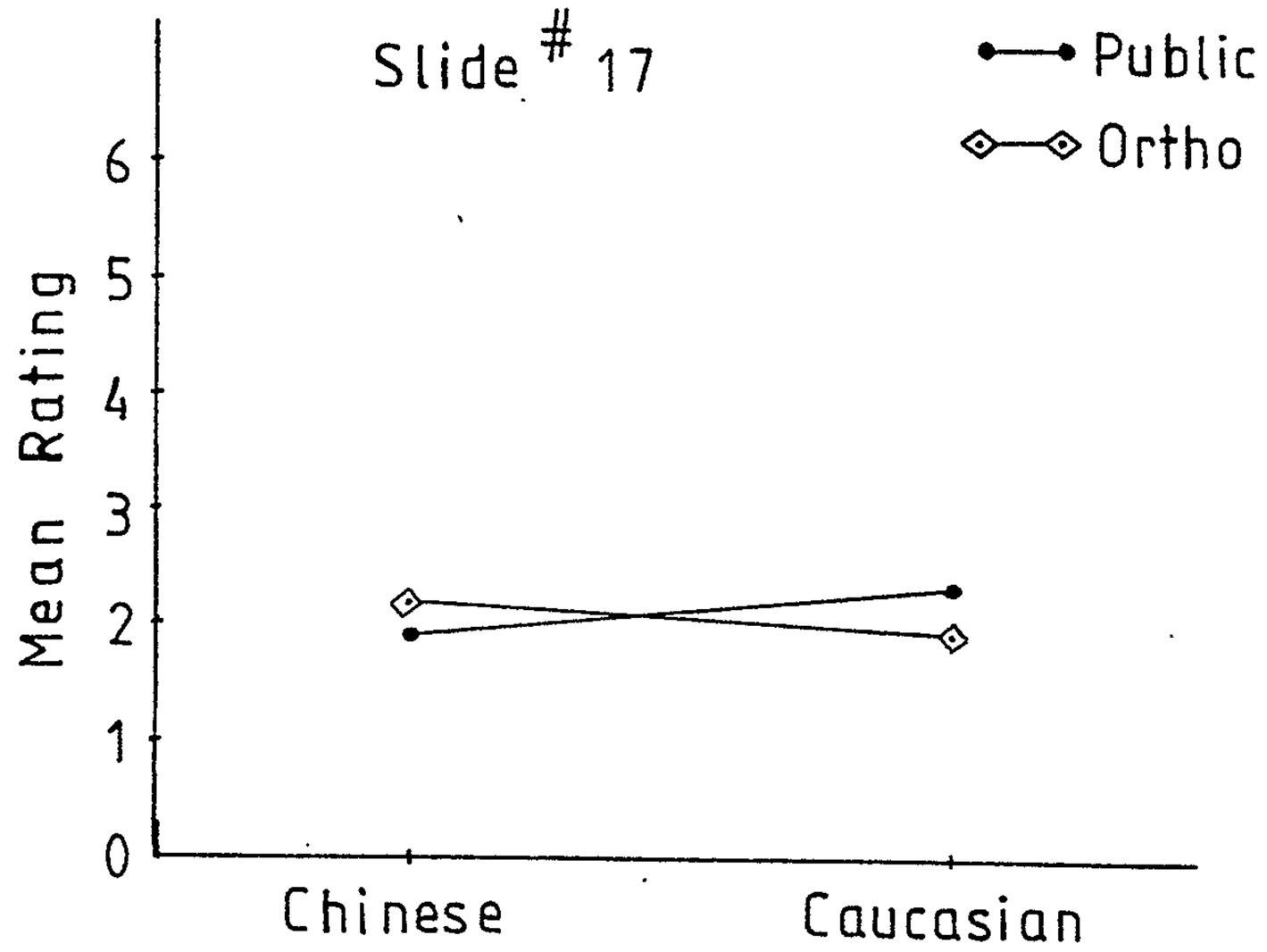


Fig 6.6 Slide #17 shows an interaction effect : the Chinese orthodontists gave a higher rating than the Chinese public; the Caucasian orthodontists gave a lower rating than the Caucasian public.

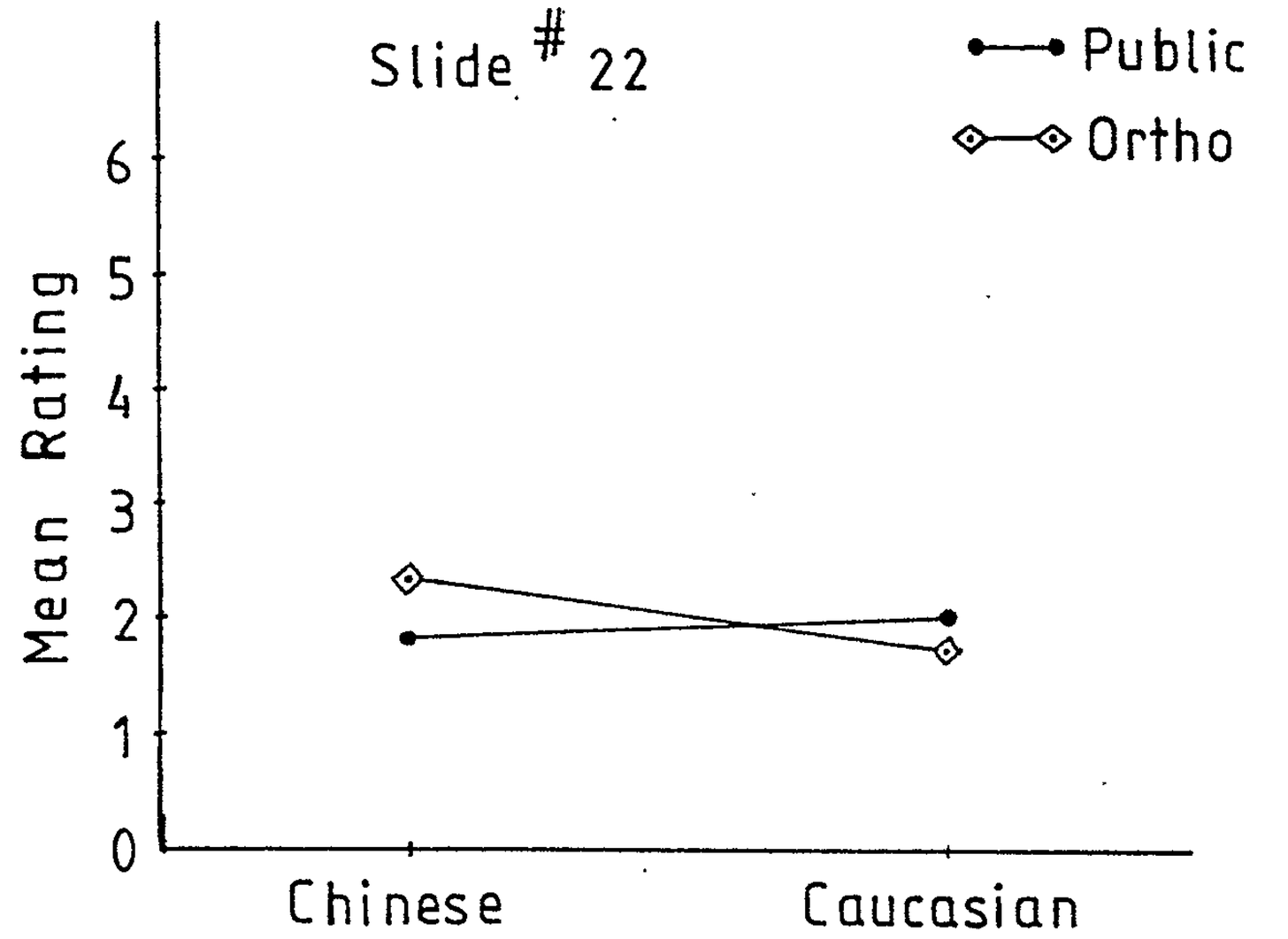


Fig 6.7 Slide #22 shows an interaction effect : the Chinese orthodontists gave a higher rating than the Chinese public; the Caucasian orthodontists gave a lower rating than the Caucasian public.

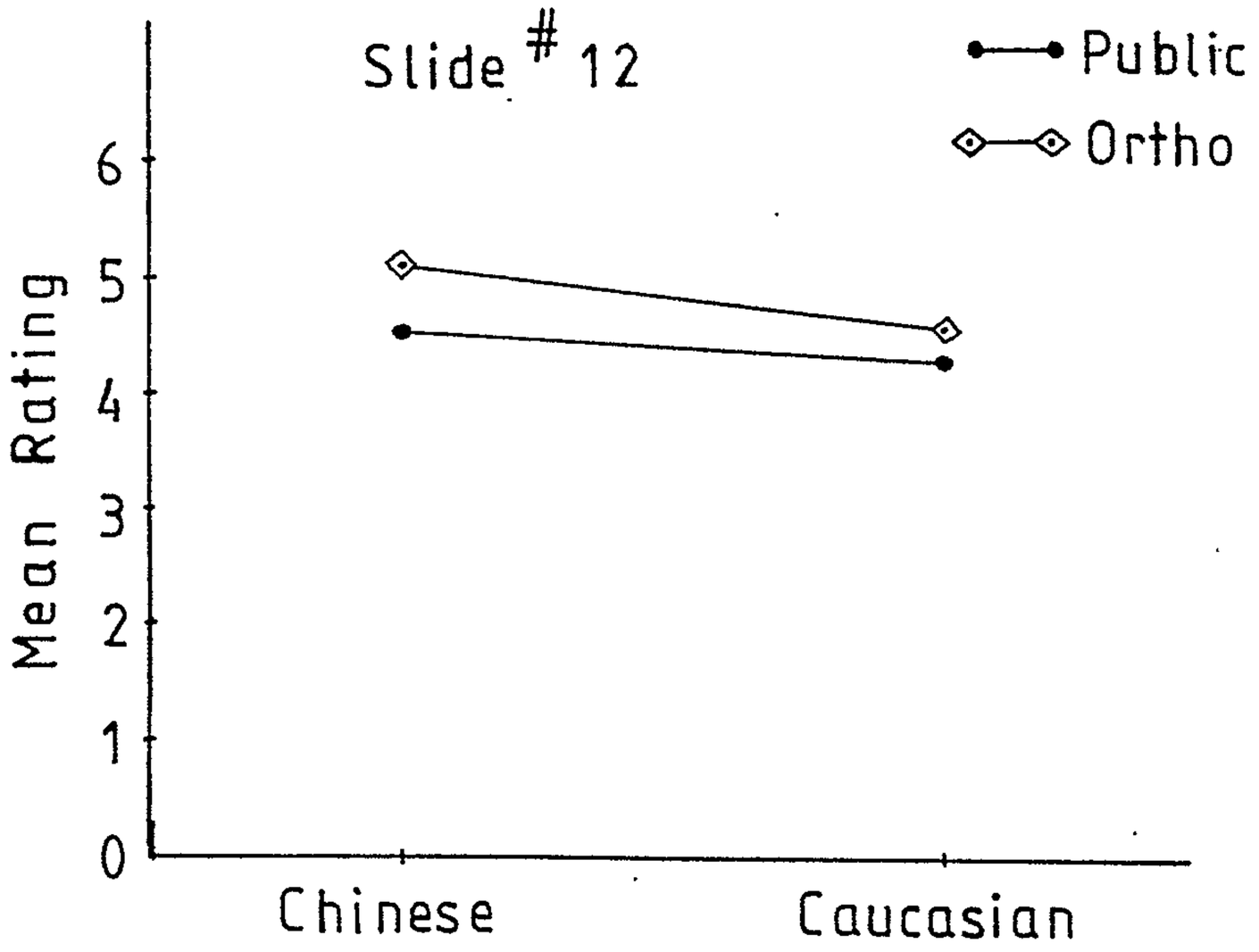


Fig 6.8 Slide #12 shows "profession" effect : the 2 orthodontist groups gave higher ratings than the 2 public groups.

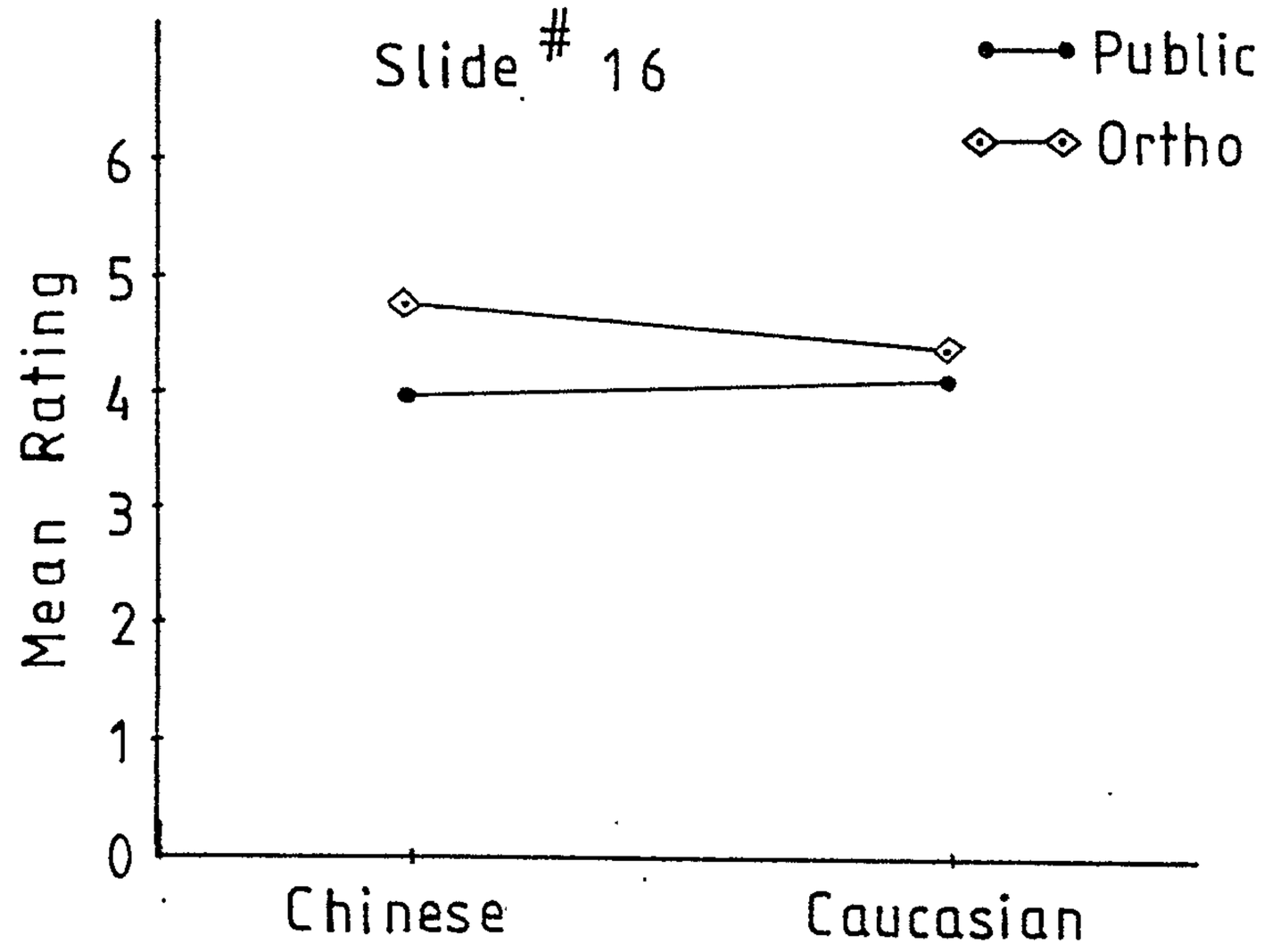


Fig 6.9 Slide #16 shows "profession" effect : the 2 orthodontist groups gave higher ratings than the 2 public groups.

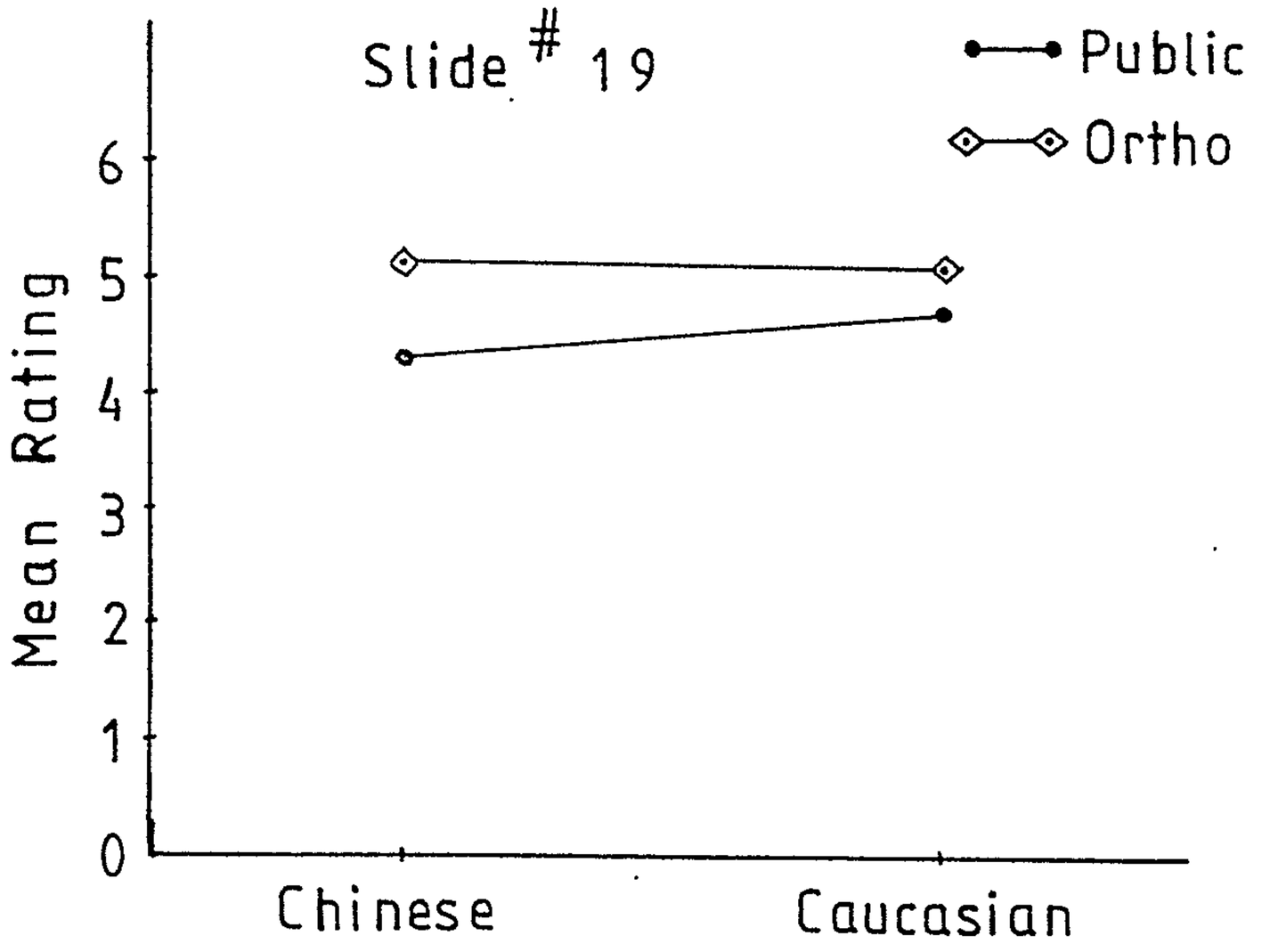


Fig 6.10 Slide #19 shows "profession" and "race" effects : the orthodontist groups gave higher ratings than the public groups; the Caucasian groups gave higher ratings than the Chinese groups.

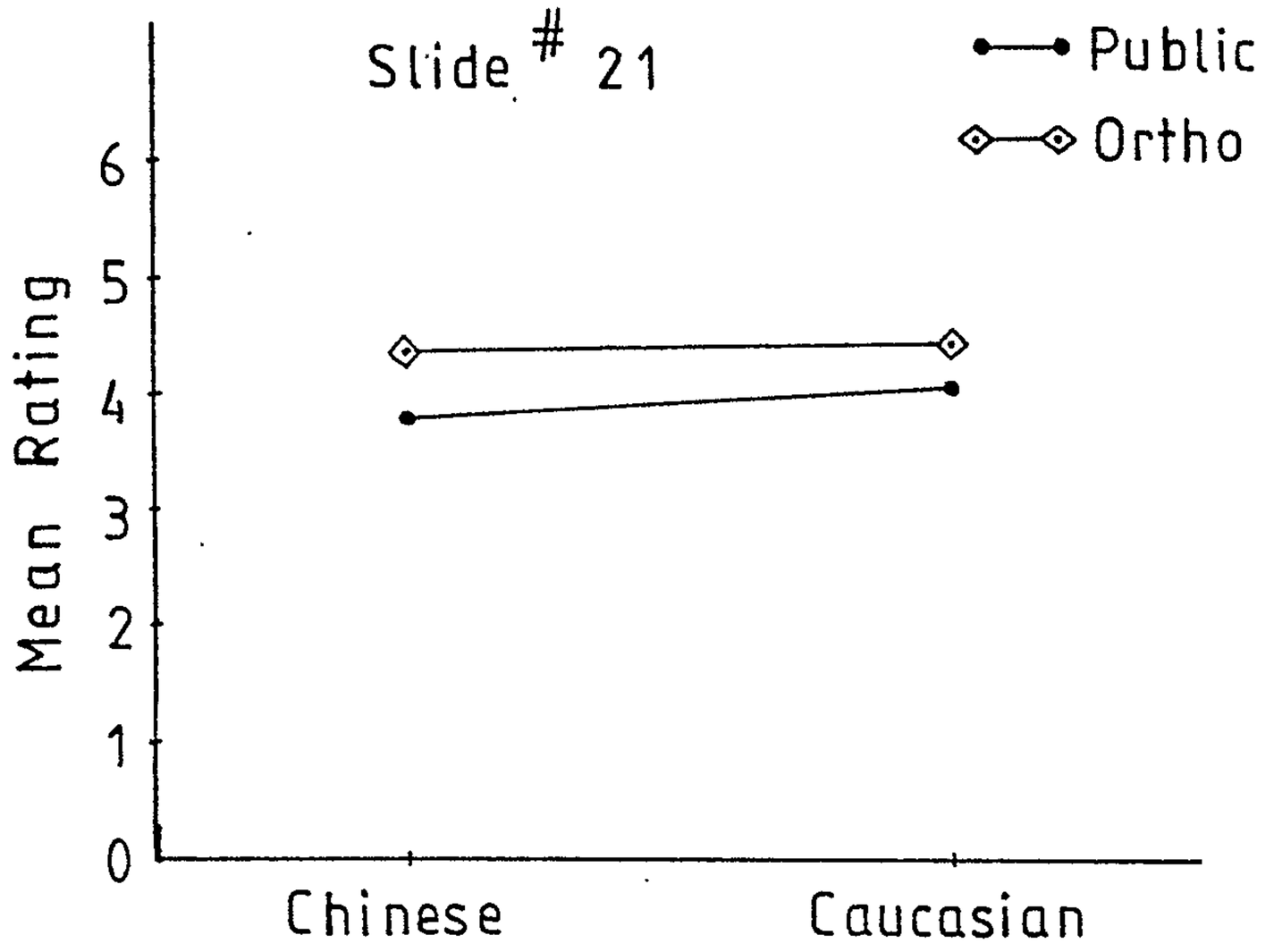


Fig 6.11 Slide #21 shows "profession" effect : the orthodontist groups gave higher ratings than the public groups.

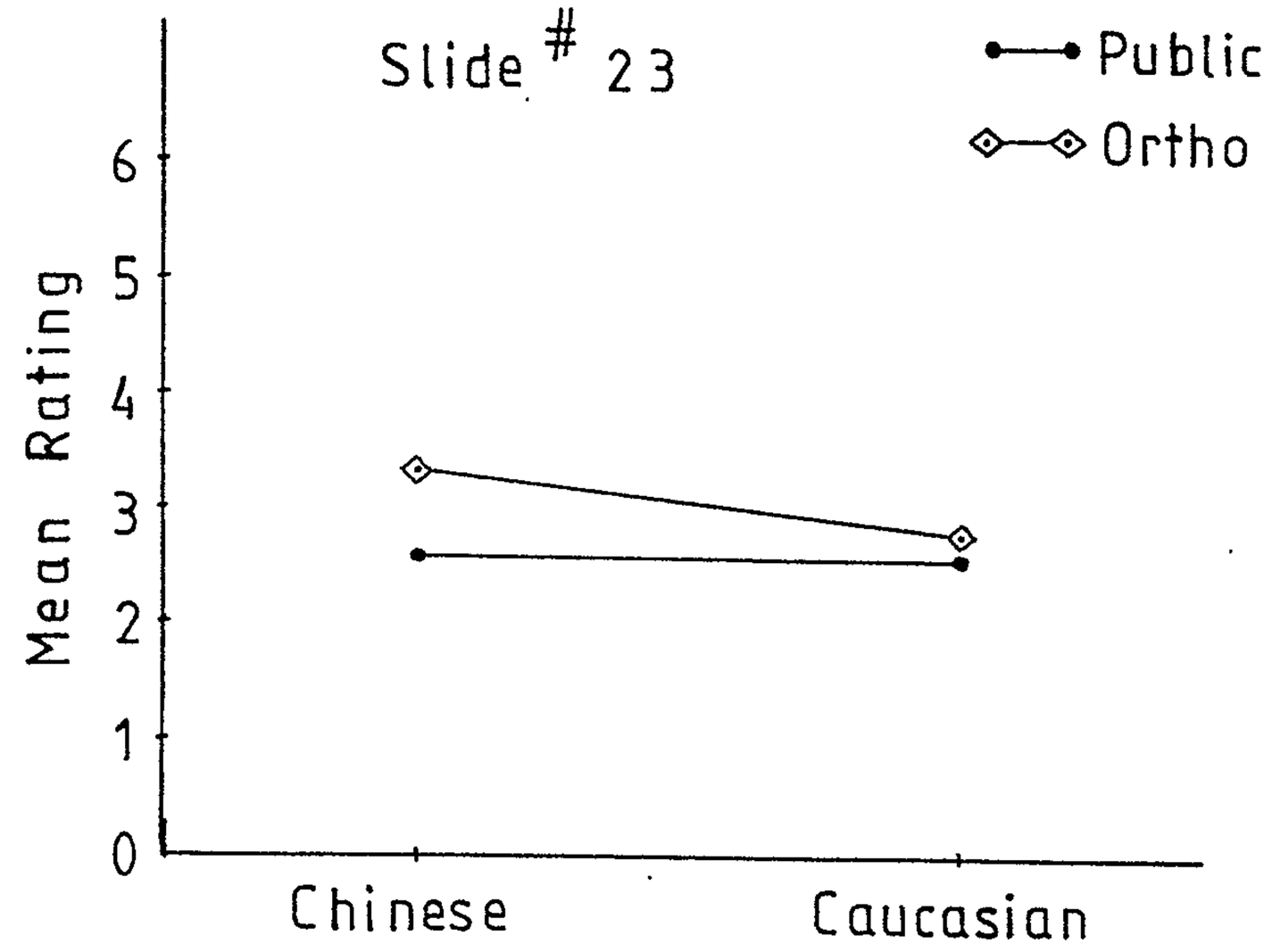


Fig 6.12 Slide #23 shows "profession" effect : the orthodontist groups gave higher ratings than the public groups.

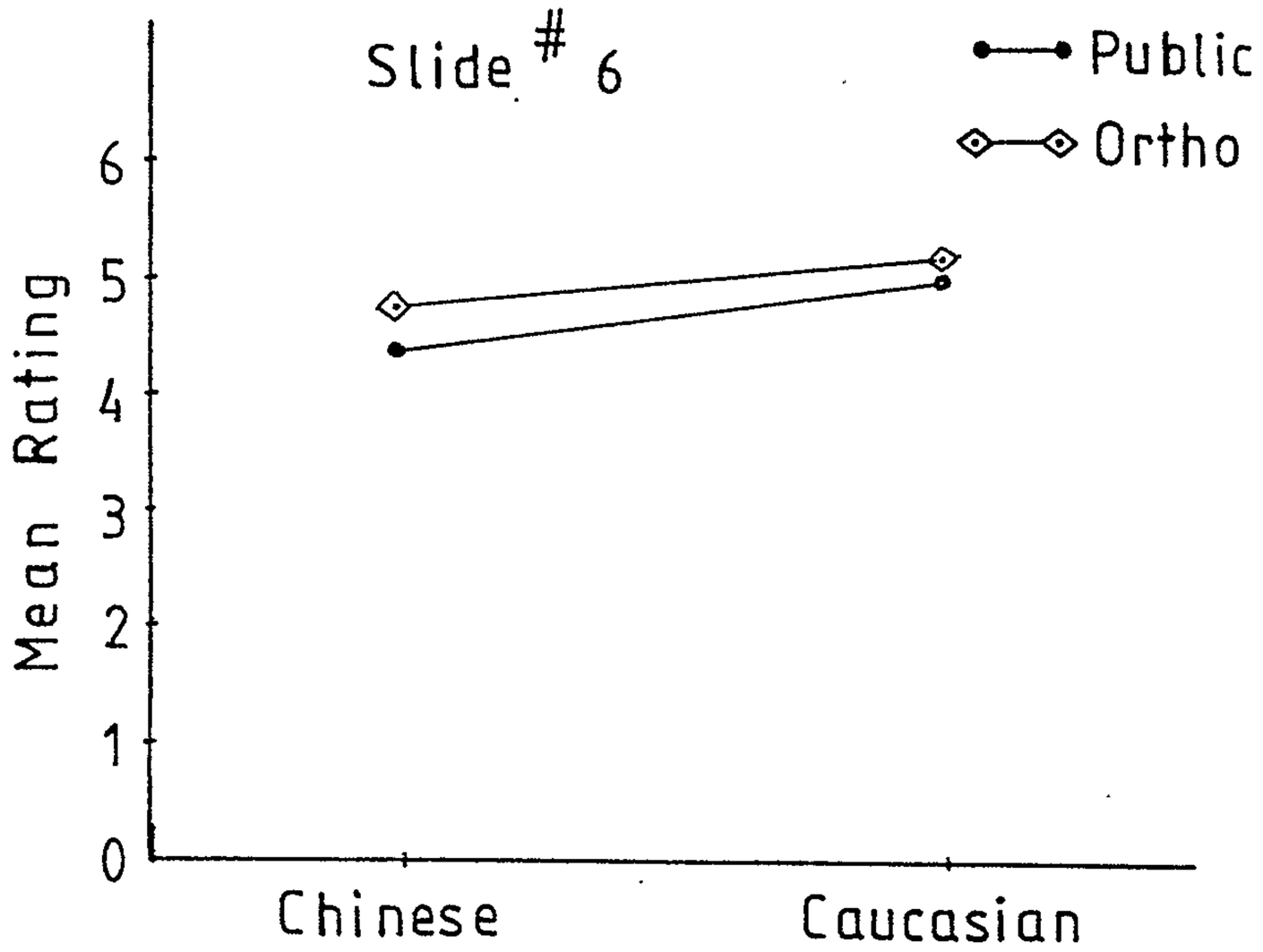


Fig 6.13 Slide #6 shows "race" effect : the 2 Caucasian groups gave higher ratings than the 2 Chinese groups.

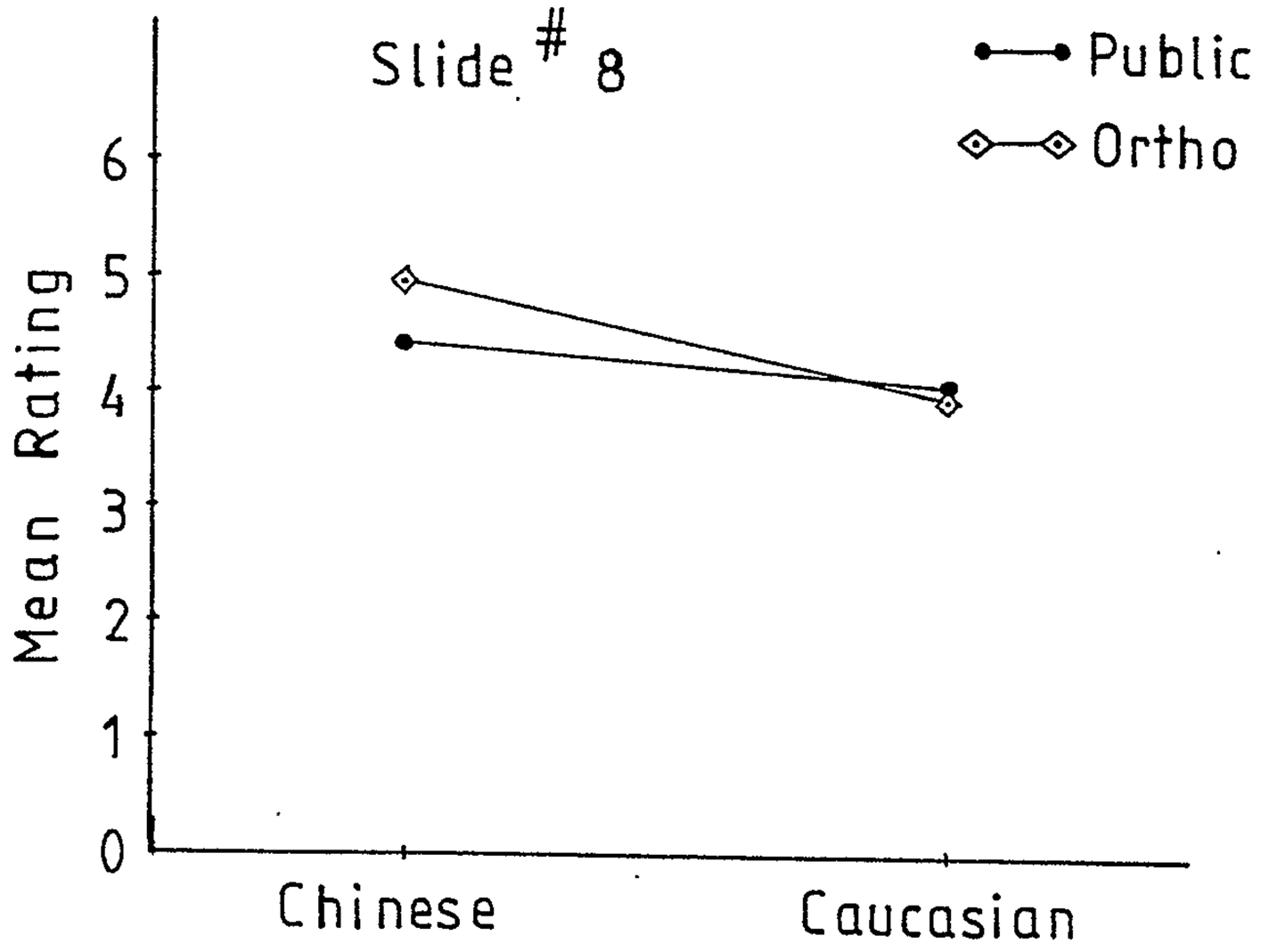


Fig 6.14 Slide #8 shows "race" effect : the Chinese groups gave higher ratings than the Caucasian groups.

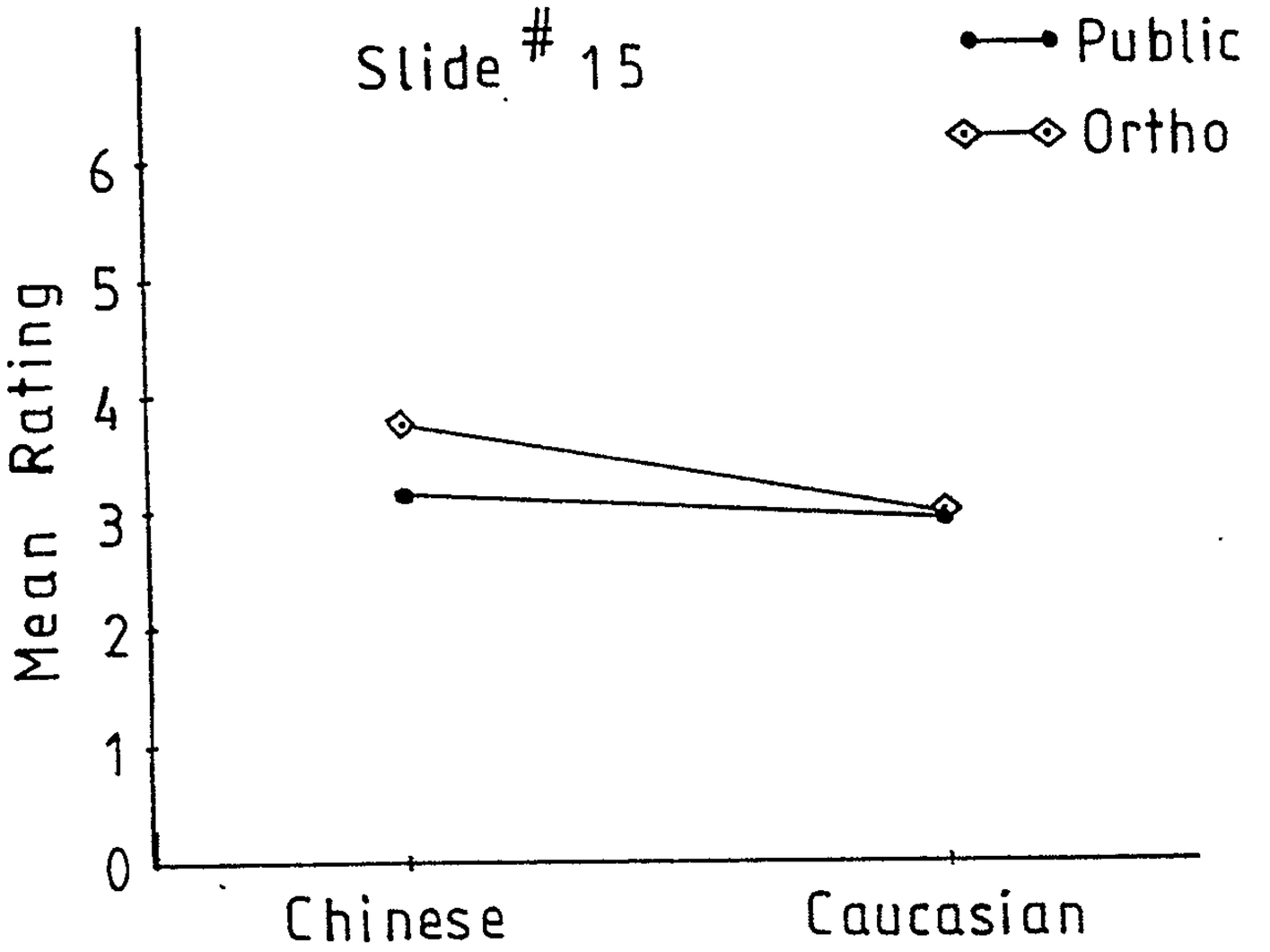


Fig 6.15 Slide #15 shows "race" effect : the Chinese groups gave higher ratings than the Caucasian groups.

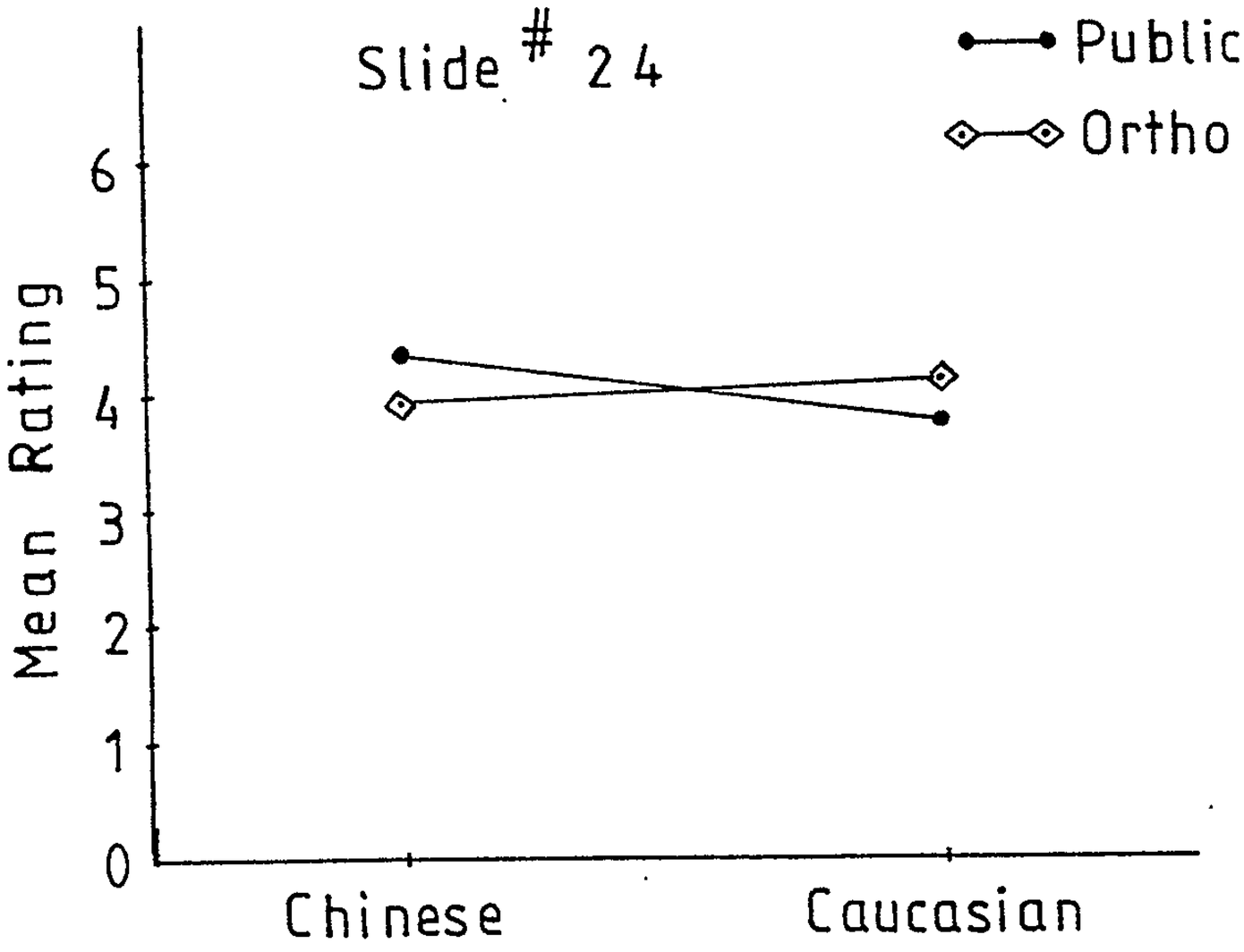


Fig 6.16 Slide #24 shows some "race" effect : the Chinese group on average, gave higher ratings than the Caucasian group.

6.2.3 CORRELATION BETWEEN EACH PROFILE VARIABLE AND THE ATTRACTIVENESS RATINGS

Correlation analyses were performed to determine any significant relationships between the individual profile variable (eg. Na/Sn perp) and the attractiveness ratings for each of the 4 groups of judges. Table 6.8 shows the Pearson's product-moment coefficient of correlation (r) for each individual profile variable with the attractiveness ratings for each group of judges. The formulae for the statistical evaluation have been listed in Section 3.7.

The closer the correlation coefficient (r) approaches either negative 1 or positive 1, the stronger is the association between the two variables.

Table 6.8 Zero order correlation coefficient of profile variables with attractiveness ratings

PROFILE VARIABLES	CHINESE PUBLIC	CAUCASIAN PUBLIC	CHINESE ORTHODONTIST	CAUCASIAN ORTHODONTIST
Profile Assessment :				
1. Na/Sn perp	-0.055	-0.054	0.008	-0.140
2. Pog/Sn perp	-0.098	-0.021	-0.179	-0.070
3. Na-Sn-Pog	-0.192	-0.118	-0.273	-0.199
4. Na-Prn-Pog	-0.300	-0.206	-0.387	-0.261
Nose :				
5. Prn-Na-Pog	0.117	0.085	0.215	0.112
6. Prn/Sn perp	0.260	0.109	0.248	0.113
Nose-Upper Lip :				
7. Cm-Sn-Ls	0.355	0.386	0.469	0.378
Upper Lip :				
8. Ls/Sn perp	-0.549	-0.450	-0.630	-0.476
9. U. lip/E-plane	-0.509	-0.417	-0.471	-0.406
10. U. lip/Sn-Pog	-0.574	-0.503	-0.612	-0.502
11. H-angle	-0.195	-0.184	-0.155	-0.131
12. A'/Sn-U. lip	-0.203	-0.226	-0.263	-0.225
Lower Lip :				
13. Li/Sn perp	-0.721	-0.587	-0.740	-0.625
14. L. lip/E-plane	-0.673	-0.565	-0.553	-0.567
15. L. lip/Sn-Pog	-0.750	-0.647	-0.680	-0.655
16. L. lip/H-line	-0.715	-0.615	-0.582	-0.627
17. B'/L. lip-Pog	-0.362	-0.341	-0.347	-0.366
Vertical Facial Prop. :				
18. Na-Sn : Na-Me	0.421	0.216	0.436	0.302
19. Sn-Stm : Stm-Me	0.333	0.381	0.315	0.420

6.2.4 REGRESSION ANALYSIS BETWEEN EACH PROFILE VARIABLE AND THE ATTRACTIVENESS RATINGS

Regression analysis was performed to determine the relationship between the individual profile variable and the attractiveness ratings for each group of judges. If the correlation was high, then an equation was computed to estimate the degree of attractiveness, based on the measured profile variable (see section 3.7 for the formula of the equation). The profile variables were grouped according to : overall profile assessment, nose, nose to upper lip, upper lip, lower lip, and vertical facial proportions.

NB. * prob < 0.05

** prob < 0.01

*** prob < 0.0005

1. Overall Profile Assessment

Profile variables : Na/Sn perp.

Pog/Sn perp.

Na-Sn-Pog

Na-Prn-Pog

None of these profile variables were statistically significant (prob > 0.05) for the 4 groups of judges and hence they were not considered determinants of attractiveness.

2. Nose

Profile variables : Prn-Na-Pog

Prn/Sn perp.

None of these profile variables were determinants of attractiveness for any of the groups of judges.

3. Nose-Upper lip

Profile variable : Cm-Sn-Ls (nasolabial angle) *

For the Chinese public, the Caucasian public and the Caucasian orthodontists, the nasolabial angle is not a determinant factor for attractiveness.

However, for the Chinese orthodontists :

Degree of attractiveness = - 0.91 + 0.05 x (nasolabial angle)

$R^2 = 0.22$

$F(1, 23) = 6.49$ prob (F) = 0.0180 *

Thus, the Chinese orthodontists find larger nasolabial angles, more attractive in a profile.

4. Upper Lip

Profile variables :
- Ls/Sn perp. **
- Upper lip/E-plane
- Upper lip/Sn-Pog **
- H-angle
- A'/Sn-Upper lip

a) Chinese Public

Degree of attractiveness = 4.92 - 0.29 x (Upper lip/Sn-Pog)

$R^2 = 0.329$

$F(1, 23) = 11.27$ prob F = 0.003 **

The Chinese public perceive a shorter distance from the upper lip to Sn-Pog plane, as more attractive in a profile.

b) Caucasian Public

Degree of attractiveness = 4.75 - 0.24 x (Upper lip to Sn-Pog)

$R^2 = 0.253$

F(1, 23) = 7.78 prob F = 0.01 **

Again, the shorter the distance the upper lip to Sn-Pog plane, the more attractive is the profile to the Caucasian public.

c) Chinese Orthodontists

Degree of attractiveness = 4.79 - 0.28 x (Upper lip/Sn perp)

$R^2 = 0.40$

F(1, 23) = 15.16 prob F = 0.0007 **

The smaller the distance the upper lip to Sn perp., the more attractive is the profile to the Chinese orthodontists.

d) Caucasian Orthodontists

Degree of attractiveness = 5.11 - 0.29 x (Upper lip/Sn-Pog)

$R^2 = 0.252$

F(1, 23) = 7.75 prob F = 0.0106 **

The shorter the distance between the upper lip to Sn-Pog plane, the more attractive is the profile to the Caucasian orthodontists.

5. Lower Lip

Profile variables :	Li/Sn perp.	***
	Lower lip/E-plane	
	Lower lip/Sn-Pog	***
	Lower lip/H-line	

B'/Lower lip-Pog

a) Chinese Public

Degree of attractiveness = 4.23 - 0.20 (L. Lip/Sn-Pog) - 0.13 (Li/Sn perp)

R^2 = 0.69

F(2,22) = 24.37 prob (F) = 0.0000 ***

The smaller the distances between the lower lip to Sn-Pog plane, and the lower lip to Sn perpendicular, the more attractive is the profile perceived by the Chinese public.

b) Caucasian Public

Degree of attractiveness = 4.53 - 0.24 x (Lower lip/Sn Pog)

R^2 = 0.42

F(1, 23) = 16.59 prob (F) = 0.0005 ***

The smaller the distance between the lower lip to Sn-Pog plane, the more attractive is the profile to the Caucasian public.

c) Chinese Orthodontists

Deg. of attractiveness = 4.54 - 0.17 (L. lip/Sn perp) - 0.16 (L. lip/Sn-Pog)

R^2 = 0.64

F(2, 22) = 19.97 prob (F) = 0.000 ***

The smaller the distances between the lower lip to Sn-Pog plane, and the lower lip to Sn perpendicular, the more attractive is the profile to the Chinese orthodontists.

d) Caucasian Orthodontists

Degree of attractiveness = 4.86 - 0.30 x (Lower lip/Sn-Pog)

R^2 = 0.43

F(1, 23) = 19.97 prob(F) = 0.0004 ***

The shorter the distance between lower lip to Sn-Pog plane, the more attractive is the profile to the Caucasian orthodontists.

6. Vertical Facial Proportions

Profile variables : Na-Sn : Na-Me' *

Sn-Stm : Stm-Me' *

a) Chinese Public

Degree of attractiveness = - 3.89 + 0.18 x (Na-Sn : Na-Me')

R^2 = 0.18

F(1, 23) = 4.96 prob (F) = 0.04 *

The larger the midface height to the total face height ratio, the more attractive is the profile to Chinese public.

b) Caucasian Public

The degree of attractiveness is not dependent on any of the above variables.

c) Chinese Orthodontists

Degree of attractiveness = - 4.22 + 0.19 x (Na-Sn : Na-Me')

R^2 = 0.19

F(1, 23) = 5.40 prob(F) = 0.0293 *

The larger the midface height to the total face height ratio, the more attractive is the profile to the Chinese orthodontists.

d) Caucasian Orthodontists

Degree of attractiveness = - 1.46 + 0.11 x (Sn-Stm : Stm-Me')

R^2 = 0.18

F(1, 23) = 4.92 prob(F) = 0.0367 *

The larger the upper lip to lower lip ratio, the more attractive is the profile to the Caucasian orthodontists.

6.2.5 COMPARISON OF PROFILE VARIABLES FOR THE 6 MOST AND LEAST ATTRACTIVE PROFILES

Profile variables that were statistically significant or showed a high correlation to the attractiveness ratings have been averaged and listed in Table 6.9. These values were computed for the first to sixth "most attractive" profiles and the first to sixth "least attractive" profiles, as chosen by the 4 groups of judges.

When the values for the 6 "most attractive" profile variables were averaged out, they appeared to be fairly similar for all groups of judges. This will be discussed in the next chapter.

Table 6.9 Mean values of significant profile variables for the first to sixth "most attractive", and the first to sixth "least attractive" profiles.

	Cm-Sn-Ls	Ls/Sn perp	UL/E. Pl	UL/Sn-Pg	Li/Sn perp	LL/E. Pl	LL/Sn-Pg	NaSn:NaMe	SnSt:StMe
1 - Most Attractive									
Chinese Public	97.3	3.4	0.7	6.2	-2.5	-0.9	3.6	41.4	50.3
Caucasian Public	104.3	2.5	-1.3	4.2	-0.5	-2.0	2.5	41.2	46.1
Chinese Orthodontist	122.8	-0.6	-0.6	3.7	-5.5	-0.4	3.5	47.3	44.0
Caucasian Orthodontist	111.2	1.8	-1.0	4.7	-1.0	1.4	5.4	39.9	52.3
1 - Least Attractive									
Chinese Public	97.2	2.5	4.2	8.8	-0.5	7.8	11.0	44.8	53.6
Caucasian Public	97.2	2.5	4.2	8.8	-0.5	7.8	11.0	44.8	53.6
Chinese Orthodontist	93.2	8.0	2.4	8.5	6.0	2.9	7.6	38.3	41.9
Caucasian Orthodontist	97.2	2.5	4.2	8.8	-0.5	7.8	11.0	44.8	53.6
2 - Most Attractive									
Chinese Public	102.7	2.0	-0.4	4.8	-3.4	-1.4	2.8	43.4	46.5
Caucasian Public	107.8	2.2	-1.1	4.4	-0.8	-0.3	4.0	40.6	49.2
Chinese Orthodontist	117	0.6	-0.8	4.2	-3.3	0.5	4.5	43.6	48.2
Caucasian Orthodontist	107.8	2.2	-1.1	4.4	-0.8	-0.3	4.0	40.6	49.2
2 - Least Attractive									
Chinese Public	95.2	5.3	3.3	8.7	2.8	5.4	9.3	41.5	47.8
Caucasian Public	100.1	3.2	1.3	6.7	2.3	4.4	8.6	42.4	47.3
Chinese Orthodontist	95.2	5.3	3.3	8.7	2.8	5.4	9.3	41.5	47.8
Caucasian Orthodontist	95.2	5.3	3.3	8.7	2.8	5.4	9.3	41.5	47.8

Table 6.9 Mean values of significant profile variables for the first to sixth "most attractive", and the first to sixth "least attractive" profiles. (cont.)

	Cm-Sn-Ls	Ls/Sn perp	UL/E. Pl	UL/Sn-Pg	Li/Sn perp	LL/E. Pl	LL/Sn-Pg	NaSn:NaMe	SnSt:StMe
3 - Most Attractive									
Chinese Public	101.6	1.8	-1.7	4.2	-2.7	-1.8	2.6	42.6	47.2
Caucasian Public	109.5	2.0	-1.1	4.6	-0.9	0.1	4.3	40.4	50.0
Chinese Orthodontist	114.0	0.6	-1.0	3.9	-3.6	-0.3	3.6	44.2	46.3
Caucasian Orthodontist	102.6	2.2	-1.5	4.6	-1.6	-0.7	3.7	40.8	50.4
3 - Least Attractive									
Chinese Public	97.8	4.8	1.7	7.3	3.5	3.9	8.2	41.0	45.5
Caucasian Public	97.8	4.8	1.7	7.3	3.5	3.9	8.2	41.0	45.5
Chinese Orthodontist	94.5	6.2	3.0	8.6	3.8	4.5	8.7	40.5	45.8
Caucasian Orthodontist	97.8	4.8	1.7	7.3	3.5	3.9	8.2	41.0	45.5
4 - Most Attractive									
Chinese Public	98.4	2.4	-1.7	4.6	-2.4	-2.3	2.5	42.6	47.3
Caucasian Public	106.5	2.3	-0.6	5.0	-1.3	-0.1	4.2	40.7	50.1
Chinese Orthodontist	110.3	0.8	-1.9	3.7	-3.0	-0.9	3.3	43.4	46.9
Caucasian Orthodontist	106.5	2.3	-0.6	5.0	-1.3	-0.1	4.2	40.7	50.1
4 - Least Attractive									
Chinese Public	96.7	5.6	1.9	7.6	4.1	3.7	8.1	40.3	44.6
Caucasian Public	96.7	5.6	1.9	7.6	4.1	3.7	8.1	40.3	44.6
Chinese Orthodontist	96.7	5.6	1.9	7.6	4.1	3.7	8.1	40.3	44.6
Caucasian Orthodontist	96.7	5.6	1.9	7.6	4.1	3.7	8.1	40.3	44.6

Table 6.9 Mean values of significant profile variables for the first to sixth "most attractive", and the first to sixth "least attractive" profiles. (cont.)

	Cm-Sn-Ls	Ls/Sn perp	UL/E. P1	UL/Sn-Pg	Li/Sn perp	LL/E. P1	LL/Sn-Pg	NaSn:NaMe	SnSt:StMe
5 - Most Attractive									
Chinese Public	99.7	2.3	-2.0	4.4	-2.3	-2.5	2.3	42.8	47.6
Caucasian Public	106.1	2.3	-1.1	4.7	-1.4	-0.8	3.6	41.2	49.8
Chinese Orthodontist	110.9	0.9	-1.7	3.9	-2.7	-0.5	3.6	42.8	47.9
Caucasian Orthodontist	106.1	2.3	-1.1	4.7	-1.4	-0.8	3.6	41.2	49.8
5 - Least Attractive									
Chinese Public	98.1	5.4	1.4	7.2	4.1	3.2	7.7	39.9	44.9
Caucasian Public	95.4	5.0	1.1	6.9	3.6	2.9	7.4	41.0	44.2
Chinese Orthodontist	98.1	5.4	1.4	7.2	4.1	3.2	7.7	39.9	44.9
Caucasian Orthodontist	98.1	5.4	1.4	7.2	4.1	3.2	7.7	39.9	44.9
6 - Most Attractive									
Chinese Public	100.8	2.3	-2.4	4.2	-2.2	-2.7	2.2	43.1	47.6
Caucasian Public	103.3	2.6	-1.2	4.9	-1.4	-1.2	3.4	41.5	49.5
Chinese Orthodontist	109.8	1.2	-1.8	3.9	-2.4	-0.9	3.4	42.7	47.8
Caucasian Orthodontist	106.5	2.0	-1.2	4.4	-1.9	-0.9	3.4	41.9	48.6
6 - Least Attractive									
Chinese Public	96.8	4.9	0.8	6.7	3.7	2.7	7.3	40.5	44.6
Caucasian Public	96.8	4.9	0.8	6.7	3.7	2.7	7.3	40.5	44.6
Chinese Orthodontist	95.8	5.7	1.6	7.5	3.7	2.8	7.4	40.0	45.8
Caucasian Orthodontist	96.8	4.9	0.8	6.7	3.7	2.7	7.3	40.5	44.6

6.2.6 COMPOSITE TRACINGS OF THE 6 MOST ATTRACTIVE PROFILES

The 6 most attractive profiles, as chosen by each of the 4 groups of judges, were translated to a composite profile tracing (Fig 6.17 to Fig 6.20). The profile tracings were reduced or enlarged on a photostating machine to produce a nasion to menton measurement of 113 mm (an averaged measurement). A line of best fit was then constructed by superimposing the 6 profiles on two reference landmarks :

1. Subnasale perpendicular to the true horizontal, using the 2 intersecting planes, the true horizontal and its perpendicular through subnasale;
2. Nasion perpendicular to the true horizontal, using the 2 intersecting planes, the true horizontal and its perpendicular through nasion.

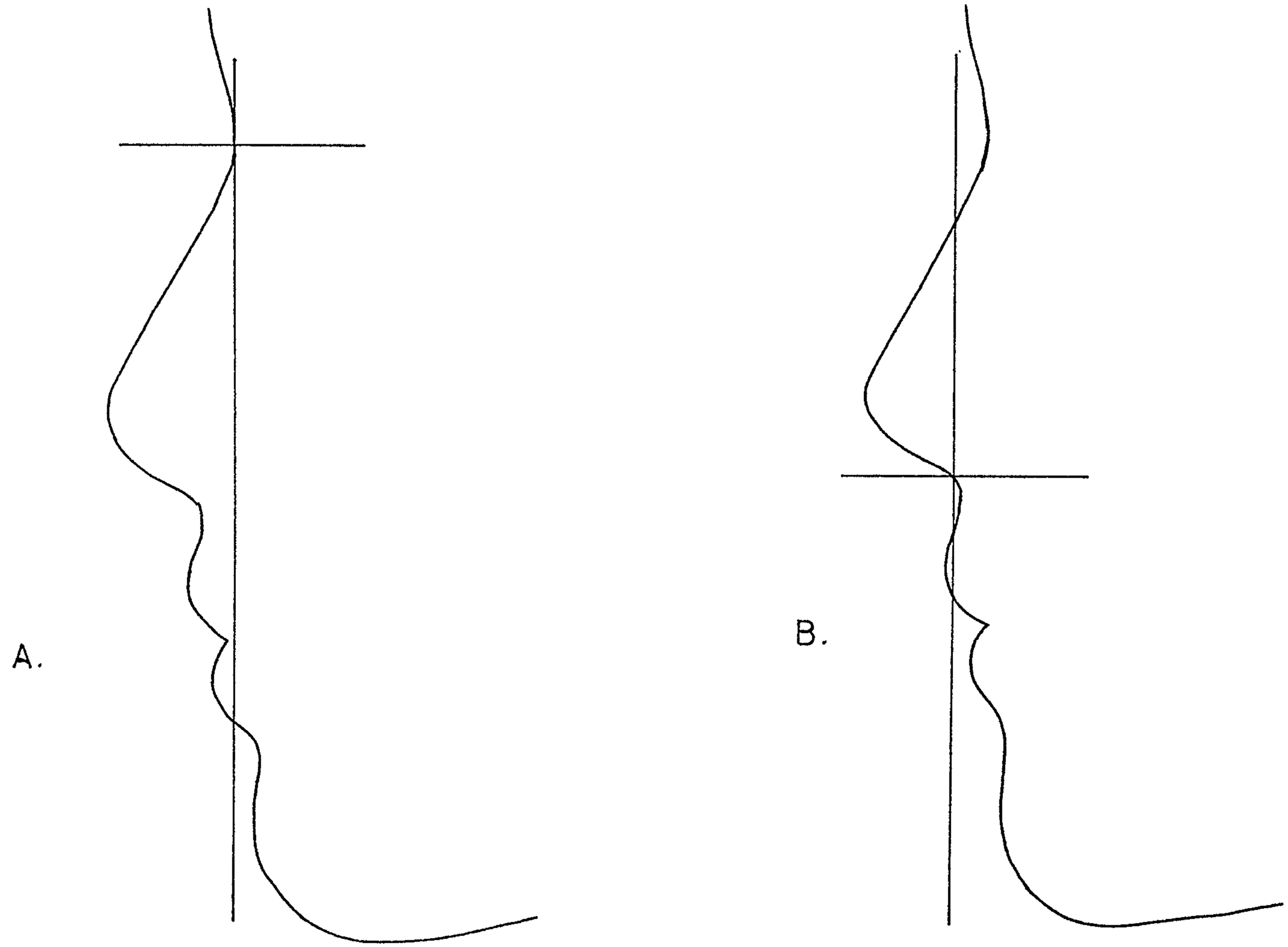
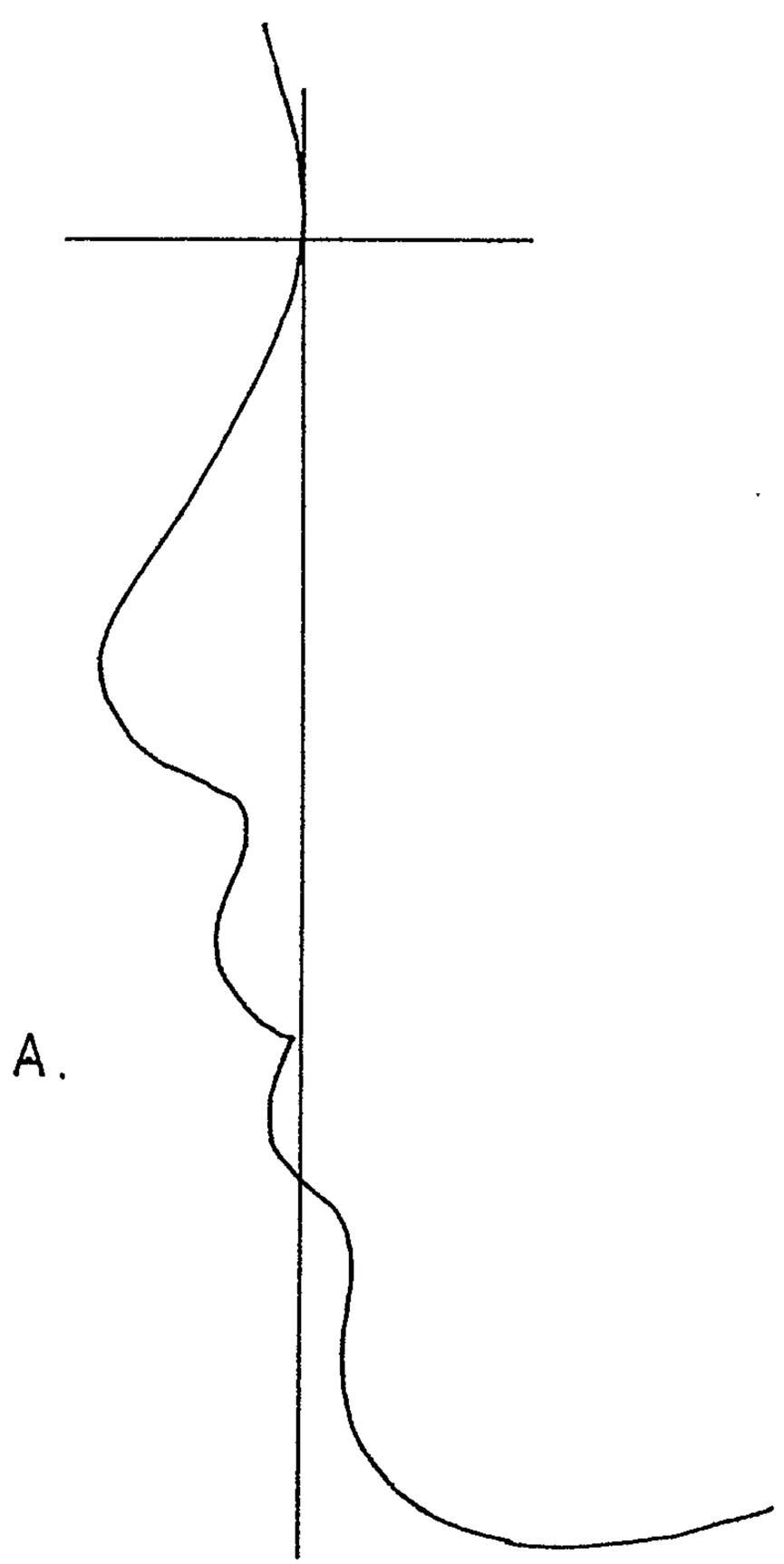


Fig 6.17 Composite tracing of the 6 best profiles chosen by the Chinese public group, superimposed on **A.** soft tissue nasion perpendicular; **B.** subnasale perpendicular.



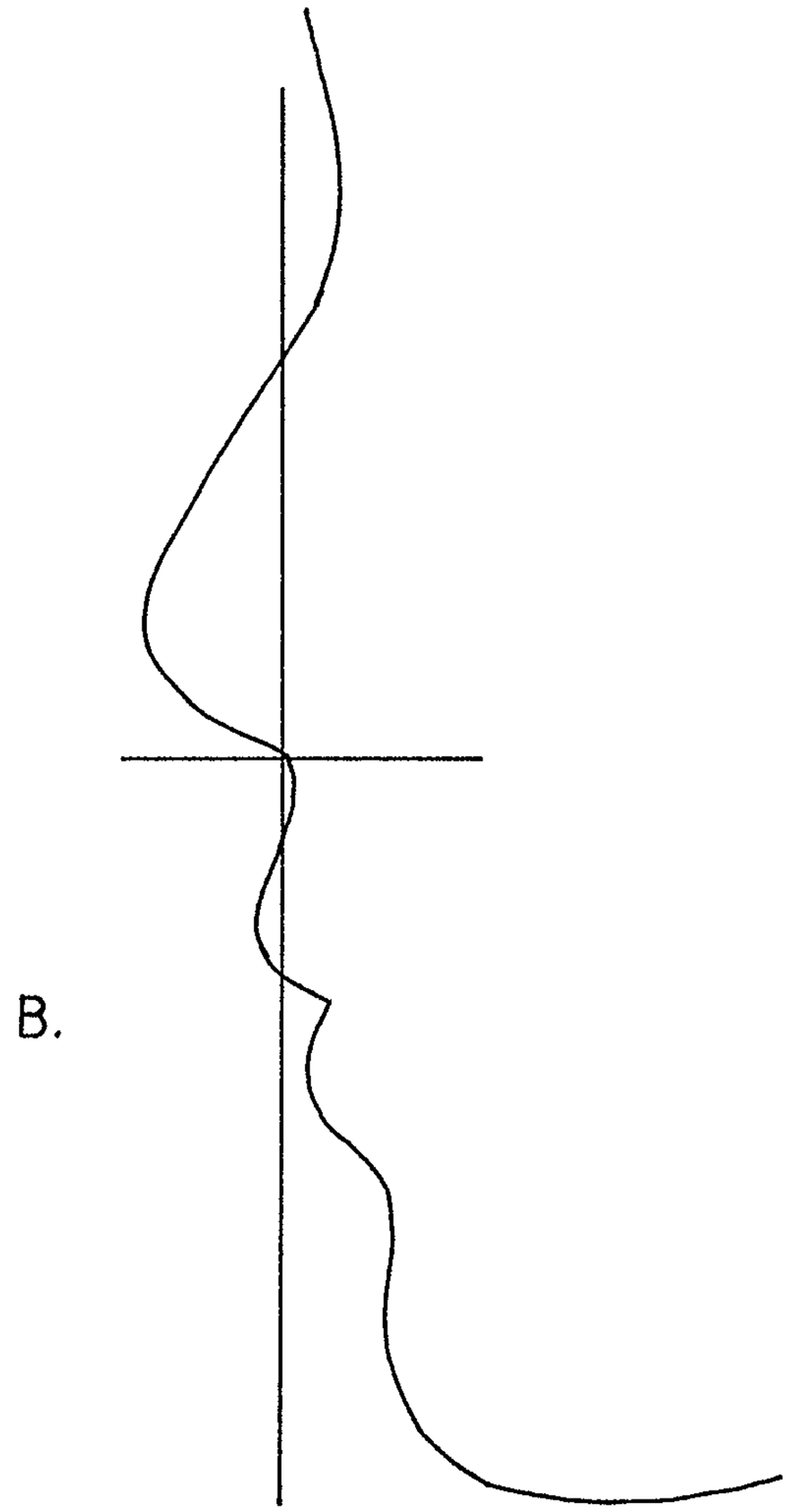


Fig 6.18 Composite tracing of the 6 best profiles chosen by the Caucasian public group, superimposed on **A.** soft tissue nasion perpendicular; **B.** subnasale perpendicular.

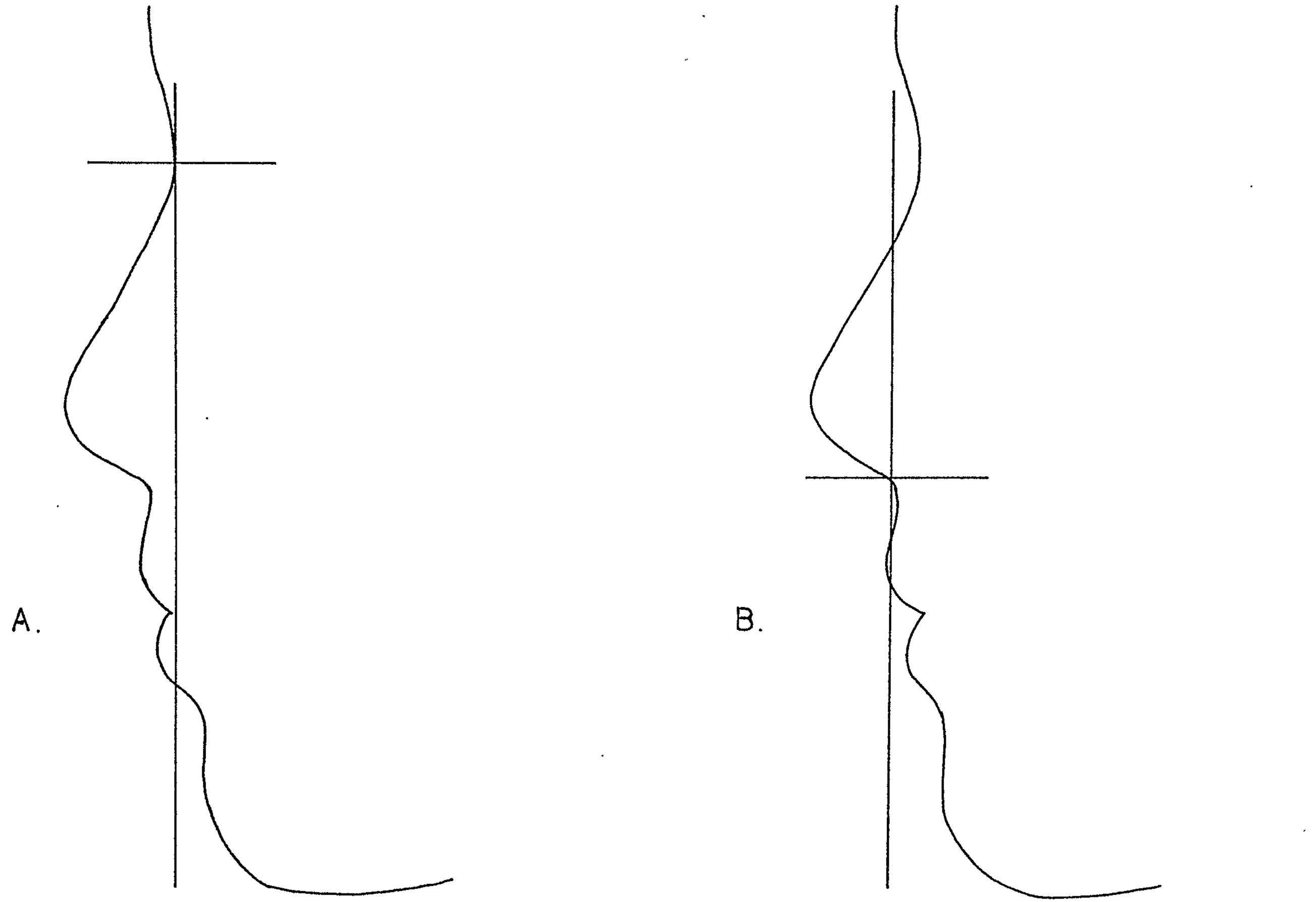
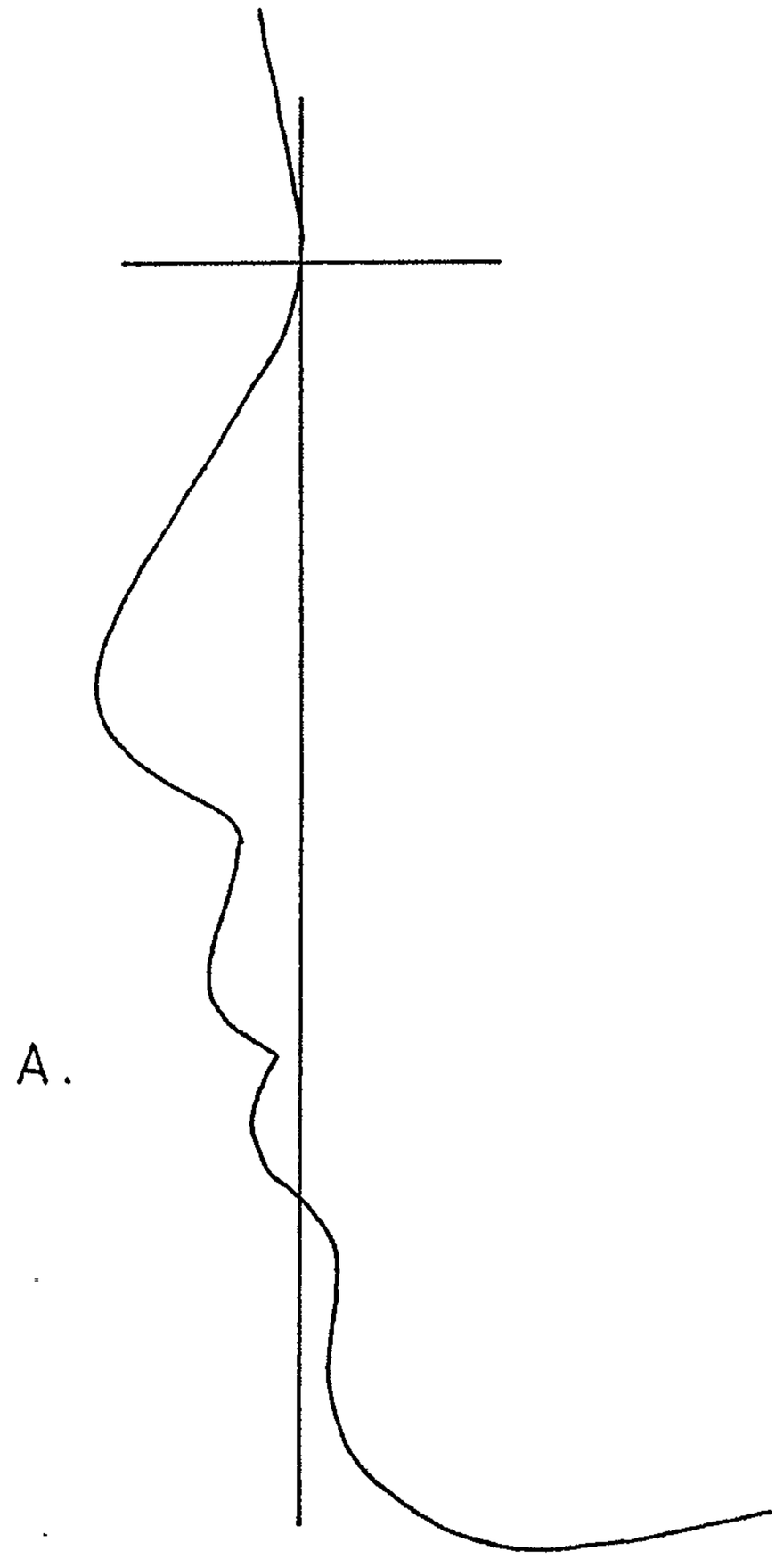


Fig 6.19 Composite tracing of the 6 best profiles chosen by the Chinese orthodontist group, superimposed on **A.** soft tissue nasion perpendicular; **B.** subnasale perpendicular.



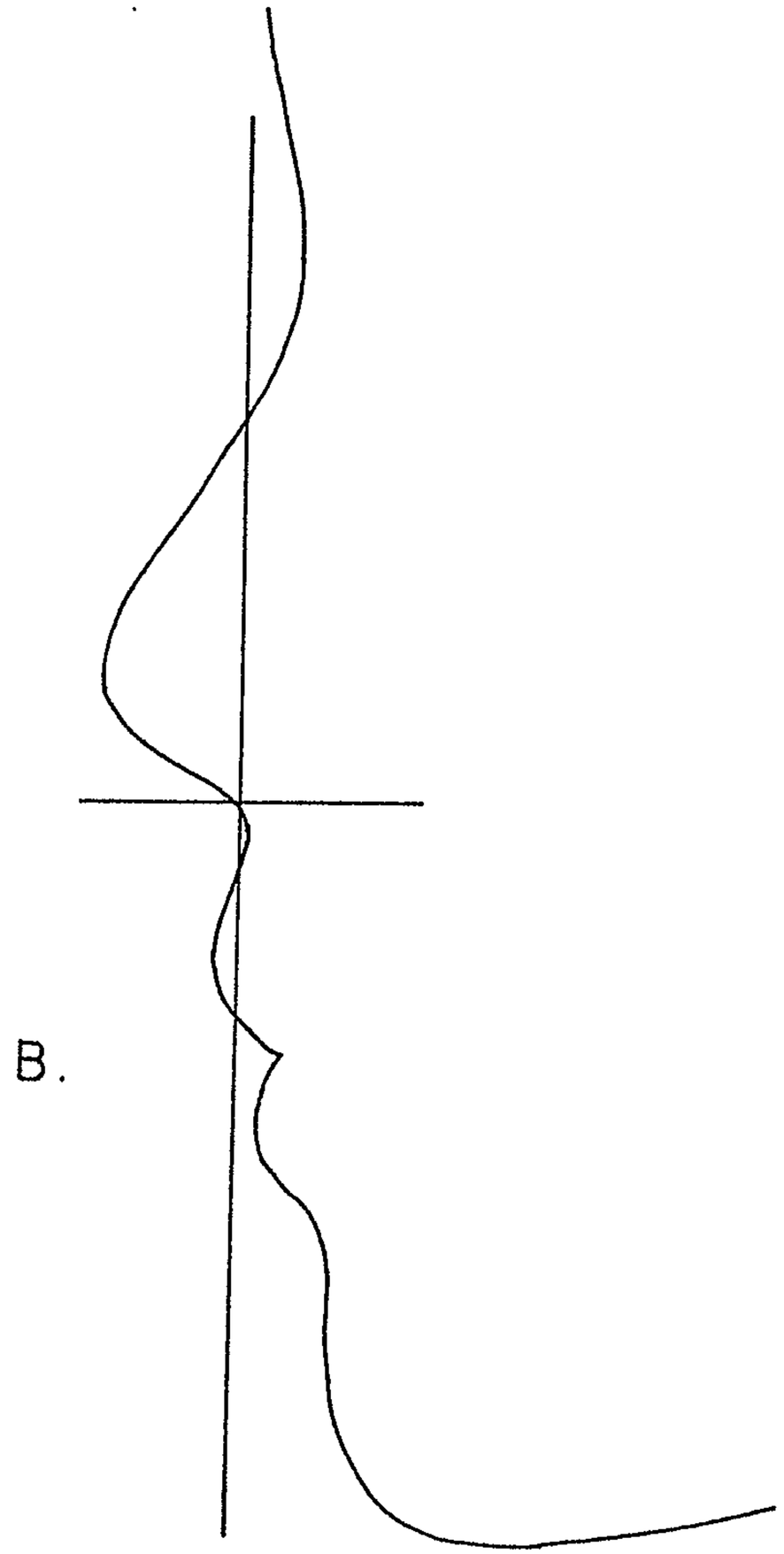


Fig 6.20 Composite tracing of the 6 best profiles chosen by the Caucasian orthodontist group, superimposed on **A.** soft tissue nasion perpendicular; **B.** subnasale perpendicular.

CHAPTER 7 : DISCUSSION

7.1 SELECTION OF SUBJECTS

7.1.1 SUBJECTS FOR THE PHOTOGRAPHS/SLIDES

The subjects were all of Chinese origin, selected from undergraduate dental students, patients at the United Dental Hospital, or the Chinese general public. Although, the subjects were born in different countries eg. China, Malaysia, Hong Kong, Singapore, Taiwan, Vietnam, Cambodia and Australia, their parents or grandparents were born in China or Hong Kong. Most subjects classified themselves not by their country of origin, but according to dialect groups originating from the South Eastern provinces of China : Cantonese, Hokkien, Teochew and Hakka.

The subjects were not deliberately recruited to represent either a cross-section of the total Chinese population or one particular subgroup (eg. Cantonese people). Nevertheless, a sufficiently wide variety of different Chinese profiles was demonstrated among the volunteers. A past history of orthodontic treatment was not a criterion for exclusion from the study.

7.1.2 SUBJECTS FOR JUDGING THE PROFILES

A random, cross-sectional selection of Chinese and Caucasian "judges" to rate the profiles was required, thus making extrapolations to

the general Chinese and Caucasian population possible. Volunteers ranging widely in terms of age, sex, occupation and education were recruited from various religious and social groups.

a) The Chinese public sample were of Chinese descent.

b) The Caucasian public sample were of European origin.

However, because of the limited numbers available, the selection of judges for the two orthodontist groups was biased and does not represent a random sample of the population. There was a larger proportion of graduate orthodontic students to registered orthodontists (approximately 54%) for the Chinese orthodontist group, as compared to the Caucasian orthodontist group (approximately 18%). Due to the paucity of numbers, two subjects who were only partly of Chinese descent were included in the Chinese orthodontic group. One was from Malaysia and the other from Thailand. and both these countries have large Chinese populations.

7.2 ERRORS OF THE METHOD

7.2.1 RELIABILITY OF MEASUREMENTS

Houston (1983) indicated that the sources of error in measurement studies may be systematic or random. He believed that soft tissue studies are prone to random errors due to the way the subject poses (ie. the posture of the lips and other facial muscular activities at the time of taking the photograph), and the difficulty in some landmark identification. Random errors are reduced if measurements are replicated and averaged. Houston suggested that the tracings should also be replicated and not just the measurements of tracings, because the

greatest errors may arise in point identification rather than in measurement. Systematic errors can be partly controlled by randomising the order in which the records are traced and measured to avoid bias, and by using a single observer to perform the tracings and measurements.

Baumrind and Frantz (1971) found three sources of measurement errors : (1) errors of projection, (2) errors of landmark location and (3) mechanical errors in drawing lines between points on tracings and in measuring with ruler or protractor.

1. Errors of projection

Baumrind and Frantz indicated that the x-ray source caused distorted enlargements with the head films. This error does not apply in this study. The photographic negatives were enlarged to live dimensions (1:1) and measured using the 5 cm ruler scale. The enlargement factor was calculated to exclude any discrepancies. Angular measurements were not affected by photograph enlargement, and remained constant (Hautvast 1971).

2. Errors of landmark location

Most references refer to the cephalometric landmark location, which has limited relevance to the measurement of photographs. Gravely and Benzies (1974) attributed the lack of clarity of cephalometric landmarks to superimposition of structures, blurring of the image brought about by movement during exposure, lack of film contrast and emulsion grain. These problems were not applicable here because the midsagittal landmarks used were easily located on the external surface of the profile on the photograph. Richardson (1966), Baumrind and

Frantz (1971 b) and Hillesund et al (1978) found that some cephalometric landmarks can be located with greater degree of reproducibility than others. Some landmarks are more reproducible vertically than horizontally, and vice versa. These findings were considered when selecting the points, planes, or lines for this study. For example, soft tissue nasion was used instead of soft tissue glabella to mark the upper limit of the face as it is more reproducible (Powell and Humphreys 1984).

Burstone (1958), Wisth and Boe (1975) and Hillesund et al (1978) reported that variation in facial expressions can lead to difficulty locating the landmarks. Standardisation of facial expression and lip posture is important to minimize this effect. However, because the present study is basically descriptive, reproducibility of the lip position is not as critical as, for example, in the evaluation of changes following treatment. Here, a natural relaxed lip position with the lips in light contact (the normal lip posture during the day) is preferred as it is a truer reflection of the soft tissue facial features of that individual and this is how the public normally sees a person (refer to section 3.3).

Richardson (1966) also found that intraobserver variability is less than interobserver variability. A single observer can reproduce the measurements with an acceptable degree of accuracy, if all measurement of results were carried out by the same observer and the observer did not vary in measuring technique. Hence, in the present study, all tracing and landmark location were performed by the author to maximise measurement reproducibility and minimise systematic errors.

3. Mechanical errors in drawing lines between points on tracings and in measuring with ruler or protractor.

Gravely and Benzies (1974) found that measurement error, associated with thickness of pencil lines and perceptive limits of the human eye, contributed to tracing errors. Baumrind and Frantz (1971) suggested that errors from this source can be largely eliminated by using machines to compute linear and angular relationships algebraically from landmark coordinates.

Digitising

According to Bondevik et al (1981), it is possible to keep the errors in tracing, manual measurement and recording at a low level by exercising great care. Nevertheless, the risk of introducing errors during these procedures will always be present.

By using a digitiser to calculate angular and linear measurements, this source of error is largely eliminated. This would leave landmark identification and tracing as the major sources of measurement errors.

Houston (1982) suggested that direct digitisation of radiographs (or photographs) would be less time-consuming, and the elimination of tracing would remove one potential source of error. However, he noted that many authors who advocated direct digitisation, still digitised tracings, perhaps because the accuracy of direct digitisation might be poor where landmark identification depended on an irregular outline. The cursor used for digitisation obscured the structures peripheral to the landmarks of interest and sometimes the cross hairs of the cursor were not easy to see against the darker parts of the radiographic (or

photographic) image. These problems did not arise with the digitisation of tracings.

In the present study, to assess the extent of the total errors,10 photographs were randomly selected, retraced, landmark points marked again and redigitised. The measurements were recorded for the 19 soft tissue profile variables. This was performed again one week later, to assess reproducibility of landmark identification, and to avoid memorization as outlined by Houston (1982) and Sandler (1988). To test measurement reproducibility, the paired Students t-test was used. The mean difference, standard error of the mean difference, standard deviation and the t-test value of each profile variable in the 10 photographs are shown in Table 6.1.

From the probability computed, only the upper lip to E-plane measurement differed significantly ($p = 0.003$). The upper lip to Sn-Pog measurement is close to being significant ($p = 0.053$).

The upper lip to E-plane measurement is the minimum perpendicular distance between the upper lip and tangent of the nose and the chin. As mentioned earlier, certain points are more difficult to reproduce accurately. Wisth and Boe (1975) and Hillesund (1978) found that the vertical position of a point situated on a wide curvature difficult to define. In addition, the soft tissue contours of the upper lip, nose and chin were not included in the digitising procedure. Since only a few points were digitised from this difficult area, errors were more likely to occur.

Thus, except for the upper lip to E-plane measurement, statistical analyses show that the reproducibility of the measurements used in this method is very reliable,

7.2.2 RATER'S RELIABILITY

To check for reliability and consistency of the judges, 3 profile slides (14% of the profile sample) were duplicated and shown with the other slides, without forewarning the judges.

The results for Pearson product-moment correlation (Table 6.2) show a moderate to high correlation between the three sets of slides. The Chinese public group was less consistent in its ratings than the Caucasian orthodontist group for slide 3 with slide 19, and slide 4 with slide 17; but, both these groups had similar correlation coefficients for slide 7 with slide 21. The Chinese public group was again less consistent than the Chinese orthodontist group for rating slide 4 with slide 17, and slide 7 with slide 21; however, both these groups had similar correlation coefficients for slide 3 with slide 19.

Cross-tabulation of each pair of slides, with Kendall's tau b and percentage of agreement (Table 6.3 a-c), demonstrated a moderate percentage of agreement, ranging from 45.3% to 60.9%. Slide 4 with slide 17, showed the highest percentage of agreement, and were consistently rated by the 4 groups of judges as one of the least attractive profiles. However, the results for Kendall's tau-b and percentage of agreement for both, slide 3 with slide 19, and slide 7 with slide 21 were only moderate (46.8% and 45.3% respectively).

The judges tended to rate the profiles more favourably on the second observation, except for the Caucasian public group, where slides 4 and 17 had the same mean ratings (Tables 6.3 a-c and Table 6.5).

7.3 PROFILE PREFERENCE STUDY

The summated or Likert-type scale (Likert 1932; Guilford 1954; Edwards 1957; Kidder and Judd 1986; Mok 1990) is the most widely used attitude scale in the social sciences today, and has been applied to this study. Similar to both Thurstone (or differential), and the Guttman (or cumulative) scales, a Likert scale consists of a set of items with which the judge either agrees or disagrees. However, there are significant differences. Likert scales only use monotone items, ie. items that are definitely favourable or unfavourable, and not items that reflect a middle or uncertain position on the issue. In the present study, a 7-point Likert scale is used, where the attractiveness of different profiles is assessed on a continuous scale, ranging from very unattractive (1) to very attractive (7). This continuous scale has equal-unit intervals for ease of construction and statistical analyses. Almost all the common statistical procedures may be applied to interval-scale values, eg. finding the mean of ratings, standard deviation, Pearson product-moment coefficient. Thus, the mean rating for each group of judges is determined by summating the rating scores, and dividing by the number of judges.

7.3.1 PREFERENCE RATINGS FOR THE CHINESE FEMALE PROFILES

Table 6.5 shows that all 4 groups of judges differed in their choices of the most attractive profile. The two groups of orthodontists gave higher mean rating scores for the profile they perceived as most attractive than the two general public groups. The judges correlated better in the selection of the least attractive profile. Three groups of judges : the Chinese public, the Caucasian public and the Caucasian orthodontist groups, nominated slide 14 as the least attractive. The two Caucasian groups of judges gave marginally lower mean rating scores for the least attractive slide, than the two Chinese groups of judges. Table 6.7 shows that, the Chinese orthodontist group gave higher average ratings than the Chinese public group (except for slide 24).

In Table 6.6, when groups of the 6 and 7 most attractive profiles (excluding the slides duplicated) selected by the 4 groups of judges were compared, the percentage of agreement in profile preferences improved. The percentage of agreement was highest between the Caucasian orthodontists and the Caucasian public group; and lowest between the Chinese public group and the 2 orthodontist groups.

In contrast, there was a 100% agreement among all judges for the 6 least attractive profiles (excluding the duplicate slides). The Caucasian orthodontists ranked the 10 least attractive profiles identically to the Chinese public. Thus, the two orthodontist groups (particularly, the Caucasian orthodontist group), correlate closely with the Chinese public in identifying unfavourable Chinese profiles.

7.3.2 CORRELATION AND REGRESSION ANALYSES BETWEEN THE PROFILE VARIABLES AND THE ATTRACTIVENESS RATINGS

To determine if the profile variables used in this study were reliable soft tissue profile indicators of attractiveness for the Chinese female, correlation and regression analyses were performed. Referring to the results in Section 6.2.4, the following 7 soft tissue profile variables were found to be statistically significant :

i. Nasolabial angle

As noted in Section 6.2.4, the nasolabial angle is statistically significant only for the Chinese orthodontist group as an indicator of attractiveness (probability of F = 0.0180 *). The Chinese orthodontist group prefers a more obtuse nasolabial angle (Table 6.9). It is interesting to note that the Chinese public group prefer a more acute nasolabial angle than the other 3 groups of judges.

ii. Upper lip (Ls/Sn perp; upper lip/Sn-Pog)

For three groups of judges (Caucasian public, Caucasian orthodontists and particularly the Chinese public), the upper lip to Sn-Pog plane measurement is a significant indicator of attractiveness. Hence, the less protrusive the upper lip is from the Sn-Pog plane, the more attractive the profile is rated. This profile variable explains about 32.9%, 25.3% and 25.2% of the variance of attractiveness in the Chinese public, the Caucasian public and the Caucasian orthodontist groups respectively. The correlation coefficients between the upper lip to Sn-Pog plane measurement and the attractiveness rating for the Chinese public, the Caucasian public, the Chinese orthodontist and Caucasian orthodontist groups are -0.574, -0.503, -0.612, -0.502 respectively. Note that despite

the Chinese orthodontist group showing the highest correlation coefficient, the regression analysis of the upper lip to Sn-Pog plane variable does not explain the variance of attractiveness for this group.

For the Chinese orthodontist group, the labrale superius to subnasale perpendicular measurement (Ls/Sn perp) is a more significant indicator, explaining 40.0% of the variance of attractiveness. This profile variable is a strong determinant of attractiveness for this group. The correlation coefficients between the labrale superius to subnasale perpendicular measurement and the attractiveness rating for the Chinese public, the Caucasian public, the Chinese orthodontist and the Caucasian orthodontist groups are -0.549, -0.450, -0.630, -0.476 respectively.

iii. Lower lip (Li/Sn perp; lower lip/Sn-Pog)

For all groups of judges, the lower lip to Sn-Pog plane measurement is a very significant indicator of attractiveness. Thus, the less protrusive the lower lip is from Sn-Pog plane, the more attractive the profile is rated.

For both Chinese groups, the labrale inferius to subnasale perpendicular measurement is also a significant indicator of attractiveness. In fact, for both the Chinese public and the Chinese orthodontist groups, the lower lip to Sn perpendicular measurement and the lower lip to Sn-Pog plane measurement together explain 69% and 64% respectively of the variance of attractiveness and are extremely significant.

For the Chinese public, F (2,22) = 24.37 prob (F) = 0.0000 ***

For the Chinese orthodontist, F (2,22) = 19.97 prob (F) = 0.0000 ***

For the Chinese public,

r (Li/Sn perp, attractiveness) = -0.721

r (L. lip/Sn-Pog plane, attractiveness) = -0.750

For the Caucasian public,

r (Li/Sn perp, attractiveness) = -0.587

r (L. lip/Sn-Pog plane, attractiveness) = -0.647

For the Chinese orthodontist,

r (Li/Sn perp, attractiveness) = -0.740

r (L. lip/Sn-Pog plane, attractiveness) = -0.680

For the Caucasian orthodontist,

r (Li/Sn perp, attractiveness) = -0.625

r (L. lip/Sn-Pog plane, attractiveness) = -0.655

Correlation coefficients of the lower lip to E-plane is fairly high for all 4 groups of judges, especially the Chinese public group. However, when the regression analysis is done for the profile variables associated with the lower lip, Li/Sn perpendicular and lower lip/Sn-Pog measurements are more powerful indicators of attractiveness.

iv. Vertical Facial Proportions (Na-Sn : Na-Me' & Sn-Stm : Stm-Me')

For both Chinese groups, the midfacial to total face height ratio (Na-Sn : Na-Me') is an indicator of attractiveness (ie. the larger the ratio, the more attractive the profile is perceived). This ratio explains 18% and 19% of the variance of attractiveness for the Chinese public and the Chinese orthodontist groups respectively.

In contrast, the upper to total face height height ratio measurement is not a significant indicator of attractiveness for the both Caucasian groups. However, the vertical lip to chin ratio measurement (Sn-Stm : Stm-Me') is an indicator of attractiveness for the Caucasian orthodontist, ie. the larger the ratio, the more attractive the profile.

7.3.3 CHARACTERISTICS OF THE PREFERRED CHINESE FEMALE PROFILE

The Chinese soft tissue profile is characterized by a retrognathic maxilla or a more flattened midface, less prominent nose, and more prominent lips due to bimaxillary dentoalveolar protrusion in comparison with the Caucasian (Wei 1965, 1968; Chan 1969, 1972; Yen 1973; Enlow 1982; Foo and Woon 1984; Foo 1986; Cooke and Wei 1989).

As revealed in the regression analysis between the profile variables and the attractiveness ratings, there are 7 statistically significant profile variables that may help to discriminate an attractive profile from an unfavourable one. These are :

the nasolabial angle (Cm-Sn-Ls),

the amount of upper lip protrusion (Ls/Sn perp),

(U. lip/Sn-Pog),

the amount of lower lip protrusion (Li/Sn perp),

(L. lip/Sn-Pog),

the vertical proportions of the face (Ns-Sn : Na-Me'),

(Sn-Stm :Stm-Me').

As shown in Table 6.9, when all 4 groups of judges are considered, the profile characteristics that seem to distinguish the most attractive

profile from the least attractive profile appear to be the degree of upper lip and lower lip protrusion. Thus, the more protrusive the upper and the lower lips are from the Sn-Pog plane, the Sn perpendicular to the true horizontal, and the E-plane, the more the profile is perceived as undesirable. Based on the judges' choices of the most attractive profile, the Chinese orthodontist group prefers an increased nasolabial angle (122.8 degrees), whereas, the Chinese public group prefers a more acute nasolabial angle (97.3 degrees). In fact, the Chinese public group prefers a more acute nasolabial angle than the other 3 groups of judges. However, solid conclusions cannot be drawn by just comparing only the most attractive and the least attractive profiles, as chosen by each group.

The 7 profile variables described have been shown to be statistical indicators for assessing profile attractiveness. Generally, all 4 groups appear to prefer a more obtuse nasolabial angle, less protrusion of the upper and lower lips, a shorter lower anterior face height and a longer upper lip to lower lip-chin height.

Khor (1986) in his study compared the 20 most attractive profiles with the 20 least attractive profiles selected from 101 profile silhouettes. He found that in an ideal Chinese profile, the upper lip would be approximately 3.5 mm in front, and the lower lip would be approximately 0.5 mm in front of the Diagnostic Line (a line passing through subnasale and perpendicular to Frankfort Horizontal).

The lips in the Chinese are generally more prominent compared to the Caucasians. Chan (1969, 1972) found that in a normal Chinese adult from Hong Kong, the upper lip is 0.82 $\pm$ 1.93 mm in front, and the lower lip 2.88 $\pm$ 2.19 mm in front of the E-plane; the upper lip is 7.86 $\pm$ 1.62

mm in front, and the lower lip 6.86 ± 2.03 mm in front of the subnasale-pogonion plane. Foo (1986) in her study of Malaysian Chinese females found that the upper lip is 0.89 ± 1.92 mm in front, and the lower lip 1.24 ± 2.33 mm in front of the E-Plane.

In the present study, the Chinese public prefers less protrusive lips compared with Chan's (1969,1972) normal Chinese adult sample, Foo's (1986) normal Chinese female sample, and Khor's (1986) ideal Chinese profile. Based on the 6 most attractive profiles (Table 6.9), the Chinese public prefers the upper lip to be 2.3 mm anterior, and the lower lip 2.2 mm posterior to the subnasale perpendicular line; the upper lip 4.2 mm anterior, and the lower lip 2.2 mm anterior to the subnasale-pogonion plane; the upper lip 2.4 mm behind, and the lower lip 2.7 mm behind the E-plane.

Burstone (1967, 1975) used the subnasale-pogonion plane of reference for measuring the relative protrusion or retrusion of the lips. He found that in a normal adolescent Caucasian sample, the mean for the upper lip is 3.5 mm anterior and the lower lip 2.2 mm anterior to the Sn-Pog plane. The lower lip in the present study is similar to Burstone's Caucasian sample; although the upper lip is slightly more protrusive than Burstone's sample.

Ricketts (1957, 1968) recognized that most Caucasians objected to lips that are anterior to the E-plane. In a sample of normal Caucasian adults, he found the lower lip was located 2 ± 3 mm posterior to the line and the upper lip 4 mm posterior to the line. In 1968, he stated that a normal white person's lips should be contained within the E-plane with the lower lip closer to the line than the upper. The lips should be smooth

in contour when the mouth is closed with no strain. Characteristically, the Chinese have a less prominent nose and more prominent lips. When a tangent is drawn from the nose tip to the soft tissue chin, the lips are often ahead of the E-plane, with the upper lip generally ahead of the lower lip. However, the Chinese public group in this study generally prefers to have the lips contained within the E-plane; although in the profile the Chinese public chose as the most attractive one, the upper lip was slightly ahead of E-plane.

All the values used to assess the amount of lip protrusion preferred by the Chinese public seem to indicate that they prefer lips that are less protrusive than that for their racial norms. In fact, when the averages for the 6 most attractive profiles are compared, the Chinese public group prefers a slightly more retrusive lower lip than the other 3 groups of judges (Table 6.9).

The ideal nasolabial angle has been quantified as 97 degrees for Chinese (Khor 1986) and102 degrees for Caucasians (Legan and Burstone 1980). These values reflect the more protrusive upper lip of the Chinese. Khor's ideal nasolabial angle for the Chinese differed somewhat from the present study, as noted in Table 6.9. The Chinese public selected a profile with a nasolabial angle of 97.3 degrees (slide 13), as being the most attractive. However, when the next 5 most attractive profiles were included in the assessment, the Chinese public appeared to favour a more obtuse nasolabial angle (100.8 degrees). The two orthodontist groups (especially the Chinese orthodontists), and the Caucasian public group were more constant in their preference for an obtuse nasolabial angle, which was slightly greater than that favoured by the Chinese public.

The results from the present study support Khor's findings that the contribution of the perioral region is vital, to the extent that it may decide whether or not a profile is perceived as attractive. A profile with a protrusive perioral region, accompanied by a small nasolabial angle is considered undesirable by all groups of judges. The findings from this study suggest that the Chinese public generally prefers a straight profile, with a more retrusive upper lip and lower lip; and a slightly more obtuse nasolabial angle than their racial "norms". They prefer Chinese females to have a profile that is closer to the Caucasian norms than their own racial characteristics.

The ideal midface to total face height (Na-Sn : Na-Me') is 43% (Powell and Humphreys 1984). When this parameter for the 6 most attractive profiles is averaged across the Chinese public group, a similar ideal ratio (43.1%) is found. The Chinese public group prefers a larger midface to total face height ratio than the other 3 groups of judges. When the 6 most and least attractive profiles were compared for the 4 groups of judges, a larger midface to total face height is generally preferred.

Despite different profiles being judged as the most attractive one by different groups of judges, when the profile characteristics were analysed, similar measurements were found. The 4 groups of judges identify similar profile characteristics as being attractive (Fig 6.17 to 6.20). This confirms the results of Iliffe (1960), Martin (1964), Udry (1965), Peck and Peck (1970), Foster (1973), and Srisuk (1982). There appears to be a common aesthetic standard for judging female faces in our society. Martin (1964) and Peck and Peck (1970) believed that the aesthetic agreement among the Americans (and similarly among the

Australians) is largely the product of many cultural mechanisms and reinforcements operating in our society. This close agreement between different ethno-racial or ethno-cultural groups has been suggested by the above researchers to be due to the influential effect of mass media in unifying peoples' tastes. Television, motion picture, newspapers and magazines all provide daily reinforcement for facial stereotypes.

Thus, the appreciation of beauty is influenced by a diversity of factors such as culture, racial heritage, the society one lives in and even political and racial prejudices (Martin 1964). Chinese people living within the predominantly Caucasian culture in Australia may prefer to assimilate by adopting the Caucasian facial model.

Since the protrusion of the lips in the Chinese is related directly to the inclination and position of the incisors and not related to any prognathism of the basal region of the jaws (Wei 1965, 1968; Foo 1986; Khor 1986), it seems that the effect of incisor retraction associated with orthodontic treatment may be desirable in certain cases. This was confirmed by Chang (1983) in his investigation of soft tissue profile changes in the American Chinese as a result of orthodontic movement of incisor teeth. He found a significant correlation between flatter lip postures, straighter facial contours, and profile attractiveness.

Neger (1959) suggested that a proportionate change or improvement of the soft tissue profile does not necessarily accompany extensive dentition changes. However, others like Burstone (1958, 1959) Hambleton (1964), Rudee (1964), Hershey (1972), Wisth (1972), Angelle (1973), Anderson et al (1973), Garner (1974), Roos (1977), Oliver (1982), Rains and Nanda (1982), Lin et al (1985), and Shue (1985) have shown

that the upper and lower lips can be influenced by orthodontic treatment, though it can be variable.

Many authors, eg. Angle (1907), Riedel (1957) and Hambleton (1964), believed that face aesthetics depends on all of its component parts being in good proportion, balance and harmony. Wuerpel (1937), Susher (1977), Satravaha and Schlegel (1987), indicated that a proper blending of the integumental profile produces an aesthetically pleasing face and this varies in different ethnic groups. Thus, although the Chinese public in Sydney have identified attractive female Chinese profiles similar to those chosen by the other 3 groups of judges, - ie. a more Caucasian-type profile with less protrusive lips, the treatment should not be performed entirely to the Caucasian "standard values". Racial characteristics of the Chinese are quite different from that of the Caucasian. The appearance of each face should be assessed individually, and orthodontic treatment should be designed to meet both the aesthetic requirement of the patient as well as the stability of the occlusion. As stated by Powell and Rayson (1976), with modern aesthetic concepts in orthodontics, it is futile to apply formulae of ideal appearance universally as the appearance of each face should be evaluated independently.

CHAPTER 8 : CONCLUSION

8. CONCLUSION

This study has shown that :

1. All 4 groups of judges (Chinese public, Caucasian public, Chinese orthodontist and Caucasian orthodontist) in Sydney, have fairly similar profile preferences for the Chinese female. There was approximately 70% correlation (ie. 5 out of 7 profiles were common) between the Chinese public and the two orthodontist groups in the selection of the 7 most attractive profiles. In the identification of the 10 least attractive profiles, the order of ranking was the same for the Chinese public and the Caucasian orthodontist groups of judges.

2. All groups of judges prefer a similar type of profile, - ie. a straight profile with a more retrusive upper and lower lip, and a slightly more obtuse nasolabial angle than the corresponding racial norms for the Chinese female (Chan 1969, 1972; Foo 1986; Khor 1986).
The lower lip variables : the labrale inferius to subnasale perpendicular measurement and the lower lip to subnasale-pogonion plane were found to be especially significant in determining profile attractiveness for all 4 groups of judges.

Thus, the first hypothesis that the profile preferences of the Chinese public living in Sydney is similar to that of the orthodontists was found to be true. However, the second hypothesis that, generally, the Chinese public prefers a straight profile with only a slight convexity in the

dentoalveolar region had to be modifed. The Chinese public group in Sydney prefers a straight profile, with a more retrusive upper and lower lip, and a slightly more obtuse nasolabial angle than their own racial norms.

Thus, although the judgement of facial aesthetics is very subjective, all 4 groups of judges share a common aesthetic standard. This supports the findings of Iliffe (1960), Martin (1964), Udry (1965), Peck and Peck (1970), Foster (1973), and Srisuk (1982). Certain well recognised factors eg. race, culture, social background, as well as, the mass media such as films, advertisements and magazines may influence and mould a person's perception of facial aesthetics.

Future Investigations

It would be useful to conduct a parallel study on the methodology used here on the following groups of judges :

- the Chinese living in China who have remained in their society all the time, and who have little contact with the Western mass media.

- the Chinese living in countries that are predominantly Chinese, ie. Hong Kong, Taiwan and Singapore. These people are probably more exposed to cross-cultural interactions due prominent Western influence on their culture.

A study could be done to include a larger random sample of Chinese public living in Sydney, and another in the above Asian countries. Investigations could then be done to determine if age, sex, education,

and exposure to the Western culture influence their perception of aesthetics for the Chinese female profile.

A concurrent study of Chinese male profiles could be done to see if there is a difference in the profile preferences between the two sexes.

Since this study shows that a Chinese public group in Sydney prefers a soft tissue profile with retrusive lips and a more obtuse nasolabial angle, it would be useful to assess the attractiveness rating of Chinese patients prior to and following orthodontic treatment. Standardised photographs of Chinese patients taken before and after orthodontic retraction of upper and lower teeth, could be rated by the Chinese public and the orthodontists to determine if these alterations improve their profile assessment of the Chinese subjects.

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APPENDIX

APPENDIX A : CONSENT FORM

Title : To evaluate facial profile preferences of Chinese females in Australia.

A study is to be carried out on the above topic by Dr. May-Yoong Lee Orthodontic Department, University of Sydney.
The main aims of this study are:

1. To establish preferences in Chinese female facial profiles within Chinese groups in Australia.
2. To evaluate from photographs taken of Chinese females, the similarity in facial profile preferences between the Chinese living in Australia and the Australian orthodontists.

Full name :
Address :
Phone :
Date of birth :
Country of birth :
Ethnic background of father :
Ethnic background of mother :
Had previous history of orthodontic treatment :

I, (full name _____)
hereby give my consent to assist in this study as a subject.
I understand that my photos may be used in the study.
I have been informed of the nature of the research.

signed _____ date _____

APPENDIX B (i) : QUESTIONNAIRE FOR THE ORTHODONTISTS

This is a research survey to determine the preferred Chinese female facial profile. It aims to compare the preferences of Chinese groups in Australia with orthodontists.

1. Sex : Male ☐
   Female ☐
2. Marital status : Single ☐
   Married ☐
3. Age : _____ years old.
4. Country of birth : _____
5. If not born in Australia, how long have you lived here?____years
6. Ethnic background of mother : _____
   Ethnic background of father : _____
7. Place of orthodontic training : _____
8. How many years have you been in orthodontic practice?____years
9. What is the percentage of Asian patients seen in your orthodontic practice? _____

APPENDIX B (ii) : QUESTIONNAIRE FOR THE GENERAL PUBLIC

This is a survey to determine the preferred Chinese female facial profile. The results will be evaluated to help Australian orthodontists plan future treatment.

1. Sex : Male ☐
   Female ☐
2. Marital status : Single ☐
   Married ☐
3. Age : _____ years old.
4. Country of birth : _____
5. If not born in Australia, how long have you lived here? ____years
6. Ethnic background of mother : _____
   Ethnic background of father : _____
   (NB. If Chinese, please indicate what dialect group eg Cantonese, Hokkien, Teochew, Shanghainese, Mandarin, etc.)
7. Occupation : _____
8. Do you think orthodontic treatment ("braces") can
   i. correct crowding of teeth ? Yes ☐ No ☐
   ii. correct protruding teeth ? Yes ☐ No ☐
9. Do you think orthodontic treatment ("braces") can change/improve a person's facial profile ? Yes ☐ No ☐

* **EACH SLIDE will be shown for 20 seconds .**
* For each slide, please assess each person's face **by circling a number** on the 7-point scale.
  If possible, indicate on the right, why you find this profile attractive or unattractive. (Eg. receeding/straight/ flat/ prominent/protruding forehead/nose/lips/chin)
* If any of these females are recognised as one of your friends or relatives, please indicate this on the left hand side, beside the slide number.

Slide No. **REASONS**

1 1 2 3 4 5 6 7
Very Unattractive — Average — Very Attractive

2 1 2 3 4 5 6 7
Very Unattractive — Average — Very Attractive

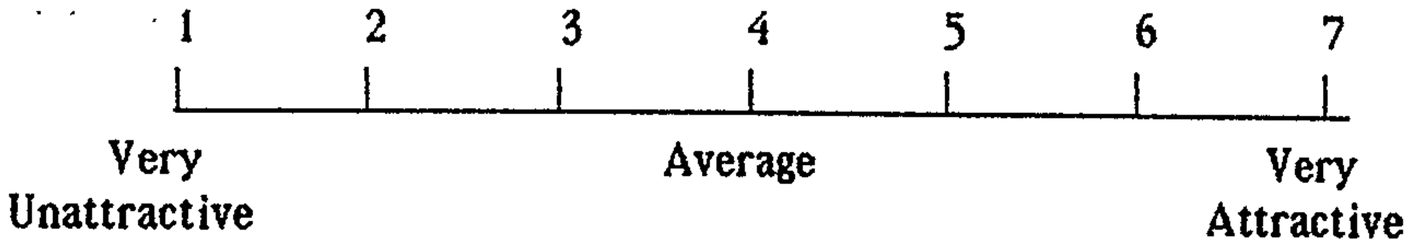
3 1 2 3 4 5 6 7
Very Unattractive — Average — Very Attractive

4 1 2 3 4 5 6 7
Very Unattractive — Average — Very Attractive

5 1 2 3 4 5 6 7
Very Unattractive — Average — Very Attractive

Slide No. **REASONS**

6



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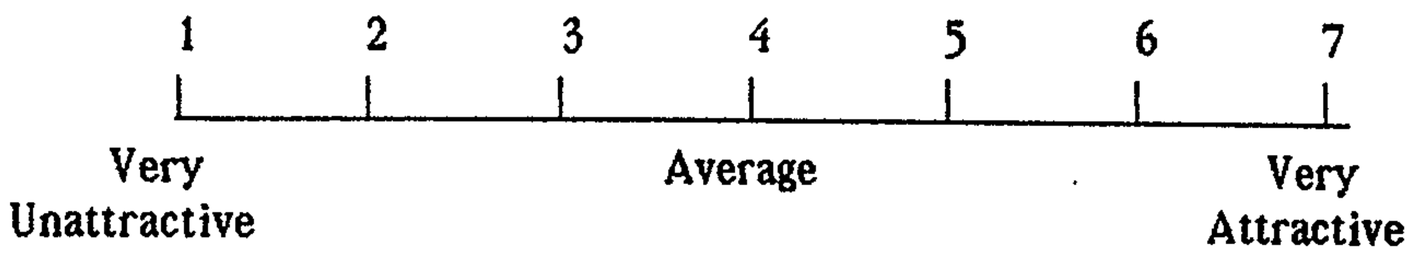

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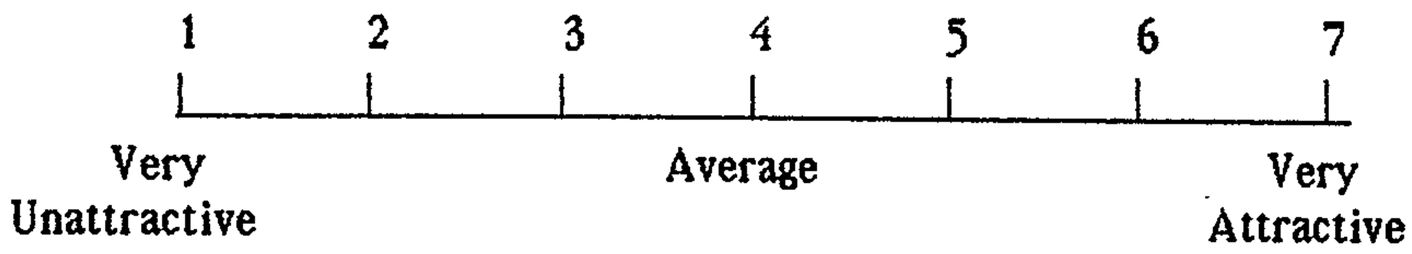

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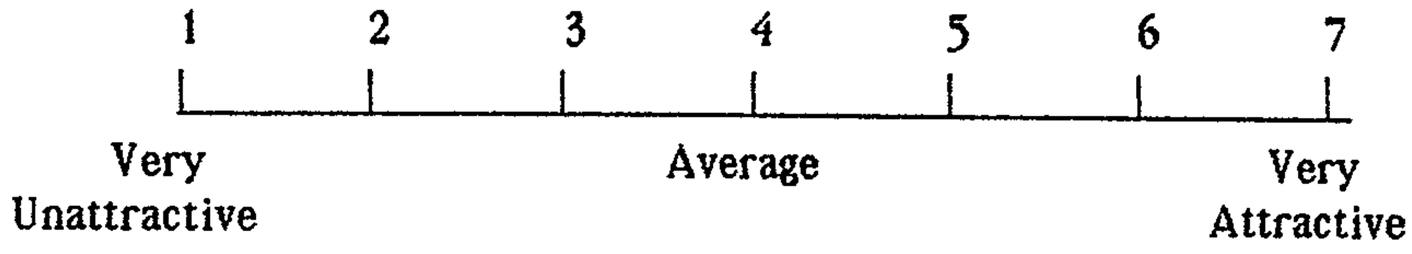

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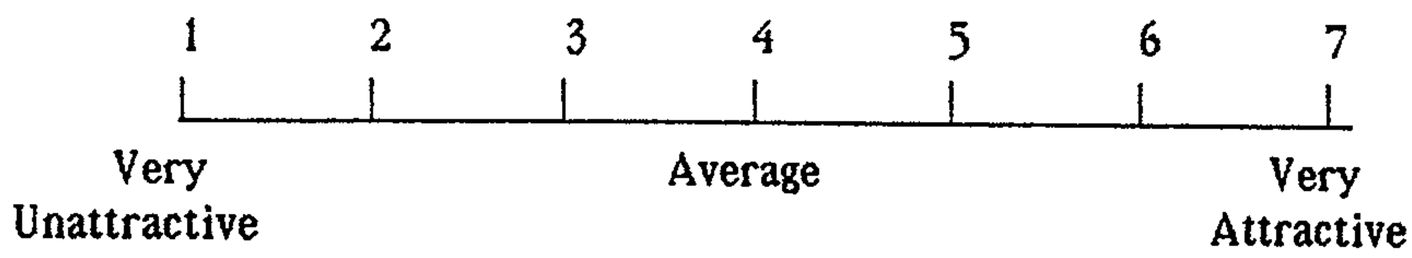

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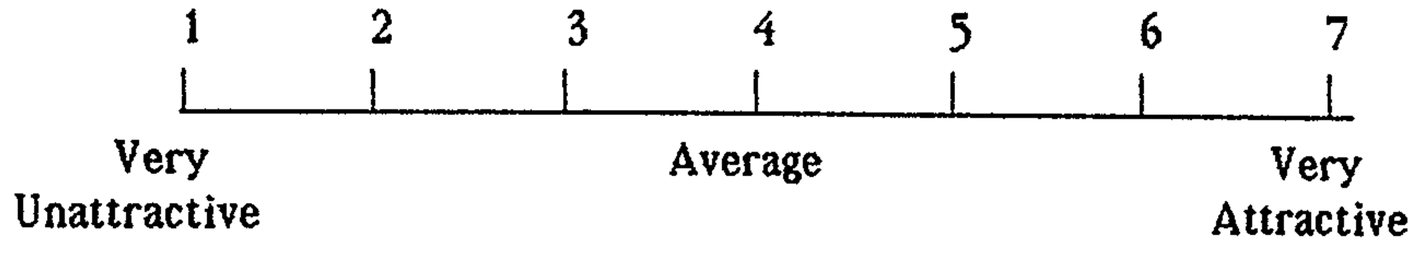

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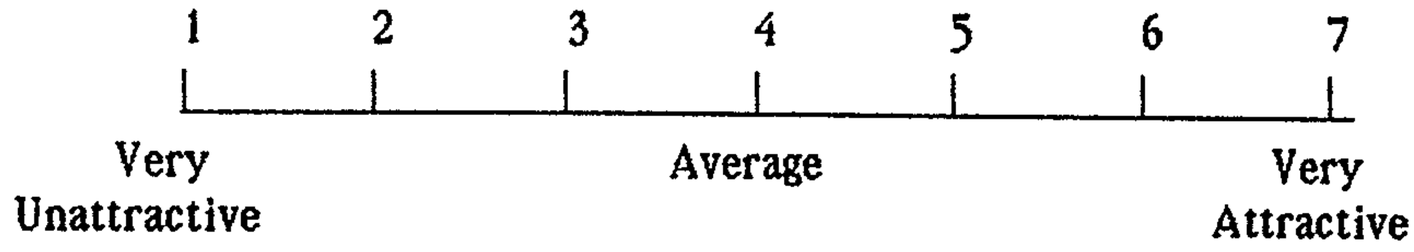

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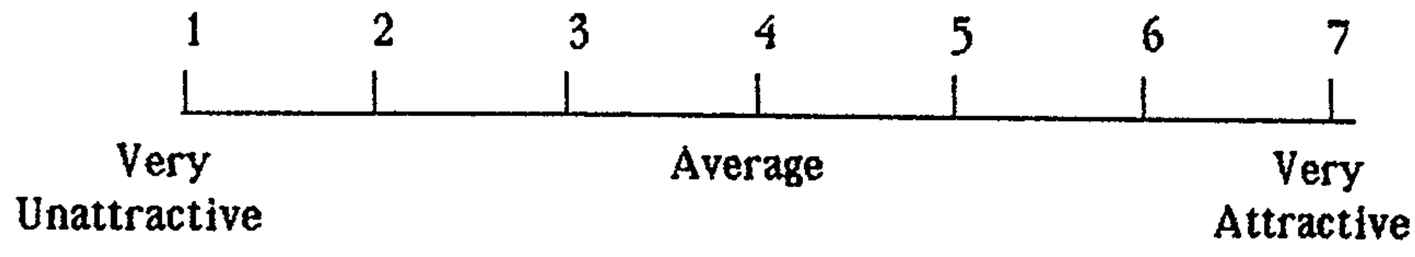

Slide No.	REASONS

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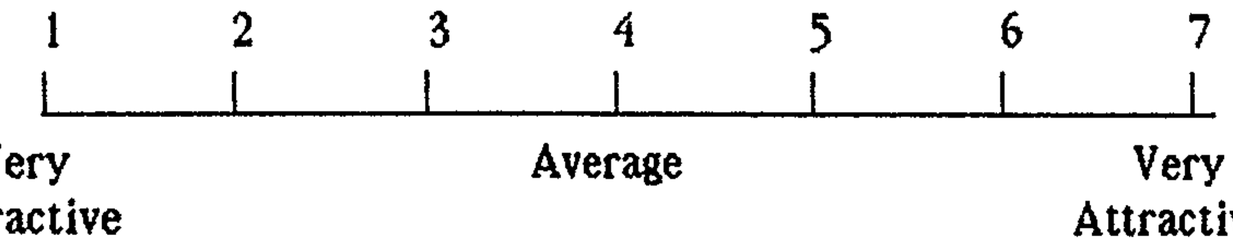

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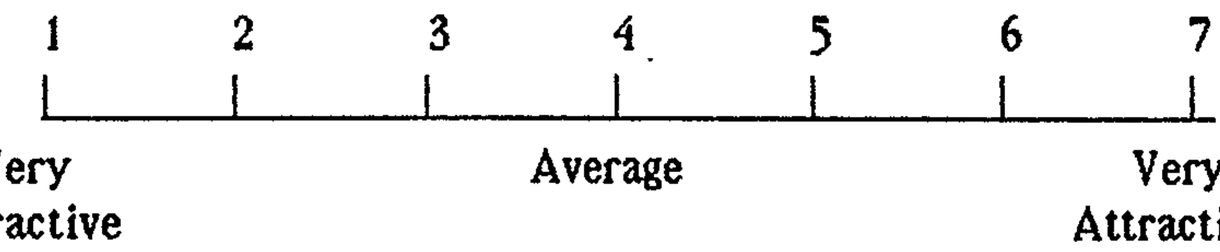

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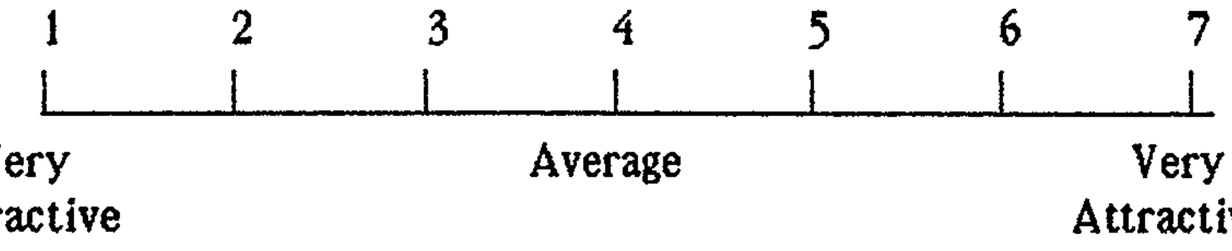

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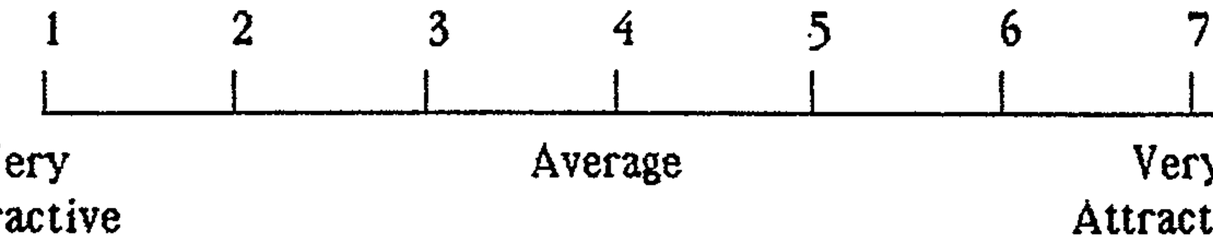

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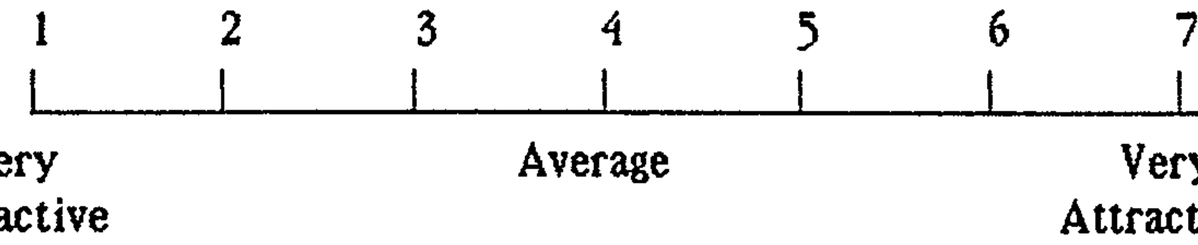

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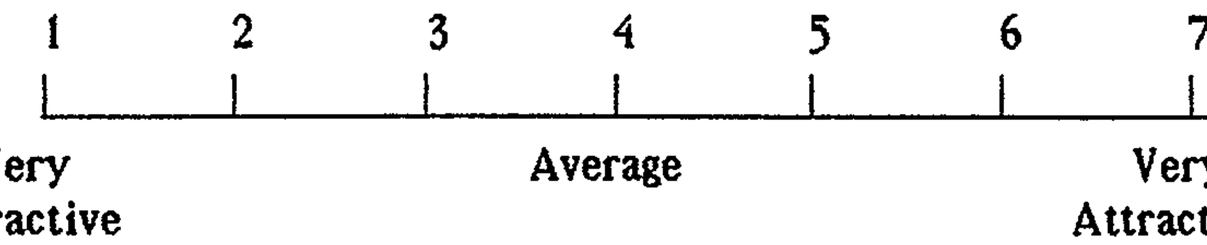

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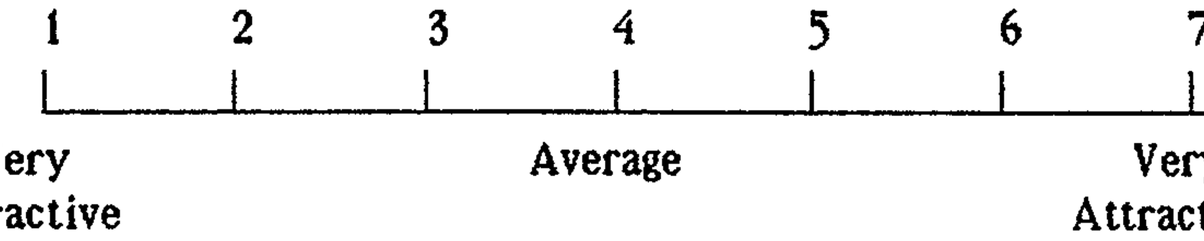

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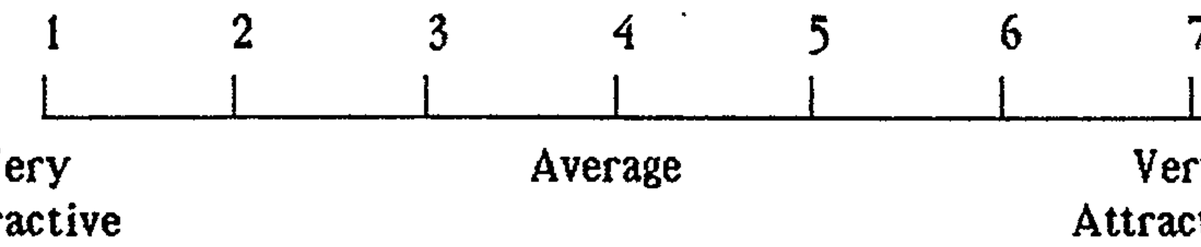

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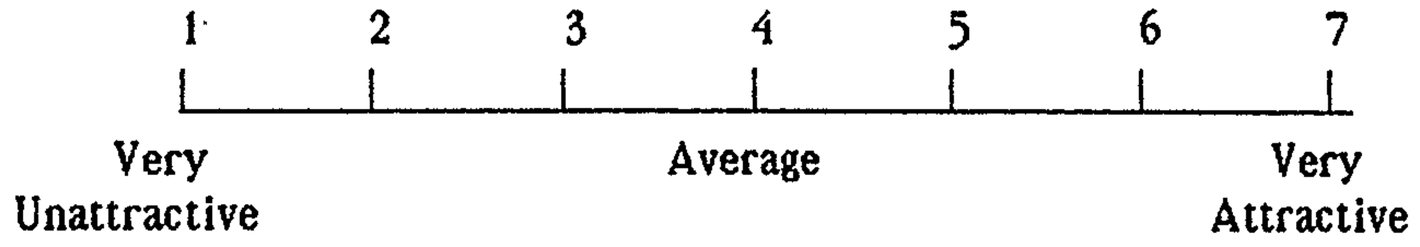
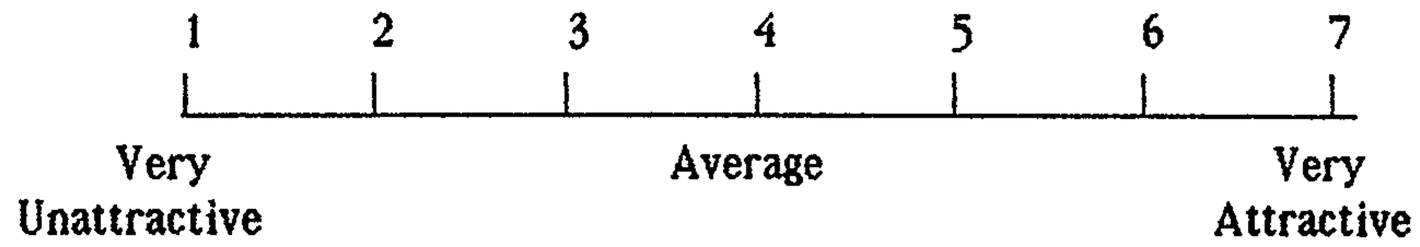
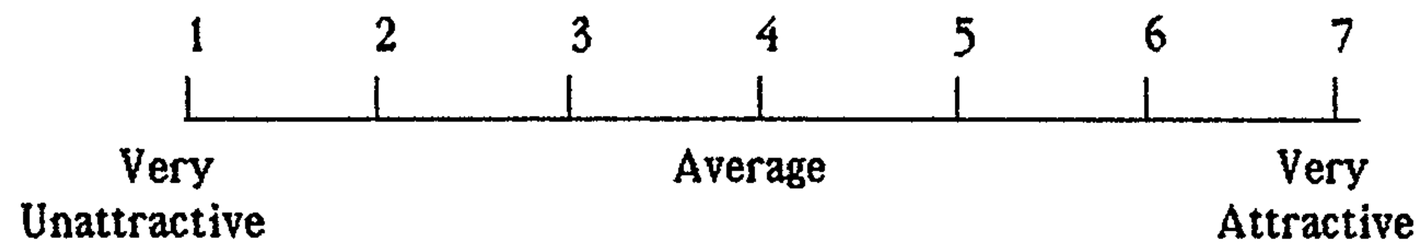
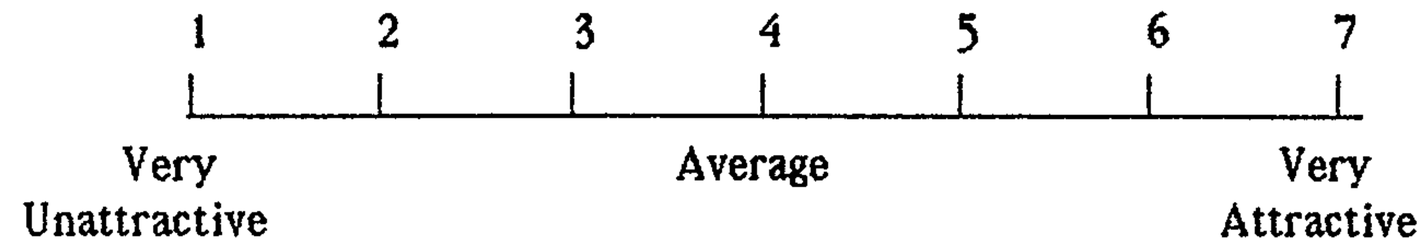
22	
23	
24	
25	

Appendix C Profile measurements for each photograph

PROFILE VARIABLES		SLIDES 1	2	3	4	5	6	7	8	9	10	11
1. Na/Sn perp	(mm)	-1.2	-4.2	-2.6	-4.4	-5.8	-4.9	-8.0	-1.6	-2.4	-2.4	-5.1
2. Pog/Sn perp	(mm)	-15.3	-3.8	-9.9	-1.8	-1.2	-5.9	-9.5	-5.3	-4.1	-6.5	-5.3
3. Na-Sn-Pog	(deg)	157.2	170.5	165.0	171.8	171.7	166.2	159.5	171.6	171.7	169.1	168.2
4. Na-Prn-Pog	(deg)	127.6	141.3	132.9	142.5	138.1	138.0	135.5	137.4	140.7	139.7	139.3
5. Prn-Na-Pog	(deg)	32.7	24.1	30.7	25.0	24.8	26.3	28.4	26.2	26.0	25.6	24.5
6. Prn/Sn perp	(mm)	14.0	11.9	13.2	10.4	13.9	10.6	9.7	14.0	11.2	11.9	12.7
7. Cm-Sn-Ls	(deg)	124.2	102.2	111.2	93.2	85.3	103.9	116.7	99.8	103.8	116.6	105.3
8. Ls/Sn perp	(mm)	-0.8	2.2	1.8	8.0	6.7	2.5	2.8	1.3	4.5	1.0	1.7
9. U. lip/E-plane	(mm)	-0.7	-3.2	-1.0	2.4	-0.6	-1.3	1.4	-4.5	-0.3	-2.6	-3.3
10. U. lip/Sn-Pog	(mm)	3.3	3.3	4.7	8.5	7.1	4.2	5.4	2.9	5.7	2.9	3.2
11. H-Angle	(deg)	17.0	9.5	15.0	16.5	16.0	13.5	19.5	9.0	9.5	9.0	11.0
12. A'/Sn-U. lip	(mm)	-0.9	-2.4	-1.3	0.1	-0.6	-1.0	-0.7	-0.3	-0.7	-0.9	-1.1
13. Li/Sn perp	(mm)	-5.5	-0.5	-1.0	6.0	4.5	-0.5	-1.0	-1.0	4.0	-1.5	-2.0
14. L. lip/E-plane	(mm)	-0.2	-2.7	1.4	2.9	-0.8	-1.8	1.6	-2.8	1.6	-1.8	-3.0
15. L. lip/Sn-Pog	(mm)	3.2	1.8	5.4	7.6	5.1	2.5	4.8	2.1	6.4	2.5	1.5
16. L. lip/H-line	(mm)	1.0	0	2.5	2.5	0.5	-0.5	1.5	0	2.5	0.5	-1.0
17. B'/L. lip-Pog	(mm)	-2.7	-3.3	-3.5	-2.4	-3.9	-2.8	-1.7	-1.6	-1.1	-1.2	-3.7
18. Na-Sn : Na-Men	(%)	47.1	40.9	39.9	38.3	42.8	40.9	42.7	40.7	38.0	40.1	44.2
19. Sn-Stm : Stm-Men	(%)	45.2	49.1	52.3	41.9	49.4	46.6	55.6	48.2	46.4	44.2	48.1

Appendix C Profile measurements for each photograph (continued).

PROFILE VARIABLES		SLIDES 12	13	14	15	16	18	20	22	23	24	25
1. Na/Sn perp	(mm)	-7.2	-5.4	-2.9	-2.2	-7.4	-3.7	-8.9	-4.4	-6.1	-4.9	-8.0
2. Pog/Sn perp	(mm)	-10.8	-10.2	-22.6	-18.2	-3.9	-5.2	-7.2	-2.3	-6.7	-4.7	-7.4
3. Na-Sn-Pog	(deg)	157.8	161.5	154.2	157.5	165.6	169.4	160.4	171.5	165.6	169.4	162.3
4. Na-Prn-Pog	(deg)	131.7	132.8	128.4	127.9	136.8	135.5	129.6	141.5	138.8	138.5	137.9
5. Prn-Na-Pog	(deg)	28.8	30.1	33.9	34.8	26.3	27.4	31.4	24.1	24.3	24.3	25.8
6. Prn/Sn perp	(mm)	11.4	11.9	13.5	14.0	11.0	14.1	12.5	11.3	11.9	14.3	10.3
7. Cm-Sn-Ls	(deg)	105.3	93.7	97.2	112.6	106.8	91.7	84.4	103.0	90.4	105.5	102.8
8. Ls/Sn perp	(mm)	0.5	3.5	2.5	0.1	1.7	4.4	7.0	3.9	2.5	1.8	3.6
9. U. lip/E-plane	(mm)	-1.7	0.7	4.2	-0.2	-3.2	-1.7	2.5	-1.6	-2.1	-4.6	0.4
10. U. lip/Sn-Pog	(mm)	3.2	6.3	8.8	4.7	2.8	5.9	9.0	4.5	4.3	3.1	5.7
11. H-Angle	(deg)	16.5	17.5	24.0	17.0	11.5	14.0	22.0	12.5	13.5	10.0	16.5
12. A'/Sn-U. lip	(mm)	-0.7	-0.1	-0.5	-0.9	-0.7	-0.8	-1.2	-1.3	-0.4	-0.9	-1.8
13. Li/Sn perp	(mm)	-4.5	-2.5	-0.5	-5.5	-2.0	-1.5	1.5	5.0	1.5	-1.5	-2.0
14. L. lip/E-plane	(mm)	-1.9	-0.9	7.8	0.5	-3.6	-3.6	0.4	1.0	-0.2	-4.6	-1.5
15. L. lip/Sn-Pog	(mm)	1.7	3.6	11.0	3.9	0.6	2.2	5.7	6.1	4.8	1.3	2.0
16. L. lip/H-line	(mm)	0	-0.5	5.0	1.5	-1.0	-1.5	0.5	4.0	2.0	-0.5	-0.5
17. B'/L. lip-Pog	(mm)	-3.8	-3.0	-0.9	-2.2	-2.2	-2.7	-5.6	-1.9	-1.7	-3.1	-2.9
18. Na-Sn : Na-Men	(%)	45.0	41.3	44.8	42.6	41.6	42.1	40.6	39.9	43.8	44.9	41.7
19. Sn-Stm : Stm-Men	(%)	42.9	51.5	53.6	45.0	49.4	48.6	49.8	40.9	42.7	47.6	55.0

Appendix D Repeated profile measurements for 10 photographs.

PROFILE VARIABLES		SLIDES 1	3	6	8	11	12	13	16	18	24
1. Na/Sn perp	(mm)	-1.1	-2.8	-4.5	-2.1	-4.5	-7.7	-5.5	-6.8	-3.9	-4.6
2. Pog/Sn perp	(mm)	-14.1	-10.9	-6.0	-5.3	-4.9	-10.8	-10.2	-4.4	-5.4	-5.5
3. Na-Sn-Pog	(deg)	158.4	163.7	166.6	170.9	169.5	157.3	161.2	165.9	168.8	168.6
4. Na-Prn-Pog	(deg)	126.6	131.9	138.3	138.1	139.5	132.2	133.8	137.8	135.4	137.1
5. Prn-Na-Pog	(deg)	33.0	31.0	26.1	25.5	24.6	28.1	29.1	25.7	27.4	24.5
6. Prn/Sn perp	(mm)	14.9	13.4	10.7	13.5	13.3	11.0	11.3	10.9	13.9	14.3
7. Cm-Sn-Ls	(deg)	121.5	115.0	104.7	99.0	104.2	110.6	101.0	106.3	86.3	107.2
8. Ls/Sn perp	(mm)	-0.4	1.5	2.5	1.4	2.2	0.5	3.3	2.1	4.4	1.7
9. U. lip/E-plane	(mm)	-0.4	-0.7	-1.3	-4.1	-3.1	-1.2	0.7	-2.3	-1.4	-4.3
10. U. lip/Sn-Pog	(mm)	4.1	4.9	4.2	3.0	3.7	3.3	6.1	3.4	5.9	3.2
11. H-Angle	(deg)	17.5	15.0	13.5	9.0	11.0	16.5	17.5	12.0	14.0	10.5
12. A'/Sn-U. lip	(mm)	-0.7	-1.4	-0.7	-0.7	-0.9	-0.8	-0.7	-0.7	-0.8	-0.5
13. Li/Sn perp	(mm)	-5.5	-1.5	-0.5	-1.5	-1.5	-4.0	-2.5	-2.5	-1.5	-1.5
14. L. lip/E-plane	(mm)	-0.5	0.7	-2.3	-2.5	-3.5	-1.8	-1.0	-3.7	-3.3	-3.6
15. L. lip/Sn-Pog	(mm)	3.8	4.8	2.6	2.2	1.8	2.2	3.6	0.6	2.2	1.7
16. L. lip/H-line	(mm)	1.0	2.5	0	0.5	-1.0	0	0	-1.5	-1.5	-0.5
17. B'/L. lip-Pog	(mm)	-3.9	-3.2	-2.1	-2.0	-3.5	-3.9	-3.2	-2.6	-2.4	-3.4
18. Na-Sn : Na-Men	(%)	47.6	40.5	41.4	41.2	42.7	45.8	41.5	41.7	42.8	44.9
19. Sn-Stm : Stm-Men	(%)	42.7	51.0	45.6	49.1	49.4	42.3	49.0	52.6	46.8	47.6

APPENDIX E : EXAMPLES OF ANOVA RESULTS DERIVED FROM COMPUTER PRINTOUT

Slide #9 : Analysis of variance result, judged by Chinese and Caucasian public and orthodontists.

Source of variation	SS	df	MS	F	p
Profession	0.910	1	0.910	1.269	0.261 (NS)
Race	1.196	1	1.196	1.668	0.198 (NS)
Interaction	4.728	1	4.728	6.592	0.011 *
Residual	139.138	194	0.717		
Total	147.480	197	0.749		

* Significant at 5 % level

Slide #19 : Analysis of variance result, judged by Chinese and Caucasian public and orthodontists.

Source of variation	SS	df	MS	F	p
Profession	10.159	1	10.159	9.825	0.002 **
Race	4.235	1	4.235	4.096	0.044 *
Interaction	1.265	1	1.265	1.223	0.270 (NS)
Residual	204.723	198	1.034		
Total	230.104	201	1.145		

* significant at 5 % level

** significant at 1 % level