

The influence of different facial components on facial aesthetics

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SUMMARY Facial aesthetics have an important influence on social behaviour and perception in our society. The purpose of the present study was to evaluate the effect of facial symmetry and inter-ocular distance on the assessment of facial aesthetics, factors that are often suggested as major contributors to facial aesthetics.

The material consisted of 36 standardized facial photographs of patients (10–17 years of age) attending the orthodontic department. All except one were Caucasian. Eleven of these photographs (all Caucasian) were either left in their original form or modified by: (1) enlargement of the inter-ocular distance by 20 per cent; or (2) mirroring the right part of the face over the left part to obtain symmetry.

Three series of 36 slides were composed, each including 11 modified slides or their unmodified counterparts. These were evenly distributed over the three series using a Latin square design. The photographs were assessed for their facial aesthetics using a visual ratio scale by a panel of 50 undergraduate dental and law students. The 11 modified/unmodified photographs enabled calculation of the effect of the modifications undertaken on the assessment of facial aesthetics. The scores of the 25 remaining photographs in each series were used as baseline data in order to estimate the inter- and intra-observer reproducibility.

MANOVA and *post-hoc t*-test revealed significant differences between the unmodified and modified photographs ($P < 0.001$). The results show that symmetry and inter-ocular distance enlargement have a negative effect on facial aesthetics.

Introduction

Social behaviour is markedly determined by the perception of facial aesthetics (Dion *et al.*, 1972; Bull and Rumsey, 1998). Facial appearance not only appears to be an influential quality in being asked as a dating partner, but handsome people are also thought to have a nicer personality (Cunningham, 1986; Cunningham *et al.*, 1990; Feingold, 1990; Riggio *et al.*, 1991). Furthermore, they are expected to be more intelligent, which implies a higher educational potential, and to have more socially desirable characteristics (Berscheid and Walster, 1974; Baldwin, 1980; Berscheid, 1980; Shaw, 1981; Cunningham, 1986). Studies concentrating more specifically on presumed personality characteristics related to dento-facial appearance have shown that attractive persons are judged as more extrovert, more interesting,

and of a higher social class (Shaw, 1981; Shaw *et al.*, 1985; Lew, 1993). These findings clearly show that facial attractiveness is an important factor in our daily social interactions.

An interesting question within the field of orthodontics is which facial features are determinants of these interpersonal judgements. Do we only look at the eyes to estimate someone's attractiveness; is it the position of the teeth, the symmetry of a face, or a combination of several facial features? In order to answer this question, several researchers have focused on the importance of various facial features in the assessment of facial aesthetics (Feinman and Gill, 1977; Keating, 1985; Cunningham, 1986; Franzoi and Herzog, 1987; Cunningham *et al.*, 1990; Meerdink *et al.*, 1990). Male and female judges agree on the importance of features such

as inter-eye distance, face length, face width, mouth size, and cheek position (Keating, 1985). Mature features such as prominent cheekbones, square jaws, or a large chin are positively linked with attractiveness of males (Cunningham *et al.*, 1990).

On the contrary, juvenile facial features such as large and wide eyes, greater inter-eye distance, a small chin and a wide smile are positively linked with attractiveness of females (Keating, 1985; Cunningham *et al.*, 1990). However, the importance of many other facial features is not quite clear. The results of studies by Cunningham (1986) and Meerdink *et al.* (1990), for example, agree on the importance of nose size and cheek width in the perception of facial attractiveness, but they differ with respect to the importance of eye size, face length, and eyebrow shape. Hair colour, eyebrow height, eye placement, and size of the smile are other examples of contradictory features (Feinman and Gill, 1977; Cunningham, 1986; Franzoi and Herzog, 1987; Cunningham *et al.*, 1990; Feingold, 1990; Meerdink *et al.*, 1990).

Facial symmetry and averageness have also been studied, leading to conflicting results. They have been created by combining several individual faces into one composite face. Such a face possesses the average features of the selected group. Some argue that the degree of averageness and symmetry in faces is an essential factor in the perception of attractiveness (Thornhill and Gangestad, 1993; Gangestad *et al.*, 1994). Some researchers have found that averaged and symmetrical faces are indeed perceived as more attractive (Langlois and Roggman, 1990; Grammer and Thornhill, 1994; Langlois *et al.*, 1994). However, their conclusions have not been shared by others who have found that averaged faces were judged less attractive (Cunningham, 1986; Cunningham *et al.*, 1990; Johnston and Franklin, 1993; Perrett *et al.*, 1994) or that facial attractiveness was independent of facial symmetry (Kowner, 1996).

In orthodontics, studies on the relationship between different growth directions of the mandible, and the attractiveness of profiles have shown that a straight profile with normal vertical dimensions and a horizontal mandibular direction is considered facially attractive. The

least appreciated profile is a long face with a more vertical mandibular plane and a large lower face height (Cox and van der Linden, 1971; Smit and Dermaut, 1984; Lundström *et al.*, 1987, 1989). Other studies have dealt with the importance of the oral area in an attempt to categorize dental preferences. It appears that misaligned anterior teeth, with severe crowding or a median diastema, negatively influence attractiveness (Shaw *et al.*, 1985; Kerosuo *et al.*, 1995). Normal incisor alignment was judged most favourably (Shaw *et al.*, 1985; Soh and Lew, 1992; Kerosuo *et al.*, 1995) and seems to be more important than inter-arch disharmonies, such as an overjet or maxillary protrusion (Soh and Lew, 1992). The effect of the dental parameters on the assessment of overall facial attractiveness, however, has not been evaluated.

Psychological research on facial aesthetics has identified several features that are altered simultaneously (Feinman and Gill, 1977; Keating, 1985; Cunningham, 1986; Franzoi and Herzog, 1987; Cunningham *et al.*, 1990; Feingold, 1990; Meerdink *et al.*, 1990), which makes it difficult to draw conclusions about particular facial features. In order to gain more information about the relative importance of the various facial features, it might be preferable to alter each feature separately. This would give the opportunity to judge one altered facial feature at a time and compare these judgements to those of the original, unmodified photograph.

Therefore, in this study two facial features were modified separately and participants were asked to judge the original, unmodified photographs and the modified photographs in three separate sessions with a 2-week interval. The two chosen features were inter-ocular distance and facial symmetry. The choice for enlargement of the inter-eye distance was based on its reproducibility and good standardization. The reason to modify the facial symmetry is the considerable attention of this feature in the literature. Furthermore, it is often a starting point in plastic and orthognathic surgery.

Prior to the start of this study, a method for quantification of facial aesthetics had to be chosen. Three scales are often used in the literature, namely the analogue, ratio, and ranking scale

(Smit and Dermaut, 1984; Howells and Shaw, 1985; Shaw *et al.*, 1985; Evans and Shaw, 1987; Lundström *et al.*, 1987, 1989; Peerlings, 1992; Peerlings *et al.*, 1995). However, little research has been performed to determine the optimal method for quantification of facial aesthetics. The usefulness of the three scales was examined in a pilot study. The most reproducible and valid scale was then used in the main study.

Pilot study

Material and methods

Photographs. The material consisted of a random selection of 24 standardized frontal colour photographs of patients who had attended the Department of Orthodontics and Oral Biology, University of Nijmegen, The Netherlands (11 males, 13 females; 10–15 years of age, all but one with a Caucasian background, which can be considered as representative for the Dutch population).

These photographs were randomly chosen from the listings of the archives of the Department of Orthodontics in which no racial background is indicated.

Panel. Eleven undergraduate dental students (six female, five male, all Caucasian and between 19 and 22 years of age) from the College of Dental Science, University of Nijmegen, The Netherlands, participated in the pilot study. They were asked to assess the facial aesthetics of the photographs, using three commonly used scales: the analogue, the ratio, and the ranking scale. All three scales were used twice with a time interval of two weeks between each session.

1. Visual analogue scale (VAS). The participants were presented with 24 photographs in random order and were asked to assess the facial aesthetics of each photograph on a scale from 0 to 100. Participants were asked to mark their score on a form with a horizontal bar divided into 10 equal sections.

2. Ratio scale. A reference photograph was selected based on the results of the VAS assessments. This reference photograph had a

mean score of 60 and a small standard deviation ($SD = 5.95$). The reference photograph was first presented to the participants and they were informed that the score was 60. The remaining 23 photographs were presented in the same order as in the previous sessions and facial aesthetics was assessed, while the reference photograph remained visible. The same forms were used as described above. The 60-point was marked as the value for the reference photograph.

3. Ranking scale. The set of 24 photographs was presented to each of the participants separately and they were asked to arrange the photographs from the least to the most aesthetic.

Statistics

Data obtained by using the VAS and the ratio scale were analysed by a 2×2 ANOVA for repeated measurements on the two scales. Data obtained with the ranking scale were analysed by Pearson's multiple comparisons test.

Results

The mean scores of the photographs judged with the VAS and ratio scale, for the first and the second assessment, are shown in Table 1. A 2 (VAS and ratio scale) \times 2 (first and second assessment) ANOVA with repeated measures on both factors showed no significant effect between either scale (ANOVA, $P = 0.296$) or between either assessment (ANOVA, $P = 0.130$). This indicated that the panel judged the photographs equally for both scales and in both assessments.

The ranking scores for the first and second assessment showed that most photographs

Table 1 Scores of facial aesthetics (means \pm SD) in the pilot study.

	Assessment	
	First	Second
VAS ($n = 24$)	55.28 \pm 7.13	57.43 \pm 5.84
Ratio scale ($n = 23$)	57.99 \pm 4.75	58.84 \pm 6.08

were ranked in the same position or at most two positions up or down. Pearson's multiple comparisons test resulted in an intra-observer correlation coefficient of $r = 0.839$, the inter-observer correlation coefficient was $r = 0.540$.

The judgements of the first and second assessment for the three scales showed no different response pattern. For the main study, therefore, the ratio scale was used, because of its simplicity and appropriateness for statistical evaluation.

Main study

Material and methods

The material consisted of a newly selected series of 36 slides of standardized frontal colour photographs of patients attending the Department of Orthodontics and Oral Biology, University of Nijmegen, The Netherlands (19 females, 17 males; aged 10–17 years, all but one with a Caucasian background). The same method as described in the pilot study was performed for selection of the photographs. Eleven of the 36 photographs (all with Caucasian background) were digitized and modified twice using image manipulation software (Macintosh: Photoshop 3.0).

The first modification was enlargement of the inter-eye distance by 20 per cent and the second mirroring of the right part of the face over the left part to obtain symmetry. In order to preserve a natural look, the hair was not manipulated. Three versions of these 11 photographs were available: an original (unmodified) face, an enlarged inter-ocular distance counterpart, and a symmetrical counterpart (Figure 1).

Three series of 36 slides were composed each consisting of 25 control slides and 11 slides chosen from the modification series, one of each individual. The choice for the original, the modified inter-ocular distance, or symmetrical slide varied across the three series, and was determined by a Latin square design.

The panel consisted of a group of 50 undergraduate dental and law students (33 females and 17 males, 93 per cent with a Caucasian background).



Figure 1 (a) Unmodified frontal photograph used as an original for one of the modification series. (b) Modified frontal photograph in which the inter-eye distance was enlarged by 20 per cent. (c) Modified frontal photograph in which facial symmetry was obtained by mirroring the right part of the face over the left part.



Figure 2 Photograph with a mean VAS score of 60 (SD = 5.95) that has been selected in the pilot study as a reference photograph for the main study.

The series of slides were presented at each of the three assessment sessions in the same order, and the panel was asked to judge the facial aesthetics of each slide on a scale from 0 to 100. During the session, a reference slide was projected continuously (Figure 2). This was the same as used in the pilot study for the assessment of the ratio scale and its value had been set at 60. The members of the panel were informed about this set score. The participants were asked to mark their assessment of each slide on a form with a horizontal bar on which the tens were indicated from 0 to 100, keeping in mind that the reference slide had a score of 60. Participants assessed the series of 36 slides three times with a time interval of two weeks. Each series contained 25 unmodified slides as a control; the other 11 slides were either presented unmodified or in one of the modified forms (Figure 1). The participants were not informed about the fact that some of the photographs had been modified.

Statistics

The reproducibility of the 25 unmodified control slides was assessed by a 2 (dental and law students) \times 3 (assessments 1–3) MANOVA with repeated measures on the last factor. The mean scores of the two groups of students were pooled

as this factor showed no significant difference (Table 2).

The effect of the modifications on the 11 slides was calculated by a 2 (dental and law students) \times 3 (modification: normal, inter-ocular, symmetry) MANOVA with repeated measures on the last factor. For this analysis, the mean scores for the groups of students were also pooled, as this factor showed no significant difference (Table 3).

Results

The results of the assessment score of the dental and law students showed no difference between both groups [$F(1.48) = 1.45$, $P = 0.234$] or between the assessment sessions [$F(2.96) = 1.46$, $P = 0.237$]. This means that the assessment of the slides was constant for the dental and law students, and remained constant over the three sessions. The mean scores of the 25 unmodified control slides were (assessments 1–3 of law students) 47.41 ± 4.40 , 46.24 ± 4.46 , 47.42 ± 5.90 , and (assessments 1–3 of dental students) 45.34 ± 7.46 , 44.38 ± 7.23 , 44.08 ± 7.34 , respectively.

The mean scores and their standard deviation for the 11 experimental photographs were as

Table 2 Scores of facial aesthetics (means \pm SD) of the control photographs at the different assessments ($n = 25$).

Assessment	Law students	Dental students
First	47.41 ± 4.40	45.34 ± 7.46
Second	46.24 ± 4.46	44.38 ± 7.23
Third	47.42 ± 5.90	44.08 ± 7.34

Table 3 Scores of facial aesthetics (mean \pm SD) for the different modified or unmodified photographs ($n = 11$).

	Unmodified	Symmetry	Eyes
Score	44.42 ± 6.52	$42.50 \pm 7.32^*$	$38.64 \pm 7.14^{**}$

Significantly different from unmodified:

* $P < 0.01$; ** $P < 0.001$.

follows: the unmodified slides scored the highest (44.42 ± 6.52), the mean scores for the eye-manipulated slides were the lowest (38.64 ± 7.14), and the symmetry slide lay in between (mean score = 42.50 ± 7.32 ; Table 3). This main effect for modification was confirmed by the MANOVA [$F(2.96) = 54.12$, $P < 0.001$].

Post-hoc t-tests with Bonferroni correction confirmed the difference between the normal and symmetric modification ($T = 3.88$, $df = 49$, $P < 0.01$), and the symmetry and inter-ocular distance modifications ($T = 7.63$, $df = 49$, $P < 0.001$).

Discussion

Judgement of the aesthetics of the unmodified control slides remained constant over the three sessions, indicating that the differences in judgement of facial aesthetics between the three conditions (normal, inter-ocular distance, and symmetry) were caused by the modifications. Both modifications were considered less attractive than the original slides and the modified inter-eye distance had a stronger negative effect on participants' judgement of aesthetics than the manipulated symmetry. The negative influence of the modified inter-ocular distance on facial aesthetics might be caused by the amount of eye-displacement that had been carried out. Although this modification did not create 'malformed' faces, it could be valued as negative in the perception of aesthetics. Comparison of the data with the literature is difficult as in earlier investigations dealing with manipulated eye placement (Franzoi and Herzog, 1987; Feingold, 1990); other features were also manipulated at the same time.

As far as facial symmetry is concerned, judgement of its influence on facial aesthetics seems to be diverse (Langlois and Roggman, 1990; Johnston and Franklin, 1993; Grammer and Thornhill, 1994; Langlois *et al.*, 1994; Perrett *et al.*, 1994; Kowner, 1996). This might be due to the different methods applied to create symmetric photographs. Most studies used facial composites, which not only manipulate facial symmetry, but also other facial characteristics. Kowner (1996), for instance, used composite photographs, which were divided into halves and flipped horizontally. In the present study individual photographs

were used to achieve total facial symmetry after flipping one half horizontally. This may have resulted in unnatural facial regularity, which probably caused some loss of expression and liveliness and thus less positive judgements. The fact that Kowner's (1996) results show no difference in judged attractiveness between the original photographs and the flipped composite suggests that it was not symmetry, but the averageness obtained by creating a composite, that was the decisive factor in the perception of facial attractiveness.

The observers comprising dental and law students of the same age agreed on the judgement of facial aesthetics of the photographs, although they had variable racial origin. Other investigations also confirm that a high agreement on facial aesthetics exists among panels with different backgrounds (Lundström *et al.*, 1987; Peerlings *et al.*, 1995).

Conclusions

The present investigation shows that the technique used, in which solitary modifications of facial photographs was performed, is suitable for the study of the influence of isolated facial features on perceived aesthetics. These modifications had a negative effect on perceived facial aesthetics. The type of modification might cause this, but in the case of the inter-ocular distance, perhaps the degree of modification also has to be considered. An increase of 20 per cent, as used in the present study, was judged as less favourable, but an increased inter-ocular distance of 10 per cent might yield more favourable results. A better understanding of the relative importance of separate facial features on aesthetics can be obtained by analysis of gradual changes in different parts of the face. Items of interest may be neonate features for women (increased eye size, enlarged mouth width) or masculine features for men (increased thickness of the eyebrow, increased jaw prominence), which are frequently mentioned in the literature as potentially influential facial aspects. Further work will also include specific orthodontic features such as the influence of tooth irregularity, position of the jaws, and mandibular form.

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References

- Baldwin B C 1980 Appearance and esthetics in oral health. *Community Dentistry and Oral Epidemiology* 8: 244–256
- Berscheid E 1980 An overview of the psychological effects of physical attractiveness. In: Lucker G, Ribbens K, McNamara J A (eds) *Psychological aspects of facial form*. University of Michigan Press, Michigan, pp. 1–25
- Berscheid E, Walster E 1974 Physical attractiveness. In: Berkowitz S (ed.) *Advances in experimental social psychology*, Volume 6. Academic Press, New York
- Bull R, Rumsey N 1998 *The social psychology of facial appearance*. Springer Verlag, New York
- Cox N H, van der Linden F P G M 1971 Facial harmony. *American Journal of Orthodontics* 60: 175–183
- Cunningham M R 1986 Measuring the physical in physical attractiveness: quasi-experiments on the sociobiology of female facial beauty. *Journal of Personality and Social Psychology* 50: 925–935
- Cunningham M R, Barbee A P, Pike C L 1990 What do women want? Facialmetric assessment of multiple motives in the perception of male facial attractiveness. *Journal of Personality and Social Psychology* 59: 61–72
- Dion K K, Berscheid E, Walster E 1972 What is beautiful is good. *Journal of Personality and Social Psychology* 24: 285–290
- Evans R, Shaw W 1987 Preliminary evaluation of an illustrated scale for rating dental attractiveness. *European Journal of Orthodontics* 9: 314–318
- Feingold A 1990 Gender differences in effects of physical attractiveness on romantic attraction: a comparison across five research paradigms. *Journal of Personality and Social Psychology* 59: 981–993
- Feinman S, Gill G W 1977 Sex differences in physical attractiveness preferences. *Journal of Social Psychology* 105: 43–52
- Franzoi S L, Herzog M E 1987 Judging physical attractiveness: what body aspects do we use? *Personality and Social Psychology Bulletin* 13: 19–33
- Gangestad S W, Thornhill R, Yeo R A 1994 Facial attractiveness, developmental stability and fluctuating asymmetry. *Ethology and Sociobiology* 15: 73–85
- Grammer K, Thornhill R 1994 Human facial attractiveness and sexual selection: the role of symmetry and averageness. *Journal of Comparative Psychology* 108: 233–242
- Howells D J, Shaw W C 1985 The validity and reliability of ratings of dental and facial attractiveness for the epidemiologic use. *American Journal of Orthodontics* 88: 402–408
- Johnston V S, Franklin M 1993 Is beauty in the eye of the beholder? *Ethology and Sociobiology* 14: 183–199
- Keating C F 1985 Gender and the physiognomy of dominance and attractiveness. *Social Psychology Quarterly* 48: 61–70
- Kerosuo H, Hausen H, Laine T, Shaw W 1995 The influence of incisor malocclusion on the social attractiveness of young adults in Finland. *European Journal of Orthodontics* 17: 505–512
- Kowner R 1996 Facial asymmetry and attractiveness judgement in developmental perspective. *Journal of Experimental Psychology* 22: 662–765
- Langlois J H, Roggman L A 1990 Attractive faces are only average. *Psychological Science* 1: 115–121
- Langlois J H, Roggman L A, Musselman L 1994 What is average and what is not average about attractive faces. *Psychological Science* 5: 214–220
- Lew K K 1993 Attitudes and perceptions of adults towards orthodontic treatment in an Asian community. *Community Dentistry and Oral Epidemiology* 21: 31–35
- Lundström A, Woodside D G, Popovich F 1987 Panel assessment of facial profile related to mandibular growth direction. *European Journal of Orthodontics* 9: 271–278
- Lundström A, Popovich F, Woodside G 1989 Panel assessment of the facial frontal view as related to mandibular growth direction. *European Journal of Orthodontics* 11: 290–297
- Meerdink J, Garbin C P, Leger D W 1990 Cross-gender perceptions of facial attributes and their relation to attractiveness: do we see them differently than they see us? *Perception and Psychophysics* 448: 227–233
- Peerlings R H J 1992 *Orthodontie en dento-faciale esthetiek*. PhD Thesis, University of Nijmegen, The Netherlands
- Peerlings R H J, Kuijpers-Jagtman A M, Hoeksma J B 1995 A photographic scale to measure facial aesthetics. *European Journal of Orthodontics* 17: 101–109
- Perrett D I, May K A, Yoshikawa S 1994 Facial shape and judgements of female attractiveness. *Nature* 368: 239–242
- Riggio R E, Widaman K F, Tucker J S, Salinas C 1991 Beauty is more than skin deep: components of attractiveness. *Basic and Applied Social Psychology* 12: 423–439
- Shaw W C 1981 The influence of children's dentofacial appearance on their social attractiveness as judged by peers and lay adults. *American Journal of Orthodontics* 79: 399–415
- Shaw W C, Rees G, Dawe M, Charles C R 1985 The influence of dentofacial appearance on the social attractiveness of young adults. *American Journal of Orthodontics* 87: 21–26
- Smit A de, Dermaut L 1984 Soft-tissue profile preference. *American Journal of Orthodontics* 86: 67–73
- Soh G, Lew K 1992 Assessment of orthodontic treatment needs by teenagers in an Asian community in Singapore. *Community Dental Health* 9: 57–62
- Thornhill R, Gangestad S W 1993 Human facial beauty: averageness, symmetry and parasite resistance. *Human Nature* 4: 237–269

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