Background Considerations to Facial Aesthetics

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Abstract. *This paper examines the nature of our objectives in attempting to improve facial appearance. Questions are addressed concerning the basis for any collective agreement on 'improvement' and the nature of an agreed 'ideal', including an exploration of the reasons for its existence. The discussion focuses on the concept of 'averageness', as well as supplementary hypotheses. Finally, the origins and validity of contemporary clinical guidelines are addressed.*

Index words: Aesthetic standards, Averageness, Multiple-motive hypothesis, Secondary sex characteristics.

Introduction

The improvement of a patient's facial appearance is an objective common to a variety of clinicians including, of course, orthodontists. Planning an improvement requires guidelines, or some kind of generally agreed 'ideal' set of facial proportions. These presently exist in a variety of forms, from 'atlas' presentations of soft tisssue facial landmarks involving linear and angular parameters and ratios (e.g. Powell and Humphries, 1984) to a plethora of cephalometric analyses, albeit in the latter case, somewhat handicapped by the inclusion of two-dimensional soft tissue data alone. It is interesting how rarely one comes across an attempt at defending the validity of recommended guidelines, even in established texts. However, there are some other fundamental questions relating to the achievement of facial attractiveness that deserve to be considered first, beginning with the question of the validity of collective assessment of attractiveness itself.

Collective versus individual aesthetic judgements

Clearly, when a clinician sets about improving someone's appearance, it is important first to know whether his mental picture of the anticipated improvement will coincide with that of the patient, the patient's family and acquaintances, and indeed, the public at large. In other words, is it possible to make collective judgements about the quality of facial appearance? Or is there truth in the adage that 'beauty is altogether in the eye of the beholder', as pointed out by Margaret Hungerford in l878. This latter viewpoint, namely that individual judgements are paramount and indeed, that collective assessments may vary according to the whims of fashion can be found in a variety of texts involving authors as diverse as Proffit (2000) to the feminist writer Naomi Wolf (1990). This would seem at first, therefore, to be a controversial topic, but perhaps the answer lies in the sheer magnitude of change in appearance that is being proposed for a particular patient. For example, the change in the patient's appearance (from Figure la to Figure lb) would surely be regarded universally as entirely satisfactory, with a high level of inter-examiner agreement that Figure lb would clearly provide a better facial appearance. At this level of difference therefore, there is clearly no problem in achieving collective agreement. However, at a more subtle level of change, i.e. that seen between Figure lc and Figure ld, it would be more difficult to achieve a high level of agreement between the examiners. It is at this fairly small magnitude of difference that individual judgements become significant. From the psychological literature, it becomes clear that agreement on attractiveness ratings has been shown to be high in a number of cross-cultural studies, such as that undertaken by Bernstein *et al*. (1982) in comparing Chinese and Caucasian attitudes. Similarly, Thakera and Iwawaki (1979) who showed that English, Asian, and Oriental female raters tended to show very close agreement in assessing the attractiveness of a selection of Greek males. In reciprocal studies, Maret (1983) first showed that a combined group of male/female raters of White and Cruzan (Native of US Virgin Islands) racial origin similarly assessed a group of Cruzan subjects in terms of attractiveness. Maret and Harling (1985) subsequently found that a similarly constituted group of raters also agreed on the relative attractiveness ratings of Caucasians. From these and other studies, it is possible to conclude that perception of attractiveness is, in fact, universal, i.e. cross-cultural. Certainly, at the level at which orthodontists and their surgical colleagues' function, it seems reasonable to assume that we all share a common perception of what our clinical objectives should be.

This being the case, it is interesting to speculate as to how this perception of attractiveness originated. On the one hand, it was once assumed that attitudes to attractiveness were assimilated from early childhood via stereotypes through contemporary culture, i.e. by images through the media, press, cinema, etc. The sort of preferences for attractiveness shown amongst children towards their peers from 3 or 4 years of age (Berscheid and Walster, 1974; Dion and Berscheid, 1974; Langlois, 1986) were in effect, environmentally induced, i.e. a product of indoctrination. However, there is a body of evidence to indicate that perceptions towards attractiveness are, in fact, genetic in origin. Some studies on infant perception (Langlois *et al*., 1987; Samuels and Ewy, 1985) indicate that infants as young as three months of age are able to discriminate between faces previously judged by adults as either attractive or unattractive, with a high level of agreement. Langlois *et al*. (1987) showed that when infants in two age groups, namely 3 and 6 months, were shown slides of faces previously assessed as either attractive or unattractive, they showed distinct signs of preference for the attractive faces. Maurer (1985) indicated that during the first year of life, infants show evidence of

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(a) (b) (c) (d)

FIG. 1 (a,b) Predictable collective agreement on relative attractiveness. (c,d) Unpredictable collective agreement, at this level of difference.

being able to make judgements about faces. There is evidence that very young infants show preference for one face over another by the length of time they spend in looking at each face (Fantz, 1965; Fantz *et al*., 1975). Indeed, adults as well as children tend to look longer at faces judged as attractive (Dion, 1977; Hildebrandt and Cannan, 1985). Langlois *et al*. (1987) found this to be true of extremely young infants.

Accordingly, it would seem that our perceptions of attractiveness are both inherited (or inherent) and, additionally, are universal or cross-cultural. Incidentally, this also applies to our perceptions of facial expression of basic emotions such as fear, horror, joy, etc. As pointed out by Darwin, an instinctive reaction such as the facial expression of grief, is interpreted by 'Europeans in exactly the same way as ... the Aboriginal hill tribes of India' (Darwin, 1872). Darwin showed that facial expressions of emotion are both instinctively produced and, indeed, perceived, and that these are cross-cultural, universally appreciated phenomena, presumably with a common evolutionary biological basis (Ekman *et al*., 1982).

The principle that perception of attractiveness is instinctive, based on a common perception of an 'ideal' provokes the question as what this common denominator might be?

'Averageness' as the ideal

In the mid to late nineteenth century, Francis Galton was amongst those influenced by 'physiognomists', such as J. C. Lavater (1780) who believed that character and personality could be determined by examination of an individual's facial morphology. Galton's subsequent attempts at providing the ultimate 'villainous countenance' (Galton, 1879), using early photographs of convicted prisoners, overlaid one in front of the other, produced composite portraits which quite contrary to his expectations, were

> '*... much better looking than those of the components ... All composites are better looking than their components, because the average portrait of many persons is free from the irregularities that variously blemish the looks of each of them*'.

This discovery was investigated and subsequently supported by others such as Treu (1914) and much later by the anthropologist Symons (1979). Symons went so far as to define beauty as '... Averageness, the average values of the features of faces in a human population'. More recently, digital imaging techniques have allowed the production of composite portraits to become very sophisticated. Langlois and Roggman (1990) showed that (with a few exceptions) composite portraits gained higher attractiveness ratings than their individual components and that the more components were incorporated into a composite, the higher the rating. Accordingly, composites produced from 32 individuals scored higher attractiveness ratings than those produced from eight. Additionally, inter-examiner agreement levels were high. Strzalko and Kaszycka (1991) using facial measurement, rather than composites, found that men rated women with average features particularly highly. However, Grammer and Thornhill (1994) found that whilst female composite faces were more attractive than individual female faces, this did not apply in quite the same way to male faces as rated by females. Symmetry that, of course, is associated with composites, rated highly as an attractiveness feature. From the literature, there appears to be a general view that the mean is an important component of attractiveness, in that the outcome of a proposed orthognathic/orthodontic treatment, for example, would hopefully be that the patient's facial morphology would subsequently conform more closely to the mean of the relevant population, than hitherto. However, as might be expected in a subject of this type, inevitably there are other factors that also need to be taken into account.

'Multiple-motive' hypothesis of attractiveness

An established approach to determine what facial proportions make a face attractive or otherwise, has been to measure a variety of facial components in those faces selected by raters as particularly attractive and then to determine whether those particular faces shared common characteristics. Keating (1985) constructed 'Identi-kit' composite portraits of male and female faces, in the process altering the relative size of each particular component such as eye size, lip thickness, etc. Female raters selected mens faces that had 'dominant', 'mature' features such as relatively large jaws, small eyes, and thin lips, whilst the opposite features were selected by males assessing females, in

the process preferring mainly 'non-dominant' features. Similarly, Cunningham's (1986) experiments on the relationship between specific female features and male response indicated that men were especially attracted to faces demonstrating those features that Keating had demonstrated as 'non-dominant' (see Figure 2) or 'neonatal' in type, having large foreheads, large, wide set eyes, small nose and chin, and full lips. It was suggested that these characteristics tended to stimulate a nurturing or caring instinct in the male observer as these features are particularly characteristic of infants (Enlow, 1990). However, the most attractive female faces of all, had additionally some 'maturity' features such as prominent cheekbones. In Cunningham's words, '. . . the contribution of mature with neonate features may signal that the female is at an optimal age for mating . . .'.

In their study on female perception of male facial attractiveness, Cunningham *et al.* (1990) concluded that females were attracted to males who had dominant or mature characteristics such as wide jaws, strong chins, and relatively thin lips, but that the most attractive men additionally had some neonatal features (as in Figure 2), i.e. expressing both 'ruggedness' and 'cuteness'. Additionally, a third feature, namely 'expressiveness' was also present amongst those male and female faces judged to be the most attractive, and these would include width of smile, and the presence of high-arched eyebrows, indicating sociability and responsiveness. Thus, these three features—neoteny, maturity, and expressiveness—all contribute to the 'multiple-motive' hypothesis of attractiveness, indicating that male attractiveness is based on a combination of these three features with maturity or dominance particularly emphasized, whilst female attractiveness places more emphasis on neoteny.

This theory and that of 'averageness' are not necessarily mutually exclusive. Alley and Cunningham's (199l) commentary points out that average faces are attractive, but that the most attractive faces additionally have these extra features, i.e. those shown in Figure 2. They argue that other factors beyond averageness are in operation since:

1. In the natural environment, 'non-average' male animals are often the most successful at mating and producing offspring, i.e. those with greatly enhanced secondary sex characteristics (for example, ornamental such as brightly coloured plumage, e.g. peacock feathers, or as weapons, e.g. deer antlers). Similarly, women might be expected to prefer males with evidence of increased muscularity or robustness rather than those with merely average characteristics.
2. Langlois and Roggman's (1990) data did show that there were a few exceptionally attractive individuals, who were more attractive than the composites.
3. The process of producing composites from a large number of individuals inevitably eliminates facial skin blemishes including creases, wrinkles, etc., thus providing the composite face with an 'unfairly' clear complexion.

Additionally, there is some evidence that attractive composites can be made even more attractive by further manipulation (Perrett *et al.*, 1994). Accordingly, other factors such as enhanced facial secondary sex characteristics appear to be involved, especially in males, where these will include such 'dominant' features as a large jaw, strong chin, etc. So, if the ideal that clinicians are striving to achieve (albeit unknowingly) is a sexually modified form of 'averageness', how does this come about? In other words, why should this be the common denominator for facial aesthetics?

Sexual reproduction and parasite resistance

Needless to say, the reason for a modified form of 'averageness' being the aesthetic ideal is not to be found in

Figure 2

"Multiple motive hypothesis" of facial attractiveness

features	Neonate *"nurturing, caring"*	Mature *"dominant"*	Expressive *"responsive"*
female:	large eyes wide-set eyes large forehead small nose small chin full lips	prominent malars	wide smile high, "arched" eyebrows
male:	*some* of above features	prominent malars wide mandible strong chin thin lips thick eyebrows	wide smile high, "arched" eyebrows

FIG. 2 'Multiple motive' hypothesis of attractiveness. (Cunningham *et al.*, 1990)

the orthodontic literature, or indeed any of the surgically related texts. Instead, one has to examine the zoological literature, where the assumption is clearly made (e.g. Thornhill and Gangestad, 1993) that human perception of attractiveness is firmly based in evolutionary biology, in that it is an essentially sexual characteristic, based on the need to find the most suitable mate for the production of healthy offspring. In the natural environment, parasites are constantly evolving in a bid to break down their potential hosts' defences and the hosts, in turn, are also evolving, albeit at a slower rate, to improve their defences in a form of natural 'arms-race'. The strongest defence that a host has is its genotype, so that a heterozygous host will have a better genetic code or 'good genes' (Hamilton and Zuk, 1982) than a host derived from in-breeding. Usually, the female is the one who actively selects the mate (males being relatively indiscriminate) and the female will often go to some lengths to ensure that her potential mate shows evidence of pathogen or parasite resistance. Indeed, Hamilton and Zuk (1982) likened this phenomenom to that of a family doctor examining a patient for eligibility for life insurance and that careful examination of, for example, plumage or fur quality may be undertaken and in some cases, urine or faeces may be inspected. Hamilton and Zuk further showed that there was a very clear, inverse relationship between parasitaemia levels in varieties of North American birds with brightness of plumage—particularly in males, where plumage colour is a secondary sex characteristic. In other words, the presence of brightly coloured plumage on a male bird would indicate to a female that the male is relatively free of parasites and so is likely to prove to be a suitable mate for offspring production. Other qualities, such as size and vigour, similarly prove useful indicators of suitability in terms of warding off competitors, provision of appropriate breeding facilities, etc.

This hypothesis, namely that secondary sex characteristics advertise parasite resistance and thus the presence of 'good genes' has been the subject of many zoological investigations since the publication of Hamilton and Zuk's paper. The introduction by Hausfater and Thornhill (1990) and, indeed, all the subsequent papers in that special edition of *American Zoologist*, were devoted to this topic, the conclusions conferring a considerable amount of validity to the concept. Following this, Folstad and Karter (1992) presented a further explanation for the role of testosterone that, of course, is responsible for the production of secondary sex characteristics. In introducing their 'immunocompetence handicap' hypothesis, they pointed out that testosterone has a known side-effect, namely that it reduces the male animal's immunocompetence, potentially rendering it more susceptible to pathogens. Only a 'strong' male could therefore cope with this. Thus, by a process of 'honest advertising', a male animal with highly developed secondary sex characteristics is essentially announcing to potential female mates that his genetic make-up is so strong, that he can afford the mild immunocompetence handicap that the production of his testosterone is producing and still be healthy. Grammer and Thornhill (1994) indicate that in the human male, those facial characteristics such as a particularly wide mandible and strong chin are, in fact, the testosterone-produced human equivalent of secondary sex characteristics. This would help explain why these features when present (within limits) tend to rate highly amongst females, indeed those individual males that rated more highly for attractiveness than the composites, had these very characteristics.

It is also clear that symmetry is an important indicator of freedom from disease, providing evidence that the individual is in good condition and thus a worthy potential mate. Needless to say, the reverse is equally true, so that what is termed 'fluctuating asymmetry' (indicating its haphazard nature, and in distinction to some forms of deliberate natural asymmetry) is a biological signal that the phenotype has been subjected to stress in some way and so is unlikely to provide his mate with healthy offspring. For example, environmental stress in the form of fowl mite concentrations were shown by Moller (1992) to produce asymmetry in the length of the tail feathers of male barn swallows. For this particular bird, the tail feathers are considered to be the secondary sex characteristics and the production of asymmetry in their length would impair its chances of finding a suitable mate. Parsons (1992) has described how fluctuating asymmetry can be used as a means of monitoring the degree of stress undergone by a particular phenotype, stress being applied environmentally (as shown by Moller in using parasites), or equally through extremes of temperature, protein deprivation, or noise, combinations of such stressess provoking asymmetries in mandibular and maxillary first molar sizes in Wistar rats (Sciulli *et al*., 1979). A different type of stress that can result in asymmetry is genomic, i.e. associated with 'in-breeding', producing homozygosity. This has been shown to produce a variety of asymmetries (Clarke *et al*., 1986; Clarke and MacKenzie, 1987). The implication is that the somewhat asymmetric phenotype is perceived by a potential mate as unsatisfactory. Needless to say, symmetry and averageness are closely related factors in the perception of attractiveness and to biologists such as Thornhill and Gangestad (1993), human perceptions have a clear evolutionary biological basis.

In summary, facial attractiveness is essentially a prelude to sexual selection and thus to reproduction. In other words, its biological basis is as a means of providing offspring. The basis for sexual selection is health, i.e. parasite resistance, which is 'advertised' by enhanced secondary sex characteristics, in the human male by those aspects of facial growth enhanced by testosterone at puberty, i.e. jaw size, chin prominence (within limits), and to some extent, malar eminence, whilst in the female this is limited to malar prominence alone. As mentioned earlier, parasite resistance is enhanced by heterozygosity, which in turn is 'advertised' by averageness—particularly, in humans, in the female. Thus, sexual selection favours both averageness (especially in the human female) and enhanced secondary sex characteristics (especially in the human male).

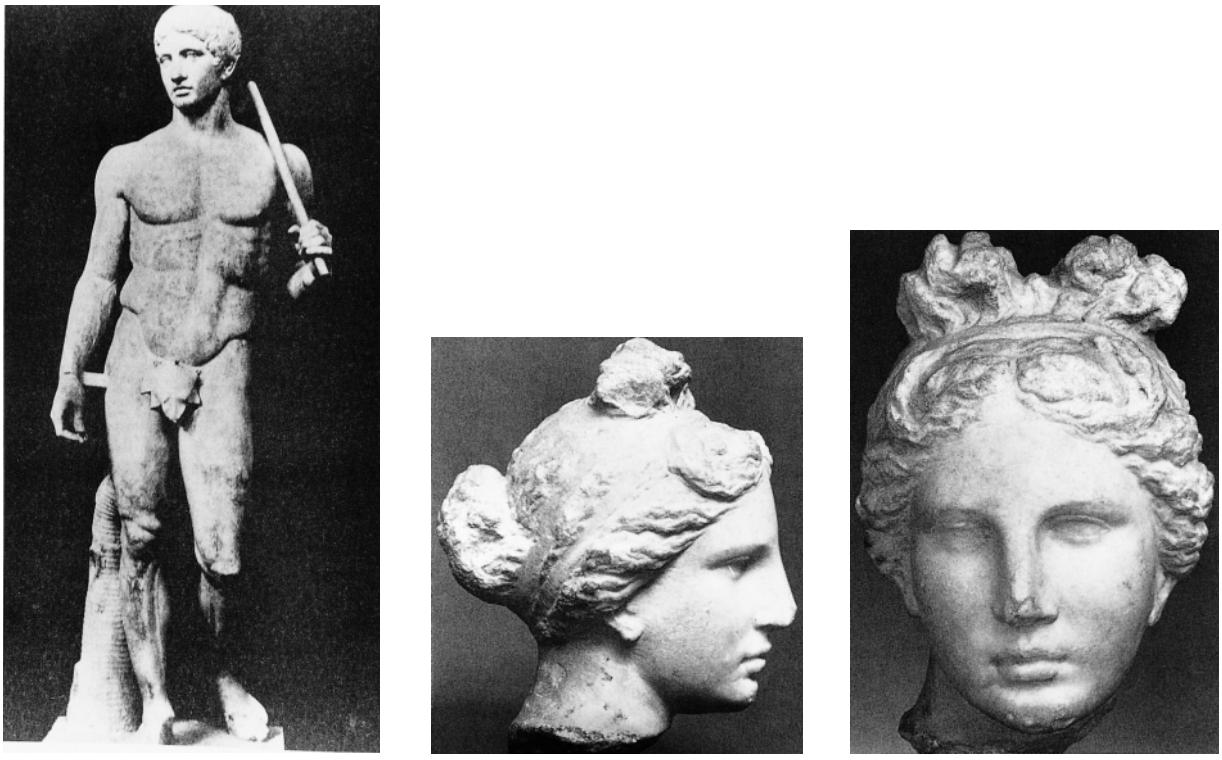
It would appear that there is an evolutionary basis for our perception of attractiveness and thus for our objectives as clinicians. Accordingly, our objective is a symmetrical face, with appropriate enhancement of secondary sex characteristics and, most importantly, with dimensions very close to the mean of the population. With this in mind, it is appropriate to consider the merits of the guidelines or recommendations for this 'ideal', which one comes across in the literature.

Aesthetic standards—sources of evidence

Guidelines for the 'ideal' in facial attractiveness have been presented in a number of ways, namely: artistic, cephalometric (including growth study material), and anthropometric.

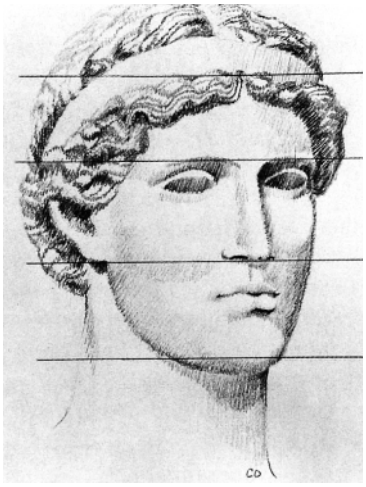
Artistic guidelines

It was only as recently as the mid-1970s that 'true' evidence in the form of mean data derived from growth studies became available for clinical use. Until then, those interested in improving an individual's facial appearance had to rely on guidelines based on the experience of representational artists over the ages, notably the Renaissance artists during the fifteenth and sixteenth centuries. Whilst the ancient Egyptians were possibly amongst the first to try to describe facial and bodily proportions in mathematical or in grid form, the main contribution seems to have developed during the ancient Greek civilization, particularly during the fourth and fifth centuries BC. Sculptures of the human form produced during that period invariably showed proportions that conform to certain established rules or 'canons'. Guidelines were laid down by a number of artists, one of the most famous, Polykleitos in the fifth century BC, whose statue and accompanied written work (Pollitt, 1965) displayed a number of recommended ratios for the human figure. Whilst the 'canon' itself no longer exists, many of Polykleitos' recommendations remained and were later modified and copied by the Romans. The second century Roman physician and philospher, Galen, noted that the earlier Greek sculptors had been very much aware of 'averageness' in aesthetics, pointing out: '. . . whatever form is most beautiful in man or in the cow or in the lion, always looking for the mean within each Genus' (Olds, 1993, referring to Pollitt, 1965). A famous sculpture by Polykleitos called 'The Lance Bearer' (Figure 3a) conforms to certain carefully laid down proportions, for example, the head and face together comprises two of fifteen equal vertical segments into which the human form could be divided, a principle which holds true today. The head of Aphrodite (Figure 3b) symbolizes the ideal facial proportions as envisaged by Greek sculptors in the fourth century BC. The concept of the so-called 'golden' or 'divine' proportion (Ricketts, 1982) also developed in the same period. This concept is believed to have orginated with the sculptor Phidias, hence the expression 'phi' in relation to the golden proportion which has been used as an aesthetically pleasing relationship of vertical and/or horizontal structures, from the Parthenon to contemporary design (viz credit cards). More to the point, as indicated by Ricketts, this relationship seems to occur naturally in a variety of guises in the human face and body. Whilst the Romans relied on the work of the Greeks, there are some significant original Roman contributors, such as the architect Vitruvius. His famous facial trisection (Figure 4) is still recommended in modern texts (e.g. Powell and Humphries, 1984), and used by orthodontists and orthognathic surgeons today, i.e. 2000 years later. During the thousand years that followed the Roman Empire, artists moved away from depictions of 'ideal' human form as the concept of physical beauty gradually became unacceptable as an 'ideal' in an increasingly

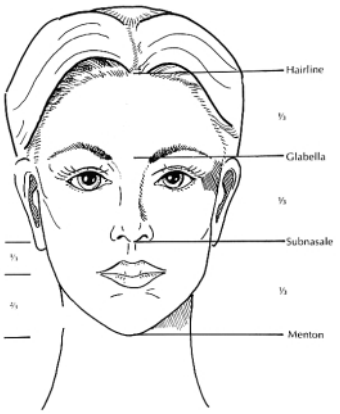


(a) (b) (c)

FIG. 3 (a) Polykleitos' 'The Lance Bearer', fifth century BC. The head and face comprise two of the 15 equal vertical parts dividing the figure. Reprinted by permission of Charles C Thomas, Illinois. (b,c) Aphrodite, fourth century BC. Reprinted by courtesy of the Museum of Fine Arts, Boston.

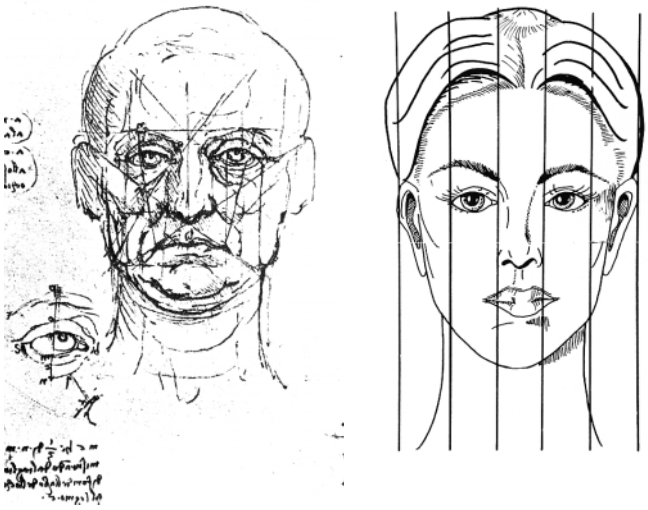


(a)



(b)

FIG. 4 (a) Facial transection, as originally described by Vitruvius (c. 70–c. 25 BC) Reproduced by permission, Center for Human Growth & Development, Ann Arbor. (b) As shown by Powell and Humphries (1984). Reproduced with permission.



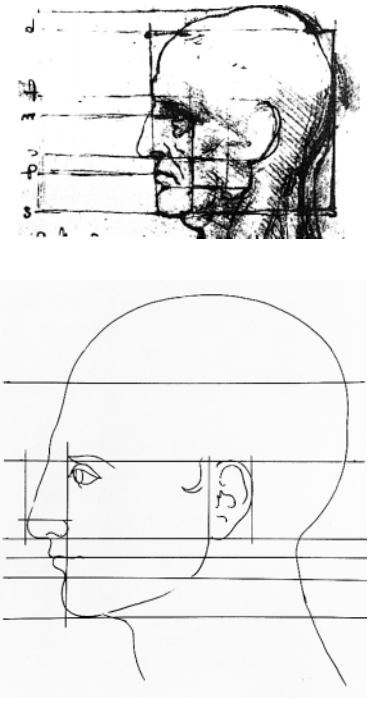
(a) (b)

FIG. 5 (a) Drawing of the proportions of the head (and eye). Da Vinci (date unknown) reproduced by permission, Bridgeman Art library. (b) The face divided equally into vertical fifths, Powell and Humphries (1984), reproduced by permission.

religious atmosphere. Physical beauty in other words gave way to 'spiritual' beauty (Peck and Peck, 1993). During the Renaissance, however, the Roman/Greek guidelines for beauty again came under close examination. Figure 5a may well represent Da Vinci's precursor to the subsequent 'rule of fifths', dividing the ideal face transversally into five equal eye widths. Figure 6a illustrates Da Vinci's work on proportions within the face as compared with Figure 6b, namely some of Durer's proposed arrangements for ideal proportions. Amongst these, the relationship between nose and ear length is identical to Da Vinci's. Durer incidentally additionally suggested that upper lip height (subnasale–stomion) should constitute approximately a quarter of the total lower facial height (subnasale–menton). Many other Renaissance artists (e.g. Francesca and Pacioli, Cennini and others) contributed to an overall scheme of proportions that subsequently became the norm (based on the average) for use by artists, and subsequently (perhaps unknowingly) by surgeons and orthodontists.

However, despite the undoubted brilliance of the Renaissance and later Baroque artists, their recommendations were of course essentially anecdotal in nature. It would be hard to describe their aesthetic guidelines as 'evidence-based'. Greater validity in the search for ideal proportions (i.e. a modified form of averageness) would require several other criteria to be satisfied including details of the population sample and how they were selected:

(1) the accuracy and precision with which the measurements were taken;
(2) together with an assessment of reproducibility;
(3) presentation of the raw data from which means and standard deviations were calculated.



(a) (b)

FIG. 6 Sagittal and vertical relationships within the face:
(a) Da Vinci – proportions of head, C1488–90, R L 12601, The Royal Collection c. 2000, Her Majesty, Queen Elizabeth II, Royal Library, Windsor Castle.
(b) Durer, reproduced by permission, J. Pierpoint Morgan library.

These and other criteria are important in assessing validity and were only really fulfilled this century, following the introduction of cephalometry, and subsequent growth studies and by anthropometry.

Cephalometry

A discussion on the background to facial attractiveness must obviously acknowledge the enormous impact that cephalometry has had and the manner in which it has been used to provide a vast array of data useful for the representation of ideal proportions. However, to those interested in finding a dataset that could accurately describe an ideal model for facial attractiveness, there are three areas of deficiency in cephalometrics that need to be addressed.

First, in many cephalometric analyses, the population details from which mean data was derived is not always clear. Where the size of the sample is known, there can be enormous variation, e.g. Ricketts analysis which involved the examination of 1000 individuals (Ricketts, 1957) to Downs analysis, involving just 25 (Downs, 1948). In some instances, for example, the analyses of Holdaway, Jarabak, and Steiner, the population size is unknown and this introduces an element of doubt when considering the validity of suggested guidelines. Despite this, one has to acknowledge that some of the guidelines, for example Steiner's aesthetic plane (possibly based on just one patient), have undoubtedly proved to be extremely useful.

Secondly, most of the data presented are two-dimensional in nature and thus incomplete. Measurements to represent the transverse dimension, i.e. as taken from PA cephalometric radiographs are, of course, entirely dentoskeletal and yet it is the soft tissue appearance that the patient presents to the outside world. In other words, at the present time there are no comprehensive, cephalometrically-based three-dimensional soft tissue measurements available to represent the mean, nor as yet from any other imaging techniques such as video or optical scanning.

Finally, whilst acknowledging the value of cephalometric growth study material such as that of the Burlington (Popovich and Thompson, 1977), Michigan (Riolo *et al*., 1974) and the Cleveland (Broadbent *et al*., 1975) studies, Proffit's (2000) comment is relevant, namely that these studies were undertaken as long ago as the period 1935–1965, raising the question as to their current validity, bearing in mind population changes that have since occurred. In other words, the most well known growth study material is, as Proffit describes, historical in nature. Bhatia and Leighton's (1993) growth study material is more up-to-date, their study having begun in 1952, but despite its great value in providing norms, especially those for orthognathic planning, it is still two-dimensional in nature.

In order to provide relevant information to facilitate aesthetic improvement, what seems to be needed is a comprehensive, up to date dataset of soft tissue-based measurements, which need to be three-dimensional in nature. Interestingly, all these criteria are more than adequately fulfilled by a source of evidence that has been neglected for perhaps too long, namely, anthropometry.

Anthropometric evidence

Direct measurements taken from living subjects would seem an obvious source of valuable data. As pointed out by Ward (1989) and Rogers (1974), the advantages of this approach include its non-invasiveness, simplicity, cheapness and, above all, the fact that there is a comprehensive dataset of age- and sex-matched standards (albeit presently limited to Caucasians) to which patients' measurements can be compared. In assessing the validity of direct measurements taken with sliding and spreading calipers and tape, Ward and Jamison (199l) found the magnitude of error amongst most of the 52 craniofacial variables studied to be low, i.e. within a millimetre. Significant errors related inversely to the size of the measurement and, just as in cephalometrics, landmark identification, so that smallish measurements associated with landmarks that would be difficult to identify, i.e nasal root width, are admittedly, not particularly reliable.

Koury and Epker (1992) have summarized the key anthropometric measurements of value to our clinical area, using measurements derived from the extensive work of Farkas (198l) and Farkas and Munro (1987). The population sample of Farkas totals over 2500 Canadian subjects, the measurements having been taken during the period 1967–1984. The subjects were all Caucasian, a mixture of Anglo-Saxons, Latin, and those of Germanic origin (Farkas, 1987). Thus, currently the value of anthropometric measurements is limited to Caucasians, but for this group, there is enough evidence of mean measurements, both linear and also as ratios or proportion indices, with which to compare one's patients. This evidence has been used in an examination of the validity of previous artistic recommendations such as the work of the Greek and Renaissance artists (Farkas *et al*., 1984, 1985a,b). For example, the 'true', i.e. anthropometric relationship of upper/lower lip lengths in relation to lower face height is compared to the recommendations of two Renaissance artists, as illustrated in Figure 7 (Farkas *et al*., 1984). Figure 8 illustrates the composite 'ideal' faces constructed from neoclassical 'canons', i.e. 'Renaissance Man' and from Farkas' mean data. In this, one can see that, for example, the Vitruvian trisection is perhaps not absolutely correct, at least in the male whose lower face height is a little greater than his mid-face height, which in turn is greater than his upper face height. Additionally, his nose tends to be shorter than his ear and the interocular distance is greater than the eye fissure length, in contradiction to previously held canons. Of course, the significance of the difference in ethnicity between the two populations, separated by 500 years, has to be acknowledged.

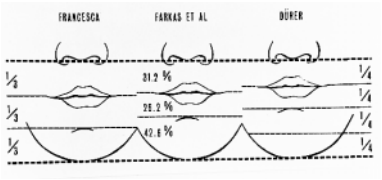


FIG. 7 Relative proportions of upper lip, lower lip, and chin lengths. Anthropometric proportions (Farkas *et al*., 1984) compared to the guidelines of Renaissance artists. Anthropometric proportions of the upper lip agree with those of Francesca and Pacioli, whilst lower lip lengths coincide with Durer's guidelines. Reprinted with permission, *American Journal of Orthodontics*.

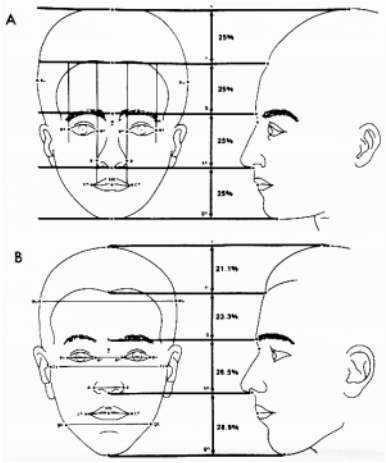


FIG. 8 'Canon' or Renaissance composite face (a) as compared to anthropometrric composite (b). The main difference lies in the lesser proportion of the length of the Renaissance face as compared to the head. Most of the increased length of the anthropometric face is in the lower third, the chin length being particularly increased, especially in the male. Reprinted with permission, Farkas *et al*. (1985), Plastic and Reconstructive Surgery.

Conclusions

It would seem that, within the margin of error that most surgeons and orthodontists operate, there is a reasonable body of evidence to suggest that collective judgements of facial attractiveness are justified. The common denominator that appeals to us all appears to be a modified version of 'averageness', in that, post-treatment, a patient's facial appearance will be closer to the mean of the population than hitherto. The reasons for this have an evolutionary biological basis, averageness being intrinsically associated with health, i.e. parasite resistance and attractiveness being the stimulus for sexual reproduction. Mean standards derive from a variety of sources, but possibly the most valid is paradoxically the most neglected, namely anthropometry, which has up to now been the mission of a very small number of researchers.

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