

ORIGINAL ARTICLE

The Circles of Prominence: Ideal Ratios That Determine the Basis of Facial Beauty

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Introduction: To test a key ratio within the face that establishes a basic order thought to define facial beauty. The ratio is based on the distance between the horizontal level of the iris to the nasal tip, the nasal tip to the lower lip, and the lower lip to the menton.

Materials and Methods: This was a subjective survey in which 27 pictures (3 variables with 3 values) were displayed to evaluators who would judge all of the pictures to assess their general attractiveness. To construct the pictures, we varied the distance between (1) the horizontal level of the iris, (2) the center of the nasal tip, (3) center of the lower lip, and (4) menton with the distance from the center of the iris to the midline fixed at 3 iris widths. These 3 distances were varied by 2, 3, or 4 iris widths. One hundred random patients (data not shown) from a head and neck surgery clinic were asked to place all of the photos in order from most aesthetically pleasing to least aesthetically pleasing. The rankings of all 100 patients/evaluators were averaged for each picture. Essentially, the lower the average, the more aesthetically pleasing the picture was thought to be by our test population. Because of the equivocal results from the first part of this study, we carried out another study placing the 2 most aesthetically pleasing pictures (pictures 5 and 14) from the first part of the study in another head-to-head study. In the second part of the study, we asked 127 patients from a facial plastic surgery office to judge whether picture 5 or 14 was the more attractive picture.

Results: The first part of the study showed that 2 facial representations of picture 5 (average ranking 4.67) and picture 14 (average ranking 4.28) were determined to be the most aesthetically pleasing, where rank 1 was judged to be the most attractive. Statistically through permutation tests ($P < .01$), picture 14 (ratio 3, 3, 3) was shown to be more preferred over all pictures other than picture 5 (ratio 4, 3, 3). Picture 5 had a $P = .2230$. A Bonferroni correction showed that

picture 14 was ranked No. 1 more often than picture 5, with $P < .0011$. In the head-to-head study, 88 people chose picture 14 and 39 chose picture 5. A 1-sample test of proportion showed that this was highly significant, showing that picture 14 was indeed the more pleasing picture ($P < .01$).

Conclusion: The study supports the idea of the importance of the iris, nasal tip, and lower lip as the main objects used when people assess beauty within a face. When the distance between these objects are varied, the presence of beauty is also varied. Based on this study, when these elements are balanced equally between each other, this arrangement is found to be more beautiful. Statistically, we were able to show that picture 14 was judged to be the most attractive where the distances were all equal (3 iris widths). This study further supports the validity of the Circles of Prominence as a theory on facial beauty.

Introduction

The elements of facial beauty have remained elusive.¹ Leonardo da Vinci's neoclassical canons, which have dominated our thoughts on this subject, have recently been shown to lack the ability to distinguish the average from the beautiful.² Previous theories, such as the canons, have concentrated on external landmarks on the face that do not occupy a significant portion of the time used by a viewer when they see a face. Because a viewer places less attention on these points (and other points that theories in the past have concentrated on), a theory based on these landmarks is inherently flawed when used to separate, aesthetically, the beautiful from the average face. A new theory should be based on elements that grasp the most attention from a viewer.¹

Previous literature has given us insight into some of the elements that occupy a person's attention when they analyze a face.^{1,3} What previous studies have shown is that a person spends most of their time concentrating on the eyes, nose, and mouth when they analyze a face. Of the many objects within the face,

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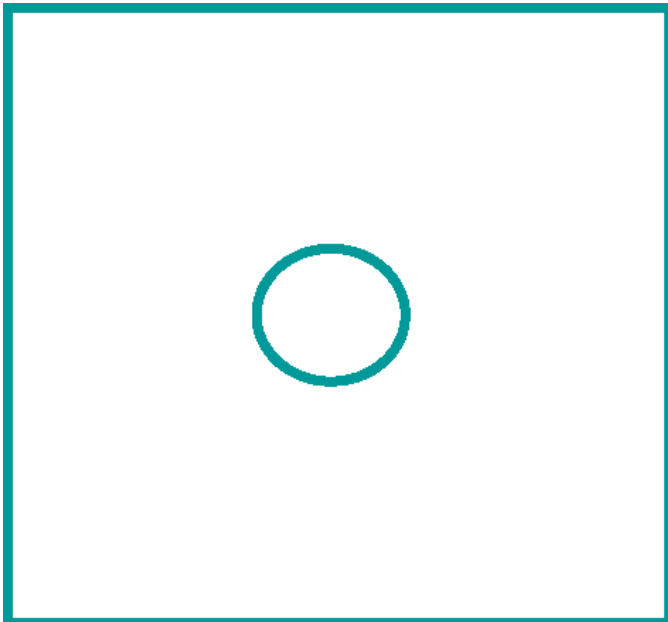


Figure 1. When you ask a group of people if they were to put a circle within the box in the most pleasing way, most will choose that circle to be in the center of the box. This subconsciously satisfies our desire for things to be in order.

the iris takes on the utmost importance. One notion is that each object, shape, or distance must have an ideal within the face to be beautiful. The ideal for each distance and shape must exist somewhere between zero and infinity. The Circles of Prominence (COP) theorizes that because we spend so much time looking at the

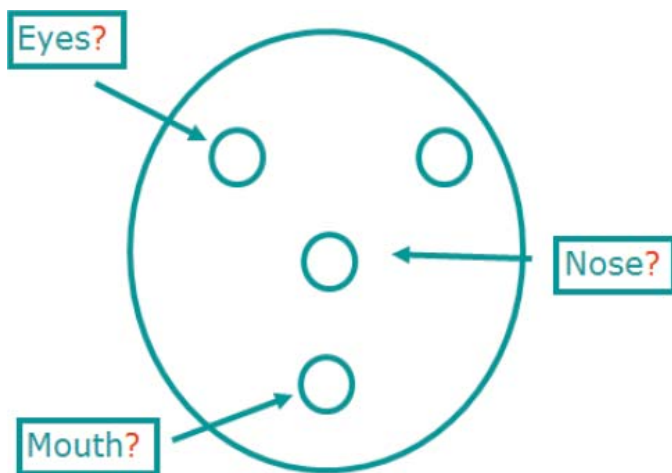


Figure 2. Along with the iris, the anatomical units of the eyes, nose, and mouth and how they relate to each other are vital to the appearance of the face. Within the oval of the face, these objects must be symmetrically related to satisfy the human beings' preference for order. When this is achieved, a basic element of beauty is satisfied, which ultimately promotes the appreciation of beauty within the face.

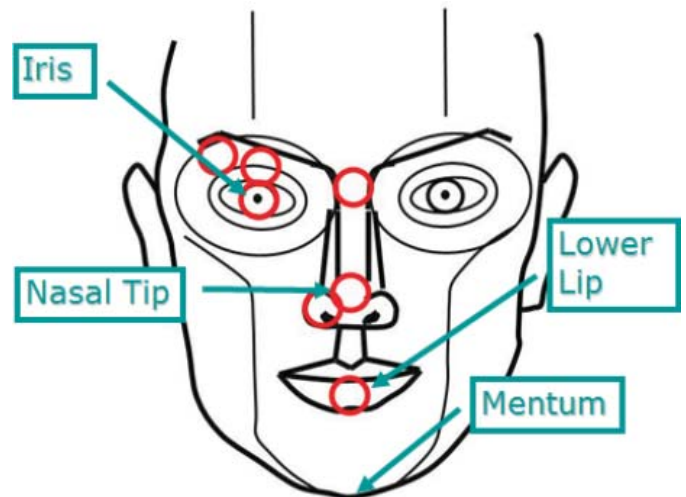


Figure 3. Within the eyes, nose, and mouth, the iris, nasal tip, and the center portion of the lower lip are the most important elements. They serve as centerpieces for each anatomical region. Their relationship with one another is paramount for establishing this order.

iris, the size of the iris must determine every shape and distance between zero and infinity in a proportionate way. Based on this simple idea, a new theory was developed to explain how beauty is structured within the face.¹

A basic premise of the COP is that order creates beauty. We find beauty within a face when all of the structures within it reminds us of this order. Take, for example, a box: when you ask a group of people if they were to put a circle within the box in the most pleasing way, most will choose that circle to be in the center of the box (Figure 1). This subconsciously satisfies our desire for things to be in order. Along with the iris, the anatomical units of the eyes, nose, and mouth and how they relate to each other are vital to the appearance of the face. Within the oval of the face, these objects must be symmetrically related to satisfy human being's preference for order (Figure 2). There is evidence that within the eyes, nose, and mouth, the iris, nasal tip, and the center portion of the lower lip are the most important elements (Figure 3).¹ They serve as centerpieces for each anatomical region. Their relationship with one another is paramount for establishing this order. Hence, the distance from iris to midline, the distance from the horizontal level of the iris to the nasal tip, the distance from the nasal tip to the center of the lower lip, and the distance from the lower lip to the menton should all be equal (Figure 4). Equality in these distances will determine whether the eyes, nose, and mouth are related in an orderly way.

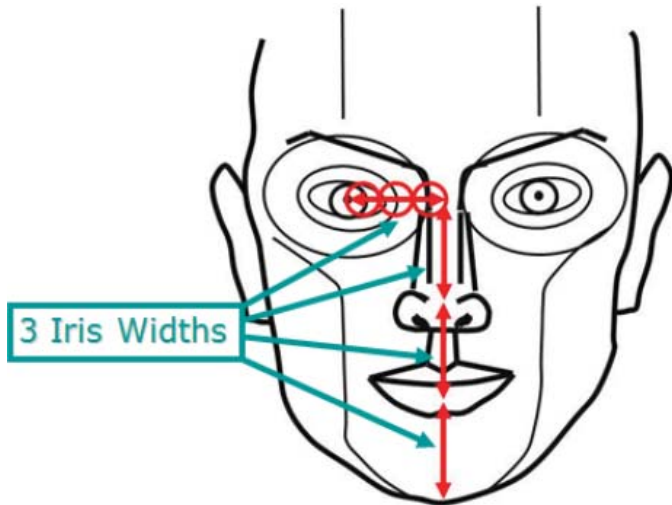


Figure 4. One basic rule for achieving beauty within the face is that the distance from iris to midline, the distance from the horizontal level of the iris to nasal tip, the distance from nasal tip to the center of the lower lip, and the distance from the lower lip to the mentum should all be equal. Equality in these distances will determine whether the eyes, nose, and mouth are related in an orderly way. When this order is achieved, a basic aspect of facial beauty is also achieved.

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Methods

To test this corollary of our new theory, we wanted to vary the relationship between the iris, nasal tip, and lower lip. We set the distance from the center of the iris to midline at 3 iris widths to make acquiring and analyzing the data more manageable. We then varied the distance from the horizontal level of the iris, center of nasal tip, center of lower lip, and menton. Each distance was either 2, 3, or 4 iris widths in length (Figure 5). With 3 variables and 3 values, we were able to draw 27 distinct pictures to represent all combinations. An example of one such drawing in Figure 6 shows picture 11 with each distance set as 3, 4, and 3 iris widths, respectively. When the distances are varied, a unique face is constructed (Figure 6). All 27 pictures that were digitally constructed were then randomly presented in front of our first population. We asked 100 random people from a head and neck surgery clinic to judge each picture for beauty. They were then asked to rank each picture from the most attractive to the least attractive (data not shown). We then averaged each picture's ranking from all of the 100 data sheets (Table).

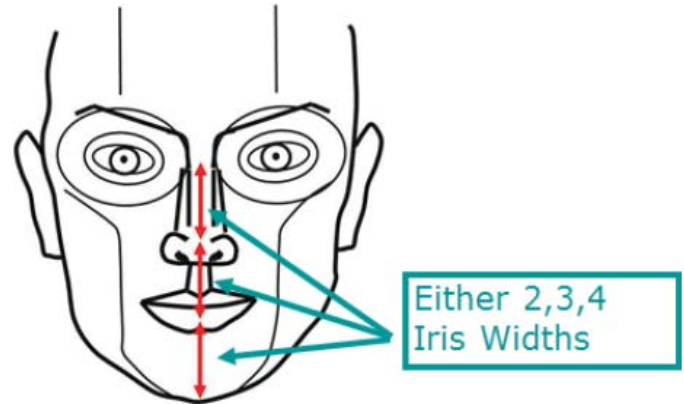


Figure 5. To test the basic principle described in Figure 4, we set the distance from the center of the iris to midline at 3 iris widths (for simplicity with data gathering and analyzing) and varied the following: (1) the distance between the horizontal level of the iris to the nasal tip, (2) the distance from the nasal tip to lower lip, and (3) the distance from the lower lip to the mentum. Each distance was either 2, 3, or 4 iris widths in length.

The first part of the study showed that 2 pictures had the lowest score after averaging the 100 data sheets. Because our statistical analysis showed equivocal results, we put picture 5 and 14 (the 2 lowest-averaged scores and thus the 2 most pleasing pictures) into a second study. We asked 127 clients from a facial plastic

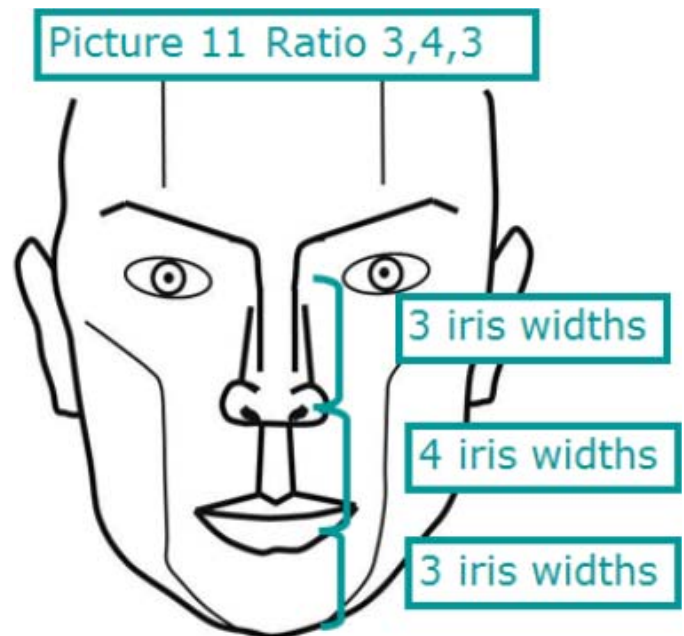


Figure 6. Picture 11 is an example of how a face appears with the distances varied as explained in Figure 5. This picture was constructed with the distance from the horizontal level of the iris to the nasal tip at 3 iris widths, the distance from the nasal tip to lower lip at 4 iris widths, and the distance from the lower lip to the mentum set at 3 iris widths.

Table. Average Ranking Based on 100 Participants Who Ranked Each Picture From 1 = Most Aesthetically Pleasing to 27 = Least Aesthetically Pleasing*

Average	Pictures	Ratio
12.19	1	4, 4, 4
10.57	2	4, 4, 3
13.75	3	4, 4, 2
7.37	4	4, 3, 4
4.67	5	4, 3, 3
9.45	6	4, 3, 2
17.32	7	4, 2, 4
17.37	8	4, 2, 3
19.13	9	4, 2, 2
12.22	10	3, 4, 4
9.29	11	3, 4, 3
12.36	12	3, 4, 2
7.49	13	3, 3, 4
4.28	14	3, 3, 3
9.76	15	3, 3, 2
19.93	16	3, 2, 4
19.67	17	3, 2, 3
21.07	18	3, 2, 2
13.64	19	2, 4, 4
10.26	20	2, 4, 3
24.41	21	2, 2, 2
14.13	22	2, 3, 2
24.14	23	2, 2, 3
14.84	24	2, 4, 2
13.47	25	2, 3, 4
10.59	26	2, 3, 3
24.47	27	2, 2, 4

*Ratios are the distance between the horizontal level of the iris, nasal tip, lower lip, and menton in iris widths.

surgery office to judge whether picture 5 or 14 was more aesthetically pleasing (Figure 7).

Statistical Analysis

To determine if the hypothesized 3-3-3 facial representation was considered the most aesthetically pleasing, a permutation test was performed.⁴ From the permutation tests, it was found that picture 14 was more pleasing to the eye than all pictures ($P < .01$), other than picture 5 (4-3-3 IW). Based on this test, picture 5 did not have a statistically higher average ranking than picture 14 ($P = .2230$). To further analyze the data, a permutation test may also be used to determine if the 3-3-3 IW image was ranked “1” more

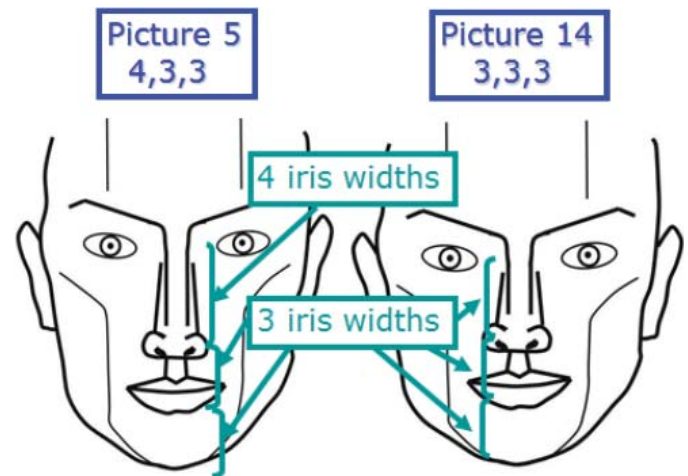


Figure 7. The first portion of our study showed that picture 5 with the ratio of 4, 3, 3 and picture 14 with the ratio of 3, 3, 3 were the most pleasing pictures for our test population. These equivocal results prompted us to place these 2 pictures in a head-to-head study to find which of the 2 was more pleasing when directly compared.

often than the others, but a test of proportions was more straightforward and thus applied. In this instance, the proportion of No. 1 rankings (with 1 ranking indication the most pleasing picture versus 27) for each picture was compared with picture 14 (ratio 3, 3, 3). To alleviate problems of multiple testing, a Bonferroni correction was used to adjust the type I error,^{5,6} a significant difference was determined if the test’s associated P value was less than or equal to .0019. For the second part of the study in which picture 5 and 14 were tested against each other, we employed some common statistical methods to carry out a 1-sample test of proportion and binomial test to find if the results of the second study were statistically significant.

Results

With the parameter that a lower score indicated a more aesthetically pleasing picture from the person being tested, we showed that 2 pictures were found to be much more pleasing than the rest of the pictures. The first part of the study showed that 2 facial representations, picture 5 ($P = 4.67$) and picture 14 ($P = 4.28$), were determined to be the most aesthetically pleasing given their lowest scores (Table). A permutation test showed that picture 14 (ratio 3, 3, 3) was more pleasing than all other pictures ($P < .001$) except picture 5 ($P = .223$). However, a Bonferroni adjustment showed that picture 14 was ranked No. 1 more than any other picture ($P < .002$), including picture 5 ($P = .0011$). Although picture 14 had a lower score (ie, it was thought to be the most aesthetically pleasing

based on its lower average of 4.28) and one of the statistical methods showed that it was ranked No. 1 more times in a statistically significant manner, we wanted to test which picture was more pleasing by testing a separate population. In the head-to-head study consisting of a test population of 127 participants, 88 people chose picture 14 and 39 chose picture 5 (Figure 7). A 1-sample test of proportion showed that this was highly significant, showing that picture 14 was indeed the more pleasing picture ($P < .01$). A binomial test further confirmed that this was significant ($P = .000016$).

Comments

The power of facial beauty is unquestioned, but the answers as to what makes a face beautiful has alluded us.² Leonardo da Vinci's neoclassical canons have dominated our thoughts on facial beauty, but many recent studies have shown that these canons are not able to distinguish the average from the beautiful.^{1,2,7,8} Many other theories have shown similar inadequacies.^{8,9} The problem with previous theories is their dependence on external landmarks on the face that have little importance to the viewer.^{2,7,8,9} The Glabellar, trichion, and so forth are essentially much less important in our assessment of whether beauty exists because we spend so little time looking at these points on the face. Theories based on elements that occupy little time during those critical moments of assessing beauty within the face will not ultimately explain beauty. A new theory should be based on what viewers spend the most time concentrating on when they see a face.¹

It is obvious that the eyes take precedence in this hierarchy of time spent by the observer in their assessment of the face.^{1,3} Previous studies have found evidence that the iris is the object within the eye that occupies the most time when someone assesses a face.¹ The COP¹ theorizes that every object or shape on the face has to have an ideal between zero and infinity. Take, for instance, the alae. If the alae were pinpoint in size at one end or the size of the entire face at the other, both extremes would be very unattractive. There has to be an ideal between those two. It is the contention of the COP theory that because we spend so much time looking at the iris when we assess someone's face, its size determines that ideal in some proportion.¹ Hence, every distance, dimension, or shape is ideally determined by a proportion of the width of

the iris. To follow this rule, the width of the nasal dorsum, size of the nasal tip, size of the nasal alae, distance from the bottom of the nose to the top of the upper lip, height of the lower lip, and the distance from the eyelid margin to the bottom of the brow all should be 1 iris width in dimension. This idea was supported in our original article.¹ With this basic tenet, the rest of the elements of a theory on beauty can be more attainable.

The very idea that there is a mathematical, scientific answer to beauty is controversial. Many believe that beauty is in the eye of the beholder. Because there are so many examples of very beautiful faces that do not look exactly alike, this idea has been supported in the past. The COP theorizes that because we can discern that one person is more beautiful than another, there must be a continuum from the least attractive to the most attractive. At the extreme end of the most attractive in this continuum lies this ideal that the COP has possibly discovered. But what about cultural differences? Previous studies¹ have shown that there is similar cross-cultural agreement that certain faces are more attractive than others. From this cultural standpoint, the COP's ideal still fits and can explain beauty. Each culture will have some minor deviations from the ideal that allow the person to be identified as part of one's culture while still possessing beauty that adheres to the ideal.

One idea that is important in discovering beauty is that beauty is really just a representation of a subtly presented order of objects within the face. This idea of order is central to the basic purpose of this study. We are attempting to find the most basic order in the face. Why is order so important for beauty to exist in the face? In essence, humans have a strong desire for order in their lives from birth to death. This desire is translated into the things they appreciate abstractly as well. We find a face beautiful when shapes are ordered within it. When there is less order, the face increasingly offends this desire for order, and hence it is found to be less beautiful. The next step is to attempt to find how the face achieves that order. To begin with, the face can be most simply thought of as an oval with several objects within it (Figure 2). It is important for all of these objects to be balanced in relation to one another to achieve this order. The more ordered and symmetric, the more beautiful the face is determined to be. Determining which objects are the most important and how they ideally relate to each

other is then the challenge. It was this study's aim to elucidate what those objects are. The COP contends that the iris, nasal tip, and center of the lower lip are the 3 most important objects within the face that humans use to determine this order. Hence, this study varied the distances of these objects and created diagrams to match these variations to search for the most aesthetically pleasing diagram and order. The data in this study lend support to the contention that these objects are central to a basic level of order that defines beauty within the face. Because of their importance, they need to be symmetrically related to one another to create beauty. When the iris, nasal tip, and lower lip are balanced in relation to one another, the larger shapes within each anatomic unit of the eye, nose, and mouth are also more balanced and ordered. The ultimate interpretation is that a basic element of beauty is achieved. When this spatial relationship is not balanced, the progressive larger circles of prominences within each subunit further accentuate this asymmetry and imbalance.¹ The result is that more tension is created between the major units of the eye, nose, and mouth, and the face is ascertained to be less ordered and thus less beautiful. This study supports this basic order in the face that can serve as a building block to discover more about what makes a face beautiful.

With this study, we were able to show supporting evidence that when the distance between the iris and center of the face is equal to (1) the distance from the horizontal level of the iris to nasal tip, (2) the distance from the nasal tip to the center of the lower lip, and (3) the distance from the center of the lower lip to the menton, the subsequent image of the face with those parameters is thought to be more attractive. We found that this distance is equal to 3 iris widths. The question has been presented whether 2 or 4 iris widths can be ideal instead of 3. With either, the balance of the face is extremely disturbed, as shown by the results of this study. We set the ideal distance between the center of the iris and midline to be 3 iris widths. This was supported by our previous study.¹ We chose to fix this distance (iris to midline of the face) to make the study more manageable from a statistical perspective and a data-gathering perspective. Future studies further proving this ideal distance between the iris and midline of the face and between both irises would be helpful.

The other picture (picture 5) that was found to be also pleasing was the ratio 4, 3, 3, which constructs a longer midface. When placed head to head, picture 14 easily prevailed, indicating the balance between the primary circles of prominence (iris, nasal tip, lower lip) dominates in regard to beauty. It is possible, based

on reassessing the drawing of picture 14, that the way the nasal tip was drawn could give the impression that the tip was actually more inferior than what was meant to be conveyed. The shadowing of the columella would normally cause the tip to be perceived as more distinct and higher. This shadowing was not portrayed in the drawings. Perhaps the statistics could have even been more significant had this been present.

Alternatively, as humans mature, their faces become longer. The favorable perception of picture 5 could indicate humans' acceptance or tolerance of this growth of the face. Clinically, what a surgeon can take from this is that if one were to err on one side or the other, a longer midface may be more tolerable to people in their perception of beauty within the face as determined by the distance from the horizontal level of iris to the nasal tip. However, we have previous knowledge that the ideal female face may be found at 16 years of age.¹⁰ There is literature suggesting that this age could be even younger and closer to ages 6 to 7 years based on computer analysis. Hence, it may be that balancing these 3 shapes and their relation to each other is more essential in creating beauty (ie, picture 14 with the 3, 3, 3 ratio) than the longer midface or longer narrower face generally found in adults.

Another alternative is that the pleasing perception of picture 5 may indicate that the iris-to-iris distance may be more ideally set at 5 1/2 iris widths instead of 6.¹ Our previous study showed that 6 iris widths could be the ideal distance between irises. The thought could be that the eyes may be considered related in their ordered balanced and relation to the nose and mouth anatomic subunits instead of each eye subunit being considered separately. This study strongly suggests that the distance between horizontal level of the iris, nasal tip, lower lip, and menton should be equal to satisfy a basic level of beauty. Because the distance from iris to midline was not varied in this study, we cannot state that 3 iris widths is ideal for this distance. But our best thought at this moment is that 3 iris widths is logical because it separates the distance from iris to iris into recognizable parts. The distance from medial limbus to medial canthus is 1 iris width. The distance between medial canthus to edge of dorsum is 1 iris widths. The width of the dorsum is 1 iris width and so on.

Clinically, the application of this theory can improve our practice of facial plastic surgery. With this theory, we can begin to assess how to make a face beautiful not through dogmatic numbers but through an understanding of the exact elements that determine what

makes a face beautiful. We are beginning to cross the divide between the left analytical side (the side that analyzes our world) and the right abstract side (the side that appreciates beauty). With rhinoplasty, we now have information that suggests that the nasal tip is most pleasing when it is located equally between the iris and center of the lower lip. We also have a better idea that the size of the nasal tip and width of the nasal dorsum should approximate the size of the iris to maintain harmonizing proportion. With this study, determining the most basic ordering of shapes within the face can allow us to look further into more complex relations in the face that illicit beauty.

Finding the answers to facial beauty is paramount in our attempts to beautify our patients. It represents the goals that we set when we surgically manipulate individual aspects within the face. As seen in many people of prominence who have received treatment, there are many results that are less than ideal. Many times, this can be the result of our lack of true understanding of facial beauty and youth and how to achieve it. The COP has identified some basic elements of beauty that have begun to elucidate these answers. We must continue to discover more of the elements that define beauty to ultimately set goals that can guide us to better results for our patients forever.

Acknowledgments

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