

The Circles of Prominence, A New Theory on Beauty: Ideal Distances in the Eyes, Nose, Ears, and Lips

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Abstract

The Circles of Prominence, A New Theory on Beauty: Ideal Distances in the Eyes, Nose, Ears and Lips. The Circles of Prominence (COP) theorizes that the width of the iris serves as an ideal for multiple distances and shapes within the face. We wanted to test if the iris width (IW) dictates: 1.) the aesthetic ideal distance between eyelid margin and bottom of the eyebrow; 2.) the aesthetic ideal width of the nasal bridge and tip; 3.) the aesthetic ideal height of the upper lip; 4.) the aesthetic ideal height of the lower lip; 5.) and the aesthetic ideal distance the ear extends from the side of the face. This was a subjective survey to test these distances to find the ideal. The data supports that the ideal distance for eyebrow height, nasal bridge & tip width, and lower lip height are all 1 IW as predicted by the COP. The ideal height of the upper lip was statistically found to be ½ IW. The ideal distance that the ear extends from the side of the face was split between ½ IW and 1. As predicted, the data supports the idea that the Iris width serves as the ideal distance or shape for many elements in the face.

Keywords

beauty, cosmetic dermatologic surgery, facial cosmetic surgery, general cosmetic surgery, dermatologic cosmetic surgery, facial plastic surgery, facial reconstructive surgery

Introduction

There are many ideas of what makes a face beautiful. Most of all theories concentrate on external landmarks to attempt to solve the answer. The neoclassical canons, the golden ratio, cephalometry, the theory of averageness, etc, have all come short and the answers have eluded us.^{1-3, 5-9} The reason they have failed is because they concentrate on shapes and points that we spend little time looking at. This approach is, hence, inherently flawed. A theory that will find the answer must respect what the viewer spends most of their time looking at when they see and interact with a face.

External landmarks are likely a natural place to start when attempting to elucidate the answers. They are easy to identify. These points are not insignificant. However, what is likely even more important are the slight gradations of shading that ultimately determine the shapes and sizes of even more important anatomical elements within the face. These gradations however are hard to pinpoint to establish a theory. It is partially because of this reason that a theory on beauty may have been hard to find. Where does one part of the facial anatomy stop and another start based on these light reflections? If it is based on shades of light that change with

movement of the face, these transition points are hard to identify. Another reason for the difficulty in finding the answer is that much of our appreciation of beauty is found spread out through our brain. Visualizing the lips stimulates our sensory portion of our cortical homunculus. The emotion it stimulates extends to our limbic system. The part of the visual cortex that is most stimulated by beauty resides on the right side, whereas the part of our brain that is more concrete and rational in thinking is on the left. This wide involvement of the brain when it interprets beauty makes it hard for us to rationally understand beauty to come up with the answers. The corpus callosum further enhances this separation and loss of information as the right and left brains are constrained in their communication across this thin conduit. Our rational mind (left brain) finds it difficult to understand the abstract mind (right brain). Confounding this challenge even more

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are the slight variations from the ideal that are present in the very beautiful, although only slightly less than ideal people.

Previous research on the ideas of the Circles of Prominence (COP)^{1,2} have begun to break down the elements of beauty within the face. If you were to ask a person to place a circle within a box, they are most likely to choose the exact center. Within the oval of a face, we have found support that the iris, nasal tip, and the lower lip are like the circle within the box. When these elements are symmetrically related, another element of beauty is reached. From there, the other shapes in the face need to be related to the iris, nasal tip, and center of the lower lip ideally as well. For instance, in the area of the eyes, what is the ideal distance from eyelid margin to the bottom of the eyebrow? Is there an ideal? What ideal between zero and infinity makes sense to the viewer? The COP hypothesizes that because we spend so much time looking at the eyes and iris specifically, the iris width (IW) is the rational choice for many of these distances. And as the objects in the face exceed the iris significantly, other objects take on the same role as the iris (in press).

In our original article¹ (Figure 1), the COP hypothesized that the distance of 1 IW determines (1) the ideal distance between the eyelid margin to the bottom of the eyebrow, (2) the ideal width of the nasal bridge and tip, (3) the ideal height of the lower lip, and (4) the ideal distance that the ear extends from the side of the face. For the upper lips, the COP hypothesizes that the ideal height is $\frac{1}{2}$ IW.

Methods

To test these ideas, we created line drawings and morphed pictures for each area that we wanted to test. The distance from eyelid margin to the bottom of the eyebrow, the width of the nose bridge and tip, the height of the lower lip, and the distance that the ear extended from the side of the face were all varied and set at $\frac{1}{2}$, 1, $1\frac{1}{2}$, and 2 IWs (Figures 2 to 6, 8, 10, and 11). The height of the upper lip was varied from $\frac{1}{4}$, $\frac{1}{2}$, 1, and $1\frac{1}{2}$ IWs (Figures 7 and 9). In total, there were 10 questions with 4 pictures each for 40 total pictures. These questions with pictures were presented to 190 participants. They were asked to rate each picture from 1 to 4, where 1 was the most aesthetically pleasing picture and 4 was the least aesthetically pleasing picture. Each picture was then averaged to find the most pleasing, with the lowest average indicating the most pleasing picture. A statistical analysis was then done to study the significance of the data.

Statistical Analysis

The description here applies to each of the 12 areas that were analyzed separately. First, the #1 choice by each respondent was identified from their ranking of the 4 pictures. Let $\{f_i\}_{i=1}^4$ denote the observed number of times that each of the pictures was the #1 choice, and define $N = \sum_{i=1}^4 f_i$. Consider the

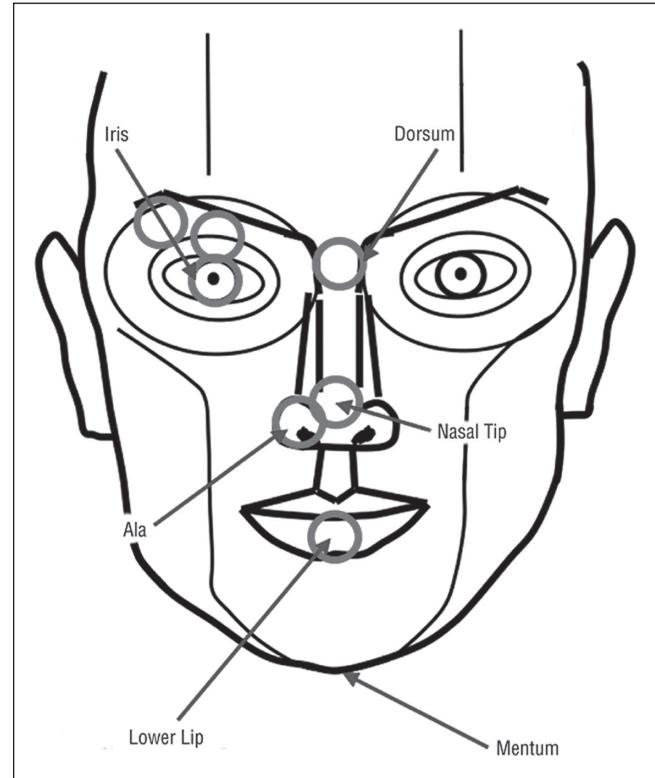


Figure 1. The ideal of many distances is dictated by the width of the iris.

Note. The ideal distance from the eyelid margin to the bottom of the eyebrow, the width of the nasal tip and bridge, the height of the lower lip, and size of the alae should all be 1 iris width (IW). The upper lip should be $\frac{1}{2}$ IW.

null hypothesis that there is equal preference for the 4 pictures. Under this null hypothesis, the expected value for each of the observed frequencies is $e_i = N/4$, where $i = 1, \dots, 4$. The null hypothesis can be tested using the statistic $\chi^2 = \sum_{i=1}^4 (f_i - e_i)^2 / e_i$. Under the null hypothesis, χ^2 has a chi-square distribution with 3 degrees of freedom. The P value for these tests is shown in column 2 in Table 1, with the value of the χ^2 test statistic shown in parentheses. In all cases, the null hypothesis of equal preference for the 4 pictures is rejected at a significance level less than .001.

The conclusion from the above analyses is that each area has at least 1 "winner." The top 2 pictures in each area are those corresponding to the 2 largest f_i values. Consider the null hypothesis that there is equal preference for these 2 pictures. To make things concrete, consider area #1 where the second and third pictures are the top 2. Under the null hypothesis, the expected value for the observed frequencies of these 2 pictures is $e_2 = e_3 = (f_2 + f_3) / 2N$, while the expected values for the observed frequencies of the other 2 pictures are $e = f/N$ and $e = f/N$, respectively. With these definitions the test statistic is again $\chi^2 = \sum_{i=1}^4 (f_i - e_i)^2 / e_i$, but now the degrees of freedom for determining the P value is 1. The P values for these tests are shown in column 3 in Table 1, again with the

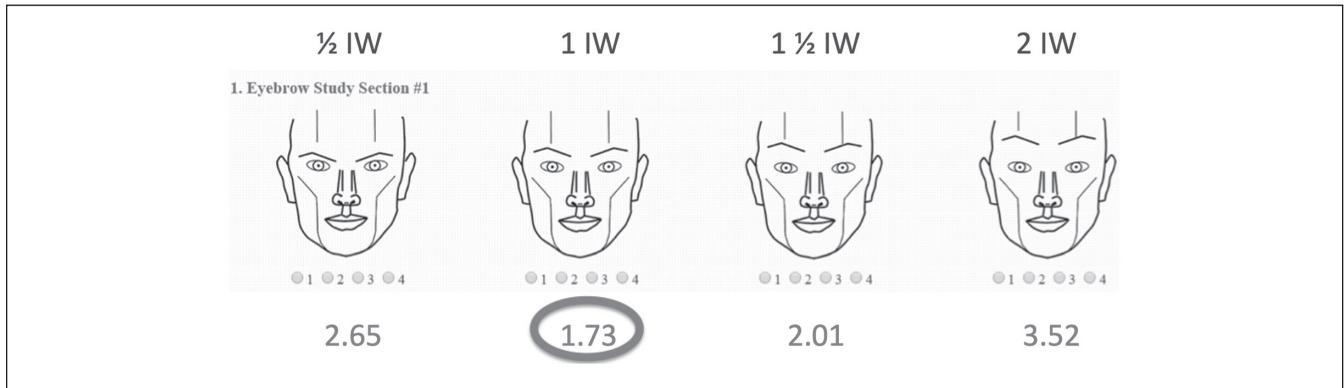


Figure 2. Line drawings with only the eyebrows manipulated to show varying distances from the bottom of the eyebrow to eyelid margin. Note. Ultimately, this is a test for eyebrow position and height. Each picture was created with this distance set at 1/2, 1, 1 1/2, and 2 iris width (IW), respectively. Out of 190 participants, 1 IW had the lowest averaged score of 1.73 indicating that this was the most aesthetic picture (statistically significant).

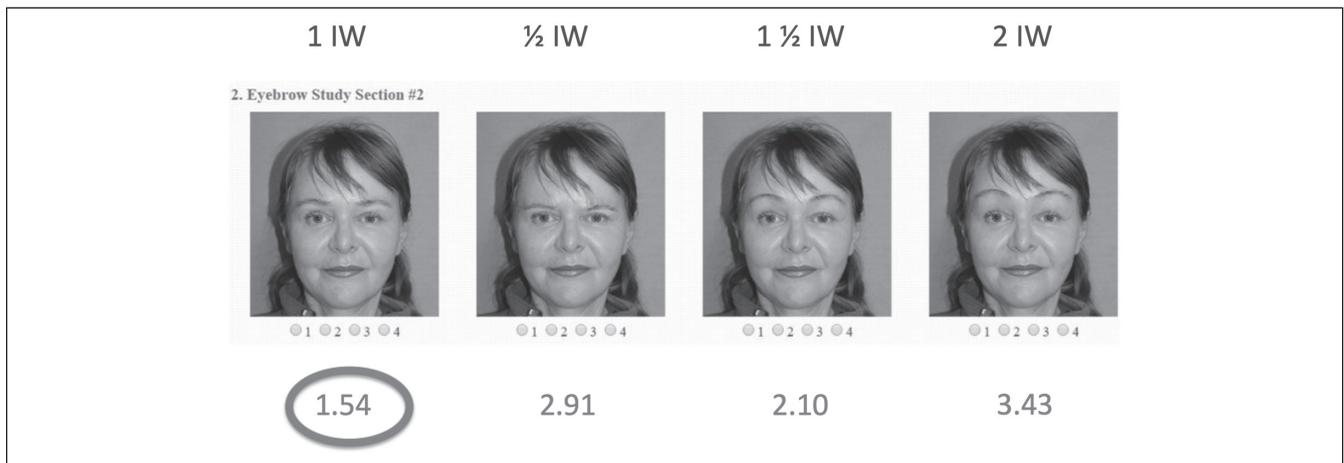


Figure 3. Morphed pictures with only the eyebrows manipulated to show varying distances from the bottom of the eyebrow to eyelid margin. Note. Ultimately, this is a test for eyebrow position and height. Each picture was created with this distance set at 1/2, 1, 1 1/2, and 2 iris width (IW), respectively. Out of 190 participants, 1 IW had the lowest averaged score of 1.54 indicating that this was the most aesthetic picture (statistically significant).

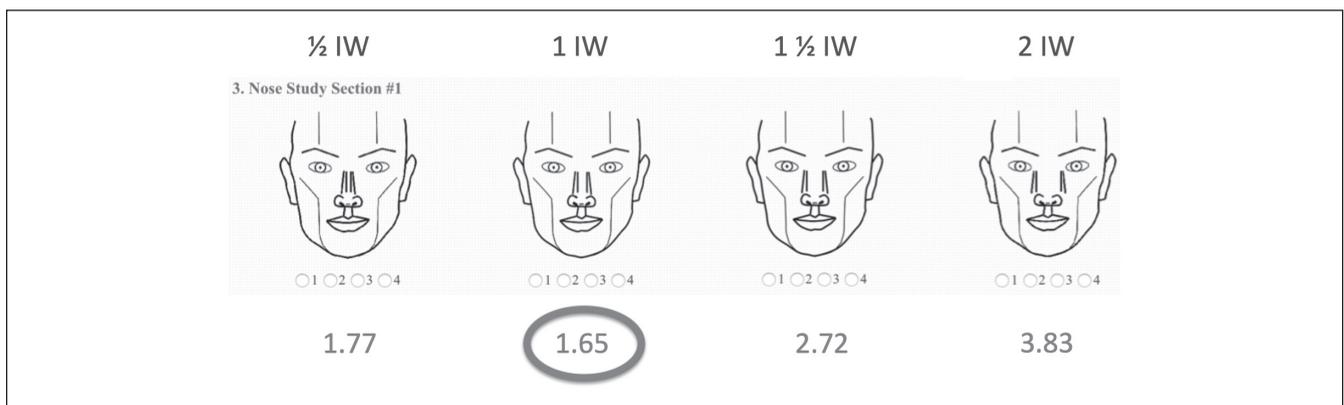


Figure 4. Line drawings with only the nasal bridge and tip manipulated to show varying widths. Note. Each picture was created with this width set at 1/2, 1, 1 1/2, and 2 iris width (IW), respectively. Out of 190 participants, 1 IW had the lowest averaged score of 1.65 indicating that this was the most aesthetic picture. This was statistically significant with the all equal null hypothesis being rejected but not when the top 2 were compared (1/2 and 1 IW).

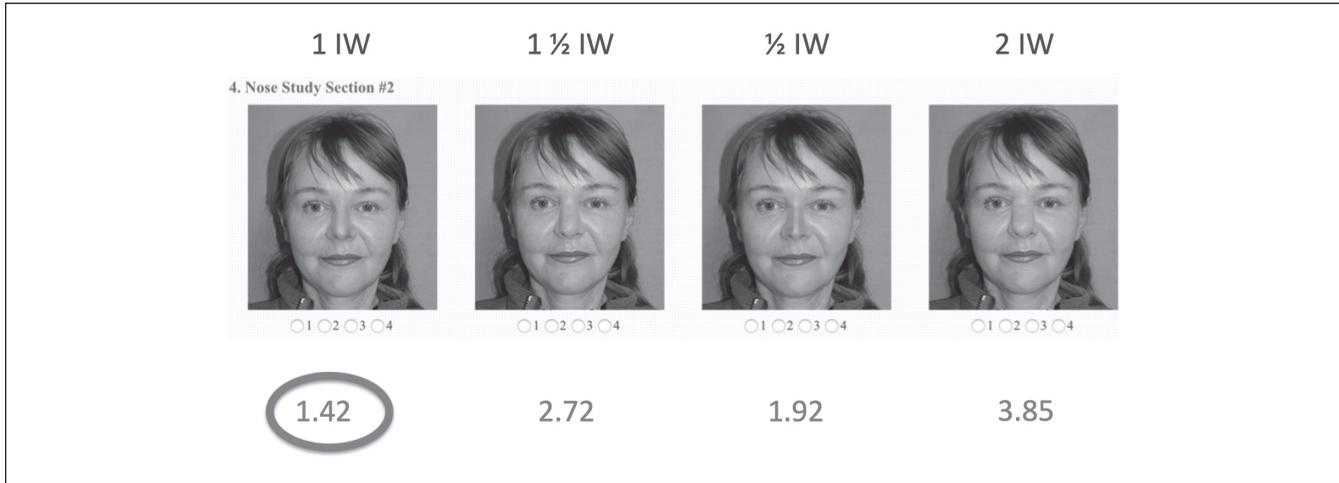


Figure 5. Morphed pictures with only the nasal bridge and tip manipulated to show varying widths. Note. Each picture was created with this width set at 1/2, 1, 1 1/2, and 2 iris width (IW), respectively. Out of 190 participants, 1 IW had the lowest averaged score of 1.42 indicating that this was the most aesthetic picture (statistically significant).

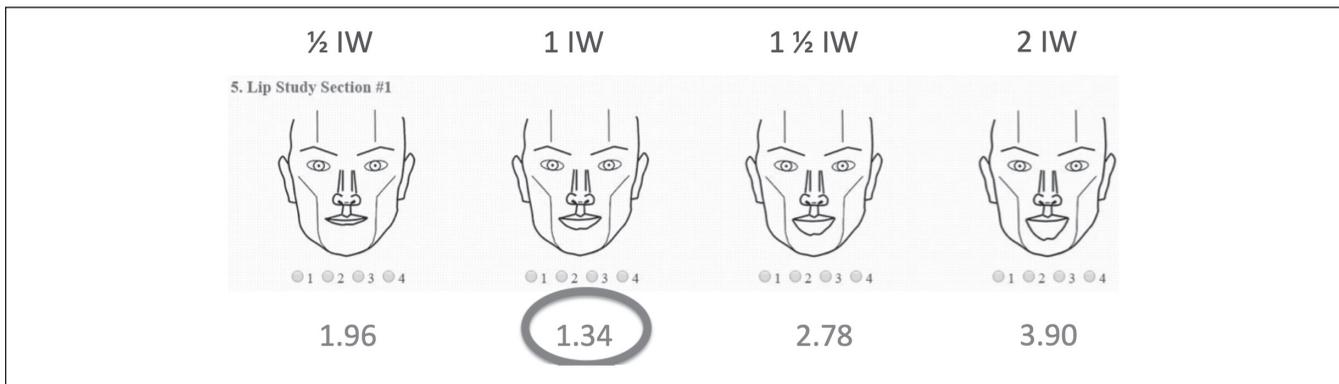


Figure 6. Line drawings with only the height of the lower lip manipulated to show varying heights. Note. Each picture was created with this height set at 1/2, 1, 1 1/2, and 2 iris width (IW), respectively. Out of 190 participants, 1 IW had the lowest averaged score of 1.34 indicating that this was the most aesthetic picture (statistically significant).

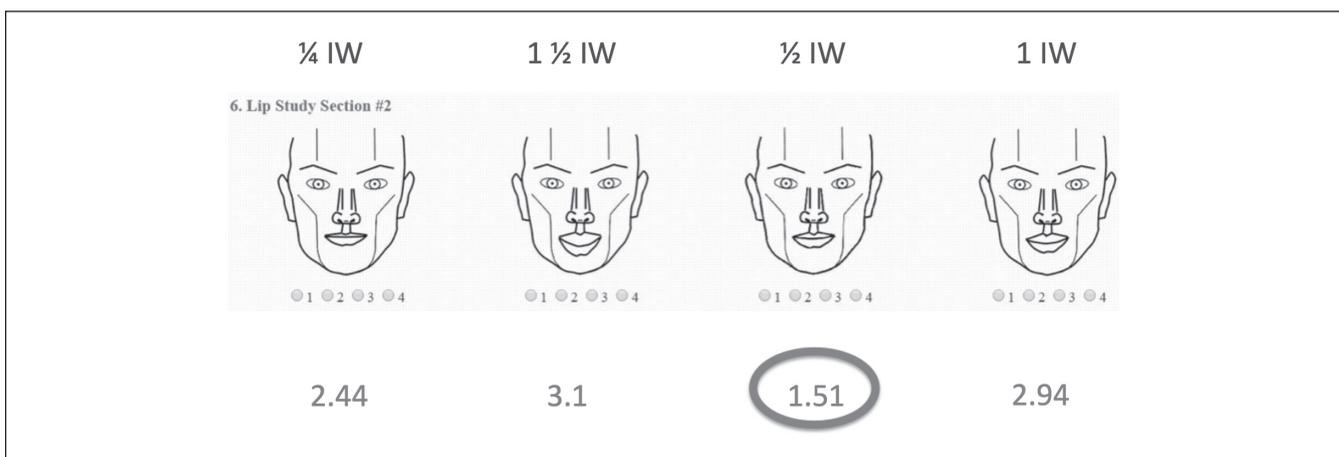


Figure 7. Line drawings with only the height of the upper lip manipulated to show varying heights. Note. Each picture was created with this height set at 1/4, 1/2, 1, and 1 1/2 iris width (IW), respectively. Out of 190 participants, 1 IW had the lowest averaged score of 1.51 indicating that this was the most aesthetic picture (statistically significant).



Figure 8. Morphed pictures with only the height of the lower lip manipulated to show varying heights. Note. Each picture was created with this height set at 1/2, 1, 1 1/2, and 2 iris width (IW), respectively. Out of 190 participants, 1 IW had the lowest averaged score of 1.18 indicating that this was the most aesthetic picture (statistically significant).



Figure 9. Morphed pictures with only the height of the upper lip manipulated to show varying heights. Note. Each picture was created with this height set at 1/4, 1/2, 1, and 1 1/2 iris width (IW), respectively. Out of 190 participants, 1/2 IW had the lowest averaged score of 1.22 indicating that this was the most aesthetic picture (statistically significant).

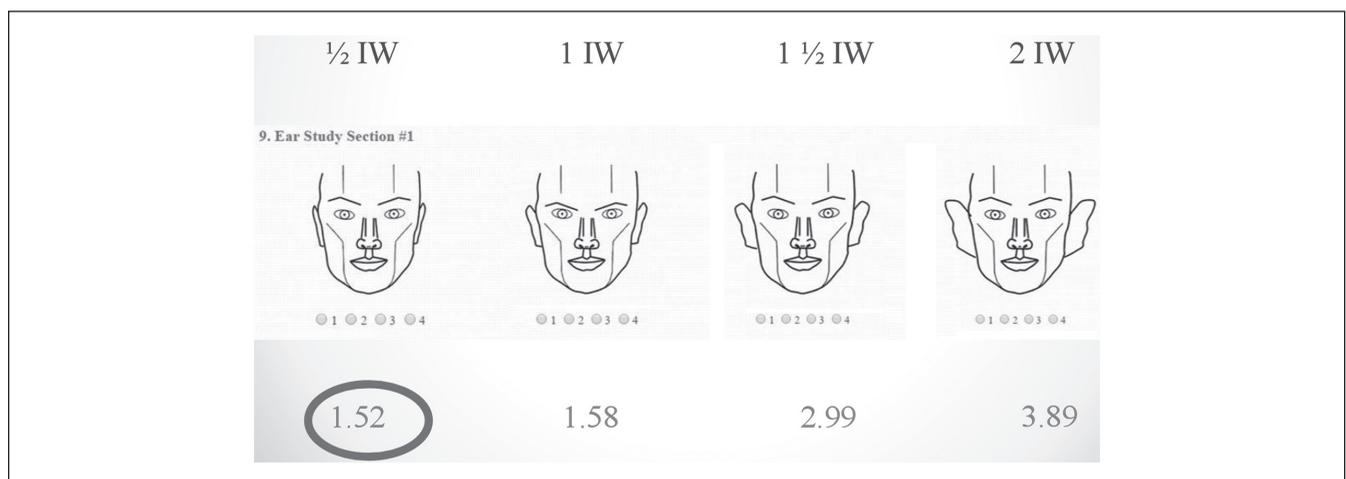


Figure 10. Line drawings with only the distance that the ear extends laterally from the side of the head manipulated to show varying distances. Note. Each picture was created with this distance set at 1/2, 1, 1 1/2, and 2 iris width (IW), respectively. Out of 190 participants, 1/2 IW had the lowest averaged score of 1.52 indicating that this was the most aesthetic picture based on the null hypothesis that they were all equal but not when the top 2 were compared (1/2 and 1 IW).

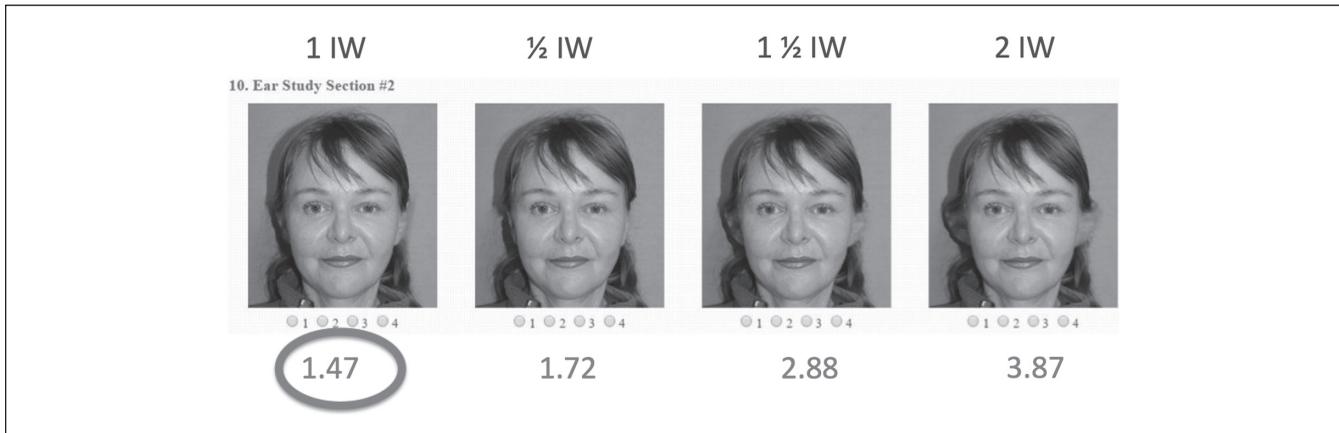


Figure 11. Morphed pictures with only the distance that the ear extends laterally from the side of the head manipulated to show varying distances.
 Note. Each picture was created with this distance set at 1/2, 1, 1 1/2, and 2 iris width (IW), respectively. Out of 190 participants, 1 IW had the lowest averaged score of 1.47 (statistically significant).

Table 1. Statistical Analysis for each question comparing all of the pictures (all equal) and the top two pictures (Top 2 equal), showing the best picture based on a significant *p* value of <0.05.

Figure	Area	P value H0: All equal	P value H0: Top 2 equal	Best picture(s)
2	1	<.001 (84.95)	.0011 (10.61)	2
3	2	<.001 (172.24)	<.001 (26.95)	1
4	3	<.001 (106.52)	.932 (0.01)	1 and 2
5	4	<.001 (160.52)	<.001 (13.74)	1
6	5	<.001 (215.92)	<.001 (44.83)	2
7	6	<.001 (131.99)	<.001 (34.27)	3
8	7	<.001 (341.61)	<.001 (101.44)	3
9	8	<.001 (273.76)	<.001 (94.08)	2
10	9	<.001 (135.86)	.324 (0.97)	1 and 2
11	10	<.001 (145.06)	.0025 (9.14)	1

value of the χ^2 test statistic shown in parentheses. Column 4 summarizes that there is a clear winner in all areas except #3 and #9, where the top 2 pictures are equally liked (Table 1).

Results

With the lower averaged score indicating the most preferred picture, as predicted by the COP, the line drawings in Question 1 showed that the ideal distance from the eyelid margin to the bottom of the eyebrow was 1 IW with the lowest averaged scored of 1.73; 1 1/2 IW was the next more preferred at 2.01. Then a lower positioned eyebrow was next preferred at 2.65. The worst height of the eyebrow was 2 IW with the highest average at 3.52. The null hypothesis that they were all equal was rejected. The null hypothesis that the top 2 were equal was also rejected indicating that Picture 2 was the most aesthetically pleasing and that the ideal distance from eyelid margin to the bottom of the eyebrow is 1 IW. In Question 2, this same part of the study was then repeated with morphed pictures (Figure 3). The 1 IW was

found to be most ideal with an even lower averaged score of 1.54. The next most preferred eyebrow height was 1 1/2 IW at 2.10. Again a lower positioned eyebrow was found to be next more preferred at 2.91 and the worst was the 2 IW picture with 3.43. In Question 2, both the null hypotheses that they were all equal and that the top 2 were equal were both rejected indicating Picture 1 was ideal in a statistically significant manner (Figures 2 and 3). For eyebrow height, 1 IW was the ideal height in both line and morphed pictures and this was statistically significant with all 4 null hypotheses.

With the line drawings in Question 3, the ideal nasal bridge and tip width was found to be 1 IW with the lowest averaged score of 1.65 in Picture 2. The next most preferred width was 1/2 IW at 1.77. A wider nose at 1 1/2 IW was the next most preferred at 2.72. The worst picture was the one with the nose tip and bridge width at 2 IW with the highest average of 3.83. The null hypothesis that they were all equal was rejected indicating that 1 IW was the most ideal nasal bridge and tip width. The null hypothesis that the top 2 were equal in terms of preference was not rejected and that both 1/2 IW

and 1 IW were equally preferred. In Question 4, the morphed pictures showed that 1 IW was also most preferred with an even lower averaged score of 1.42 for Picture 1. The next most preferred morphed picture was the one with the $\frac{1}{2}$ IW for the nasal bridge and tip at 1.92. The wider nasal bridge and tip at $1\frac{1}{2}$ IW was then next at an averaged score of 2.72. The worst picture was the 2 IW at 3.85. The null hypotheses that they were all equal and that the top 2 were equal were both rejected (Figures 4 and 5), indicating in a statistically significant manner that 1 IW was most ideal in the morphed pictures. For the ideal nasal bridge and tip width, 1 IW was the most ideal width based on average score, and this was statistically significant in 3 out of the 4 null hypotheses.

In Question 5, the ideal height of the lower lip was found to be 1 IW in Picture 2 as predicted by the COP with the lowest averaged score of 1.34 (Figures 6 and 8). The next most preferred height was $\frac{1}{2}$ IW at 1.96. The larger lip at $1\frac{1}{2}$ IW was the next most preferred at 2.78. The worst picture was the one that had the lower lip height set at 2 IW with the highest average of 3.90. The null hypotheses that they were all equal and that the top 2 were equal were both rejected indicating that 1 IW was the most ideal height for the lower lip in a statistically significant manner. In Question 7 (Figure 8), the morphed pictures showed that 1 IW height for the lower lip and Picture 3 was also most preferred with an even lower averaged score of 1.18. The next most preferred morphed picture was the one with the $\frac{1}{2}$ IW for the lower lip at 2.01. The larger lower lip set at $1\frac{1}{2}$ IW was then next most preferred at an averaged score of 2.94. The worst picture was the 2 IW lower lip height at 3.88. The null hypotheses that they were all equal and that the top 2 were equal were both rejected showing the statistical significance of 1 IW being the most ideal for the lower lip height (Figures 6 and 8). In summary, the ideal height of the lower lip was found to be 1 IW, and this was statistically significant with both line and morphed pictures and in all 4 null hypotheses.

In Question 6 (Figures 7 and 9), with the line drawings the ideal height of the upper lip was found to be $\frac{1}{2}$ IW and Picture 3 as predicted by the COP with the lowest averaged score of 1.51. The next most preferred height was $\frac{1}{4}$ IW at 2.44. The larger upper lip at 1 IW was the next most preferred at 2.94. The worst picture was the one that had the upper lip height set at $1\frac{1}{2}$ IW with the highest average of 3.10. The null hypotheses that they were all equal and that the top 2 were equal were both rejected indicating that $\frac{1}{2}$ IW was the most ideal height for the upper lip in a statistically significant manner. In Question 8 (Figure 9), the morphed pictures showed that $\frac{1}{2}$ IW height for the upper lip was also most preferred with an even lower averaged score of 1.22. The next most preferred morphed picture was the one with the $\frac{1}{4}$ IW for the upper lip at 2.17. The larger upper lip set at 1 IW was then next most preferred at an averaged score of 2.66. The worst picture was the $1\frac{1}{2}$ IW upper lip height at 3.92. The null hypotheses that they were all equal and that the top 2 were equal were both rejected showing the

statistical significance of $\frac{1}{2}$ IW being the most ideal for the upper lip height (Figures 7 and 9). In summary, the ideal height of the upper lip was found to be $\frac{1}{2}$ IW, and this was statistically significant with both line and morphed pictures and in all 4 null hypotheses.

In Question 9 (Figure 10), with the line drawings the ideal distance the ear extended from the side of the face was found to be $\frac{1}{2}$ IW and Picture 1 with the lowest averaged score of 1.52. The next most preferred height was 1 IW at a very close 1.58. The more protruding ear at $1\frac{1}{2}$ IW was the next most preferred at 2.99. The worst picture was the one that had the ear protrude 2 IW from the side of the head with the highest average of 3.89. The null hypothesis that they were all equal was rejected. While the null hypothesis that the top 2 were equal was not rejected indicating that $\frac{1}{2}$ IW or 1 IW could be the most ideal distance that the ear protruded from the side of the head. In Question 10 (Figure 11), the morphed pictures showed that the 1 IW distance the ear extended from the side of the head as predicted by the COP was most preferred with the lowest averaged score of 1.47. The next most preferred morphed picture was the one with the $\frac{1}{2}$ IW ear protrusion at 1.72. The ear that extended $1\frac{1}{2}$ IW from the side of the head was the next most preferred at an averaged score of 2.88. The worst picture was the 2 IW ear lateral extension at 3.87. The null hypotheses that they were all equal and that the top 2 were equal were both rejected showing the statistical significance that the 1 IW lateral extension of the ear from the side of the head was most ideal with the morphed representation of this area (Figures 10 and 11). In summary, for the ideal lateral extension of the ear, $\frac{1}{2}$ IW had the lower average in the line drawings but was equivocal statistically with 1 showing significance out of 2 null hypotheses. With the morphed picture the 1 IW was ideal and was significant with both null hypotheses.

Comments

The answer to facial beauty has eluded us. Numerous theories have attempted to elucidate the answer. All have come short, mainly because of their dependence on external landmarks that the viewer spends little time looking at when interacting and analyzing a face. Leonardo da Vinci's theories perhaps have dominated current thinking for the last few centuries. Studies looking at whether his neoclassical canons can differentiate the average from the beautiful have shown that they have come short in finding what people find beautiful let alone what is normal in different populations.^{2,3,5,6,7,8} Cephalometry, the golden number Phi, the theory of averageness, etc, have all come short in explaining what beauty is within the face for the same reasons.¹⁻⁸ All of these theories have used these less significant external landmarks and have not adequately explained facial beauty.

Finding a theory on facial beauty must respect what the viewer spends most of their time looking at when they see a face. It has to be simple for the brain to put things together

in an ordered manner. Something too complex will lose the instantaneous effect that beauty has on the viewer. The COP¹ originally theorized that the answer may be found in the eyes. This seemingly obvious anatomical location has never been worked into a comprehensive theory in the past. One approach to thinking about beauty is bringing extremes into our analysis. If one can say that someone is more beautiful than another person, a continuum is immediately set into this assessment. At the extremes are the most unattractive person on one end and the most attractive or ideal at the other end. To answer what is beautiful in the face, the most attractive at the extreme end of the spectrum is the ideal that we need to find. From there, we can start understanding what the elements are that create beauty in the face. Within that same continuum, you can also theorize that all shapes and objects within the face must have that same form of a continuum. For example, the size of the nasal bridge and tip must have an ideal between zero and infinity, or most unattractive and most attractive. In our original article, we introduced the concept that the iris may be the element that people feel comfortable using as a measuring stick between zero and infinity. In Figure 1, we show how this concept might look like. The width of the iris is the ideal distance for many elements or shapes in the face. The height of the eyebrow or more specifically the distance from the eyelid margin to the bottom of the eyebrow, the width of the nasal bridge and tip, the height of the lower lip, the distance that the ear extends from the side of the face, the alae's general size, the distance between the bottom of the nose to the top of the upper lip, all should ideally be an IW.

In Figures 2 and 3, we looked into the ideal distance from the eyelid margin to the bottom of the eyebrow. We hypothesized that the ideal distance for this would be 1 IW or the colored part of the eye. In both line drawings and morphed pictures, the 1 IW distance for this was found to be ideal in a statistically significant manner. The population group studied then found that a little higher brow position at 1½ IW distance was then most ideal. Then their preferences shifted and this group preferred the lower brow position at ½ IW. This phenomenon was true for both the line and morphed depictions. The reason for this was likely because the lower brow position is more frequently found in the normal population as compared with the higher position at 2 IW. The highest position at 2 IW was the worst in both the line and morphed pictures. This may be due to the rarity that this position was found in the normal population and the emotional aspects of fear, surprise, or shock that are conveyed with that brow position for the viewer.

From a clinical standpoint, this information is pertinent when discussing brow position, the type of surgical approach, and how to get the best results. If the eyebrows are already set at 1 IW, it may not be necessary to elevate the eyebrows, and an eyelift or volumizing may be the best option. If a brow lift is chosen or insisted upon, elevating the eyebrows no more than 1½ IW would be prudent. However, if the

eyebrows sit at ½ IW from the eyelid margin, it is ideal to have the brow lift elevate the eyebrows to the 1 IW to 1½ IW eyebrow height as the goal. Furthermore, it would be better for you to be conservative on elevating the eyebrow if the eyebrow position is already at 1 IW. Perhaps the most important thing we could conclude is that if the eyebrow height is near 1 IW, some other element is contributing to the aged appearance and that the absolute height is not the main determinant of a person's aged appearance. Perhaps volumizing is more the secret to making the area more youthful or it may be another more effective procedure that is better than traditional browlifting. Ultimately, with this information, your clinical decision making and discussion you have with your patients can be markedly improved.

This information can also be used to understand how people interpret emotions. By understanding ideal brow height, using these simple mathematics you may be able to say in a numerical fashion when the face is portraying the emotions of anger (1/2 IW), surprise, shock, or fear (all >1 1/2 IW). Based on these questions and data, a 1½ to 2 IW distance from eyelid margin to bottom of the eyebrow may be where these emotions are conveyed and critically reached. Conversely, somewhere between 1 IW and ½ IW is where the emotion of anger, disgust, disapproval may be conveyed. Information found in these questions and data can help our studies into human emotions and offer more insight into more recent popular thoughts into emotional intelligence, etc. Also based on the eyebrow height, the general look of one's eyes may be giving a baseline emotional expression that will be used to determine the personality of that person at the deepest intuitive level of the viewer. With this baseline look, a person may be interacting in a certain way that may or may not be intended. The ramifications of this in the world of psychology, behavioral science, and so many other areas can be significant. With this information, you may be able to tell a client better why they may or may not like the way their eyes look and what is being conveyed with their positioning.

In Figures 4 and 5, the nose was studied and we wanted to test the hypothesis that the ideal width of the bridge and tip are 1 IW. In the line drawings, it was immediately obvious through the data that 1 IW and ½ IW were both preferred with 1 IW narrowly winning. Although the all equal null hypothesis was statistically significant showing 1 IW as the most ideal picture, it was no surprise that the null hypothesis that the top 2 were equal was not rejected showing no statistically clear winner. Through these questions, we had some support to our initial obvious thought that presenting faces with line drawings would be different from actual morphed pictures. The data, in general for all of the questions in this study, showed that the more ideal picture found more distinction among the participants' subjective sense in the morphed pictures versus the line drawings. It would appear, based on the data, that the morphed pictures in 3 dimensions were able to show the differences between the pictures more clearly

than the line drawings. It is also likely obvious that the morphed picture data would matter more when considering beauty in real life situations. This is no surprise. In the line drawings, the 1 IW barely beat $\frac{1}{2}$ IW for the more preferred picture. The seemingly obvious reason would be that the nose is appreciated more accurately in 3 dimensions where gradations of lights more distinctly outline shapes and sizes within the face. The difference in light reflection is distinct between the bridge and tip versus the root of the nose. What the viewer sees more is the bridge and tip which receive the most light and whose widths are more clearly discernable in the third dimension and on a real face versus when seen in line drawings in 2 dimensions. This finding supports the impact that the 3 dimension can play in beauty as well. In the morphed pictures, the 1 IW picture showed a clear separation from the $\frac{1}{2}$ IW picture and was found to be statistically significant in rejecting both the null hypothesis for the pictures being all equal and the top 2 pictures being equal in contrast to the line drawings. Again, it would seem reasonable that the morphed pictures likely represent the more accurate assessment of what the viewer would prefer and should take more weight in assessing what happens in real life. Another conclusion that can be drawn from the questions regarding the nose is that humans may prefer a smaller nose versus a larger nose. In both the line and morphed pictures, the smaller nose that was $\frac{1}{2}$ IW was the next most preferred over the $1\frac{1}{2}$ IW nasal width and tip. As you will see, the phenomenon of smaller being better than bigger seems to be present for the lower lip, upper lip, and ears as well.

Clinically, what one can conclude is that if a surgeon had a choice, a smaller, thinner nose is more preferred than a larger, wider nose. Although the ideal is 1 IW, if one were to err on one side or the other, making the tip and bridge smaller is better than making it bigger than 1 IW based on the data. Importantly to note here is the risk of making the nose appear operated on and unnatural when making the tip and bridge smaller than 1 IW. This should also be explained to the patient. Also, the differences in the gradations of light reflection are vital in appreciating the tip and bridge and its width. Importantly, there may be a critical point in this change from the most reflected areas of tip and bridge and the root of the nose that needs to be present for the tip and bridge to distinguish itself from the root. A flatter nose will be more analogous to the 2 dimensional line drawing versus a more projected nose in the 3 dimension. A thought is that there might be a critical degree which is created by the angle formed by the lateral crura and the line straight through the columella and the center of the nose on base, worm's-eye view. Our sense is that this is 45° . A more acute association would make the tip and bridge more distinct, and a more obtuse angle would more likely give the illusion of a wider bridge and tip and less distinction. More acute would support a more refined tip and bridge. A less acute angle described would more likely appear bulbous, wide, and less refined.

Another point relating to the significance of the morphed presentations and the 3 dimension impact that could be present in the nose pictures should be made between the tip and the bridge regarding the supra tip break. Many consider that this break is 1 to 2 mm from the tip to the dorsum. This separation creates more light reflection on the tip as opposed to the dorsum. Why is this important for beauty to be present in the whole face and how is this related? An idea that may have been alluded to before by other authors is that this separation makes the tip stand out. This tip distinction helps the face become more spacially separated in a symmetric way. The tip serves as the centerpiece for the whole nose subunit along with the iris and center of the lower lip.^{1,2} With a more distinct separation, the viewer is able to assess whether symmetry is present by being able to see the tip better and allowing the viewer to assess whether a balance is present between the locations of the primary COP of the iris, nasal tip, and lower lip. This idea is related to the present study in that the more prominent nasal tip may be present more in the morphed pictures compared with the line drawings (Figure 5). Another study comparing morphed pictures that have the same light reflection versus differentially represented light reflections would be needed.

In Figures 6 and 8, the 1 IW dominated as the most ideal in both the line and morphed pictures for the ideal height of the lower lip. Both were statistically significant. As mentioned previously, similar to what we found with the nasal bridge and tip width, people showed through the data that they appear to prefer a smaller lower lip as opposed to a larger lower lip as the $\frac{1}{2}$ IW height of the lower lip was more preferred than the larger $1\frac{1}{2}$ IW lower lip. As mentioned before, this same phenomenon was present for the nose, upper lips, and ears as well. The eyebrow was the only anatomical section that did not follow this trend where smaller was more preferred.

Discussed in more detail here, the same phenomenon in the nose was seen here as well, where the data with morphed pictures showed more of a separation between the top picture and the second-best picture. Looking at the data in a slightly different way in the lower lip, the ideal in the morphed drawings had a lower average (compared with the ideal picture in the line drawing) and was further separated from the second-best picture (0.83 top 2 difference in the morphed pictures) more so than the line drawings (0.62) in comparison. This was seen in the questions looking into the eyebrow as well (Figures 2 and 3). As the difference between the averages for the top picture and second-best picture in the line drawings in the eyebrows (0.28 points of separation) was less than the morphed pictures (0.56). This phenomenon was seen in the nose as well (Figures 4 and 5), where the top picture separated from the second-best picture in the line drawings (0.12) was less than in the morphed pictures (0.5). For the nose, this was a statistically significant point in that the difference was significant in the morphed pictures but not in the line drawings between the top 2. For the lower lip (Figures 6 and 8),

the top 2 line drawings were separated by 0.62, and in the morphed picture the difference was 0.83. For the discussion on ensuing questions but related to this phenomenon, for the upper lip (Figures 7 and 9) the line drawing difference between the top 2 was 0.93 and the morphed pictures was 0.95. For the lips, it appeared that the differences between the line and morphed drawings were not as distinct. It seemed the 3 dimensions were not as necessary for judging beauty and the 2 dimensions were almost as sufficient for viewers to judge the appearance of the lips specifically for the heights of the lips. This may seem logical given that the lips do not protrude as much as the nose. As we will see in later data,⁹ the 3 dimension may be important for the light that the pucker creates. For the ears, the line drawing difference for the top 2 was 0.06 with the smaller $\frac{1}{2}$ IW lateral extension winning out. The difference between the top 2 morphed ear pictures was 0.25 with the 1 IW winning out. Like the nose, the ears were markedly dependent on the third dimension, and this was a statistically significant difference with the morphed pictures showing the possibly true ideal anatomical form in that the morphed picture data (as you will see) were statistically significant in contrast to the line drawings. In summary, this particular phenomenon here showed that the data appeared to indicate that the viewers were more impressed by what the morphed pictures were able to convey regarding the differences between pictures and is another way the data support the visual impact the 3 dimension plays in assessing beauty.

Returning to the lower lips, from a clinical point of view, the goal for the surgeon would be to augment the lower lips to the height of 1 IW. This augmentation in the horizontal dimension should be about the same width as the horizontal aperture of the eye.⁹ If in doubt, it is better to err on the smaller side unless directed by the patient. One must discuss some of these findings if patients are to choose a lip that is bigger than 1 IW. If a bigger lower lip is desired, being conservative and not making the lower lip much bigger than 1 IW would be prudent. With these data, surgeons will be able to identify why patients might not like their lips. They would also be able to explain why in more of a concrete mathematical manner. One thing to realize is that patients and the lay person will not know what is beautiful. They may be able to appreciate it, but they will not know what it is to create it. This information may allow us to help them understand what is beautiful and help them in their own desires for augmentation and change.

In Figures 7 and 9, the population in this study preferred the upper lip to be $\frac{1}{2}$ IW as predicted by the COP. The upper lip receives a lot less light by virtue of the curve that it has to take for a natural round structure to form such as the lip. Because the lower lip has all the light shining on it, the lower lip needs to dominate. We found support that the lower lip should be 1 IW and the upper lip should be $\frac{1}{2}$ IW in previous publications. The data in this study suggested the same to be true for the upper lip where the $\frac{1}{2}$ IW upper

lip dominated as the most ideally preferred picture in the line and morphed presentations. Again, as in the lower lip, and nasal bridge | tip, and ears the next most preferred size for the upper lip was smaller at $\frac{1}{4}$ IW, meaning after the ideal size humans prefer a smaller shape or distance versus a larger shape or distance. Also, the morphed picture in contrast to the line drawings showed a lower relative average and a larger separation (only slightly as compared with the other questions) from the next best picture as previously discussed.

For the clinician, augmenting the upper lips so that they are about $\frac{1}{2}$ IW is ideal and it is better to be smaller than near 1 IW based on the data. Again, this is due to the next best picture being $\frac{1}{4}$ IW versus the third best being the 1 IW upper lip. So what do you do when your patient wants a larger upper lip, greater than $\frac{1}{2}$ IW? Our suggestion would be to do so in a conservative manner and make it a little bigger than $\frac{1}{2}$ IW and know that the closer you get it to 1 IW, their aesthetics markedly decrease. Augmenting the upper lip by 1 to 3 mm greater than $\frac{1}{2}$ IW would be suggested if you must go over $\frac{1}{2}$ IW. Why is this beneficial? it can cause the viewer to look at the lips more because it is throwing off the balance that should be present (meaning that the lower lip should be 1 IW and the upper lip $\frac{1}{2}$ IW) but yet it does not dominate the lower lip by being near or greater than the ideal size of the lower lips ideal at 1 IW. This may increase the sexuality of the lips and face as a whole by emphasizing the lips with a slightly larger upper lip greater than $\frac{1}{2}$ IW by being an outlier. An outlier in aesthetics may indicate an outlier in sexuality. A discussion of what is ideal is needed to at least tell your client that $\frac{1}{2}$ IW for the height of the upper lip is likely the most ideal and ideas of what augmenting more than a $\frac{1}{2}$ IW can convey. Another thought related to this is that the lips may not increase much in the height from augmentation and that the biggest impact in beauty is the increase in light reflection that is created by increasing the protrusion of the lips. So when one measures the height of the upper lip, if the lips are close to the $\frac{1}{2}$ IW height, you may still enhance the upper lips by creating more of this protrusion versus increasing the height of the upper lip. The same idea would obviously apply to the lower lip as well.

In Figures 10 and 11, we wanted to test the ideal lateral extension of the ear. We hypothesized that it would be 1 IW. The $\frac{1}{2}$ IW extension narrowly was more preferred than the 1 IW in the line drawings in contrast to what we predicted. The statistics were equivocal showing no clear winner when the top 2 equal null hypothesis was not rejected supporting that both pictures were ideal to the participants. However, 1 IW was clearly the most ideal in the morphed picture in a statistically significant manner. The reason for this difference between the line and morphed images is the 3-dimensional positioning that can be appreciated with the morphed real life pictures. With the morphed pictures and in real life, the ears sit further back in the head relative to the face. The decreased light in this relative positioning

makes its presence less prominent in the viewers' mind. This is similar to the discussion earlier regarding the nasal tip and bridge. It would seem reasonable that the morphed picture data with this question would hold more weight in finding the ideal in contrast to the data found with line drawings. From our own experience with otoplasty, we find that the 1 IW does appear to be ideal to our patient population as we have also found with the nasal bridge and tip width. Interestingly, the greater lateral extension the ear is, preoperatively the less likely the client will want it medialized toward what we think is ideal at 1 IW. In our experience, the more lateralized the ear is for our clients, they are more likely to prefer 1.1 to 1.3 IW for their desired results instead of 1 IW. This may be merely because they are used to their ears being significantly lateralized beyond the ideal of 1 IW.

Clinically, the ideal extension of the ear can help with surgical goals and to facilitate the discussion you can have with your clients. Conveying the ideal can help your clients choose how much they would like to medialize their ears. We usually allow the patients to choose first where they want their ears through morphing. We usually start the medialization conservatively and further out from the 1 IW ideal so that we are not framing or projecting the discussion. This is to find their true desires. After finding what they want, we then discuss what we have found ideally from our data and previous studies. Patient preference should dominate the goals. Knowing their preferences can help you in the operating room. If you know patients are more comfortable having their ears more laterally positioned than more medially, etc, and knowing their true aesthetic fears can help you end up more likely with a happy patient.

Through this study, we have further found evidence that beauty can be mathematically determined and that it is not merely based on the eye of the beholder idea. As predicted in our previous studies, the data support that the ideal distance from the bottom of the eyebrow to the eyelid margin, the width of the tip and bridge of the nose, the height of the lower lip, and the distance that the ear extends from the side of the face are all 1 IW. For the upper lip, the data support that the ideal height is $\frac{1}{2}$ IW. Although equivocal in the nose and ear, the morphed pictures appear to point toward 1 IW as the ideal. Further studies looking into these 2 structures will further elucidate this ideal. However, the morphed pictures would obviously suggest the better ideal for real-life purposes. Based on the data, this study suggests that morphed pictures may be the better manner to test these ideas as well. The data also support the idea that smaller than 1 IW is better for many parts of the face especially in the nasal bridge and tip, lateral ear extension, and upper and lower lips. In contrast, for the eyebrows 1 IW was ideal and

a higher than 1 IW brow position is better than being lower at $\frac{1}{2}$ IW. But higher than $1\frac{1}{2}$ IW is to be absolutely avoided if possible. Further studies breaking up these distances into $\frac{1}{4}$ IW may further define these ideals. This was not done in this study in order to make the data gathering and analysis more feasible.

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