The Ideal Nasal Profile

Rhinoplasty Patients vs the General Public

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Objectives: To evaluate whether patients seeking reduction rhinoplasty hold a different concept of the ideal nose than does the general public, and to determine what features characterize the ideal nasal profile.

Methods: Twenty-seven patients seeking reduction rhinoplasty and 15 randomly selected members of the public evaluated a series of computer-manipulated photographic profiles using a pictorial visual analogue scale to rate their preferences for several variables. Center-scale images were created from mesh-warped ("morphed") computer averaging of 12 white women. Differences between the rhinoplasty group and the public group were then compared, as was each group's deviation from the center of the scale.

Results: Both groups preferred narrowly distributed differences from the "average" profile to a high degree of significance. No statistically significant difference was found between the ideal nasal profiles selected by the rhinoplasty group and the public group.

Conclusions: Reduction rhinoplasty patients do not appear to have a different concept of the ideal nose than does the public at large. The ideal nose, as it pertains to the ideal white female profile, has characteristics that differ from a mathematically averaged nasal profile.

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WHAT CONSTITUTES beauty? All of us have an inborn sense of it, and recent findings indicate that this perception is consistent across races and cultures, including those with little contact with Western standards.[1] Among the many features that comprise an attractive face is the nose. Its central position on the face colors our perception of the bearer's overall recognizable appearance. Should anyone doubt that the nose characterizes one's face, consider the case of cartoon facial caricatures, in which the nose is a ready target for the artist's pen to emphasize any deviation from the ideal.

It is not surprising, therefore, that individuals frequently present to the cosmetic surgeon with desires to alter the size and proportion of their noses, so as to bring their nasal appearances into harmony with what they perceive to be ideal. Much of the discussion between the surgeon and prospective patient revolves around determining what concerns the patient has with his or her appearance, and what manipulations the surgeon can perform to create a more pleasing nasal shape. In this process, the surgeon and patient are guided by their concepts of the ideal nose.

To assist in analysis and planning, the surgeon typically relies on judgment and a set of rules—proportions, angles, geometric relationships, and so on—established over millennia of study of facial proportions by artisans. The patient, on the other hand, is generally naive to these rules of design, yet usually has an innate sense of what a beautiful nose looks like.

This notion begs two important and related questions: the first is whether there indeed exists a universally accepted ideal for the nasal profile, and the second is what that ideal nose looks like. The studies of beauty dating from antiquity focused on extracting mathematical and geometrical relations to describe the nasal (as well as facial and body) ideal. These concepts can still be found in any treatise on facial aesthetics. In reality, however, the mathematics and geometry of nature are not so tidy, and the inclusion of these Byzantine, Greek, and Renaissance concepts in modern medical textbooks is mostly of historical interest. People's faces, even a supermodel's face, cannot be evenly divided into thirds or fifths, for example.

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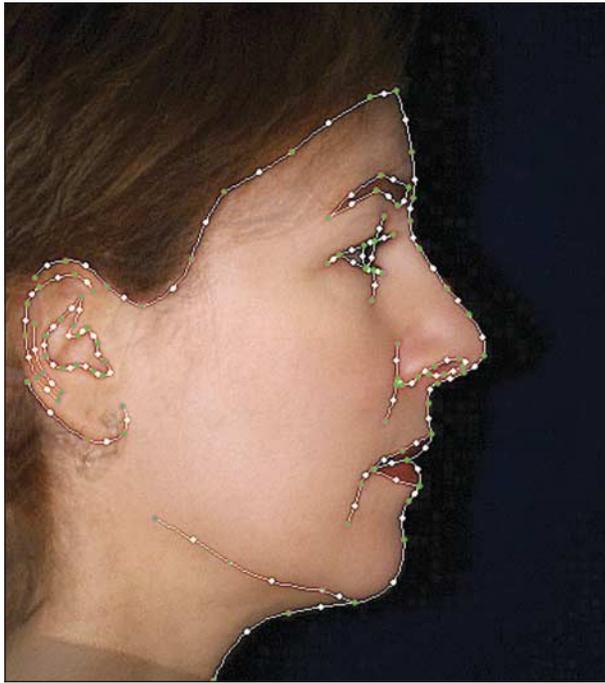
Figure 1. An intermediate image of a white female profile created from a mesh-warped (morphed) composite of randomly selected normal female faces. Control points for mesh are overlaid in green; white lines represent Bézier curve regions.

During the last 20 to 30 years, studies have been designed around newer, more scientifically rigorous concepts. Symmetry, it has been suggested, is more beautiful than asymmetry.[2] Although some aspects of this are true in general and have been helpful in understanding facial attractiveness from the frontal view, they are of no help in determining the ideal nasal profile. Another theory, which has gained increasing popularity and experimental support, is the concept of "averageness" as attractive. So-called averageness has been demonstrated in several studies[3-5] to be a preferred design, but even they concede that beauty goes beyond being merely more attractive and, in fact, differs in important ways from being simply average.

In attempting to achieve the best possible outcome for our rhinoplasty patients, we strive to realize at least the following 3 goals: a nose that the patient likes, a nose that the surgeon likes, and a nose that the general public likes. Because each nose presents a singular appearance yet needs to fulfill all 3 goals, several questions emerge. Is the average nose ideal? If not, what is ideal? Does the general public share a facial aesthetic similar to that of the rhinoplasty patient, or could the rhinoplasty candidate have a dysmorphic, or at least different, view of the ideal nose generally?

To our knowledge, despite volumes of theory, these questions have been incompletely addressed in an experimental, scientific manner. Closest to the mark in this regard is the 1995 article by Mendelsohn and Farrell,[6] in which they attempted to answer whether a consensus opinion existed between surgeons and the general public. Their methods, however, limited the precision with which an ideal nose could be discovered. Moreover, their experiment was not designed to consider whether rhinoplasty patients represent a subgroup of opinion. Other experiments looking into perceptual and aesthetic variability among patients with distorted body image (eg, patients with anorexia nervosa) prompted us to speculate as to the existence of such differences of perception among rhinoplasty patients.

In this article, we attempt to answer these questions through what we believe is a unique approach to aesthetic facial analysis using a digitally averaged photorealistic composite face and standardized, linearly distorted, derivative faces from this composite. We believe that this allowed subjects to choose which nasal profiles they prefer.

METHODS

To create a reasonable starting point for our survey, an average white female profile was generated from standardized profile photographs (105-mm lens, 35-mm color slide film, f/8, and $^1/_{125}$-second shutter) of 12 adult white female volunteers with no history of prior nasal trauma or nasal surgery. These photographs were scanned at high resolution into a Macintosh computer (Apple Computer, Inc, Cupertino, Calif) on which commercially available and freeware mesh-warping software (Morph 2.0; Gryphon Software Corp, San Diego, Calif, and, later, MorphX 2.6.1 freeware [available at http://www.norrkross.com/software/morphx/MorphX.php]) was used to warp the faces into a composite facial profile. The "morphing" algorithm is a more sophisticated technique extended from the principles described by Benson and Perrett[7] on the creation of prototypical facial images from exemplars. A mean of 75 key points per face identified points of similarity on each face (eg, hairline, pupils, eyelids, lips, ears, chin, neck, and points along the nose) (**Figure 1**). Further precision was accomplished by connecting these reference points with Bézier curves to define the warping regions (**Figure 2**). (The choice of using 12 volunteers rather than a larger number was made from empirical experience with image averaging. Although slight changes in appearance occur with more subjects added to the database, we did not find substantially perceptible changes reflected in the composite image with adding many more faces.)

From the computer-generated average facial profile, distortions of the nasal profile were created using a separate mesh-warping software program (Liquify filter, Photoshop 6.0; Adobe Systems, Incorporated, San Jose, Calif) that allowed one to apply distortions to a facial feature. MorphX was again used to create a sequence of linear transitions from one distorted image to another (eg, from a scooped nasal profile to one with a hump) and thereby allowed us to create a pictorial visual analogue scale for any particular nasal profile variable we chose to study. For the purposes of our experiment, 3 linear continua of distortions were chosen that we believed represented the most common concerns voiced by reduction rhinoplasty patients: dorsal scoop to dorsal hump, overrotation to underrotation, and underprojection to overprojection, with the midpoint of each being the averaged face. Along each continuum, the remaining nasal variables were held constant.

For practical reasons, 5 "key frames" along each continuum were selected at identical intervals and were printed in full color at 360 dots per inch along a visual analogue scale. Again, the center point of each scale was the previously created average face (**Figure 3**). More images could have been used as reference key frames, but this reduced the size of each image on the page, making subtle differences harder to see. Five was chosen as a reasonable compromise.

Twenty-seven reduction rhinoplasty patients and 15 subjects satisfied with their nasal appearance (representing the general public) were sequentially enrolled to evaluate each scale

and to select where along each continuum the nasal profile was most attractive. No one declined to evaluate the pictures, and subjects were informed only that we were studying individuals' concept of the ideal nose. In addition, the study subjects were instructed to approach each row of images as though it was a visual analogue scale, such that they could choose a point anywhere along the line and were not restricted to choosing the individual key frame images.

The midpoint of each continuum was assigned a value of zero, and the end points of each continuum ranged from –50 to 50 (**Figure 4**). Measurements of each study subject's choice along each continuum were then recorded and statistically analyzed by an independent biostatistician.

RESULTS

In the first part of the analysis, data for each of the 3 axes were compared via a Wilcoxon rank sum test to determine whether a difference could be found between the ideal profile chosen by the rhinoplasty cohort and the nonrhinoplasty cohort. No statistically significant differences were found between the ideal profiles chosen by the 2 cohorts along any of the 3 axes (**Table** and **Figure 5**). In fact, the only data approaching statistical significance involved the finding that reduction rhinoplasty patients may prefer a nose with slightly less projection (ie, greater underprojection) than the general public would consider ideal. These findings suggest that the concept of the ideal profile is no different among rhinoplasty patients than it is among the public at large or, if a difference exists, it is small enough that it was not detected within the limits of our study design and is therefore likely to be of little clinical significance.

The second part of our analysis looked at whether the 2 groups' ideal profiles varied from the average nasal profile in a consistent way. Using the Wilcoxon signed rank test to determine difference from zero (ie, the averaged nose), the ideal nose chosen by both groups differed from the averaged nose in a uniform and statistically significant way.

Both groups preferred a nasal profile with a slight scoop ($P=.005$ for the public and $P<.001$ for the rhinoplasty group), slight overrotation ($P=.08$ for the public and $P<.001$ for the rhinoplasty group), and slight underprojection ($P<.001$ for both groups). However, the degree of underrotation preferred by the public did not differ significantly from that of the averaged nose.

COMMENT

The lines and proportions of the ideal nasal profile have been described since ancient times. Perhaps driven more by a desire to find divine forces at work than to quantify reality, the Egyptians, followed by the Greeks, and later still the artists of the Renaissance sought to codify the sizes, angles, and relative dimensions of all features of beautiful human and facial design. These old principles are still to be found in modern textbooks on facial aesthetics, although tempered by modern research into actual facial proportions.

Implicit in any such discussion is that a consensus of opinion exists on what constitutes the perfect face or, for the purposes of this article, what constitutes the per-
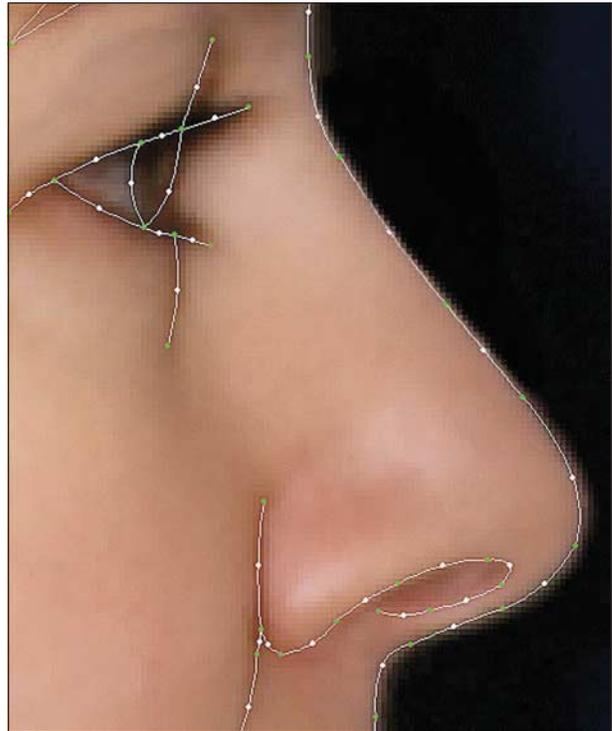

Figure 2. Close-up of a nose with control points and their associated Bézier curves. This demonstrates the precise control of the mesh made possible with this technique.
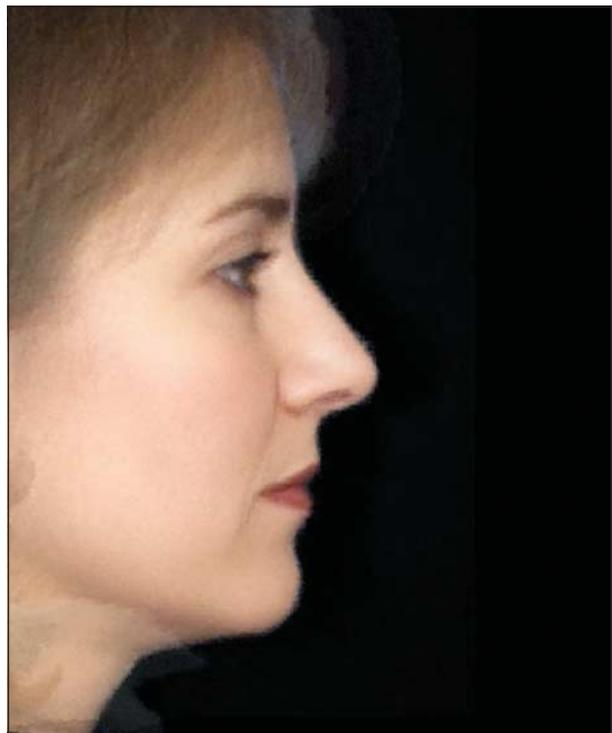

Figure 3. The final average white female profile created from a mesh-warped composite of randomly selected normal female faces (control points and curves removed for clarity).

fect nose. Only recently have investigations been conducted to determine whether such an aesthetic consensus exists. The latest research, however, suggests that

Instructions For **each row,** mark an "*x*" on the line below the pictures at the point where you find the nasal profile the most pleasing. If you are choosing between two pictures, place your "*x*" on the line between the two.
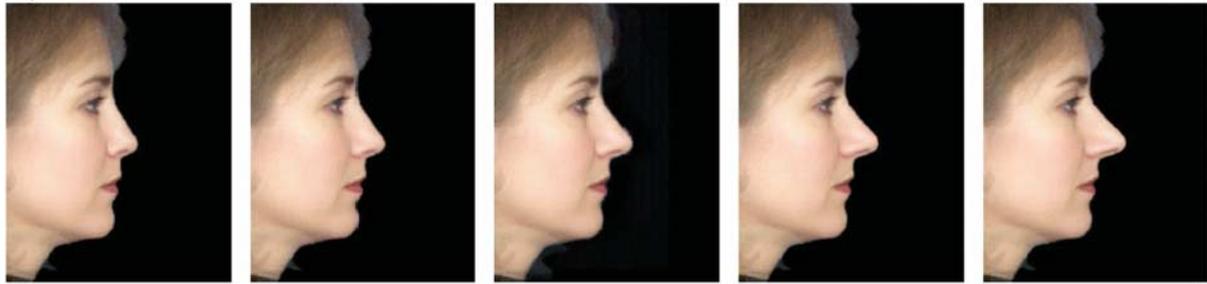
Scoop/Hump
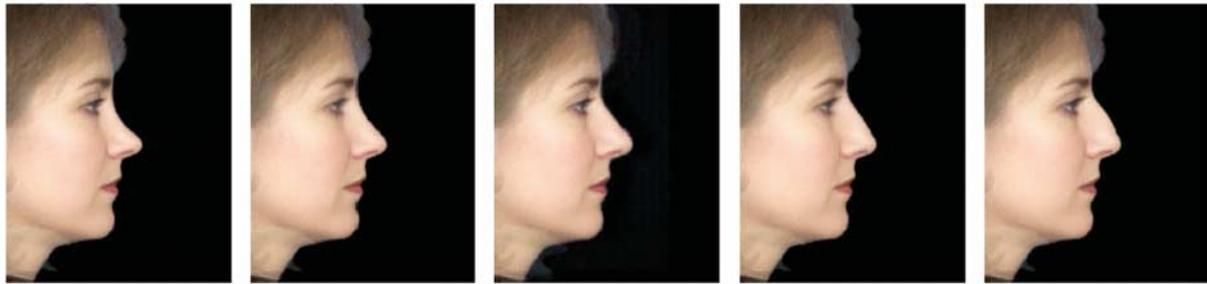
Tip Rotation
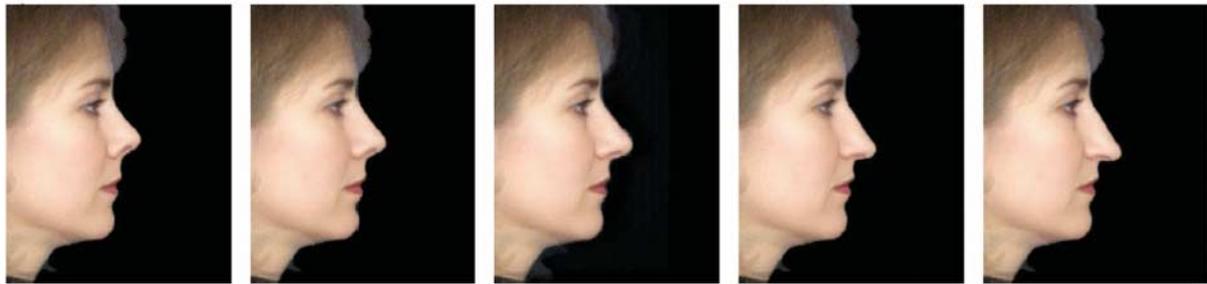
Projection

Figure 4. Spectrum of exemplars used to assess nasal profile. Top row shows spectrum of scoop to hump only, middle row shows spectrum of nasal rotation only, and bottom row shows spectrum of nasal projection only.

Ideal Profiles Among 27 Reduction Rhinoplasty Patients Compared Statistically Against Those of 15 Members of the General Public

Variable	Mean (SD)	*P* Value
Scoop or hump		
Public	−12.49 (11.37)	.32
Rhinoplasty	−11.31 (7.33)	
Rotation		
Public	−2.73 (5.48)	.36
Rhinoplasty	−4.42 (6.62)	
Projection		
Public	−12.42 (6.32)	.09
Rhinoplasty	−15.60 (10.73)	

humans from diverse cultures and heredity have a narrow aesthetic of beauty.[1]

What has been less studied is whether certain subpopulations have a different ideal in mind. Studies of patients with anorexia nervosa have examined this with these hypotheses in mind. Some researchers have concluded that patients with anorexia nervosa do not have a distorted perception of their bodies' proportions (ie, they can reliably identify body types of size and thinness similar to their own), but rather have a distorted body ideal (ie, an ideal body size that is too thin).[8-10]

Our study considered whether individuals so dissatisfied with their nasal appearance that they are willing to undergo surgery to correct it have a mental image of the ideal nose that is at variance with that of the general public and, by extension, with that of their surgeons. Whereas anorexia nervosa is a psychiatric disorder, dissatisfaction with one's nasal appearance is not, in the usual case. However, finding that a different ideal was held by patients seeking reduction rhinoplasty would have important implications for the rhinoplastic surgeon, who would then be faced with balancing his or her ideal with the ideal of the patient.

One might expect that the patient seeking a reduction rhinoplasty would be so dismayed by a large nose that his or her ideal would be one of a nose smaller, more
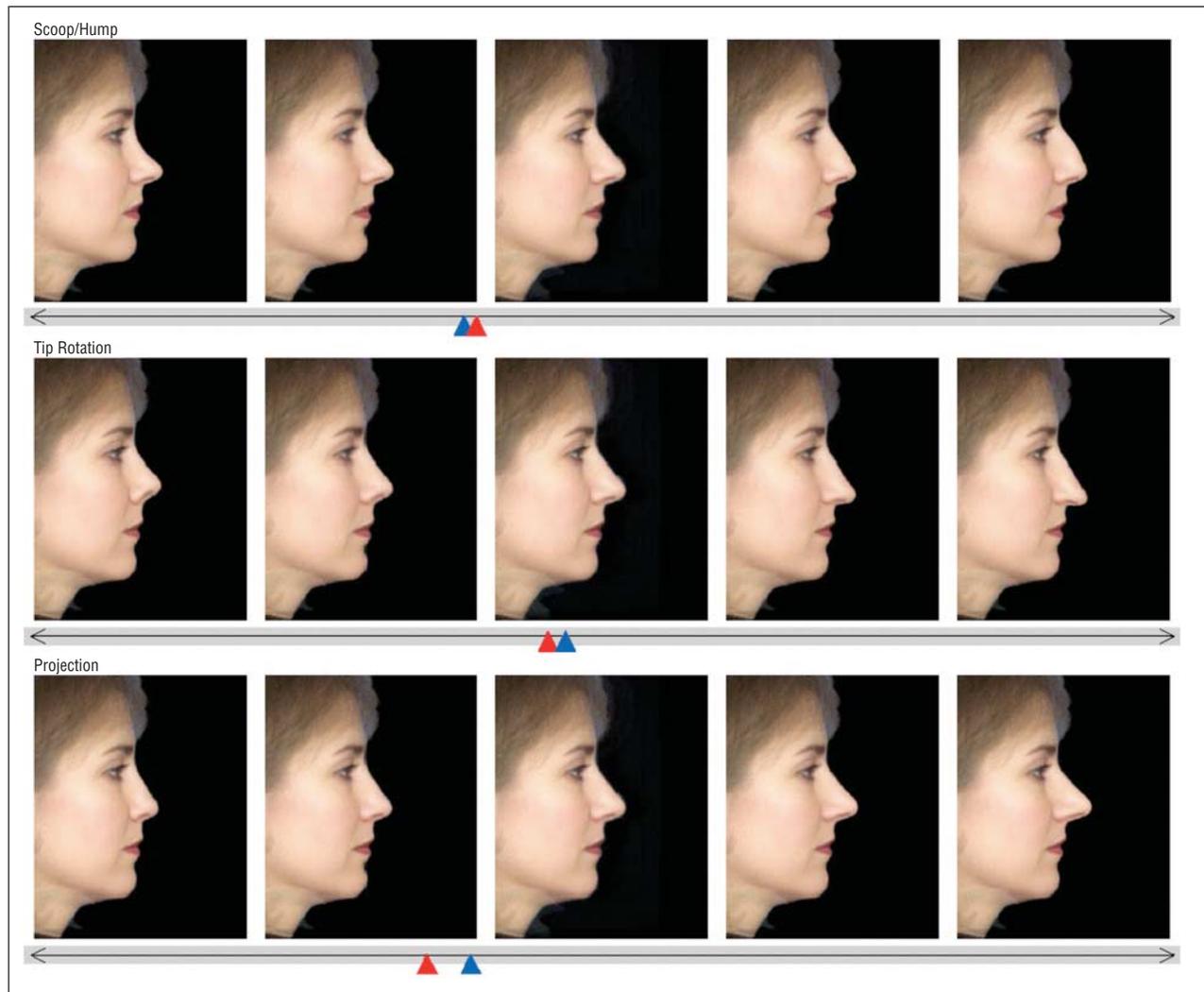
Figure 5. Arrowheads mark the mean ideal nose along each spectrum. Blue arrowheads represent the means chosen by the general public, and red arrowheads represent the means chosen by rhinoplasty patients.

scooped, or more upturned than the public would see as ideal. Conversely, although the reduction rhinoplasty patient might want a smaller nose, the ideal might be a compromise between the patient's nose and the public's ideal, with the patient preferring a slight hump, slight overprojection, or slight underrotation. This study demonstrates that little difference exists between the idealized nose in the mind of the public and in the mind of the rhinoplasty patient. This should help reassure the surgeon that a nose can be created for the patient that will satisfy the patient and the surgeon and, by extension, satisfy the patient's friends and social contacts and the surgeon's colleagues and prospective patients.

An additional finding of this study was that significant deviations existed from the morphed average nose and the mean ideal nose. Theories of facial beauty have centered on several concepts, one of which has been the concept that averageness is attractive.[3] Anecdotally, we found that the average facial or nasal profile was generally more attractive than any of the individual facial profiles used to create the composite face. However, this average was not judged to be the best by the study participants.

One might argue that our averaged nasal profile is not really the average nasal profile—that we did not use enough faces in our composite, that our participants represent an artificially select group, and so forth. However, in creating the averaged profile used in our study, the changes brought about by adding more faces did not move the image as far from the final averaged image as the study participants identified the ideal nasal profile. On the other hand, this finding is in agreement with current theories that proffer that beauty, in contrast to mere attractiveness, deviates from averageness.[4,5]

Some potential limitations warrant noting. For technical convenience, we were not able to allow patients to interactively manipulate the morphed images (eg, via a continuous on-screen slider), and the key frames may have limited the study participants' abilities to choose intermediate values. This did not appear to be the case, however, as it was noted that most patients did not choose exactly beneath key frames, but more often chose intermediate values between key frames.

Our study looked at only 3 variables of the myriad possible variables of the nasal profile. We chose these

3 as they seem to reflect the most commonly expressed complaints a patient has about his or her nasal appearance in profile: "it has a bump at the bridge," "it sticks out too far," or "it is droopy."

In addition, we did not allow for a mechanism for combining all the manipulations into a single profile. For example, it could be that a test subject would prefer a little less rotation in a nose that is slightly scooped, but had to choose more rotation to shorten the nose because the dorsal scoop or hump was fixed to the averaged nose along that scale. We had initially planned to allow subjects to move through this multidimensional data space, but technical and practical considerations prevented us from allowing such assessments, as subjects may have had difficulty manipulating all 3 variables simultaneously.

We also did not test either cohort to determine whether a perceptual distortion of self-image existed. One could imagine an arm of the study in which patients and public first selected a nasal profile from a continuum of noses that most closely resembled their own. Given the well-established data on patients with anorexia, however, we did not believe that this would have been a productive exercise for the study groups.

Two serendipitous findings are also worth mentioning. We found that the visual test scales we presented to the rhinoplasty patients helped them more clearly express concerns about their nasal profiles in a way that was more patient-directed than physician-directed (as can be the case with image manipulation done as part of a consultation). In addition, we found that the scales helped identify patients who deviated more widely from mean values than those chosen by the other patients. This might serve as a useful tool to determine whether a patient desires a nose that the surgeon will be unable or unwilling to create.

In conclusion, lest the reader assume that this article proposes that there is only one ideal nasal profile, we suggest that the ideal nose for this particular adult white female face is considered similarly attractive by rhinoplasty patients and the public; has narrowly defined characteristics with respect to projection, rotation, and dorsal contour; and is significantly different from average. One can assume that similar treatment of the adult white man or of men and women of different ethnicity would reveal similar findings between rhinoplasty patients and individuals satisfied with their nasal appearance, but these studies have yet to be done.

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