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The effect of the golden ratio in facial anatomy on beauty perception

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Abstract

Objectives: This study explores the influence of the golden ratio on aesthetic perception, focusing on facial features such as the nasal index, nasooral ratio, and upper-to-lower lip thickness ratio. The aim is to identify patterns in individuals' aesthetic preferences and examine correlations with demographic factors such as gender, educational background, and interest in visual arts.

Methods: Facial images, both digitally altered and hand-drawn, were manipulated to create variations in anthropometric measurements. A questionnaire featuring these images was distributed among adults in various social settings. Statistical analyses included chi-squared tests to compare aesthetic preferences across demographic groups and correlation coefficients to assess the relationships between binary aesthetic choices and demographic factors.

Results: Significant differences in aesthetic preferences were found based on respondents' educational background and interest in visual arts. Males exhibited a stronger preference for golden ratio proportions in nasal and nasooral features, while females demonstrated more variable preferences depending on the specific facial feature. Higher education levels and greater interest in visual arts were consistently associated with a stronger inclination towards selecting golden ratio proportions.

Conclusion: Education and exposure to the arts significantly influence aesthetic preferences, highlighting the impact of social factors on beauty perception. The use of digitally manipulated and hand-drawn images provided a controlled setting for testing the golden ratio and other proportions, ensuring consistency in the study. Future research incorporating real-life images may further enhance our understanding of the mechanisms behind aesthetic perception.

Keywords: aesthetic anatomy; aesthetic perception; facial features; golden ratio; visual arts

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Introduction

Throughout history, the human body has been a focal point of investigation in the study of aesthetics and beauty. Although each era has adopted its own unique approach to analyzing and interpreting the human form, fundamental anatomical principles have consistently played a key role in these assessments.[1] However, a universal standard for beauty has yet to be established. Among various aspects of human beauty, facial aesthetics are often considered more influential than the body.[1,2] One theory suggests that the beauty of the human face is largely derived from the golden ratio.[2,3]

The golden ratio, a concept long recognized in physics and mathematics, is represented by the value Φ=1.6180339887. It is defined as the ratio where the proportion of the longer segment of a line to the shorter segment is the same as the proportion of the whole line to the longer segment.[4] This ratio has been employed by numerous artists throughout history to create what are considered ideal works of art. Today, the golden ratio is increasingly being applied in plastic and reconstructive surgery to achieve aesthetically pleasing results.

In this study, we aim to investigate whether the golden ratio and other facial proportions influence individuals' perception of beauty. By exploring this relationship, we hope to provide the scientific community and the general public with more accurate and objective information on this subject. Furthermore, we anticipate that our findings will help guide individuals in making informed decisions before undergoing aesthetic procedures, reducing the risk of misconceptions regarding beauty standards.

Materials and Methods

A total of 384 volunteers participated to the study. Among the participants, 219 were female and 165 were male, with an average age of 32.5±8.7 years. The average age for males was 32.6±9.2, while for females it was 32.5±8.6 years. Participants were categorized into three groups based on their educational background: the first group consisted of individuals with a high school diploma or lower, the second group included those with a bachelor's degree, and the third group comprised individuals with master's or doctoral degrees. Of the volunteers, 87 had a high school diploma or lower, 228 held a bachelor's degree, and 69 had a master's or doctoral degree.

Participants were also asked about their interest in visual arts, such as sculpture, painting, photography, cinema, and design. Among them, 175 indicated an interest in visual arts, while 209 stated they had no interest.

To assess aesthetic perception, a facial image that represented aesthetic beauty, as judged by a professional artist, was created both digitally and freehand. This image, possessing proportions associated with beauty, was modified by altering specific anthropometric measurements related to the nose, resulting in a series of images. Throughout these images, parameters such as forehead height, forehead width, eye width (right and left), interocular distance, upper facial width, lower facial width, and lower facial height were kept constant. A total of 20 images were produced using both digital and hand-drawn techniques.

In the digital images, the nasal index (the ratio of nasal length to nasal width) and the upper-to-lower lip thickness ratio were adjusted to conform to the golden ratio and other specified proportions. For the hand-drawn images, the nasooral ratio (the ratio of mouth width to nasal width) was created by a professional artist according to the golden ratio and related proportions. These images were then incorporated into a questionnaire format, presenting multiple-choice options for participants. Volunteers were asked to select the most aesthetically pleasing option for the nasal index, nasooral index, and upper-to-lower lip thickness ratio in both male and female faces.

Additionally, demographic information such as age, gender, educational level, and interest in visual arts was collected.

For the male nasal index question, four images were created digitally, each illustrating different nasal length-to-nasal width ratios (nasal index) of 1.5, 1.618 (the golden ratio), 1.7, and 1.8 (**Figure 1**). Option A corresponded to a ratio of 1.5, Option B to 1.618 (the golden ratio), Option C to 1.7, and Option D to 1.8.

Similarly, for the female nasal index, four images were created digitally using the same ratios (**Figure 2**). Option A corresponded to a ratio of 1.5, Option B to 1.618 (the golden ratio), Option C to 1.7, and Option D to 1.8.

For the male nasooral ratio question, four freehand-drawn images were prepared, each depicting different mouth width-to-nasal width ratios of 1, 1.2, 1.618 (the golden ratio), and 1.8 (**Figure 3**). Option A represented a ratio of 1, Option B 1.2, Option C 1.618 (the golden ratio), and Option D 1.8.

Similarly, for the female nasooral ratio, four images were prepared in the same manner, using the same ratios (**Figure 4**). However, in this case, Option A had a ratio of 1.8, Option B 1.618 (the golden ratio), Option C 1.2, and Option D 1.

To assess the ratio of upper lip thickness to lower lip thickness, four images were produced with ratios set at 1.5, 1.618 (the golden ratio), 1.7, and 1.8 (**Figure 5**). Option A was assigned a ratio of 1.7, Option B 1.8, Option C 1.5, and Option D 1.618 (the golden ratio).

The questionnaires were then duplicated in black and white to ensure consistency with the charcoal drawings. These were distributed in crowded social venues, such as shopping malls and hospitals, targeting individuals aged 18 and above. After collecting responses from participants who volunteered for the study, the data was entered into a computerized system and analyzed statistically. The results were expressed as numbers and percentages (%).

For comparing categorical data between groups, the chi-squared test was used to examine differences in aesthetic preferences based on demographic characteristics. The Phi coefficient (Cramer's V) was employed to assess the relationships between binary (yes/no) categorical variables. The point-biserial correlation coefficient (rrb) was used to evaluate the relationship between binary (yes/no) nominal data and ordinal rankings.

Statistical analysis was performed with IBM SPSS (Statistical Package for the Social Sciences) Statistics Version 22.0 (Armonk, NY, USA), with a significance level of $p<0.05$ considered statistically significant.

Results

In our study, we calculated that 384 participants would be needed based on the assumption of a 50% correct identi-

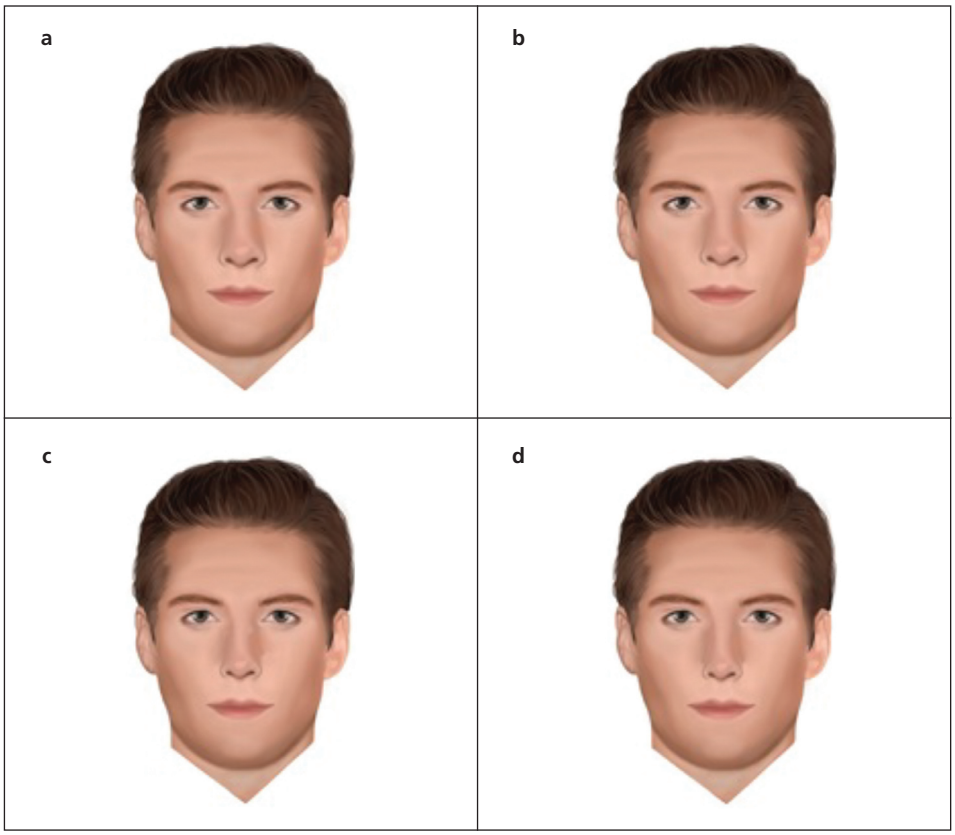

Figure 1a-d. Pictures for evaluating nasal index in men.

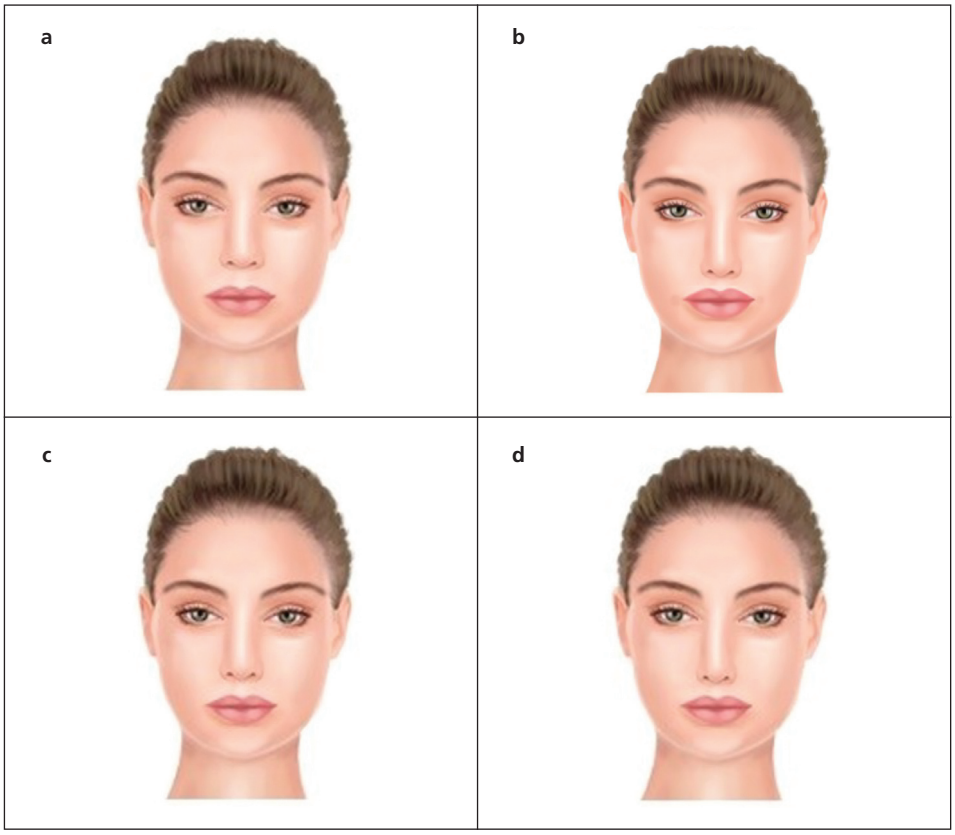

Figure 2a-d. Pictures for evaluating the nasal index in women.

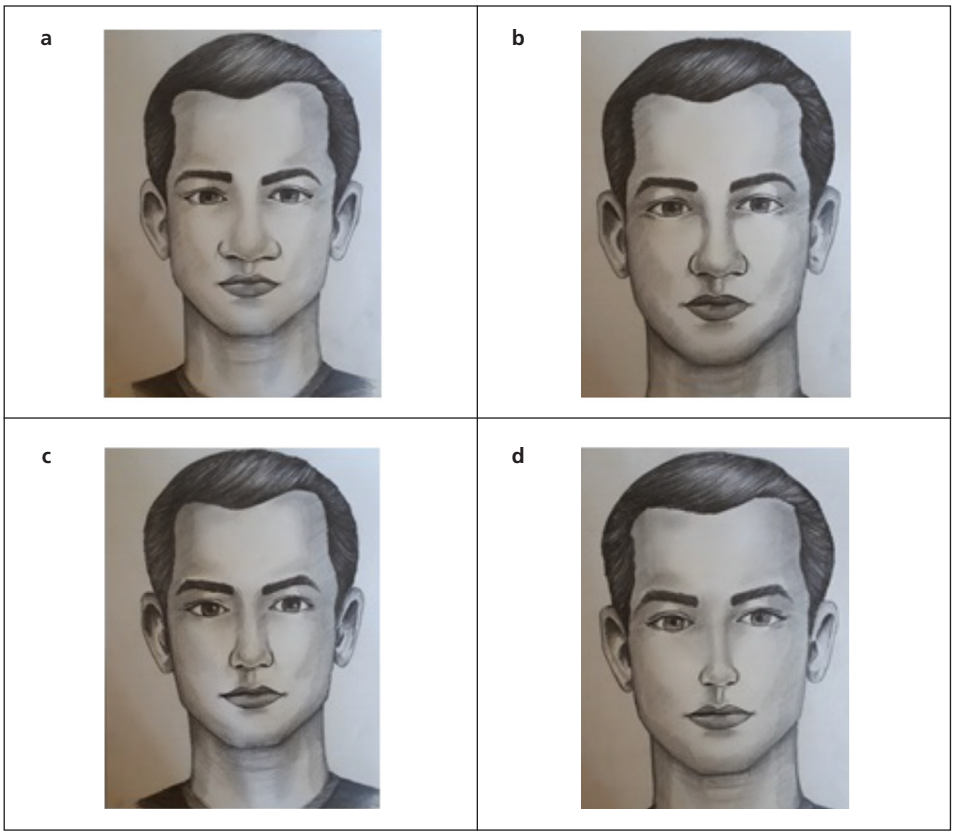

Figure 3a-d. Pictures for evaluating the nasooral index in men.

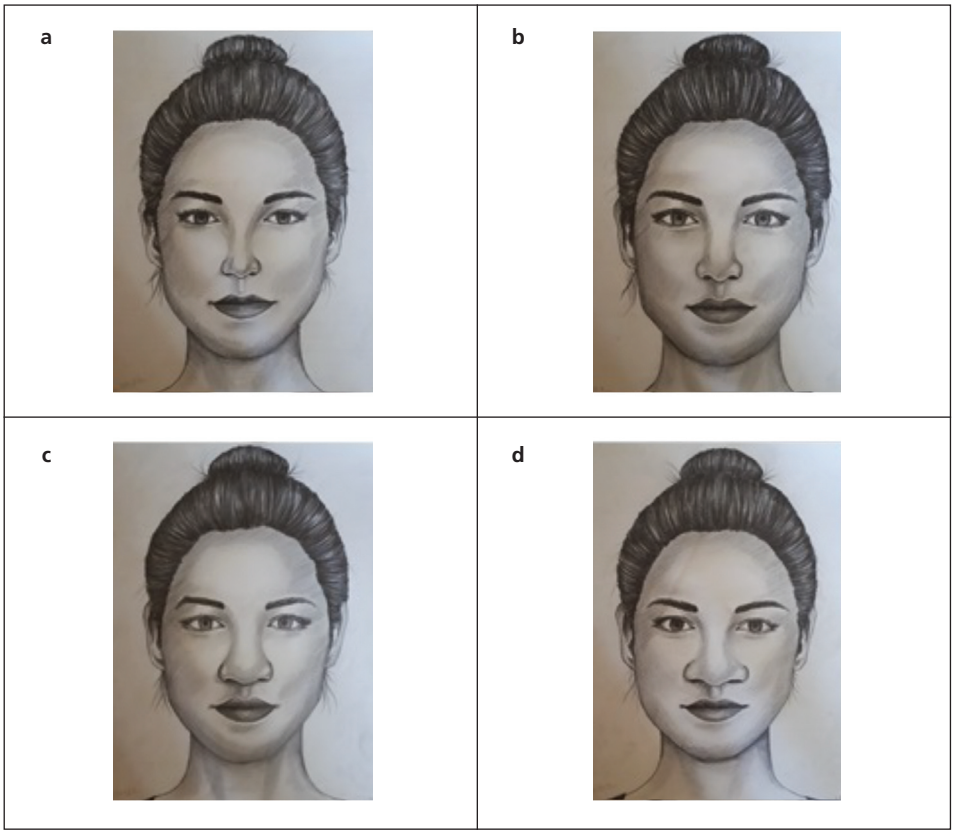

Figure 4a-d. Pictures for evaluating the nasooral index in women.

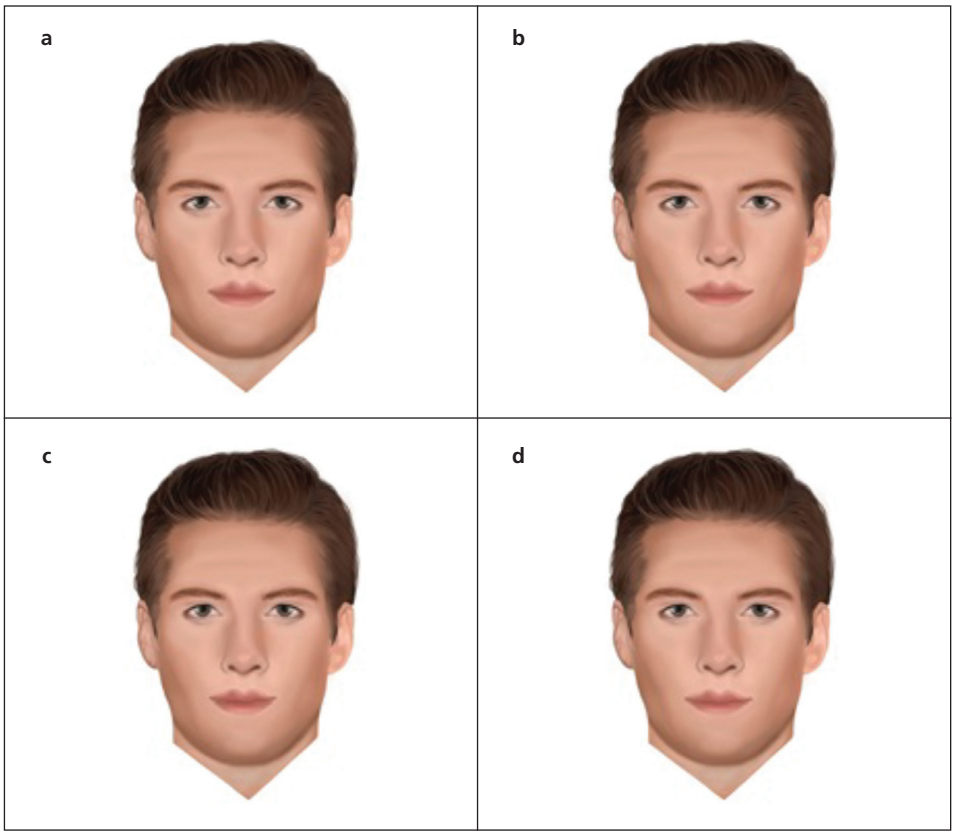

Figure 5a-d. Pictures for evaluating the ratio of upper lip thickness to lower lip thickness is questioned.

fication rate for the golden ratio (1.618), with a tolerance value (d) of 0.10 and a significance level (α) of 0.05. These 384 individuals were selected from the population using a simple random sampling method.

The questions and responses were statistically analyzed based on gender, educational level, and interest in visual arts, with the results presented in tables (**Figure 6**) (**Tables 1**, **2** and **3**). Educational level was found to be significantly correlated with the ability to identify the golden ratio in the nasal index for males ($p=0.011$, $r=0.130$), indicating that higher education levels were associated with a greater likelihood of identifying the golden ratio. Similarly, interest in visual arts was significantly correlated with identifying the golden ratio in the nasal index for females ($p<0.001$, $r=0.197$).

A negative correlation was observed between age and the ability to predict the golden ratio for the upper lip-to-lower lip ratio ($p=0.021$, $r=-0.118$), suggesting that the ability to identify the golden ratio decreased with age. However, no significant correlation was found between interest in visual arts and the ability to identify the golden ratio for the upper lip-to-lower lip ratio ($\varphi=0.141$).

Discussion

Among the volunteers in our study, 77.4% had a bachelor's degree or higher educational attainment. This percentage was higher than the 65% reported in the study by Ünver et al.[5] However, according to 2020 data from the Turkish Statistical Institute (TUIK), only 13% of the Turkish population has attained education at the bachelor's level or higher.[6] This suggests that the educational distribution of our sample diverges significantly from the general population. Conducting the study in high-population areas such as shopping malls may have resulted in a more heterogeneous group of volunteers, as individuals with higher education are often more active in public life.

In our study, 60% of the participants indicated no interest in visual arts. Given that not all participants associated the golden ratio with beauty, this result was anticipated. However, with technological advancements, visual arts have diversified and evolved.[7,8] Since we did not query the specific type of visual art participants were interested in, it remains unclear how the type of visual art might have influenced their responses.

In response to the male nasal index question, the golden ratio (114 of 384) was the most frequently select-

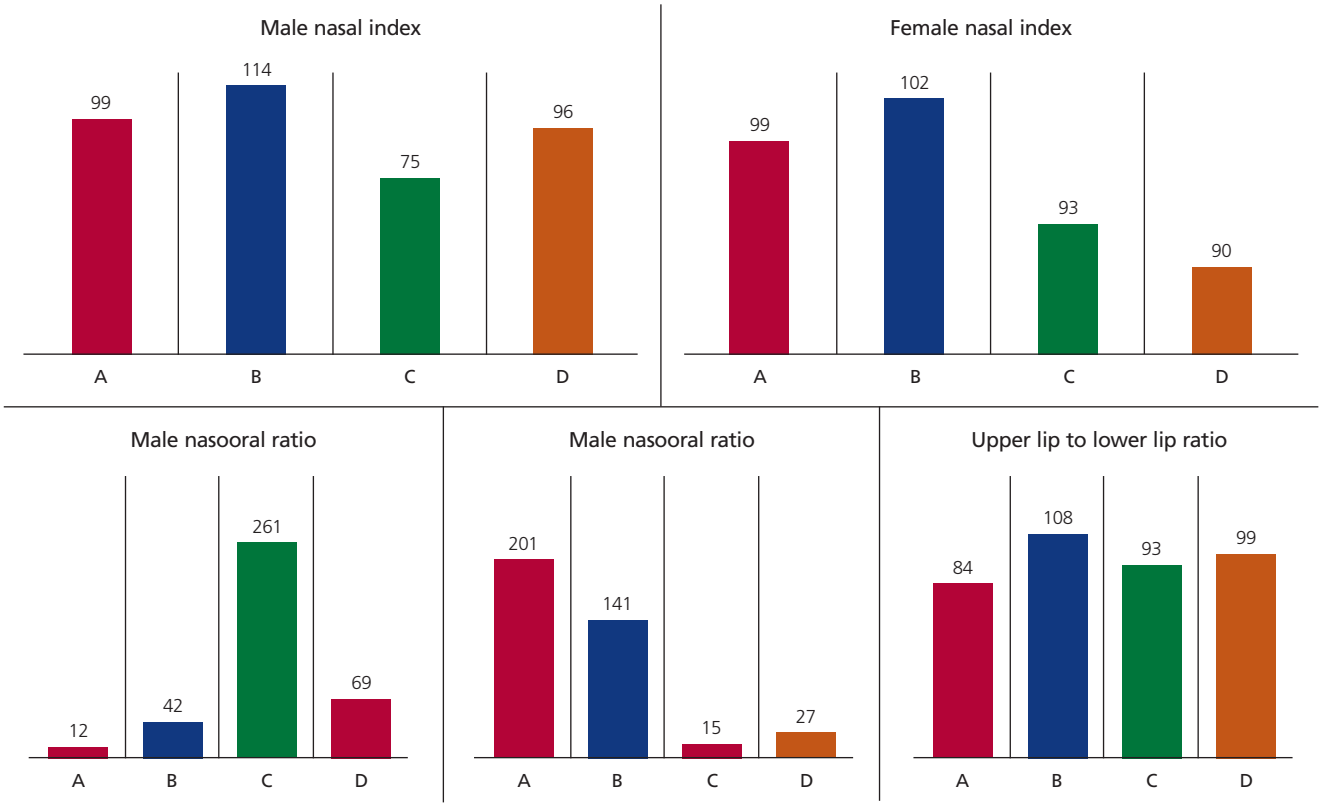

Figure 6. Bar chart representation of the answers given by the volunteers. A, B, C and D: answer options provided in the pictures.

ed option. While males were more likely to choose the golden ratio, responses for other options were also closely distributed. The significant relationship between gender and the nasal index question for males suggests that aesthetic perception differs between males and females. Educational level had a statistically significant effect on the selection of the golden ratio option, particularly among participants with a bachelor's degree or higher and those with an interest in visual arts. Correlation and regression analyses confirmed that higher education levels were associated with a greater likelihood of selecting the golden ratio for the male nasal index, consistent with findings in the literature.[5] Since the golden ratio is often employed in visual arts such as painting and sculpture, individuals interested in these areas may be more familiar with the ratio and therefore more likely to prefer it.[9,10] Additionally, the positive correlation between higher education and preference for the golden ratio aligns with studies suggesting that education influences artistic perception.[11,12]

In the study by Ünver et al.,[5] the golden ratio was the most frequently chosen option (55.2%) for the nasal index question. Although our study showed similar results, the proportion of participants selecting the golden ratio was significantly lower. We believe this discrepancy could be due to the degradation of image quality when producing black-and-white outputs of the drawings.

In the female nasal index question, the golden ratio (91 of 384) was again the most frequently chosen option. Higher education levels and interest in visual arts were associated with a stronger preference for the golden ratio, and these results were statistically significant. Correlation and regression analyses further confirmed a significant relationship between interest in visual arts and the preference for the golden ratio in female faces. These findings were consistent with the results of the male nasal index question and the findings of Ünver et al.[5]

Although both male and female participants tended to prefer the golden ratio for the nasal index, this preference was not statistically significant in either case. Based on our results, the golden ratio does not appear to have a clear superiority in determining nasal beauty for males or females. We believe that future studies using real human images and more refined nasal index measurements could provide more definitive conclusions.

Table 1
Comparison of answers and gender.

	Answer options	Female (n=219)	Male (n=165)	p-value
Male nasal index	A	42 (19.2%)	57 (34.5%)	**p<0.001**
	B	60 (27.4%)	54 (32.7%)	
	C	60 (27.4%)	15 (9.1%)	
	D	57 (26%)	39 (23.6%)	
Female nasal index	A	57 (26%)	42 (25%)	p=0.312
	B	51 (23%)	51 (31%)	
	C	54 (25%)	39 (24%)	
	D	57 (26%)	33 (20%)	
Male nasooral ratio	A	3 (1.4%)	9 (5.5%)	**p=0.026**
	B	30 (13.7%)	12 (7.3%)	
	C	150 (68.5%)	111 (67.3%)	
	D	36 (16.4%)	33 (20%)	
Female nasooral ratio	A	129 (58.9%)	72 (43.6%)	**p=0.021**
	B	69 (31.5%)	72 (43.6%)	
	C	9 (4.1%)	6 (3.6%)	
	D	12 (5.5%)	15 (9.1%)	
Upper lip to lower lip thickness ratio	A	54 (24.7%)	30 (18.2%)	p=0.506
	B	60 (27.4%)	48 (29.1%)	
	C	51 (23.2%)	42 (25.5%)	
	D	54 (24.7%)	45 (27.2%)	

The nasal index is the ratio of nasal width to nasal length. In the literature, both numerator and denominator values have been used to calculate the nasal index.[5,13] In this study, we used nasal width as the numerator to apply the golden ratio. A concept known as the "Thomson nasal rule" suggests that wider noses are more common in warmer equatorial regions, as they help transport larger volumes of warm air to the lungs. Conversely, longer and narrower noses are more common in regions closer to the poles, where they help warm cold air before it reaches the lungs.[14] Consequently, the average nasal index can vary across geographical regions.

For example, a 2019 study in Nepal reported average nasal index values of 1.18 for males and 1.23 for females.[15] A study by Nasir et al.[16] in India in 2021, measured nasal indices across four states, reporting values ranging from 1.24 to 1.58 for females and 1.26 to 1.60 for males. In a study conducted in Türkiye, nasal indices for Anatolian males across different age groups were found to be approximately 1.3 for young adults (20–40 years), and around 1.23 for adults (40–60 years) and the elderly (60 years and above). A significant difference was observed between young adults and older individuals, although no data on females were provided.[17]

A study in Nigeria examining nasal indices across different ethnic groups living in the same region found no clear link between climate conditions and nasal structure, indicating that climate might not be the sole determinant of nasal morphology.[18] These studies show that average nasal index values can vary based on several factors, even within the same ethnic group.[19,20]

In our study, the values exceeded the national average, as we included individuals with longer and narrower noses. However, the absence of options for more commonly observed nasal index values in Turkey limits our ability to draw definitive conclusions about their impact on nasal aesthetic perception.

In the question assessing the nasooral ratio in males, option C, representing the golden ratio, was the most preferred choice (68%). While preferences for other options varied by gender, knowledge of the golden ratio, belief in its association with beauty, and interest in visual arts, option C consistently remained the most favored across these factors. However, an increase in educational level was correlated with a higher preference for this ratio. Similarly, in the question about the nasooral ratio in females, the most selected option was A, representing

Table 2
Comparison of answers and level of education.

	Answer options	Highschool and below (n=87)	Bachelor's degree (n=228)	Postgraduate and above (n=69)	p-value
Male nasal index	A	24 (27.6%)	57 (25%)	18 (26.1%)	p=0.008
	B	15 (17.2%)	75 (32.9%)	24 (34.8%)	
	C	21 (24.1%)	51 (22.4%)	3 (4.3%)	
	D	27 (31%)	45 (19.7%)	24 (34.8%)	
Female nasal index	A	9 (10.3%)	72 (31.6%)	18 (26.1%)	p<0.001
	B	21 (24.1%)	54 (23.7%)	27 (39.1%)	
	C	24 (27.6%)	54 (23.7%)	15 (21.7%)	
	D	33 (37.9%)	48 (21.1%)	9 (13%)	
Male nasooral ratio	A	0 (0%)	12 (5.3%)	0 (0%)	p<0.001
	B	9 (10.3%)	33 (14.5%)	0 (0%)	
	C	54 (62.1%)	150 (65.8%)	57 (82.6%)	
	D	24 (27.6%)	33 (14.5%)	12 (17.4%)	
Female nasooral ratio	A	30 (34.5%)	129 (56.6%)	42 (60.9%)	p<0.001
	B	39 (44.8%)	78 (34.2%)	24 (34.8%)	
	C	3 (3.4%)	12 (5.3%)	0 (0%)	
	D	15(17.2%)	9 (3.9%)	3 (4.3%)	
Upper lip to lower lip thickness ratio	A	15 (17.2%)	36 (15.8%)	9 (13%)	p=0.036
	B	39 (44.8%)	135 (59.2%)	30 (43.5%)	
	C	18 (20.7%)	36 (15.8%)	15 (21.7%)	
	D	15 (17.2%)	21 (9.2%)	15 (21.7%)	
Total number	384	87	228	69	

a ratio of 1.8 (52.3%), followed by option B, representing the golden ratio (1.618) with 36.7% of selections. The most frequently chosen option for males in the nasooral ratio closely aligned with the Turkish population's average (1.45 for males, 1.53 for females).[21,22]

Reviewing the literature reveals variations in nasooral index values among populations. For example, in a 1997 study by Wang et al.,[23] Chinese populations had nasooral values below 1.5, while North American populations exceeded 1.6. While the neoclassical canon considers the nasooral proportion to be 1.5, the golden ratio is often perceived as the most aesthetically pleasing in the nasooral context.[24,25] However, a study by Burusapat and Lekdaeng[26] Thai and international beauty pageant winners suggested that the golden ratio may no longer hold as much significance in contemporary beauty standards.[26] In our study, for the nasooral ratio in females, the preference for a 1.8 ratio over the mean and the golden ratio suggests a tendency towards slightly wider lips in female beauty.

In the question evaluating the upper lip-to-lower lip thickness ratio, the most preferred option was B, representing a ratio of 1.8 (28.1%), followed by D, representing the golden ratio (25.8%). Volunteers with a master's degree or higher and those interested in visual arts tended to prefer option D. Additionally, correlation and regression analyses indicated a significant relationship between interest in visual arts and the preference for the golden ratio in the upper lip-to-lower lip thickness ratio.

In the question evaluating the lower lip-to-upper lip thickness ratio, the most selected option was D, representing a ratio of 1.5 (35.2%), followed by B, representing a ratio of 1.7 (29.7%). Option C, representing the golden ratio, was the least preferred (17.2%). Volunteers with higher educational attainment favored option D, while those knowledgeable about the golden ratio were less likely to select option C. The literature suggests that the ideal upper lip-to-lower lip ratio is 1:1.618.[27,28] However, average values reported for Caucasian women are 1:1.42 and for men 1:1.25.[29] In our study, the golden ratio was the least preferred option, with participants favoring a ratio of 1.5, which aligns more closely with population averages. This suggests that a thicker lower lip might not be as favored in male aesthetic preferences within Turkish society.

Table 3
Comparison of answers and interest in visual arts.

	Answer options	Interested in visual arts (n=153)	Not interested in visual arts (n=231)	Total (n=384)	p-value
Male nasal index	A	51 (33.3%)	48 (20.8%)	99 (25.8%)	p=0.001
	B	51 (33.3%)	63 (27.3%)	114 (29.7%)	
	C	27 %17.6%)	48 (20.8%)	75 (19.5%)	
	D	24 (15.7%)	72 (31.2%)	96 (25%)	
Female nasal index	A	27 (17.6%)	72 (31.2%)	99 (25.8%)	p<0.001
	B	57 (37.3%)	45 (19.5%)	102 (26.6%)	
	C	27 (17.6%)	66 (28.6%)	93 (24.2%)	
	D	42 (27.5%)	48 (20.8%)	90 (23.4%)	
Male nasooral ratio	A	0 (0%)	12 (5.2%)	12 (3.1%)	p=0.003
	B	24 (15.7%)	18 (7.8%)	42 (10.9%)	
	C	105(68.6%)	156(67.5%)	261 (68%)	
	D	24 (15.7%)	45 (19.5%)	69 (18%)	
Female nasooral ratio	A	93 (60.8%)	108 (46.8%)	201 (52.3%)	p=0.001
	B	54 (35.3%)	87 (37.7%)	141 (36.7%)	
	C	0 (0%)	15 (6.5%)	15 (3.9%)	
	D	6 (3.9%)	21 (9.1%)	27 (7%)	
Upper lip to lower lip thickness ratio	A	39 (25.5%)	45 (19.5%)	84 (21.9%)	p=0.001
	B	39 (25.5%)	69 (29.9%)	108 (28.1%)	
	C	24 (15.7%)	69 (29.9%)	93 (24.2%)	
	D	51 (33.3%)	48 (20.8%)	99 (25.8%)	

The assessment of the upper lip-to-lower lip ratio was based on a male character, while the lower lip-to-upper lip ratio was based on a female character. The use of virtual drawings in this study, rather than real-life photographs, and the potential degradation of image quality during black-and-white printing, may have influenced the results. We believe future studies utilizing real-person photographs with high-quality image processing could yield more accurate findings.

This study found significant gender differences in the preferences for male nasal indices, male nasooral indices, and female nasooral indices. Literature reviews indicate that aesthetic perceptions differ by gender.[30,31] However, a 2018 study by Lewandowski and Danel did not find significant gender differences in vermilion assessments.[32] While vermillion was not assessed in our study, the gender-based differences observed in facial indices represent novel findings that have not been previously reported. These results could provide a valuable guide for future research.

This study had several limitations. First, the use of both digital and hand-drawn images to manipulate facial proportions, rather than real photographs, may have affected participants' aesthetic evaluations, potentially limiting the external validity of the findings. However, this approach also allowed for the control of other morphometric variables, which could be advantageous for statistical analysis. Additionally, the transition from color to black-and-white images may have compromised image quality, affecting participants' responses. The study also only assessed the upper lip-to-lower lip thickness ratio in males, so future studies investigating both genders are needed for more accurate results. The sampling method, which targeted specific social venues, may have introduced selection bias, as the sample had a higher educational level compared to the general population. Furthermore, the assessment of interest in visual arts lacked specificity, as different forms of visual art were not differentiated, which could have influenced aesthetic preferences. The exclusive focus on facial features and the limited demographic diversity further constrain the generalizability of the results. Future research should address these limitations by incorporating real-life images, expanding the sample diversity, and exploring the influence of various forms of art and education on aesthetic perception.

Conclusion

The results of our study suggested that the education and interest in the fine arts were the most influential social parameters on beauty perception. These two factors had a significant impact across all measurements. Given the relationship between an interest in fine arts and education, it is likely that education plays a more pronounced role in shaping artistic understanding. While our study focused on facial beauty assessment, it did not account for specific fields of education or provide a detailed analysis of visual arts. Future studies in these areas will be valuable for gaining a deeper understanding of how social factors shape aesthetic perspectives.

Conflict of Interest

There is no conflict of interest to declare.

Author Contributions

Eİ: data collection, data analysis, literature review, writing the manuscript, critical review; AY: conception and design of the study, obtaining data, critical review, supervision.

Ethics Approval

Ethical approval is obtained from Local Ethics Committee of Trakya University Faculty of Medicine (TÜTF-BAEK 2019/158)

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References

1. Önal T. Evaluation of university students' anthropometric face measurements by using photographic analysis methods in terms of artistic anatomy [Doctoral dissertation] Trakya University, Edirne; 2014:1–98.
2. Peron APLM, Morosini IC, Correia KR, Moresca R, Petrelli E. Photometric study of divine proportion and its correlation with facial attractiveness. Dental Press Journal of Orthodontics 2012; 17:124–31.
3. Tatarunaite E, Playle R, Hood K, Shaw W, Richmond S. Facial attractiveness: a longitudinal study. Am J Orthod Dentofacial Orthop 2005;127:676–82.
4. Iosa M, Morone G, Paolucci S. Phi in physiology, psychology and biomechanics: the golden ratio between myth and science. Biosystems 2018;165:31–9.
5. Ünver G. In terms of artistic anatomy effect to aesthetic perception of face morphometry [Master's dissertation]. Trakya University, Edirne; 2017:1–91.
6. Turkish Statistical Institute. Education level in Türkiye. [Internet]. [Retrieved on May 08, 2022]. Available from: https://nip.tuik.gov.tr/?value=EgitimDurumu
7. Coşkun R. Teknolojinin olanakları ile değişen sanat alanı. Sanat ve Tasarım Dergisi 2014;6:76–89.
8. Türkmenoğlu H. Teknoloji ile sanat ilişkisi ve bir dijital sanat örneği olarak Instagram. Ulakbilge Sosyal Bilimler Dergisi 2014; 2:87–100.
9. Beyoğlu A. Sanat eğitiminde altın oran ve Leonardo da Vinci'nin eserleri arasındaki ilişkinin incelenmesi. Van Yüzüncü Yıl Üniversitesi Eğitim Fakültesi Dergisi 2016;13:360–82.
10. Tekkanat N. The source of golden section and its reflection to art [Master's dissertation]. Akdeniz University, Antalya; 2006:1–105.
11. Odabaş O, Tekin A. Çağdaş sanat ve eğitim ilişkileri. Kocaeli Üniversitesi Güzel Sanatlar Fakültesi Dergisi 2018;3:6–12.
12. Özalp K. Güzelin bilinçli algısı ve estetik eğitimi. İdil Sanat ve Dil Dergisi 2016;5:491–504.
13. Saadeh M, Shamseddine L, Hasan FK, Ayoub F. Nasal morphology in a young adult Middle-Eastern population: a stereophotogrammetric analysis. J Contemp Dent Pract 2024;25:199–206.
14. Thomson A, Buxton LHD. Man's nasal index in relation to certain climatic conditions. The Journal of the Royal Anthropological Institute of Great Britain and Ireland 1923;53:92–122.
15. Shrestha R, Manandhar B, Upadhyay HP, Madhikarmi NL. Mean nasal index of dental students of a dental college in Nepal. JNMA J Nepal Med Assoc 2019;57:88–91.
16. Nasir N, Asad R, Muzammil K, Hassan A, Ahmed MM, Nasir S. Anthropometric study of nasal indices in four Indian states. Clinical Practice 2021;18:1620–5.
17. Özdemir F, Özkoçak V. Anadolu erkeklerinde burun, yüz tipleri ve oranlarının yaşa bağlı değişimleri. The Journal of International Lingual Social and Educational Sciences 2017;3:135–42.
18. Antai MS. Nasal anthropometry and the validity of neoclassical nasal canons in adult Ibibios. Saudi Journal of Medical and Pharmaceutical Sciences 2019;5:1007–14.
19. Svitlana AS, Themozhi MS. Study of nasal index – a review. International Journal of Advance Research and Innovative Ideas in Education 2019;5:110–5.
20. Leong SC, Eccles R. A systematic review of the nasal index and the significance of the shape and size of the nose in rhinology. Clin Otolaryngol 2009;34:191–8.
21. Taskinalp O, Erden N, Yildiz Z. Some nasofacial indices in Turkish men and women. Acta Morphologica et Anthropologica 2005:167–70.
22. Saygili OK, Cinar S, Gulcen B, Ozcan E, Kus I. The validity of eight neoclassical facial canons in the Turkish adults. Folia Morphol (Warsz) 2016;75:512–7.
23. Wang D, Qian G, Zhang M, Farkas LG. Differences in horizontal, neoclassical facial canons in Chinese (Han) and North American Caucasian populations. Aesthetic Plast Surg 1997;21: 265–9.
24. Prendergast P. Facial proportions. Advanced Surgical Facial Rejuvenation: Art and Clinical Practice 2012:15–22.
25. Sivkov S, Hristov I, Boukov Y, Petleshkova T, Baltadjiev A, Daskalova M, Baltadjiev G. Validity of the neoclassical facial canons in adult Bulgarians. Acta Morphologica et Anthropologica 2004;9:178–82.
26. Burusapat C, Lekdaeng P. What is the most beautiful facial proportion in the 21st century? comparative study among Miss

Universe, Miss Universe Thailand, neoclassical Canons, and facial golden ratios. Plast Reconstr Surg Glob Open 2019;7:e2044.

27. Kar M, Muluk N, Bafaqeeh S, Cingi C. Is it possible to define the ideal lips? Acta Otorhinolaryngol Ital 2018;38:67–72.
28. Mandy S. Art of the lip. Dermatol Surg 2007;33:521–2.
29. Wong WW, Davis DG, Camp MC, Gupta SC. Contribution of lip proportions to facial aesthetics in different ethnicities: a three-dimensional analysis. J Plast Reconstr Aesthet Surg 2010;63:2032–9.
30. Levy B, Ariely D, Mazar N, Chi W, Lukas S, Elman I. Gender differences in the motivational processing of facial beauty. Learn Motiv 2008;39:1–10.
31. Foos PW, Clark MC. Adult age and gender differences in perceptions of facial attractiveness: beauty is in the eye of the older beholder. J Genet Psychol 2011;172:162–75.
32. Lewandowski Z, Danel DP. Facial attractiveness and lip morphology of Caucasian women. Anthropological Review 2018;81:404–13.

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