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Review Article

Beauty beyond numbers: The golden ratio and facial aesthetics

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ABSTRACT

Facial aesthetics encompasses studying facial features and proportions to understand what makes a face visually appealing. The Golden Ratio refers to a mathematical proportion of 1.618, has been compared since ages for its aesthetic harmony and has been known to play a major role in defining ideal facial proportions. The Golden Ratio is used in assessing facial symmetry and proportionality across all cultures and populations. The implications of using the Golden Ratio in fields like digital imaging, cosmetic surgery and art, and its role in shaping perceptions of beauty. By using historical insights with modern research, this article provides an outline of the relationship between facial aesthetics and the Golden Ratio, thereby emphasizing both the theoretical foundations and practical implications of the theory in the study of beauty.

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1. Introduction

Beauty is a concept as ancient as humanity and has been admired, and has been a subject of fascination and admiration across cultures.¹ In the pursuit of understanding beauty and defining it, there came up various theories, which attempted to capture the essence of beauty through different lenses—artistic, philosophical, and mathematical.² The concept of beauty is facial aesthetics and how we perceive and appreciate the proportions of the human face in harmony.¹ Among all the theories, the Golden Ratio has gained lot of attention.³

1.1. Historical significance and cultural perceptions

The Golden Ratio and the implications related to it dates back to ancient civilizations, specifically ancient Greece where architects and artists incorporated the Golden Ratio into their works of art and buildings, since it was used to

represent a divine proportion that embodied ideal beauty.⁴ This influence extended into art, shaping ideals of beauty, proportions and aesthetics in the Western culture.⁴

It is of great importance that the perceptions of beauty are diverse in different regions.⁵ What is considered attractive in one area and culture may differ from the other. In instance, Western culture value clear and symmetrical features since ages, while on the other hand, East Asian cultures usually tend to prioritize a more rounded facial appearance.⁵ The media has also contributed to the breaking of beliefs and norms of beauty ideals and model that may or may not align with the Golden Ratio, and its principles further making its universal application very complicated.⁶

1.2. Introduction to the golden ratio

The Golden Ratio, is often symbolized by the Greek letter φ (phi), which is a mathematical proportion approximately equal to 1.618. It arises from the Fibonacci sequence, a series where each number is the sum of the two preceding ones (0, 1, 1, 2, 3, 5, 8, 13, 21, etc.)⁷.

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Mathematically, the Golden Ratio is expressed as $(a + b)/a = a/b = \varphi$, where a is larger than b .⁵ This ratio is very well known for its properties of aesthetic appeal, and is observed in many natural forms like architecture and various artistic forms and human facial proportions.⁷

1.2.1. Calculation formula

The formula used to determine the Facial Golden Ratio (FGR) is as follows.⁸

$$\text{FGR} = \text{FL}/\text{FW}$$

Where,

FGR is the Facial Golden Ratio,

FL is the face length in inches,

FW is the face width in inches.

For example, if a face has a length of 8 inches and a width of 5 inches, the Facial Golden Ratio is calculated as:

$$\text{FGR} = 8/5 = 1.6$$

This result indicates that the face closely aligns with the golden ratio, often considered aesthetically pleasing.⁸

1.3. The golden ratio in facial aesthetics

In the realm of facial aesthetics, the Golden Ratio serves as a theoretical framework for assessing the proportions and symmetry of different facial features.⁹ This theory suggests that faces that closely adhere to the Golden Ratio are perceived as more attractive owing to their harmony and balance.⁹

1.3.1. Key measurements include

1. Face Length to Width Ratio: The length of face should be approximately 1.618 times its width.⁸
2. Eye Spacing: The distance between the eyes should be 1.618 times the width of a single eye.⁸
3. Nose and Mouth Widths: The width of the nose is considered aesthetically pleasing when it measures about 1.618 times the width of the nostrils, while the width of mouth should be 1.618 times the width of the nose.⁸(Figure 1)

The following ratios have been calculated in the horizontal and vertical planes⁸:

1.3.2. Horizontal ratios

1. Intertemporal/intercanthal
2. Intercanthal/intercheilion
3. Interalae/interdacryon
4. Interalae/nose width
5. Intercheilion/interdacryon
6. Intercheilion/interalae

1.3.3. Vertical ratios

1. Forehead height/intereye-interalae
2. Forehead height/stomion-soft menton
3. Ala-soft menton/stomion-soft menton

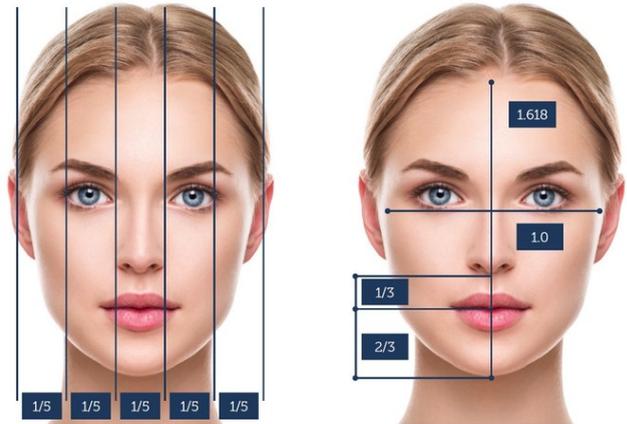


Figure 1: Horizontal ratios- Vertical ratios **Source:** <http://surl.li/rfozsf>

4. Intereye-interalae/interalae-stomion
5. Intereye-soft menton/intereye-stomion

These proportions are believed to reflect a harmonious balance that is appealing universally, but a few variations are observed universally due to individual differences and cultural preferences.¹⁰ (Figure 2)

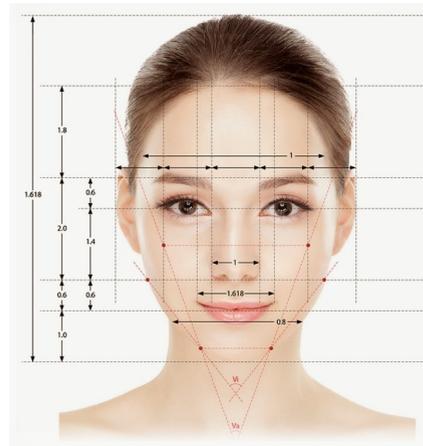


Figure 2: **Source:** <http://2.bp.blogspot.com/-MHgLOUIM61w/V CUSPs42BAI/AAAAAAAAADC4/A-chsiQ37Q4/s1600/facial%2 Bline.jpg>

More specifically, the normally used horizontal ratios were as follows ($p < 0.05$)¹¹ :

1. Intertemporal/intercanthal 1.314 (1.115 to 1556)
2. Intercanthal/intercheilion 1.852 (1.583 to 2.089)
3. Interalae/interdacryon 1.099 (0.550 to 1.459)
4. Interalae/nose width 2.026 (1.33 to 3.174)
5. Intercheilion/interdacryon 1.479 (1.050 to 2.033)
6. Intercheilion/interalaa 1.390 (1.188 to 1.909).

The most attractively considered vertical ratios found were as follows ($p < 0.05$)¹¹ :

1. Forehead height/intereye-interalae 1.410 (0.811 to 2.222)
2. Forehead height/stomion-soft menton 1.346 (0.676 to 2.051)
3. Ala-soft menton/stomion-soft menton 1.699 (1.467 to 1.909)
4. Intereye-interalae/interalae-stomion 1.357 (0.912 to 2.139)
5. Intereye-soft menton/interalae-soft menton 1.540 (1.342 to 1.806)
6. Intereye-soft menton/intereye-stomion 1.613 (1.458 to 1.864).

1.4. Scientific exploration and modern insights

Due to the recent technological advancements that enables major scientific study of the general concept of facial proportions and physical attractiveness, researchers can now utilize facial recognition software and morphometric analysis to compare facial features and proportions across diverse populations.¹⁰ Studies have found relations between facial symmetry and Golden Ratio in addition to the geographical diversities that are seen in human population, like the occurrence of long nose in people living in colder regions which help them to warm and humidify the cold air they inhale. Comparing with humid areas where people tend to have shorter nose.¹² In desert areas people tend to have more thicker and courser skin as compared to normal terrains to enable them to tolerate the dust fumes and sand bursts that occur frequently. People living in tropical region tend to have darker skin so as to compensate for the extremely harsh sun , thereby leading to increased melanin content in their skin.¹³ The attractiveness which is perceived by most people has assumed significance though these findings and are subject to cultural, geographic and individual variations.¹⁴

The Golden Ratio is used as a definitive standard of beauty has become a debatable area of concern.⁷ Critics argue that beauty is inherently subjective, influenced by cultural norms, social conditioning, and individual preferences.¹³ The application of a mathematical formula to define beauty across all contexts oversimplifies the complexity of human perception and aesthetic appreciation.¹³

1.5. Practical applications

Despite its theoretical findings, the practical application of the Golden Ratio in fields like plastic surgery and digital aesthetics raises ethical considerations .⁷ The pursuit of an idealized facial proportion based on mathematical principles can potentially reinforce unrealistic beauty standards and undermine diversity in appearance.¹

The horizontal facial proportions can be used in orthodontic surgeries to alter the shape of the jaws to improve dental occlusion stability, and temporomandibular joint function (corrective jaw surgery), and in the correction of bilateral asymmetries to improve the patient's facial proportions.¹¹ Patients are very specific in their needs for facial rejuvenation and aesthetic procedures, most demanded ones include ; Nose reduction, nose tip elevation, lip enhancement, brow lift, or chin augmentation, lip filling , cheek lifting , anti-ageing procedures, etc.¹³ Hence, we must take into consideration the measurements that can be made in areas which are anatomically complicated as the human skull, and thereby study related to this mathematical relationship before combining its clinical implications as an important parameter for achieving facial and esthetic harmony.¹⁴

Studies have also mentioned that in general certain facial proportions are generally perceived as attractive, individual preferences and cultural backgrounds play significant roles in shaping beauty standards.¹³ The diversity of the human face challenges the universal ideal and underscores the complexity of aesthetic preferences.¹⁵

1.6. Ethical considerations in facial aesthetics

Pursuing facial beauty raises and modifying it raises ethical considerations, specifically in fields like cosmetic surgery and digital enhancement treatments.¹ While these practices can enhance self-esteem and quality of life for some individuals, they also raise concerns about perpetuating unrealistic beauty standards and promoting homogeneity in appearance.¹

Furthermore, the impact of digital manipulation like filters available in camera applications and editing technologies available out there which can transform pictures by enhancing the features , reducing the fat, increasing complexion , even skin tone and what not. The social media attributions on perceptions of beauty such as being in perfect shape and physique, such as hourglass nature of women, with curvy bodies but petite and muscular well build men with chiselled body and jaws in males must be addressed.¹⁶ Images are commonly altered , edited and morphed to stick to the perceived ideal proportions, which mostly revolves around the Golden Ratio, thereby contributing to a homogenized portrayal of beauty that may not reflect the diversity of human appearances.⁷

The portrayal of idealized and symmetric flawless facial features in the media and advertising company can impact societal perceptions of beauty, thereby tend to influence the self-image and might lead to low self-esteem among individuals specially teenagers who tend to be more beauty conscious and are getting affected with the sudden change in their body and physical changes, when their physical appearance do not conform to these ideals they tend to switch to these beauty products and treatments available

and accessible to them some of them who even tend to administer medication which might turn out to be fatal for their future wellbeing.¹⁶ Some teenagers who tend to breakout in their prime teenage years due to the hormonal changes, often rely on drugs which are mostly contraceptive pills which can affect their reproductive cycle in later stages of their life.¹⁶

2. Discussion

The application of Golden Ratio in facial aesthetics and symmetry highlights the intersection of mathematics, art and culture. While its universal evidence as a symbol of harmony is evident across art, architecture and human anatomy, its relevance to beauty needs more insights.⁹ Cultural standards of beauty directly influence the significance and consideration of the Golden Ratio.¹³ However, the diversity in human anatomy and the subjective nature of beauty highlight the ratio's limitations.⁸

Technological advancements in facial aesthetics and analysis validate some correlations between the Golden Ratio and perceived attractiveness. Comparing beauty to mathematical values and precision highlights the complexity of human aesthetics and thereby personal preferences.¹¹

In aesthetic fields, the Golden Ratio is commonly used as a guideline for achieving facial harmony through reconstructive and cosmetic procedures. Its application also risks attaining unrealistic beauty standards and promoting very homogenized traits.¹¹ Ethical practices must not forget to prioritize diversity and inclusivity in the run for aesthetic enhancements.¹ Celebrating the diversity of nature is in par with the ideals and leads to debate in defining beauty and appreciating it.¹⁵

3. Conclusion

Beauty is a multi-opinioned concept and travels way beyond mathematical formulas, finds expression in the diversity of human experiences often shaped by cultural, psychological, and individual factors. It serves as a reminder of trends of nature with symmetry and proportion, to understand what makes a face, in all extensions, forms of art and nature, truly beautiful.

As we continue to explore and redefine beauty in the 21st century, it is essential to approach these opinions taking into consideration cultural diversity, ethical considerations, and the complexities about perception of beauty which is ultimately reflection of human experiences and identities, embracing differences rather than confining to certain norms and standards. It is essential to celebrate diversity and promote inclusive representations of beauty. Embracing the uniqueness of individual faces challenges us to redefine beauty beyond rigid standards and appreciate the inherent diversity of human appearances.

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5. Conflict of Interest

None.

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