

Associations of Masculinity-Femininity, Facial Ratios, and Attractiveness: Insights from an Analysis of 827 Individuals

Dillan F Villavisanis BA¹, Jessica D Blum MSc¹, Daniel Y Cho MD PhD¹, Jordan W Swanson MD MSc¹, Scott P Bartlett MD, Jesse A Taylor MD¹

¹Division of Plastic & Reconstructive Surgery, Children's Hospital of Philadelphia, Philadelphia, PA, USA

INTRODUCTION

- Males and females have known differences in anatomic facial features, including increased chin and jaw protuberance in males (Tunis 2020) and vermilion lip exposure in females (Popenko 2017).
- Manipulation of sexual dimorphic characteristics requires a diverse set of procedures relying on both bony and soft tissue contouring, including forehead manipulation (Cho 2012), brow lift (Cho 2012), rhinoplasty (Nouraei 2007), and lip augmentation (Altman 2012).
- Previous studies have evaluated the influence of facial features in determining male and female sex; however, these have relied on prototypical renderings or artificial faces (Russell 2003).
- Moreover, previous studies tend to include a relatively small sample size of both individual photos and raters (Russell 2003) which may call into question the generalizability of results.

OBJECTIVES

- Using a large set human photos and raters, this study aimed to determine associations of facial-feature representation ratios with sex, masculinity-femininity, and attractiveness. We hypothesized that:
- Certain anatomic facial ratios are associated with perceptions of masculinity and femininity;
 - these associations may persist when evaluating masculinity in females and femininity in males;
 - these anatomic facial ratios can predict sex; and
 - ratios are associated with ratings of attractiveness differently in males and females.

METHODS

- Eight hundred and twenty-seven unique individuals were included from the Chicago Face Database, a publicly available domain of soft-tissue facial measurements and ratings by 1,087 individuals on attractiveness and social characteristics (Ma 2015).
- Several anatomic measurements are reported in pixels, including face height and width, nose length and width, eye height and width, and brow-to-hairline distance, among others (Figure 1).

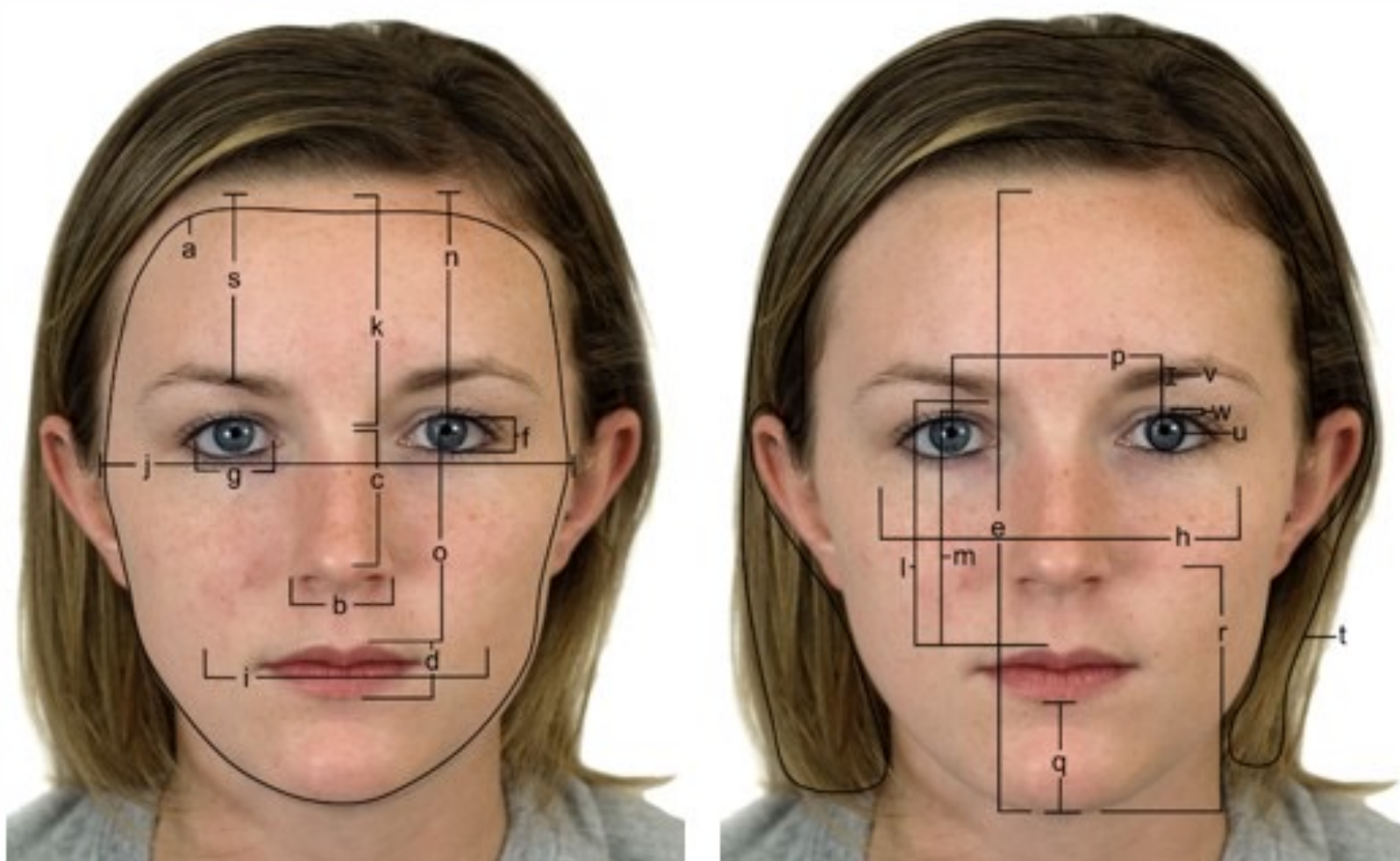


Figure 1. Facial Anatomic Measurements in Chicago Face Database

Table 1. Facial Ratios

Nasal width ratio	$= \left(\frac{b}{j}\right) \times 100$
Nasal length ratio	$= \left(\frac{c}{e}\right) \times 100$
Lip ratio	$= \left(\frac{d}{e}\right) \times 100$
Eye height ratio	$= \left(\frac{f}{e}\right) \times 100$
Eye width ratio	$= \left(\frac{g}{j}\right) \times 100$
Philtrum ratio	$= \left(\frac{[e - (c + k + d + q)]}{e}\right) \times 100$
Chin ratio	$= \left(\frac{q}{e}\right) \times 100$
Upper third ratio	$= \left(\frac{s}{e}\right) \times 100$
Middle third ratio	$= \left(\frac{[l(k + c) - s]}{e}\right) \times 100$
Lower third ratio	$= \left(\frac{[e - (c + k)]}{e}\right) \times 100$
Facial ratio	$= \left(\frac{e}{j}\right) \times 100$

- Layperson participants rated individuals in photographs on a seven-point Likert scale for masculinity, femininity, and attractiveness.

- Ratios were used to characterize relative representation of facial features, where higher ratio scores indicated increased facial feature representation (Table 1).

- For example,

$$\text{nasal width ratio} = \left(\frac{\text{interalar width}}{\text{face width}}\right) \times 100.$$

- Additional ratios included nasal length, eye height, philtrum height, forehead height, lip height, and chin height.
- Each feature was compared to facial width (nasal width ratio and eye width) or length (eye height, philtrum, forehead, lip, and chin).

RESULTS

Table 2. Facial Ratios and Masculinity-Femininity

	Masculinity Total		Femininity Total	
	ρ	p	ρ	p
Nose width ratio	0.105	0.002**	-0.243	< 0.001***
Nose length ratio	-0.199	< 0.001***	0.206	< 0.001***
Lip ratio	-0.067	0.056	0.080	0.022*
Eye height ratio	-0.263	< 0.001***	0.297	< 0.001***
Eye width ratio	-0.204	< 0.001***	0.101	0.004**
Philtrum ratio	0.149	< 0.001***	-0.223	< 0.001***
Chin ratio	0.383	< 0.001***	-0.377	< 0.001***
Upper third ratio	0.171	< 0.001***	-0.145	< 0.001***
Middle third ratio	-0.493	< 0.001***	0.499	< 0.001***
Lower third ratio	0.359	< 0.001***	-0.397	< 0.001***
Facial ratio	-0.210	< 0.001***	0.099	0.004**



Figure 3. Example Participant Photos. Top: photos of participants identifying as male with ratings of left: high femininity and high masculinity; middle: average femininity and masculinity; and right: low femininity and high masculinity; and bottom: photos of participants identifying as female with left: low femininity and high masculinity; middle: average femininity and masculinity; and right: high femininity and low masculinity.

Table 3. Facial Ratios and Attractiveness

	Attractiveness in Males		Attractiveness in Females	
	ρ	p	ρ	p
Nose width ratio	0.053	0.290	-0.183	< 0.001***
Nose length ratio	-0.123	0.013*	0.163	< 0.001***
Lip ratio	-0.044	0.380	-0.135	0.006**
Eye height ratio	-0.112	0.024*	0.074	0.132
Eye width ratio	-0.135	0.006*	-0.060	0.220
Philtrum ratio	0.067	0.175	0.004	0.934
Chin ratio	0.135	0.006**	0.019	0.701
Upper third ratio	0.131	0.008**	0.087	0.076
Middle third ratio	-0.187	< 0.001***	0.008	0.872
Lower third ratio	0.089	0.074	-0.075	0.126
Facial ratio	-0.186	< 0.001***	-0.175	< 0.001***

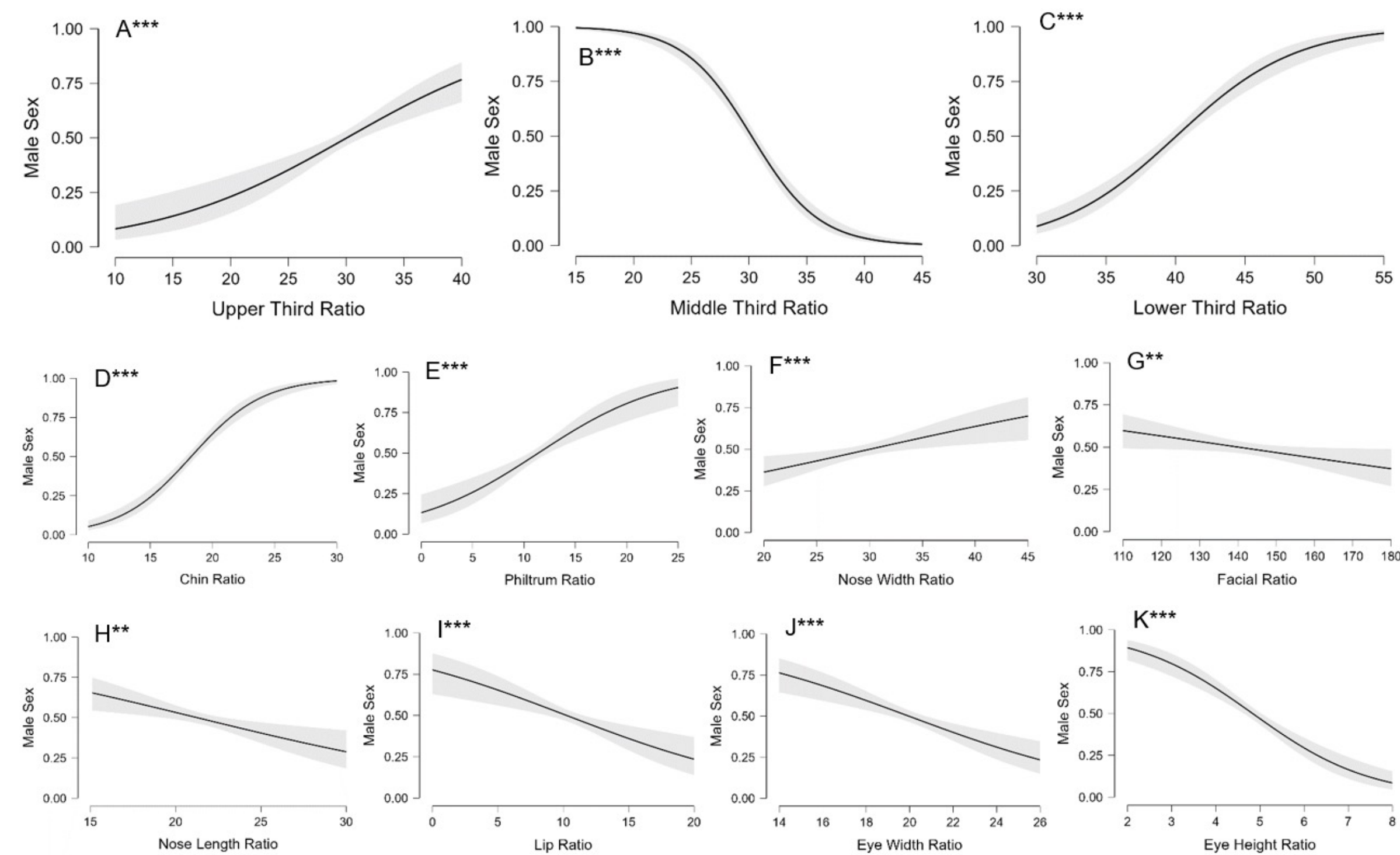


Figure 2. Facial Ratios Predicting Sex. Conditional estimate plots with 95% confidence intervals predicting male (1) and female (0) sex for A: upper third ratio; B: middle third ratio; C: lower third ratio; D: chin ratio; E: philtrum ratio; F: nose width ratio; G: facial ratio; H: nose length ratio; I: lip ratio; J: eye width ratio; K: eye height ratio. Statistical significance denoted with * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

CONCLUSION

- Increased representation of the upper and lower one-third of the face are most implicated in perceptions of masculinity and male sex, while increased representation of the middle one-third of the face is most implicated in perceptions of femininity and female sex.
- These relationships persist even in relation to masculinity in females and femininity in males.
- Results from this study have implications for gender affirming surgery and care, where additional quantifiable data may be helpful to optimize results for these patients.