Letters

RESEARCH LETTER

Nasal Distortion in Short-Distance Photographs: The Selfie Effect

The selfie, or self-photograph, has rapidly become one of the major photographic modalities of our time; in 2014 alone, there were over 93 billion selfies taken on Android phones per day.[1,2] Despite the ease with which selfies are taken, the short distance from the camera causes a distortion of the face owing to projection, most notably an increase in nasal dimensions.

According to a poll by the American Academy of Facial Plastic and Reconstructive Surgeons, 42% of surgeons reported patients seeking cosmetic procedures for improved selfies and pictures on social media platforms.[3] We present a mathematical model to describe the distortive effects, prove the increased perceived nasal size in selfies, and calculate the magnitude of this effect from different camera distances.

No patient intervention or contact was made during this study and was therefore exempt from institutional review board review.

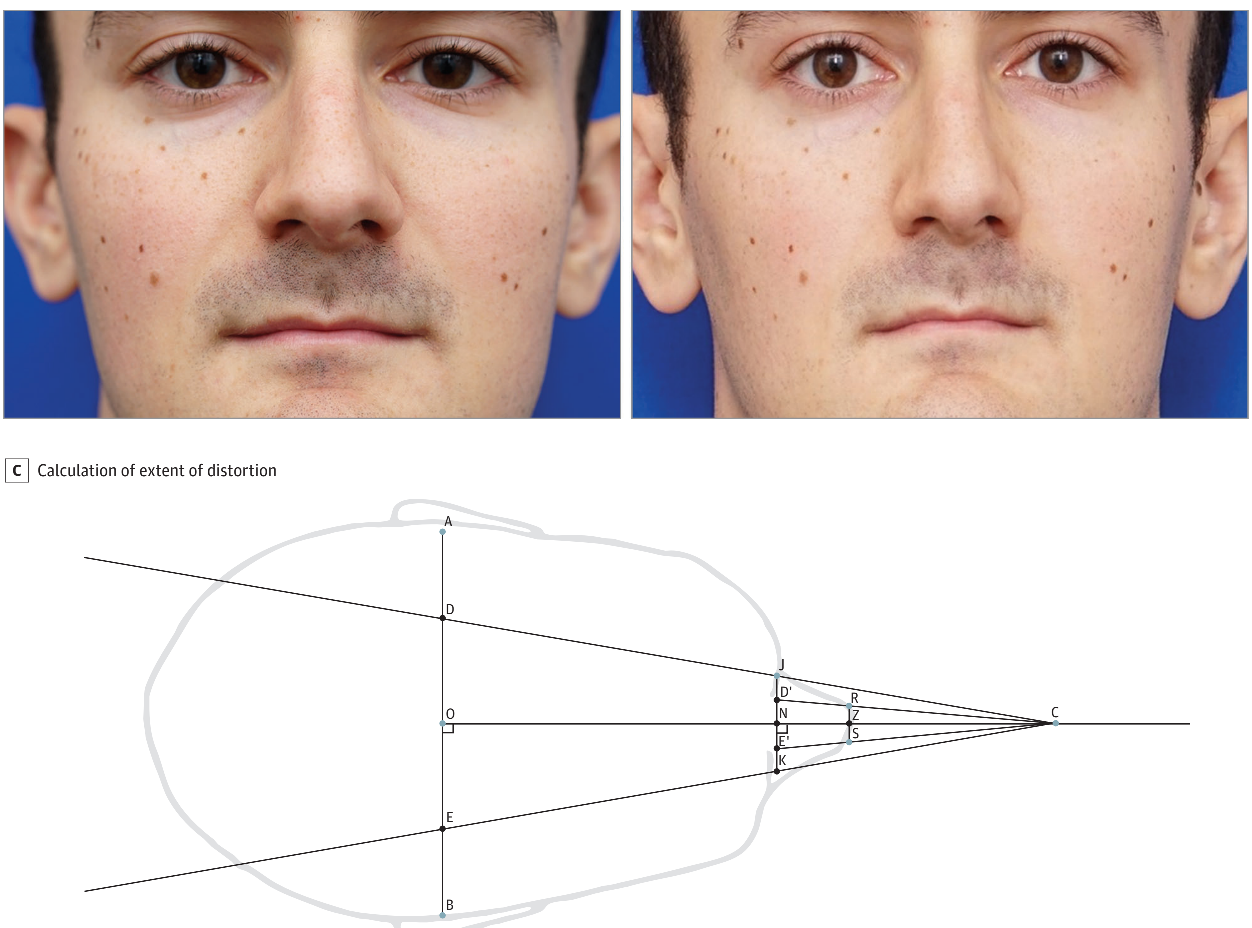
Methods | We modeled the face as a collection of parallel planes that are perpendicular to the main camera axis and calculated nasal breadth to bizygomatic breadth perceived ratio

Figure. Example of Nasal Size Distortion in a Short-Distance Photograph and Derived Model

A Portrait at 12 inches

B Portrait at 5 feet (60 inches)

C Calculation of extent of distortion



A, Individual's face when photograph is taken at 12 inches. B, Individual's face when photograph is taken at 5 feet. C, Derived model of the head and face used to calculate distortion extent. For the derived model, the line between A and B represents the bizygomatic breadth; the line between C and O, camera axis; D, D', E, and E' are unnamed points of reference; the line between J and K, nose breadth; the line between O and N, head length halved; the line between N and Z, nose protrusion; the line between R and S, intercrural distance.

Table. Facial Measurements

Feature	Population Mean (mm)	Formula Value	Value on Model
Distance between camera and half the length of the head	NA	D_1	O-C
Distance between camera and glabella landmark	NA	D_2	N-C
Male			
Nose protrusion	21.1	NA	N-Z
Nose breadth	36.6	N	J-K
Intercrural distance	8.9	NA	R-S
Bizygomatic breadth	143.5	B	A-B
Head length halved	98.7	D_3	O-N
Female			
Nose protrusion	19.8	NA	N-Z
Nose breadth	33.2	N	J-K
Intercrural distance	8.5	NA	R-S
Bizygomatic breadth	135.1	B	A-B
Head length halved	93.8	D_3	O-N

Abbreviation: NA, not applicable.

changes according to the distance from the camera to those planes (**Figure**). As the scale of a photograph can be changed, to compare sizes of different facial features, we first needed to decide on a reference feature to keep fixed to which all other measured features will be compared. Using multiview geometry,[4] we showed that, when keeping bizygomatic breadth fixed, the ratio between perceived nasal breadth (N′) and bizygomatic breadth (B) is $N'/B = N \times D_1/B \times D_2$, where D_1 is the distance between the camera and half the length of the head and D_2 is the distance between the camera and the Glabella landmark.

When comparing 2 different camera configurations, the ratio between perceived nasal breadth is $N'/N'' = D_1' \times (D_1'' - D_3)/D_1'' \times (D_1' - D_3)$, where D_1 is defined as before for the first (D_1') and second (D_1'') camera configurations, and D_3 is half the distance between the Glabella landmark and the back of the head. Similar formulae can be derived for intercrural distance when keeping nasal breadth constant, as well as for all other facial features of interest.

We used the average morphometric lengths for nasal protrusion, nasal breadth, bizygomatic breadth, head length,[5] and intercrural distance[6] (**Table**) to determine the perceived change in nasal breadth in both males and females at a selfie distance of 12 in (30.48 cm), 5 ft (1.5 m), and infinite camera distance. Data was collected from a random sample of racially/ethnically diverse participants at locations throughout the United States.

Results | For a camera placed at infinity (orthographic projection), the ratio of axis aligned planes remains true to the real-world ratio as measured on the 3-dimensional face. Thus, we compared the perceived sizes with those produced by an orthographic projection.

When taken at 12 in away and keeping the bizygomatic breadth constant, selfies increase nasal size by 30% in males and 29% in females compared with an orthographic projection. Predictably, an image taken at 5 ft, a standard portrait distance, results in essentially no difference in perceived size. When keeping nasal breadth constant, intercrural distance is 7% greater at 12 in compared with orthographic projection in both males and females (Figure).

Discussion | We found that photographs taken at shorter distances will increase the perceived ratio of nasal breadth to bizygomatic breadth. Importantly, this distortion does not accurately reflect the 3-dimensional appearance of the nose. Further studies are necessary to determine whether patients who take frequent selfies are less satisfied with their clinical outcomes and if this distortion informs future medical decisions. Additional models are necessary to explore this effect at different vertical and horizontal camera angles.

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Study concept and design: B. Ward, Fried, Paskhover.
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Statistical analysis: M. Ward, Paskhover.
Administrative, technical, or material support: B. Ward, M. Ward, Paskhover.
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