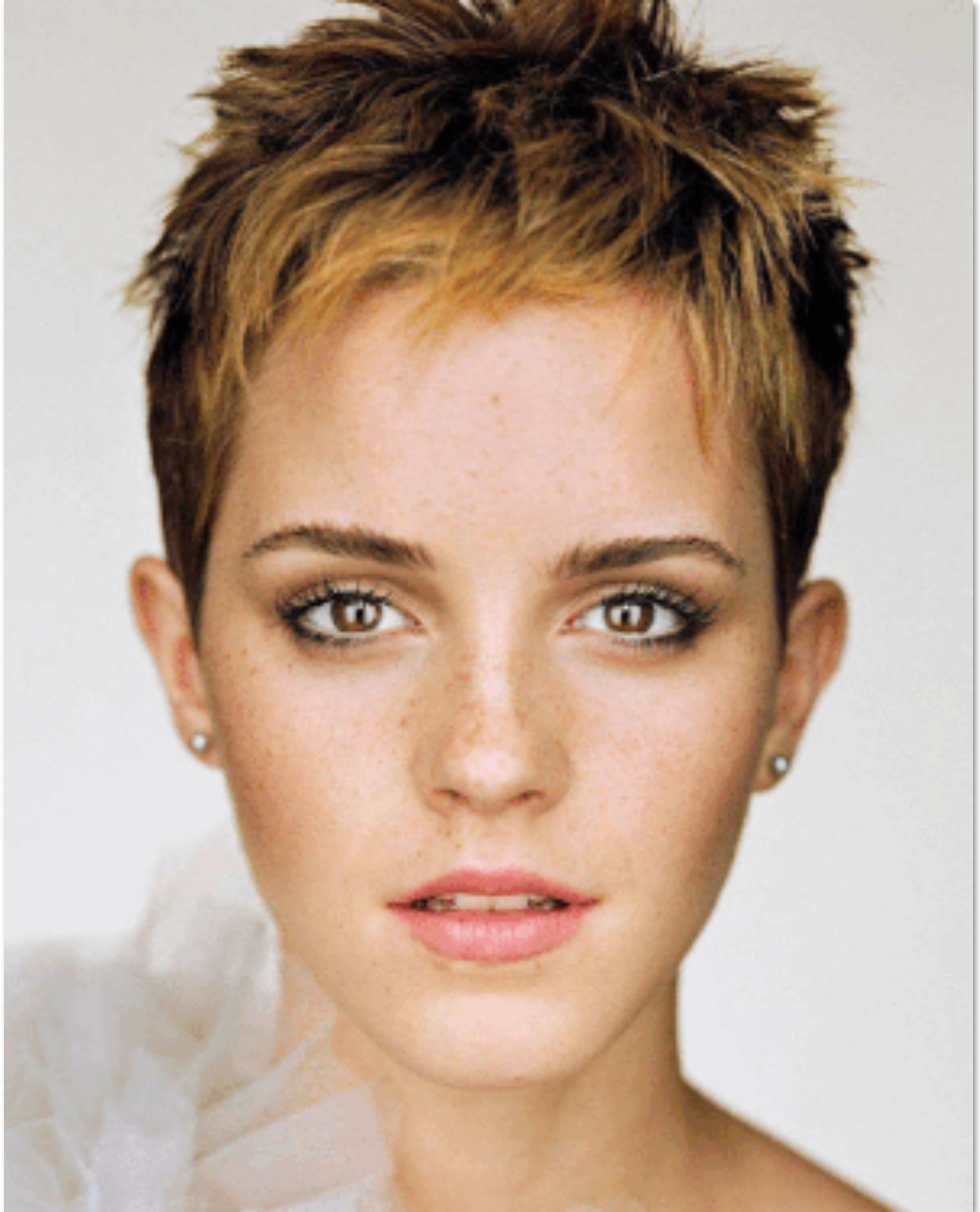
Morphing

CSE 5280



Click on the link to see video:

Source: http://0e303c09b5d540ddca1b-a32f9c73930f0077ec4cbda0c3141619.r85.cf2.rackcdn.com/project5.html

Examples

https://youtu.be/nUDIoN-_Hxs

https://youtu.be/-ZopSqoJOgo

Click on the links to see videos:

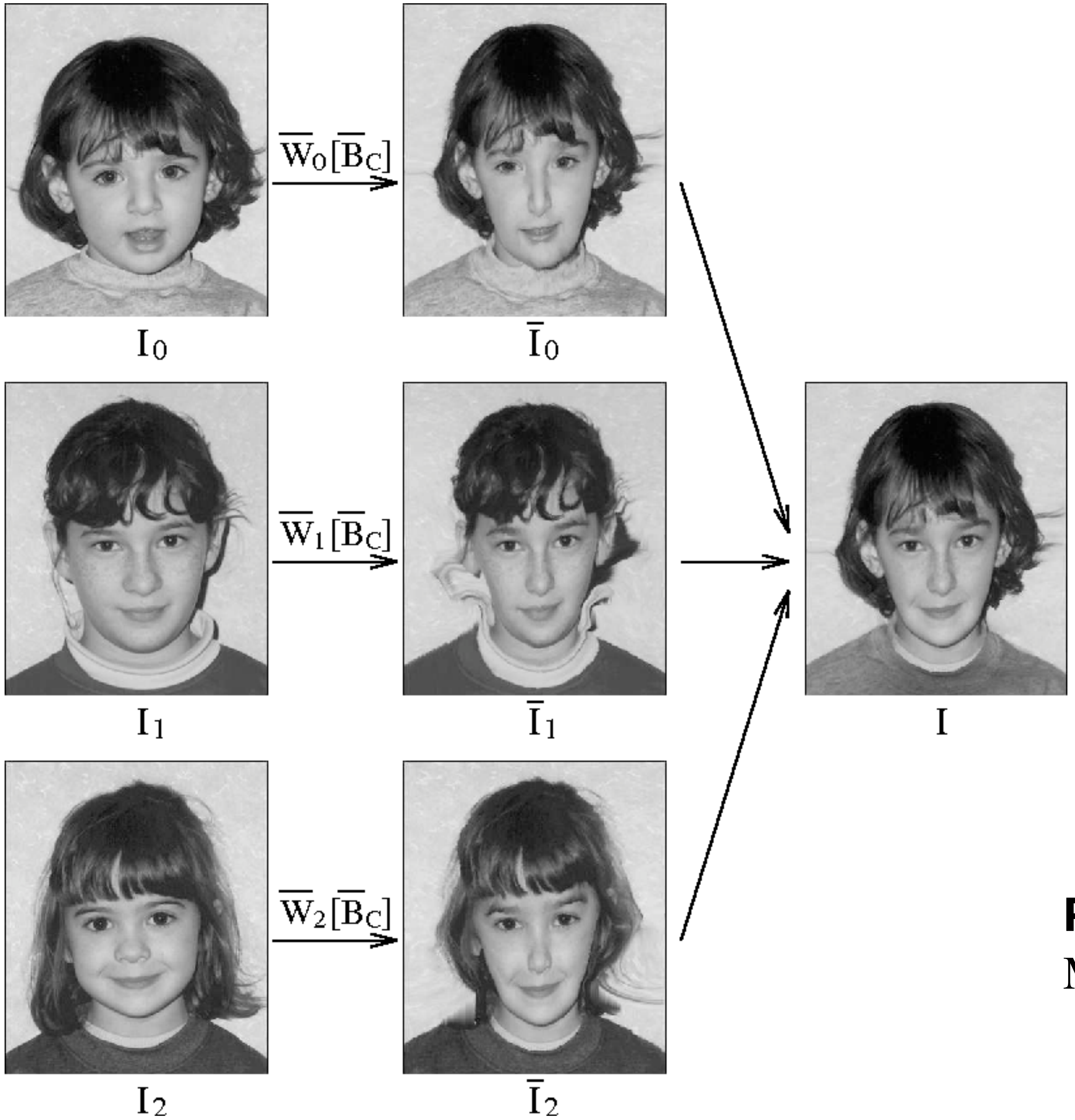
Examples

3-D morphing

https://www.cs.drexel.edu/~david/Abstracts/morph-diff-mods-abs.html

Examples

Combining multiple faces to form a new one



Paper: Polymorph:
Morphing Among Multiple Images by Lee et al. (1998)

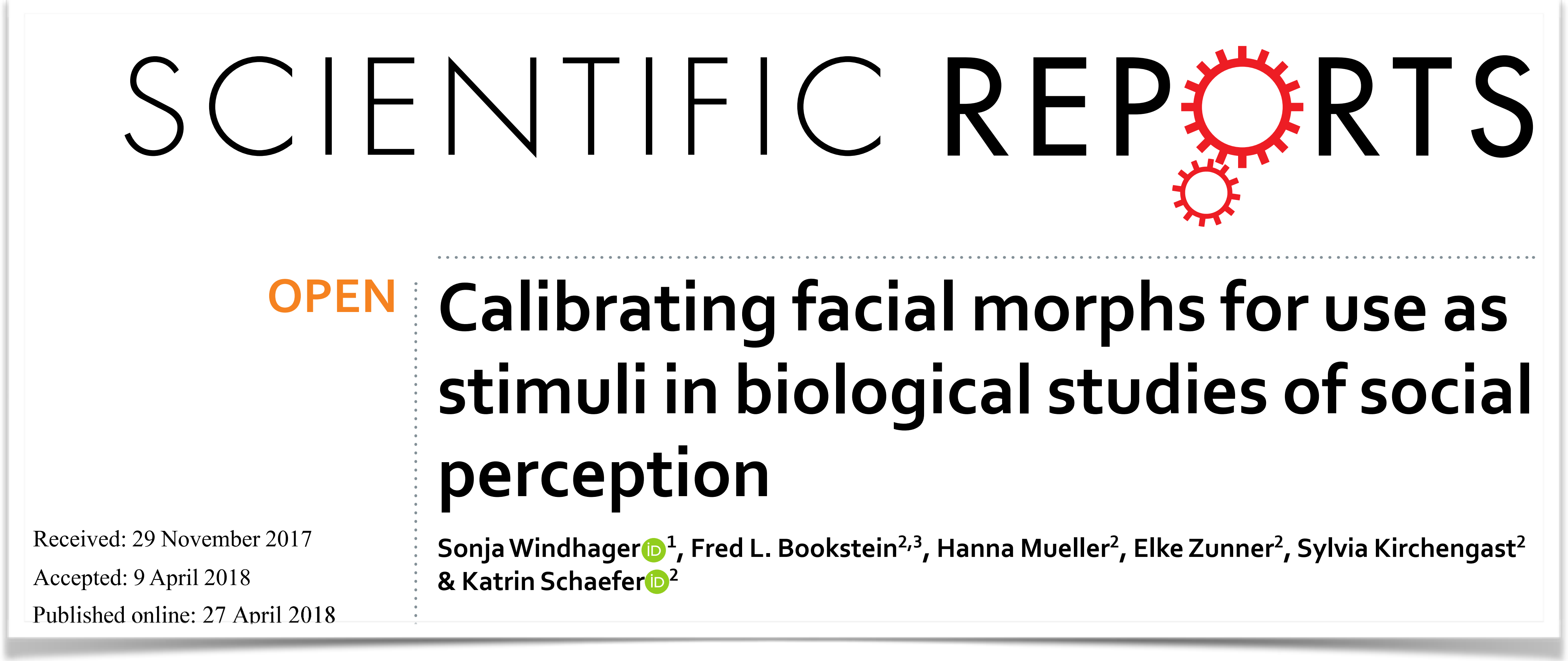
http://www-cs.ccny.cuny.edu/~wolberg/pub/cga98.pdf

Examples

Preview for plastic surgery

https://www.businessinsider.com.au/visual-plastic-surgery-2014-2

Examples


SCIENTIFIC REPORTS

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Calibrating facial morphs for use as stimuli in biological studies of social perception

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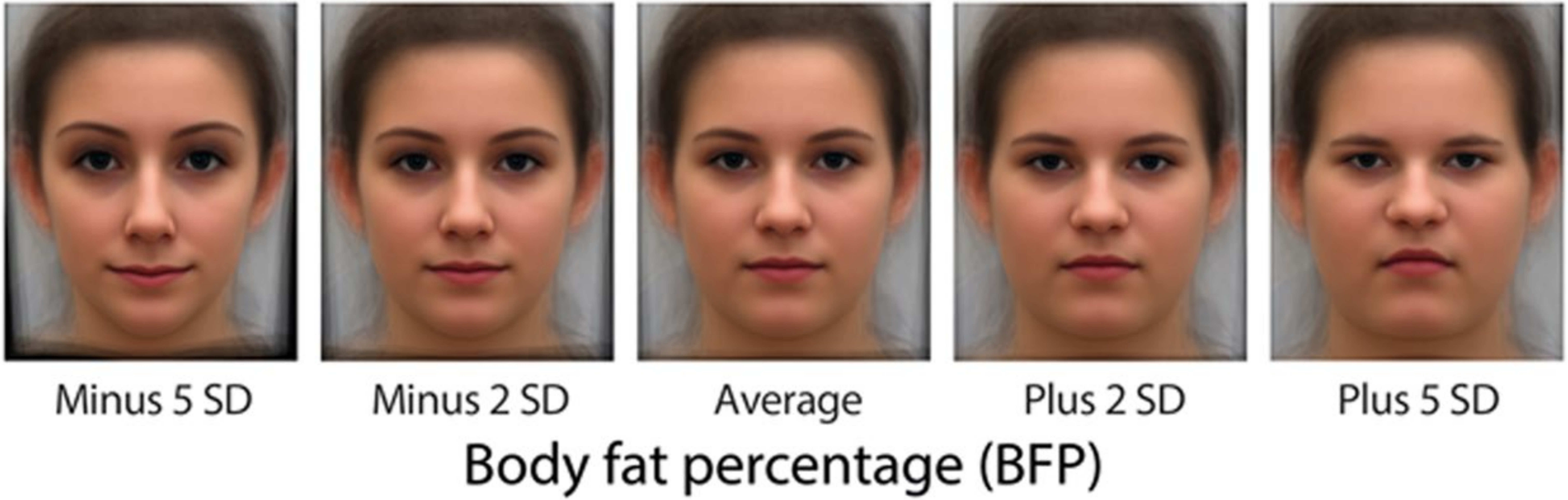
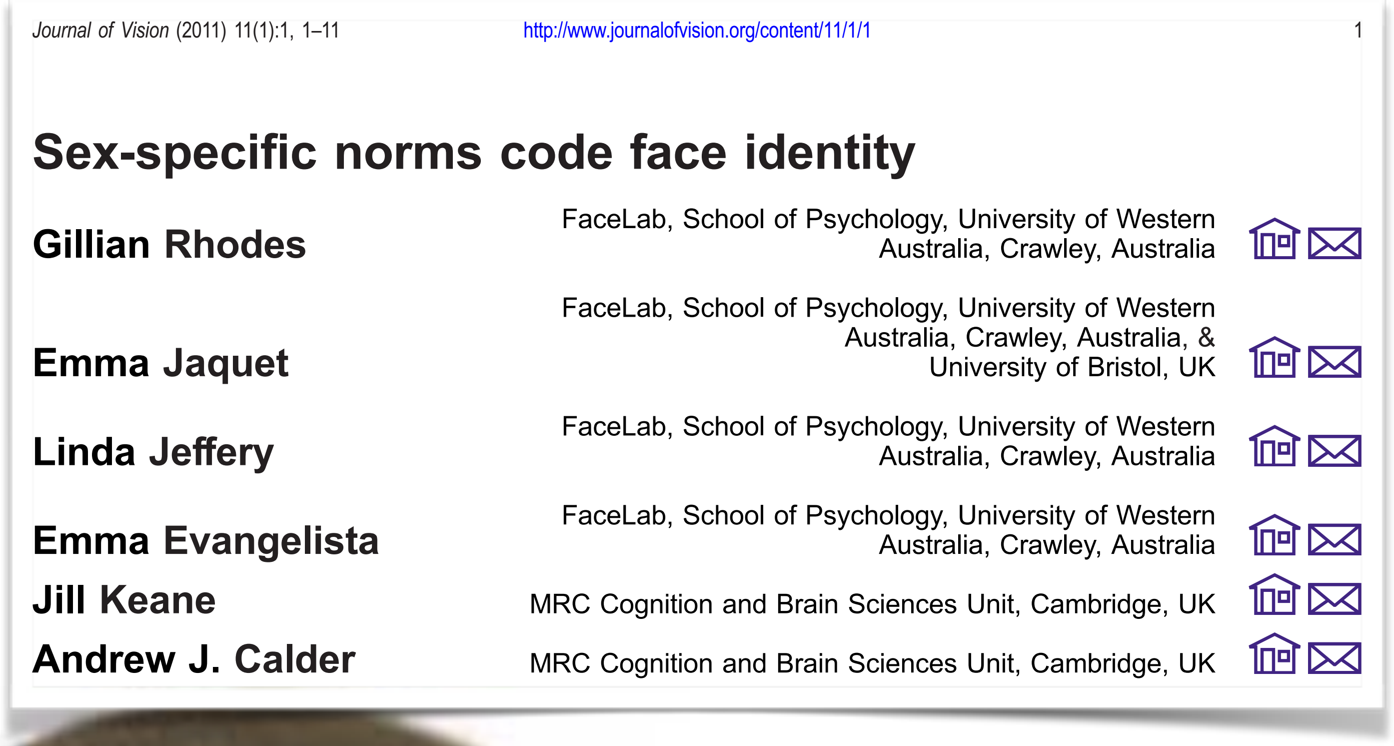


https://www.nature.com/articles/s41598-018-24911-0.pdf

Examples


Journal of Vision (2011) 11(1):1, 1–11 http://www.journalofvision.org/content/11/1/1 1

Sex-specific norms code face identity

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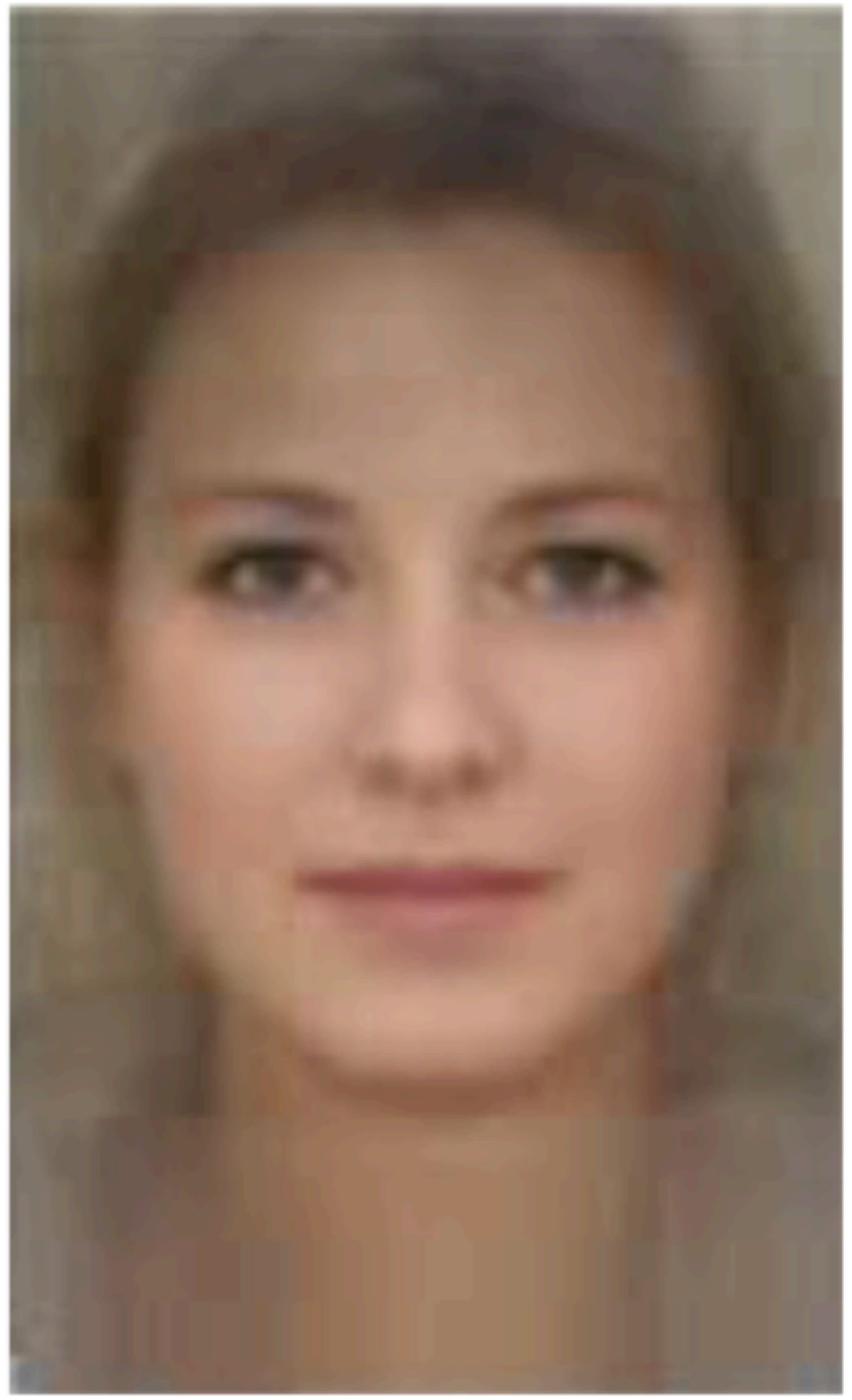
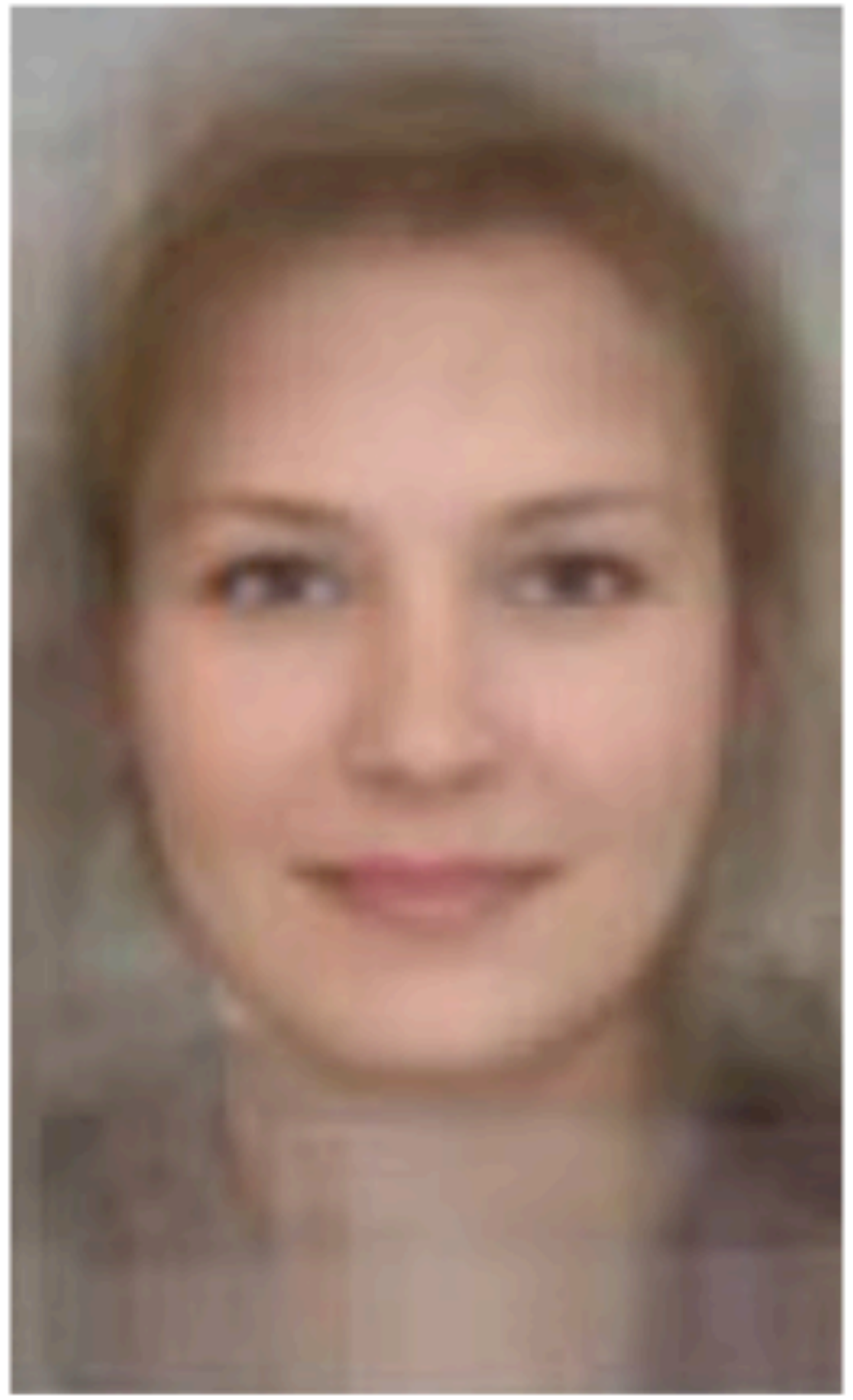
Figure 2. (Left) Male average, (center) female average, and (right) generic, androgynous average. The sex-specific averages were made by morphing together 24 male and 24 female faces, respectively. The generic average was made by morphing all 48 faces (24 males, 24 females).

https://www.semanticscholar.org/paper/Sex-specific-norms-code-face-identity.-Rhodes-Jaquet/8d95e11d78fbec0db4add7d8d64f6545ba640f3d

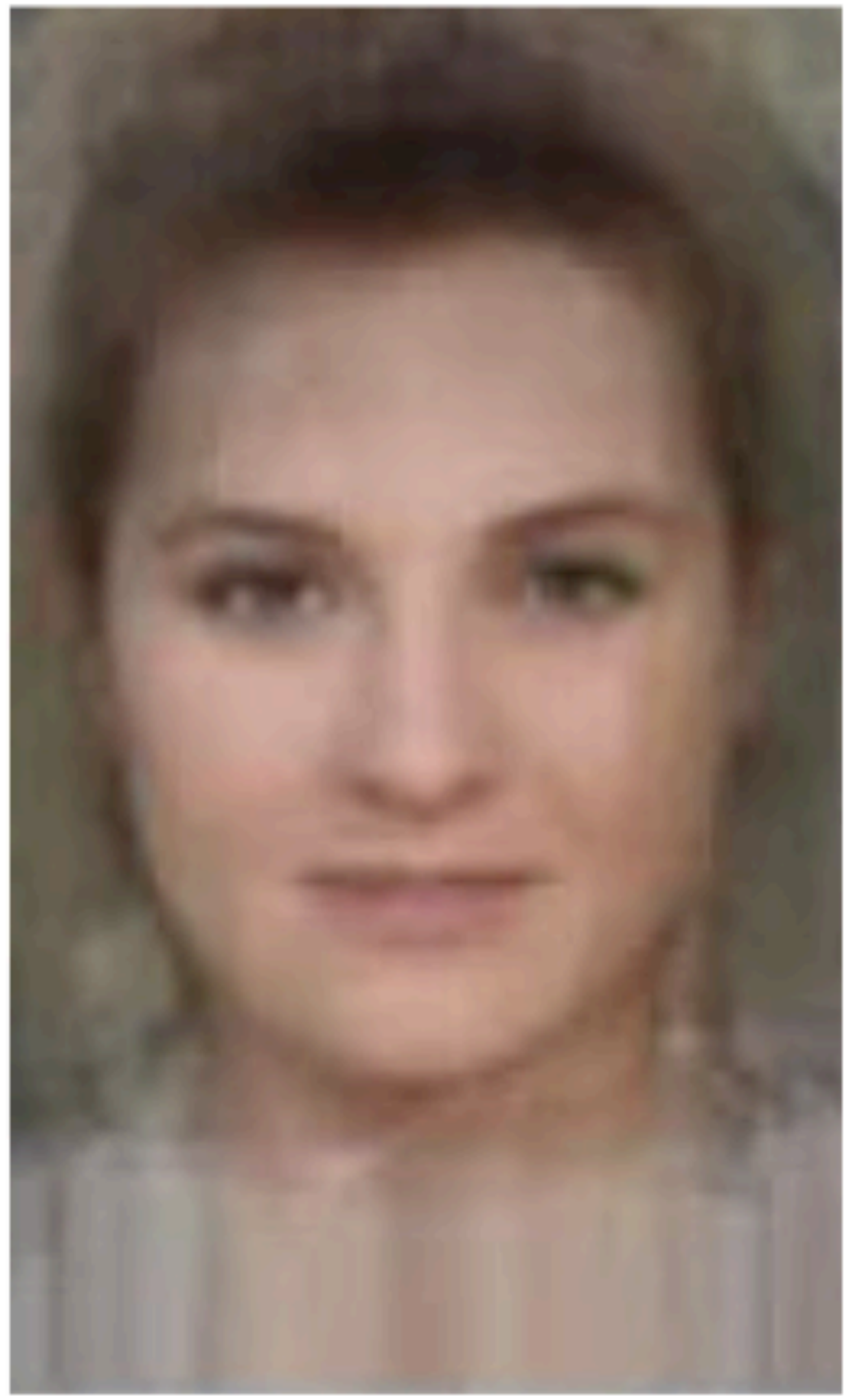
Examples: playing with averages



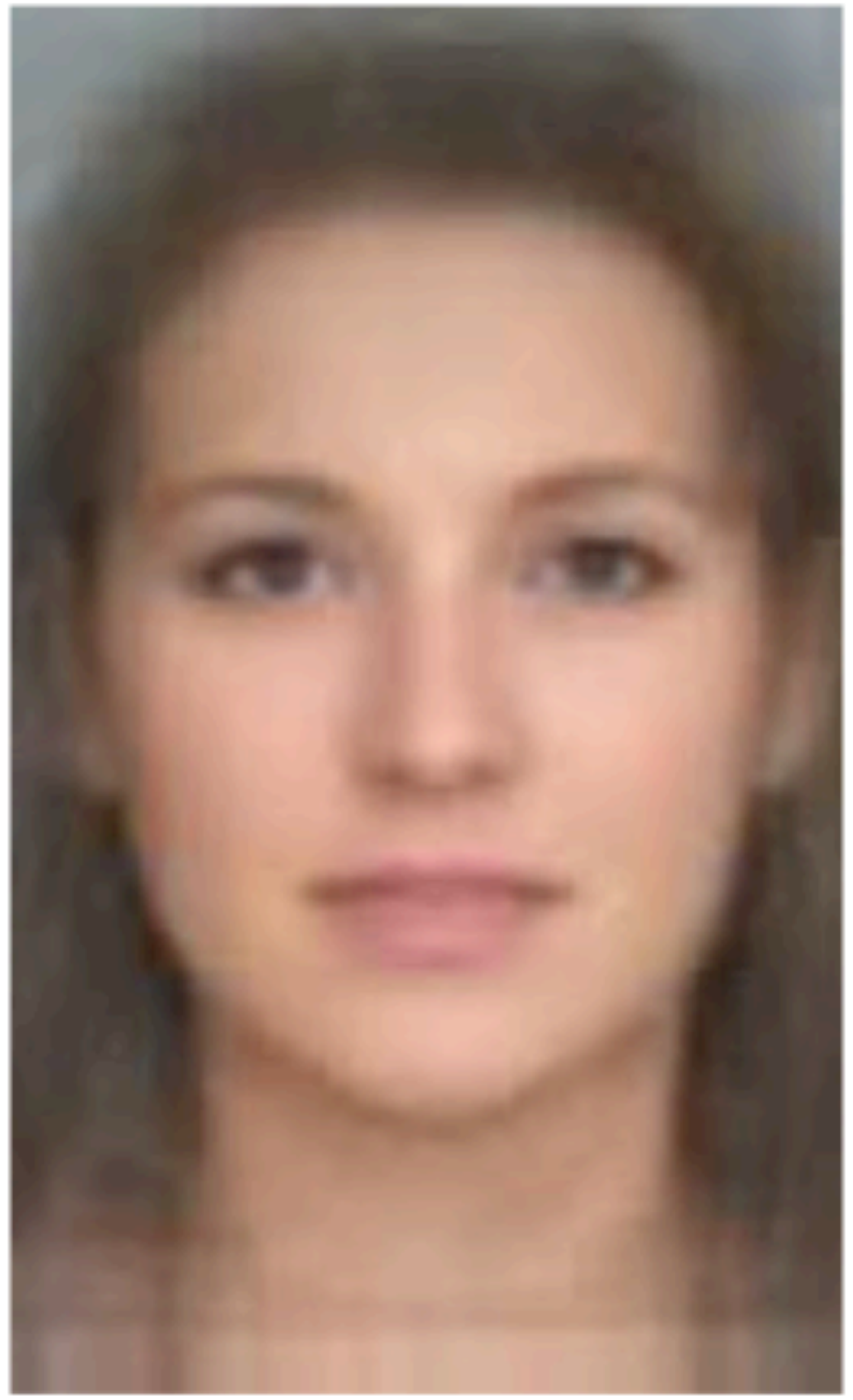
German avg.



Finnish avg.



Irish avg.



American avg.

Mongolian avg.

Examples: transferring morphings

My face

Irish avg. | More Irish | German avg. | More German | Mongolian avg. | More Mongolian | Finnish avg. | More Finnish

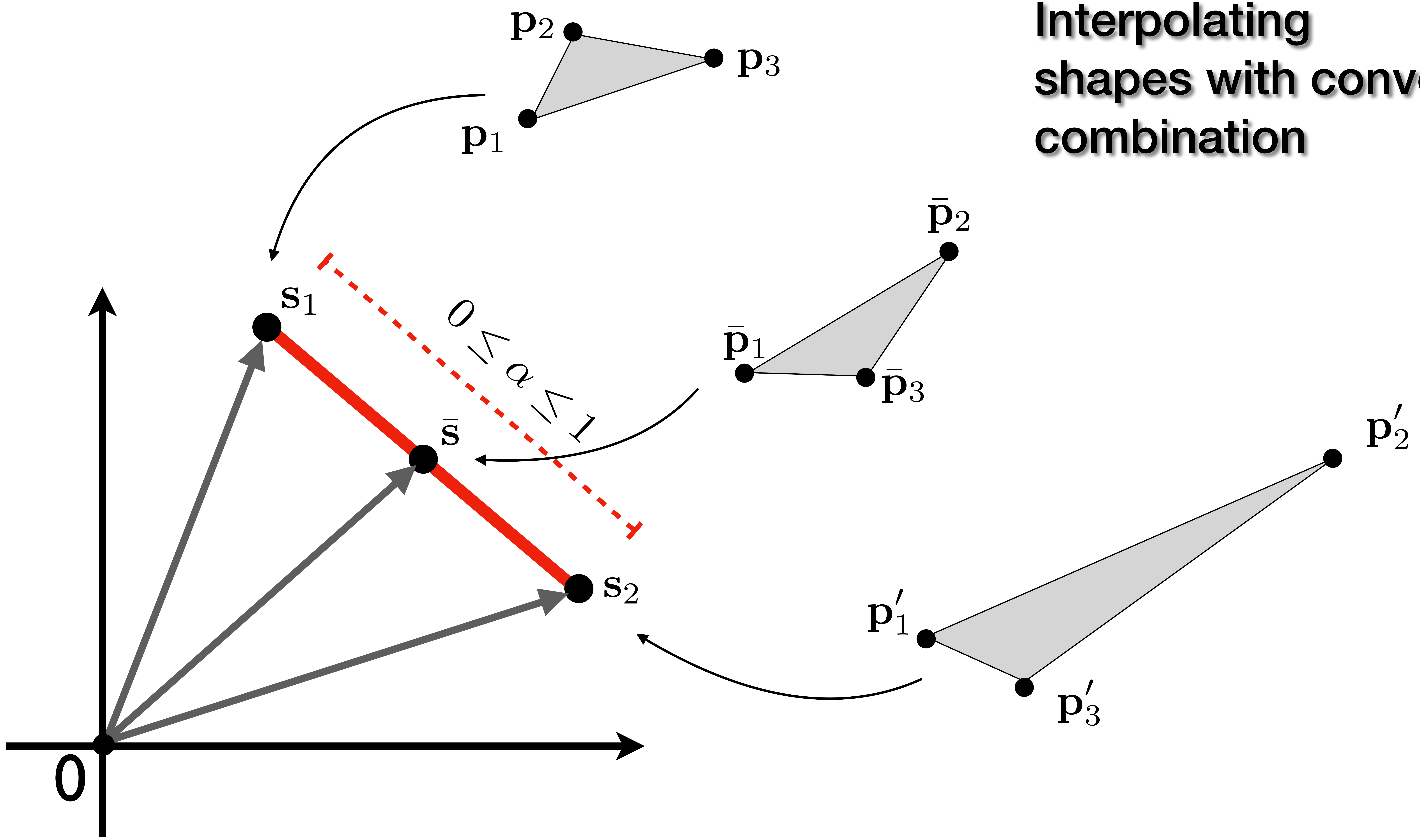
Project by Rachel Albert (UC Berkeley) http://0e303c09b5d540ddca1b-a32f9c73930f0077ec4cbda0c3141619.r85.cf2.rackcdn.com/project5.html

Show Efros' slides

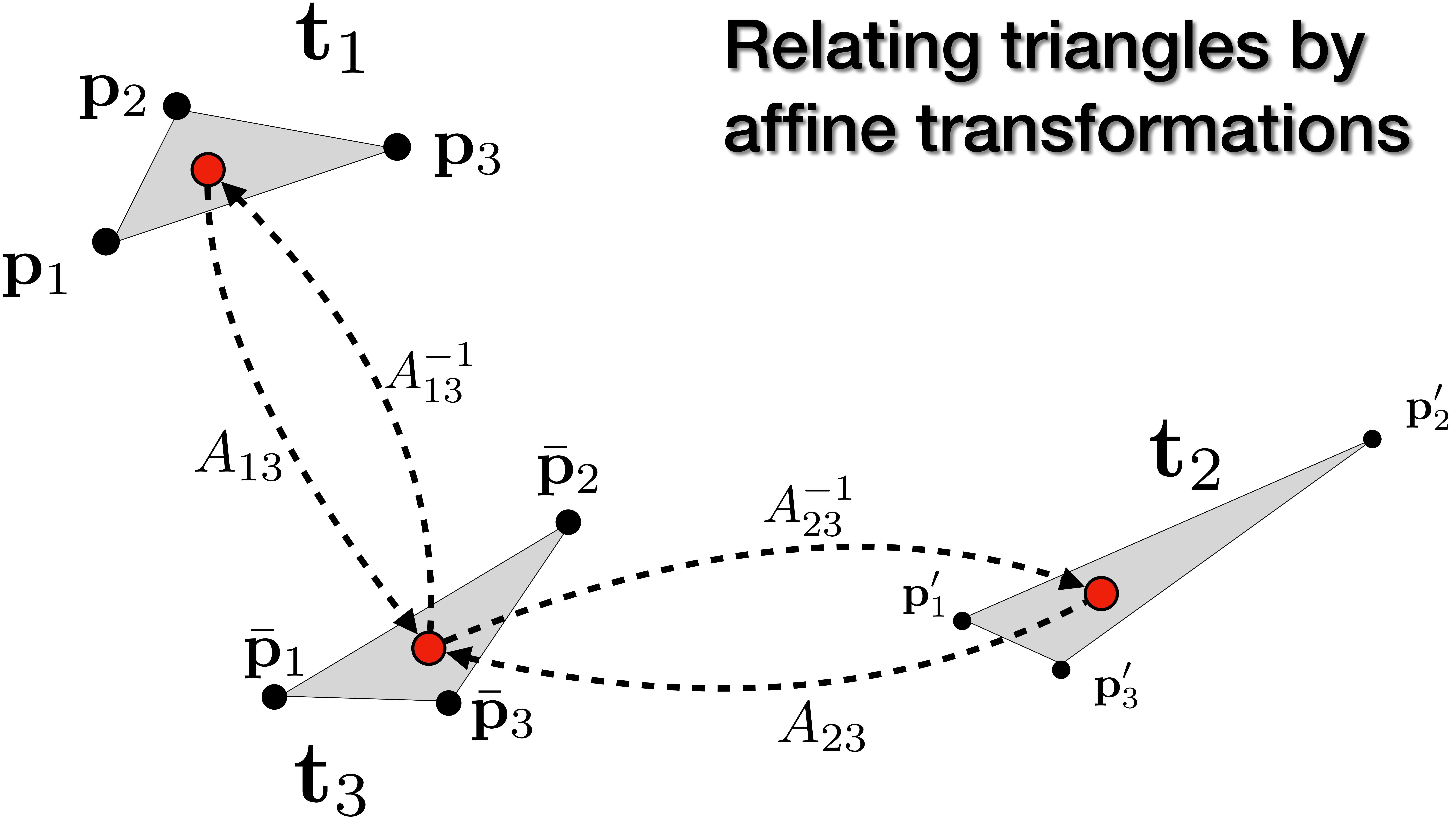
What do you need to know?

- How to estimate an affine transformation given at least 3 pairs of corresponding points.
- How to use the inverse transformation (e.g., affine) to calculate the location of a pixel on the original (i.e., un-warped) image. This is the inverse mapping that you use to transfer pixel colors.
- How to calculate the average of a set of shapes described by ordered landmarks.
- How to transfer the edges (i.e., connections) from one triangulation to another.
- How to use convex combination to synthesize new shapes and also to blend colors.
- How to determine if points are inside or outside a triangle

Interpolating shapes with convex combination



Relating triangles by affine transformations



Affine transformation and homogenous coordinates

Function form:

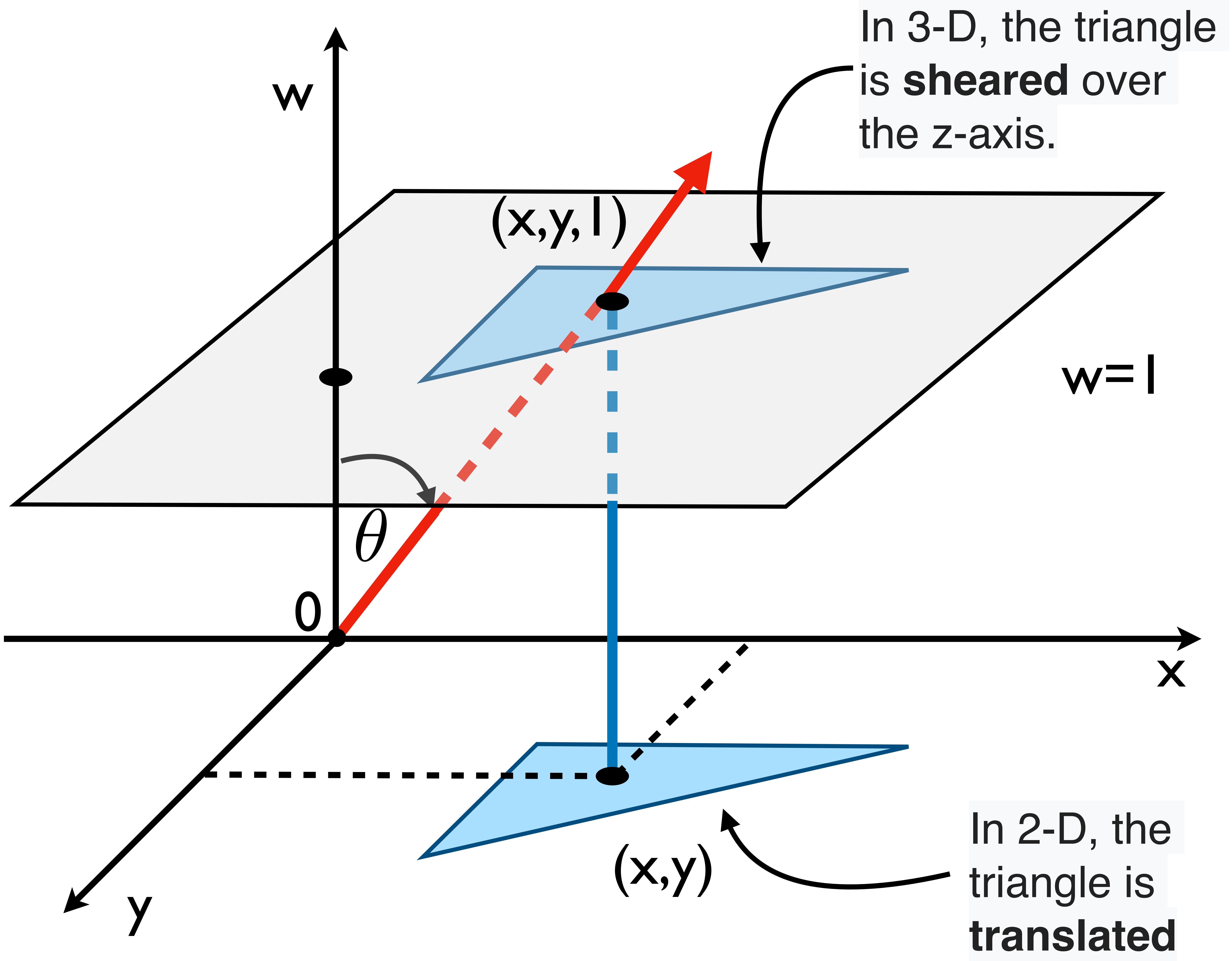
$$\vec{y} = f(\vec{x}) = A\vec{x} + \vec{b}.$$

Homogeneous coordinates (augmented matrix form):

$$\begin{bmatrix} \vec{y} \\ 1 \end{bmatrix} = \left[\begin{array}{ccc|c} & A & & \vec{b} \\ 0 & \ldots & 0 & 1 \end{array} \right] \begin{bmatrix} \vec{x} \\ 1 \end{bmatrix}$$

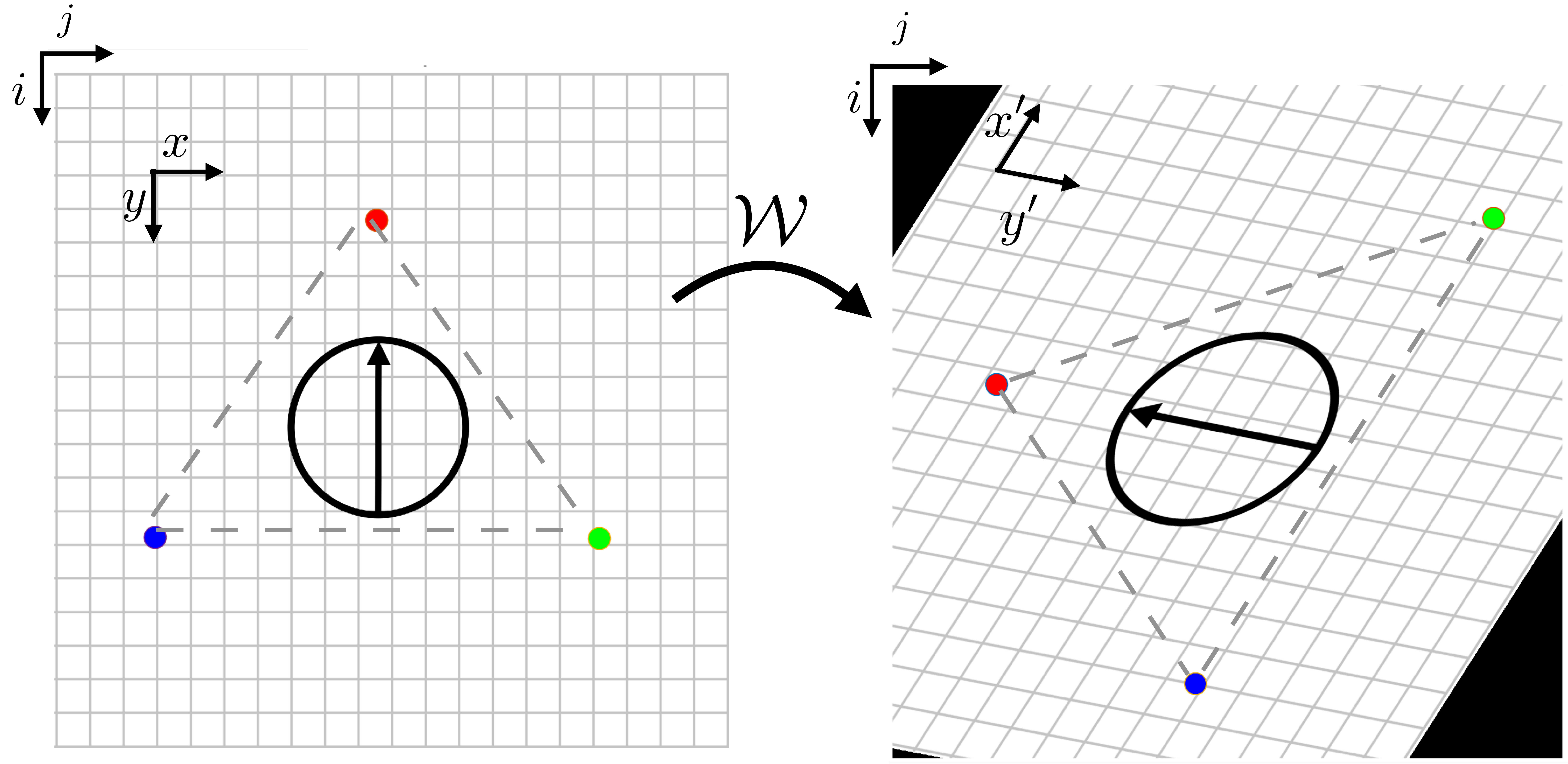
Affine transformation and homogenous coordinates

2-D affine transformations can be performed in 3-D. Translation is done by shearing along over the z axis, and rotation is performed around the z axis.



<u>Shear is a linear transformation</u> (i.e., it has a matrix form). Translation is not a linear transformation in 2-D) as it moves the origin.

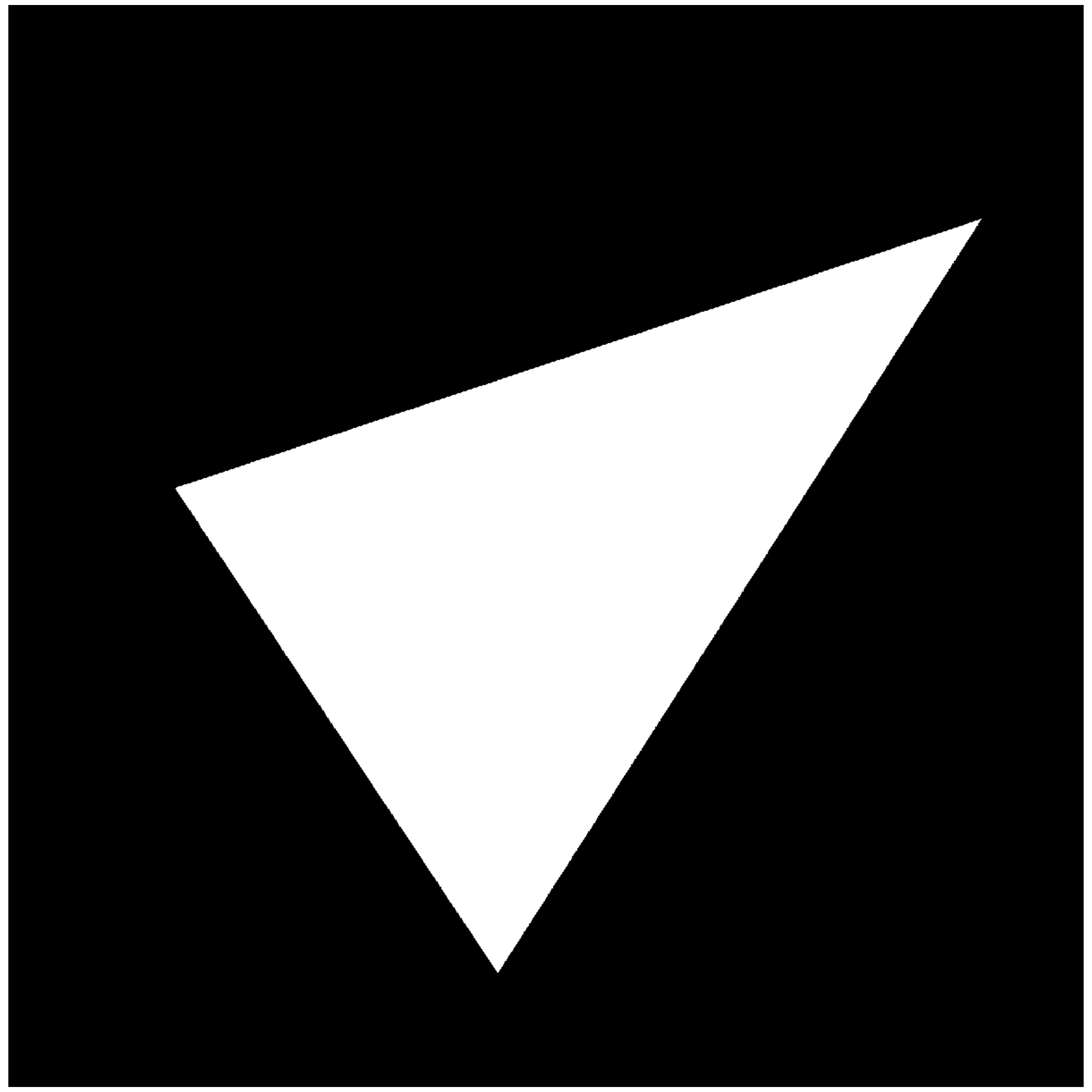
Mapping only points that are inside a triangle



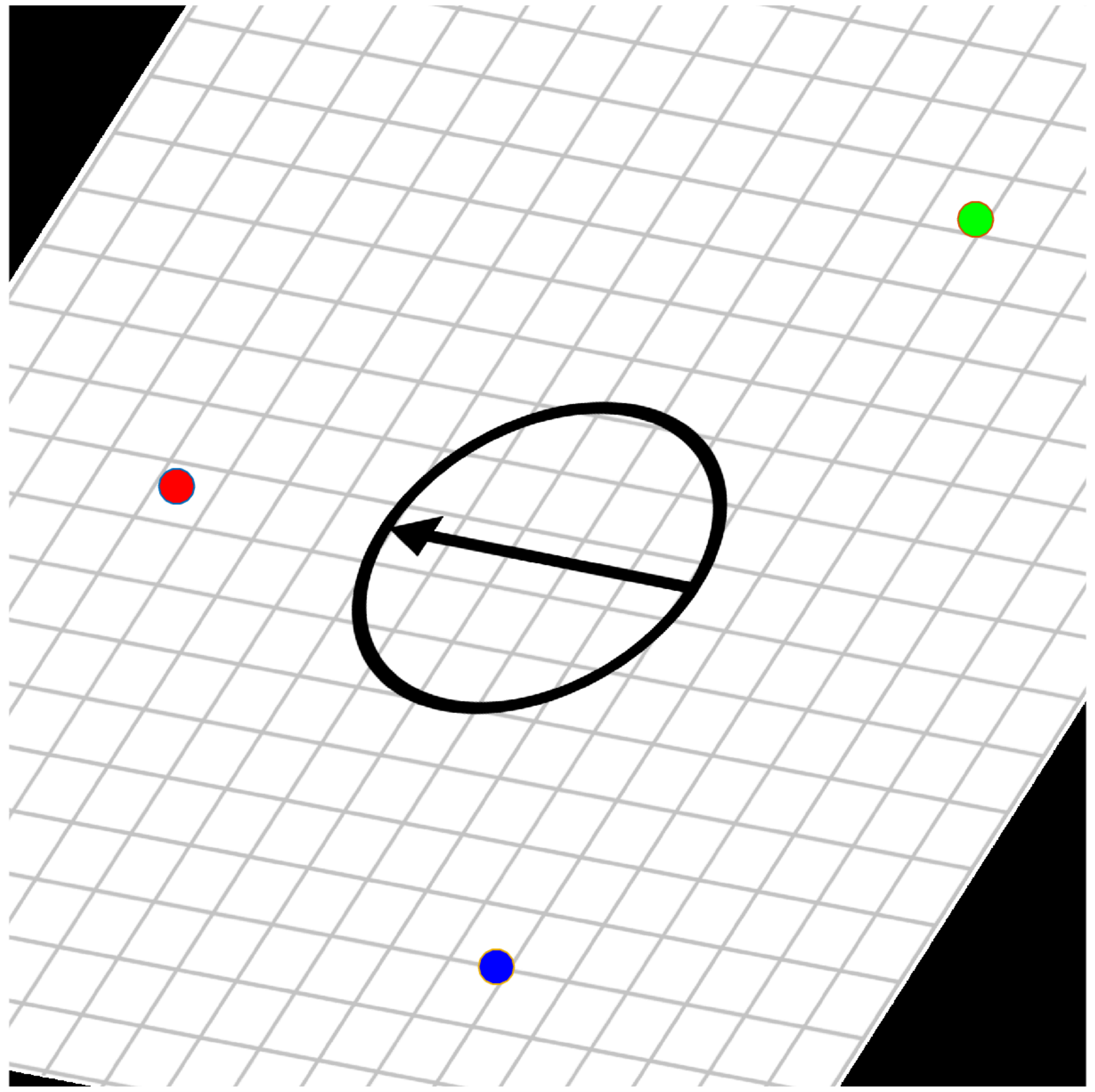
Mapping only points that are inside a triangle

We can create a binary mask with pixels inside a triangle, then transfer only pixel colors from inside the mask. Or we can warp the whole image and then multiply it by the mask.

binary mask



warped image



resulting image