

Optical Minimal Art

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Abstract

In this paper I describe how I create my Optical Minimal Art. A high-resolution image is divided into strips and pixel rows. Then the number of colors is reduced to 8 within each pixel row. The strips are arranged either parallel to each other, circularly or spiraling, or according to shapes found via Gielis' superformula. The resulting images change their character depending the distance from which they are viewed.

Input and output

Let me start with showing the input image (Figure 1) and the output image (Figure 2) next to each other. It shows why my art is optical: nearby one sees different pictures but from a distance both pictures become more and more the same.

Figure 1 is a photo image with (theoretically) 16,777,216 colors. Each RGB-color component ranging from 0 to 255. That makes 256x256x256 possibilities.

Figure 2 is an image with only 8 colors: red, green, blue, white, black, magenta, cyan and yellow. That is why I call my art Minimal. Each RGB-color component has only 2 values: 0 or 255, nothing or all. So there are 2x2x2 possibilities.



Figure 1: *Input file: Brigitte Bardot's lips*

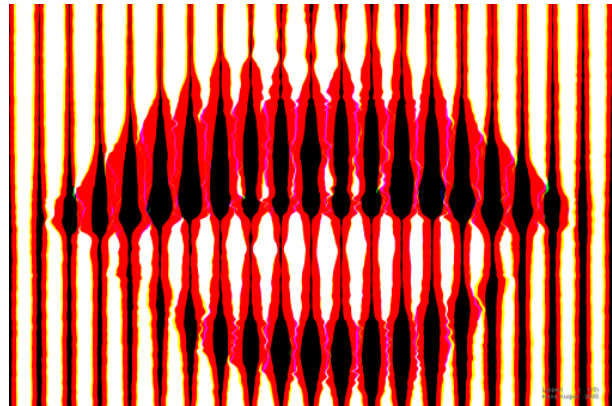


Figure 2: *Output file*

Algorithm: division in strips and rows

I wrote a computer program that converts the input '.bmp' file to an output '.bmp' file with a lower color resolution. Although the output file has a lot of redundancy –24 bits/pixel is used where 3 bits/pixel is possible—it is not my aim to get rid of that. The program divides the picture in strips and pixel rows (Figures 3 and 4). It analyses the pixel row by calculating the quantity of color and its centre of gravity. Next it reduces the color resolution by “sweeping” each RGB-component in the direction of its centre of gravity until the maximum value 255 is reached (see Figure 5). The total amount of color remains practically the same, within a pixel row, INTEGER ($\sum(\text{component value}/255)+0.5$) is equal in both pictures .

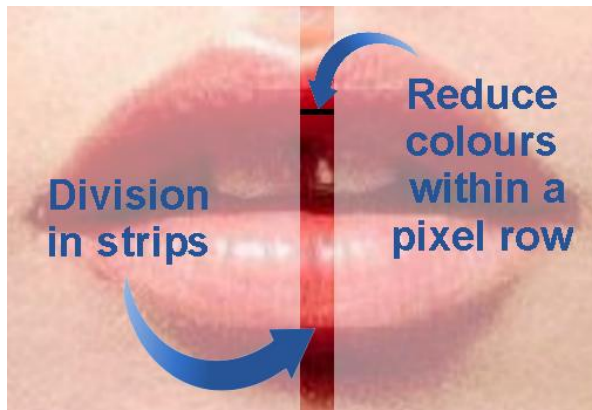


Figure 3: Division in strips and in pixel rows



Figure 4: One strip calculated

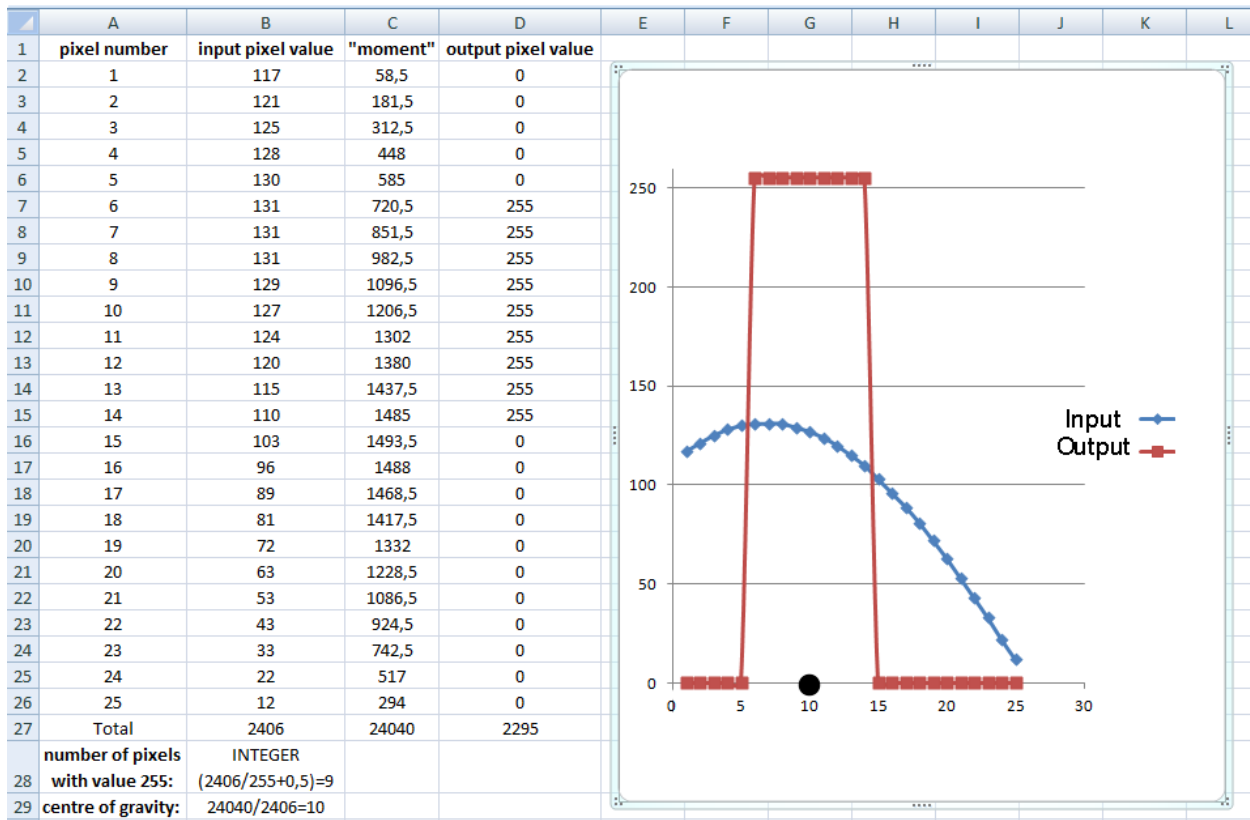


Figure 5: Example calculating centre of gravity and values of output pixels of a pixel row of 25 pixels

Shape of the strips

I started with vertical and horizontal strips. Later I extended that to circular and spiral strips. But with my discovery of Johan Gielis' Superformula [1,2] it became possible to vary the shape of the strips to an endless number of possible superpolygons. (see Figure 6).

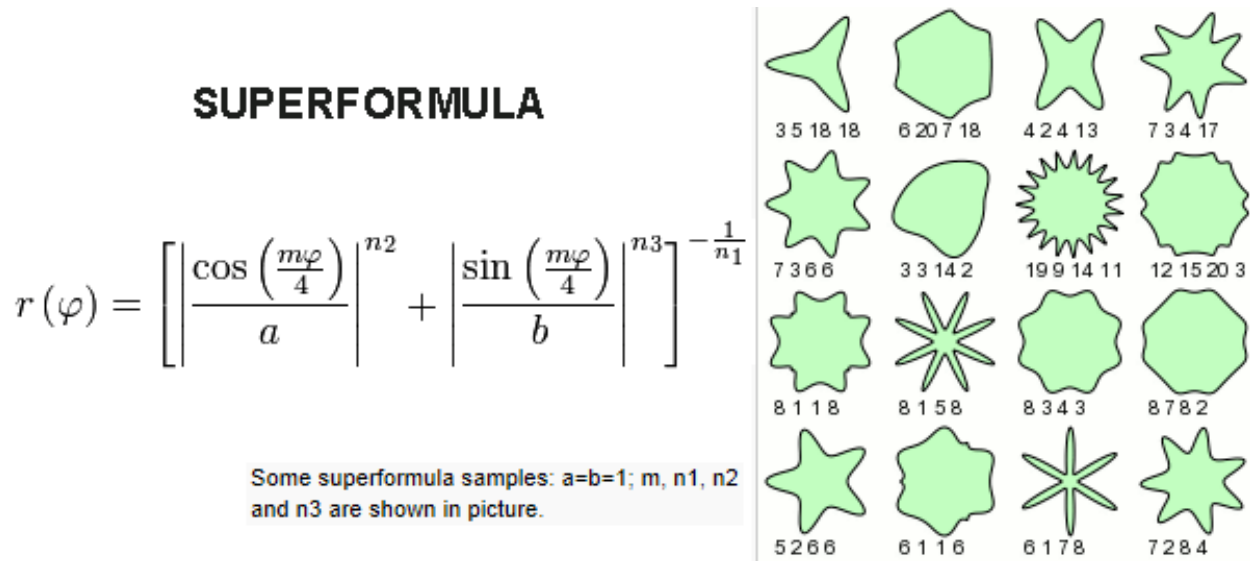


Figure 6: Johan Gielis' Superformula, illustration from Wikipedia [3]

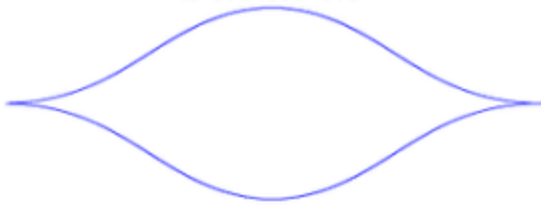


Figure 7: Diagon
 $a=b=1, m=2, n_1=n_2=n_3=0.5$
 illustration from Wikipedia [3]



Figure 8: Lips in diagons
 $a/b=1, m=2, n_1=n_2=n_3=0.5$

See for instance in the superpolygon in Figure 7. Gielis names it a *diagon*: a shape with $m=2$ has 2 angles and 2 curved sides. It has the same shape as the lips in Figure 8. The area between two isomorphic superpolygons is the strip which must be divided in pixel rows as described before.

Different strips for different colors

Until now I used for each color the same shape of the strips. But that is not necessary. These shapes may differ. In Figures 11 to 16 one can see the effect of this choice on the whole face of Brigitte Bardot and on a 50% grey image, which means that each RGB-component value is 127 (50% of 255).



Figure 9: *Face BB*

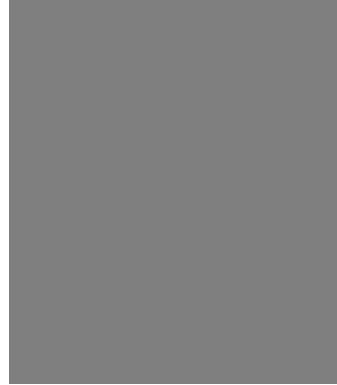


Figure 10: *50% grey*

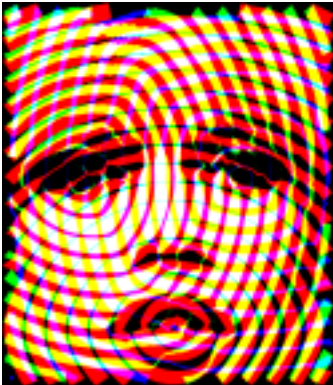


Figure 11: *Face BB*



Figure 13: *Face BB*

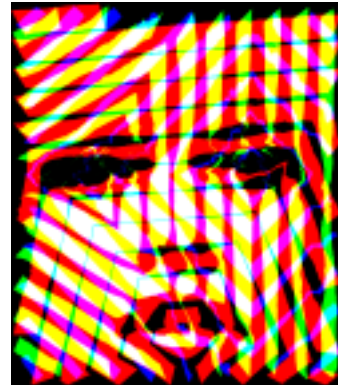


Figure 15: *Face BB*

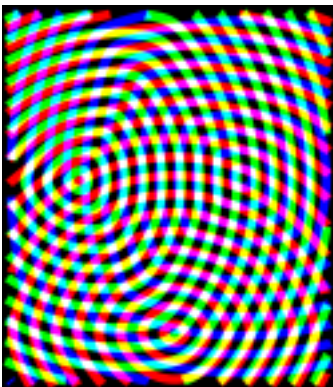


Figure 12: *Colored grey*



Figure 14: *Colored grey*

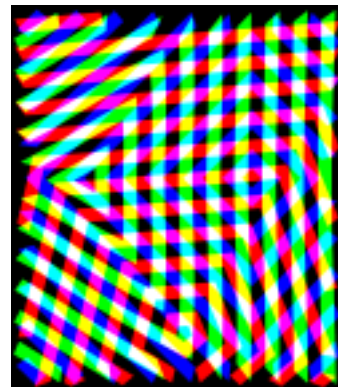


Figure 16: *Colored grey*

References

- [1] Johan Gielis, *Inventing the Circle, The Geometry of Nature*, ISBN 90-807756-1-4, Geniaal bvba, 2003
- [2] The Superformula of Johan Gielis, http://www.pg.science.ru.nl/en/art_gielis.html (as of April 24, 2012)
- [3] Wikipedia <http://en.wikipedia.org/wiki/Superformula> (as of April 24, 2012)