Fractal Analysis of a Sequence of LSD-Influenced Self-Portraits

Debanuj Chatterjee

Department of Physics, ENS Paris-Saclay ; debanuj.chatterjee@u-psud.fr

Abstract

A sequence of recently published self-portraits made over the course of 10 hours by an anonymous artist under the influence of LSD was analyzed using a box-counting technique for changes in any fractal dimension over time. The computed dimension increased, plateaued, and then quickly decreased, in synchrony with the level of hallucinatory imagery in the drawings. The errors in calculating the dimension was found to be lower for the images that were drawn while the artist was tripping; which suggest that the images attained more fractality under the influence of LSD. Since fractal dimension has often been linked to aesthetics of imagery, I also envisaged the potential of LSD to impact the aesthetic value of an artist's work.

Introduction

On 27th August 2015, a news article appeared in the online newspaper, *The Independent*, about an artist taking LSD and drawing her self-portraits over different stages of her ten hour psychedelic trip [3]. The anonymous artist apparently took 200μg of LSD and drew a sequence of eleven self-portraits (spending between 11 to 45 minutes on each self-portrait) with the aim of yielding a sort of visual map of her headspace under the influence of the drug. See Figure 1.

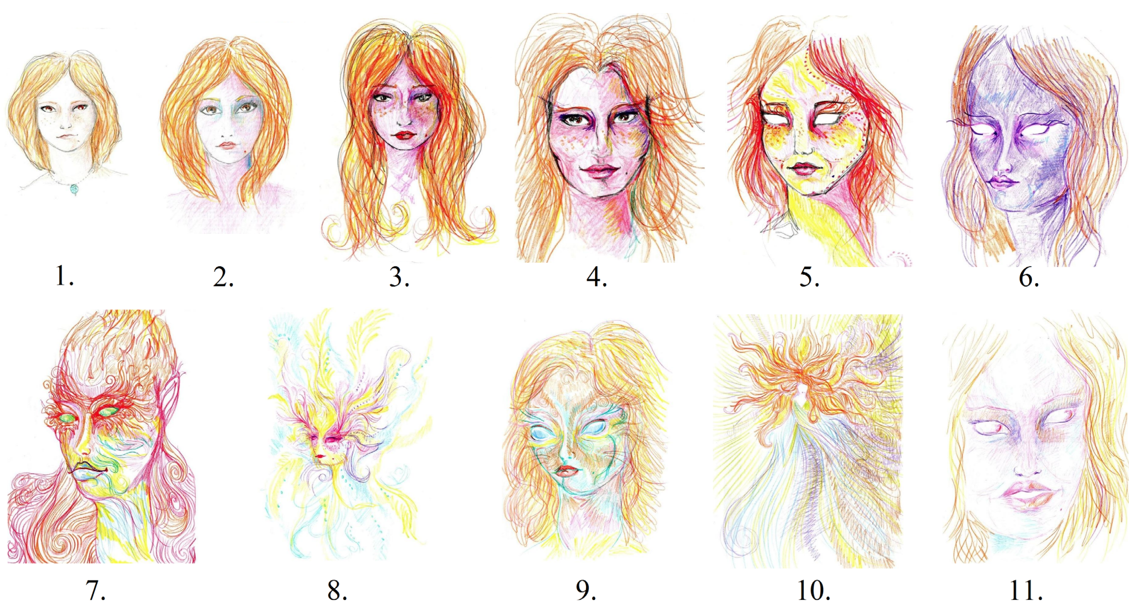


Figure 1: *Self-portraits of an artist during a LSD trip. Each of the sequence of eleven portraits was drawn 0.25, 0.75, 1.75, 2.25, 3.5, 4.75, 6, 6.75, 8, 8.75, 9.5 hours after taking the drug, respectively.*

It is evident from Figure 1 that the self-portraits look very different as we move along the sequence. But what is it that makes them so different? One way to address this question, is by performing a fractal analysis of the images. In this short paper, I calculated the fractal dimension of the drawn images and investigated its dependence as a function of the time at which it was drawn.

Visual Perception under LSD

In their pioneering studies on the effects of LSD, Hoffer and Osmond reported of blurring and distortion of vision of their test subjects under LSD [2]. Their subjects often described their visual experience as: space full of patterns and objects, weird patterns, a lacework pattern over everything, ribbons all over, superimposed patterns, air full of little circles, stuff growing all over the room, fog or smoke filling everything, unusual after-images, disproportionate change in shapes, etc.

Janiger conducted a unique study where he compared the artworks produced by artists before and after taking LSD [4]. Among other changes, he describes movement towards alteration and fragmentation, filling up the page, intensification of color, loosening up the line to curvilinear motif and intensification of the textural properties of the medium used.

Fractal Dimension

The fractal dimension of an image characterizes the scaling relationship between the patterns observed at different magnifications [5]. As mentioned earlier, test subjects under the effect of LSD describe seeing patterns, space-filling textures, smoke, enhanced curvatures, etc. Most of these effects are associated with an increase in the high spatial frequency components of the perceptual space and are often reflected in a visual artist's work. Thus to investigate the statistical properties of these intricate structures at different magnification, fractal dimension could be a good quantifier.

Fractal dimension D of a digital image can be calculated using the box-counting technique. In this technique the image is overlaid with a grid of identical square boxes of side length L. Then the number of boxes, $N(L)$, that contain a portion of the image is counted. See Figure 2. This process is then repeated over a range of different box sizes. Reducing the box size is equivalent to looking at the image at a finer magnification and capturing the higher spatial frequency components.

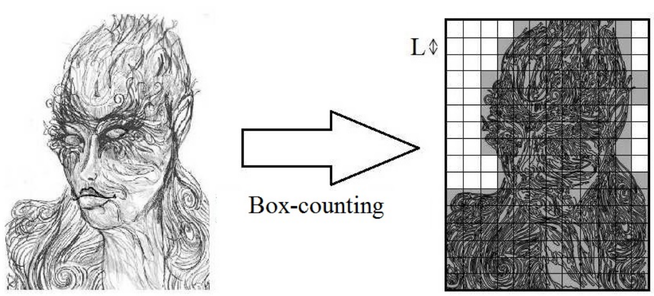
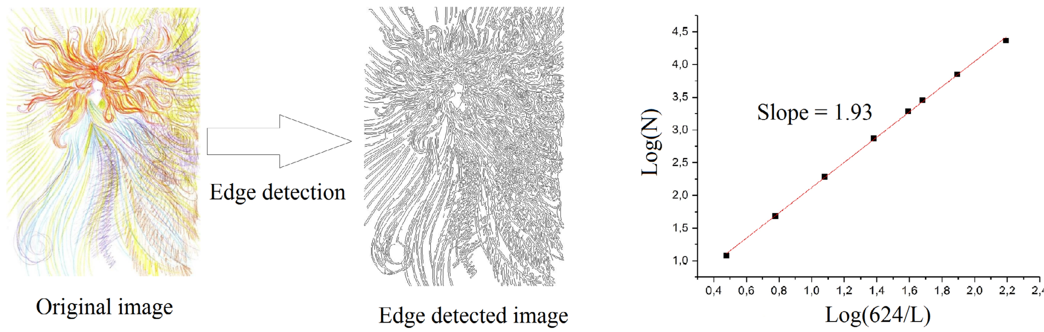


Figure 2: *An illustration of box-counting of an image. A binarized version of the 7^{th} self-portrait was overlaid with a grid of square boxes of side length L = 52 pixels. The boxes overlapping with the image are shown in grey and counted.*

For a fractal, $N(L)$ should scale according to the power law: $N(L) \sim L^{-D}$ where D is the fractal dimension. The negative exponent implies that on decreasing the box sizes, the finer details of the image are captured and thus a larger number of boxes overlap with it. Thus D can be obtained by determining the slope of the straight line of the plot of Log(N) vs Log($\frac{1}{L}$) of the considered image.

Method

To compute the fractal dimension of the images, I cropped the images to have the same pixel dimension: (624 × 832). This dimension was chosen because 624 and 832 have a lot of common factors (1, 2, 4, 8, 13, 16, 26, 52, 104, 208) which correspond to the different box sizes I have used. I used a gradient-based edge detection technique to convert the images to one bit per pixel. Edge detection extracts the luminance gradient in the image while preserving the spatial structures [6]. See Figure 3(a).



(a) (b)

Figure 3: *(a) The original and the edge detected version of the 10th image. (b) Plot of Log(box count i.e. N) vs Log(number of boxes in the horizontal direction i.e. $\frac{624}{L}$), for the 10th image. 624 is the width of the image in pixels.*

Next I computed the fractal dimension D of the images implementing the box-counting technique. See Figure 3(b). All the analysis was done in Mathematica 11.3. I plotted the respective D-values of the images as a function of the time at which each image was drawn. See Figure 4.

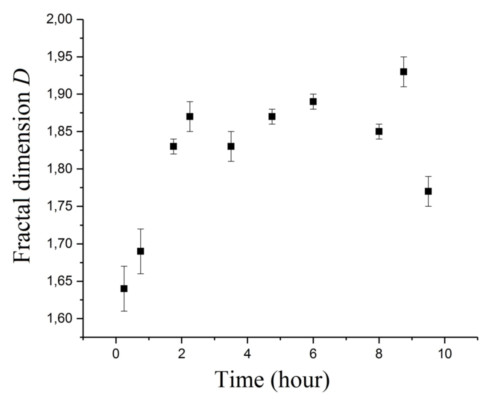


Figure 4: *Plot of D-value of an image (with error bars) vs time at which it was completed.*

The image completed at 6.75 hours (8$^{\text{th}}$ self-portrait) was excluded from the analysis because of its low color contrast which can lead to an erroneous edge detection and under-estimation of D.

Results

From the graph (Figure 4), we see an increase in D from 1.64 to 1.87 for the first two hours. For the next seven hours, D remained more or less constant at an average value of 1.86. At the 10$^{\text{th}}$ hour, when the effect of LSD was disappearing (as mentioned in [3]), D decreased to 1.77. We should also note that the errors in calculating D decreased with time and increased at the end of the session suggesting that the images attained more fractality when the artist was in a hallucinatory state.

Discussion

Humans show a consistent aesthetic preference towards fractal images [8][1]. Pickover reported that his observers expressed a preference for images with a fractal dimension of about 1.8 [7], which matches with the fractal dimension of the images that were created by the artist we considered under the influence of LSD. Taylor also showed that the paintings by Jackson Pollock were fractals with an average fractal dimension of about 1.7 [10]. However, other studies have reported the range of fractal dimension 1.3-1.5 to be aesthetically more pleasing [8].

A potential explanation of the increase of fractal dimension of the images under the effect of LSD is the over-exposure to an environment with a higher fractal dimension. Perhaps the artist on LSD sees a greater fractality in the world than normal, and this, in turn, tunes her aesthetic perception to a higher fractal dimension.

Conclusion

My analysis might suggest that an artist under the effect of LSD prefers a greater level of detail in an artwork (as characterized by fractal dimension). This effect is probably caused by an increase of fractal dimension of the visual perception of the artist.

This paper is limited to the analysis of artworks of only one artist. We are also not considering other factors such as symmetry, familiarity, etc. which can affect the aesthetic value of an artwork [1]. Hence this paper motivates us to investigate further on this issue considering a larger data set.

I also remark that invoking other techniques like wavelet analysis or statistical thermodynamics (as done for natural images by Stephens) [9], may lead to a new way of classifying psychedelic imagery.

References

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