

The Transience of Virtual Fractals

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Abstract: Artists have a long and fruitful tradition of exploiting electronic media to convert static images into dynamic images that evolve with time. Fractal patterns serve as an example: computers allow the observer to zoom in on virtual images and so experience the endless repetition of patterns in a matter that cannot be matched using static images. This year's featured cover artist, Susan Lowdermilk, instead plans to employ persistence of human vision to bring virtual fractals to life. This will be done by incorporating her prints of fractal patterns into zoetropes and phenakistoscopes.

Key Words: fractal, art, zoetrope, phenakistoscope, vision persistence

Many people are introduced to the visual world of nonlinear dynamics through a never-ending stream of fractal patterns cascading towards them from deep within their computer screens. The virtual space generated by computers seems an ideal environment for exhibiting their stunning properties. Indeed, starting in the mid-1980s, many Hollywood directors have employed computer-generated "fractal forgeries" to generate spectacular background scenery for movies. Whereas this tradition of exploiting electronic media has served artists well, this year's featured cover artist instead plans to employ the tricks of the human visual system to bring virtual fractals to life.

Susan Lowdermilk creates prints in her home studio located in Eugene, Oregon, working primarily in woodcut, wood engraving and etching. She notes: "Through my art practice as a printmaker and a book artist, I strive to express universal life experiences through allegory and metaphor. I employ a lexicon of familiar forms and shapes to visually express my ideas. These themes are meant to be thought provoking and hopeful, mindful yet mysterious" (Lowdermilk, 2011a).

"The Universe Breathes," shown in Fig. 1, demonstrates the qualities of her work through this delicate depiction of a Nautilus shell. Often referred to as a living fossil because it has survived relatively unchanged for 450 million years, the Nautilus is seen here hanging timelessly in the inky depths of an unknown space.

The use of Nautilus shells in art and literature is prevalent in part because it presents one of the finest natural examples of a logarithmic spiral.

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The logarithmic spiral, or growth spiral, was first described by Descartes and later extensively investigated by Jacob Bernoulli, who was fascinated by one of its unique mathematical properties: the size of the spiral increases but its shape is unaltered with each successive curve, creating a property known as self-similarity. The repeating patterns of many fractal patterns, most notably the computer-generated Mandelbrot set, also possess logarithmic spirals.



Fig. 1. "The Universe Breathes."

Lowdermilk recently created a limited edition hand-made artist book, shown in Fig. 2, called "Eadem mutata resurgo. Though transformed I will arise unchanged." The title is a quote by Bernoulli, which was inscribed on his gravestone. The images, diagrams and equations in this book reference the inherent nature of fractal geometry through the continual appearance of the logarithmic spiral. The structure of the book consists of bellows that give a tunnel-like perception. Tunnel books, also known as peep show books, were popular as novelty souvenirs for tourist attractions in the nineteenth century. Inspired by theatrical stage sets, they create the illusion of images in a three-dimensional perspective.

The key artistic question for Lowdermilk is how to mine the rich repetition of fractal structure at increasingly fine scales. An easy option would be to create an electronic version of an image and program a computer to zoom in towards the heart of the spiral. Although easy, this may not be an effective option. Psychology experiments by Peter Kahn's group at the University of

Washington suggest that the stunning beauty of electronic fractals might fool the intellect but not the emotions (Kahn et al., 2008). These studies show that nature's therapeutic effects cannot be triggered by images on a screen – you have to be *in* nature's environment to feel its calming effect. This was reason for celebration for one of our previous cover artists, Daniel Della-Bosca, who created his “Museum of Unnatural Form” filled with physical models of fractals (Della-Bosca & Taylor, 2009). Much like a walk through nature's forests, his sculptures surrounded the visitor to the museum, inviting them on a journey that was both visual and tactile.

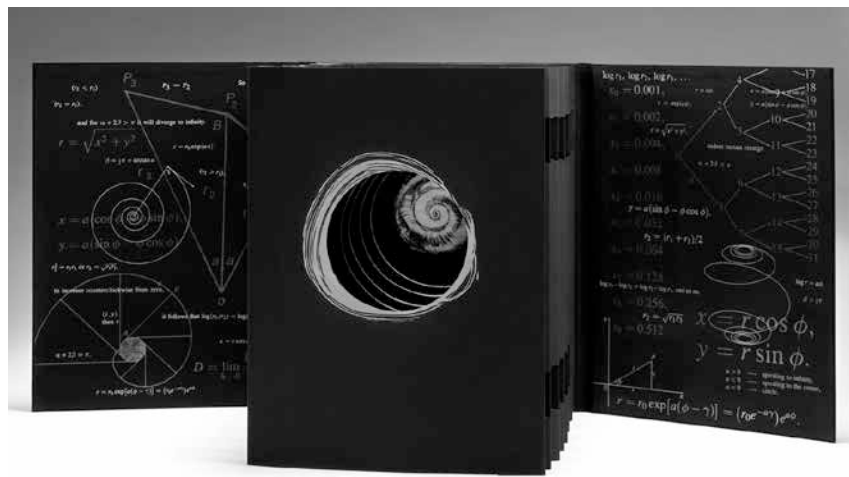


Fig. 2. “Eadem mutata resurgo. Though transformed I will arise unchanged.”

Whereas Della-Bosca's artistic escape from electronic fractals came through the physicality of his sculptures, Lowdermilk creates hand-drawn imagery and works in traditional centuries old technologies like woodcut and etching, pulling each print from a hand crank press. Through utilizing minimal technological filters, she believes the viewer experiences a more humanistic connection to the work. Her escape from the digital arena arrives in the form of a zoetrope. The zoetrope is an optical apparatus that uses the persistence of vision principle to create an illusion of motion. It consists of a simple drum with an open top, supported on a central axis. A sequence of pictures is placed around the inner bottom of the drum and slots are cut at equal distances around the outer surface of the drum, just above the pictures. Looking through the slots while the drum is spinning allows the static pictures to appear in motion similar to the effect of a movie show.

The zoetrope has had a rocky artistic journey. It was invented in 1834 by William Horner, then forgotten and then reinvented in 1867, when it was

patented by William Lincoln and named the "zoetrope" or "wheel of life." The zoetrope might, at first glance, seem relatively unsophisticated compared to high-powered computers. However, Lowdermilk's zoetropes, which have transformed static woodcut images of horses into rapid motion, generate considerable excitement when exhibited. Lowdermilk's horse images were inspired by the photographs of Eadweard Muybridge, who used multiple cameras set with trip wires to study and document animals and people in motion. A phenakistoscope, another Victorian parlor toy invented by the Belgian physicist Joseph Plateau, uses the same persistence of vision principal as the zoetrope. Whereas the zoetrope is a three-dimensional slotted drum, the phenakistoscope is a flat disk that spins with radial viewing slots and radial imagery.

Lowdermilk's grand goal is to incorporate images such as the Nautilus into the zoetrope and phenakistoscope so that, when spun, the persistence of vision will allow the observer to zoom in and out of the spiral without resorting to electronic media. Just as multiple reflections off mirrors provide a cascade of images that appear more restful on the eye than equivalent electronic imagery, the hope is that the zoetrope's physical manipulation of the visual senses will provide an appealing touchstone to reality. As such, Lowdermilk's art will represent the first, electronic-free zoom-in on a fractal image. Figure 3 shows another candidate image for the zoetrope: flames will prove to be a particularly intriguing fractal pattern because their constant flickering keeps the eye engaged.



Fig. 3. "The Flame."

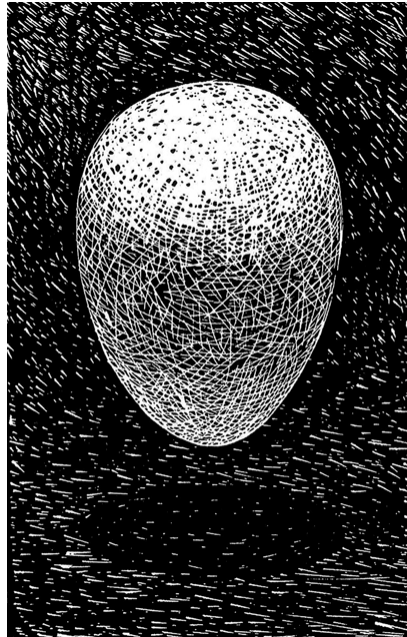


Fig. 4. “State of Grace.”

The rotation of the zootrope also serves a greater metaphorical meaning. By starting, slowing and even stopping the spin, the artist can manipulate the arrow of time. In particular, bringing life to a standstill holds an artistic fascination for Lowdermilk. In Fig. 4, “State of Grace” captures the moment before an egg encounters the ground and life lets lose its chaos. The arrestment of time is similar to that of the Nautilus prior to being spun in the zootrope. The structure of cards featured in “The Voice of Air” shown in Fig. 5 also captures that precarious moment before its collapse.

Lowdermilk concludes with the following artistic statement about the psychological importance of objects in our environment – fractal or otherwise: “Consciously or unconsciously, we assign symbolic significance, power and importance to our possessions and the objects that we surround ourselves with. They are contextually infused with memory and meaning. Objects useful or ephemeral, man-made or natural, personal or sentimental, fragmented or whole serve as memory triggers and place holders in our lives. This stuff that punctuates our lives reflects pieces of our individual stories” Lowdermilk (2011b). Lowdermilk is interested in using traditional hand manipulated technologies to create her work as a counterpart to the multitude of digital images we see every day. She is fascinated by primitive moving image loops, and obtaining movement that is transparent in its method yet succeeds in

creating compelling visual illusions. As such, images such as fractals, generated by nonlinear processes, are an ideal vehicle for her artistic endeavors.

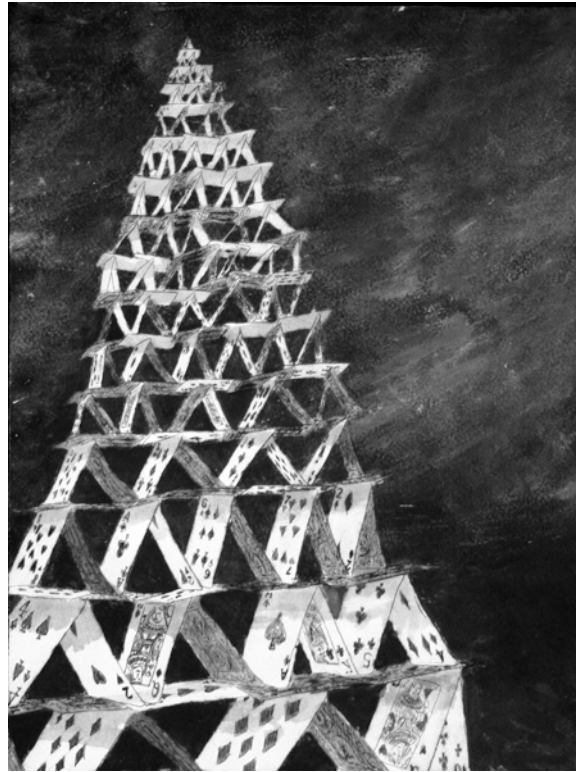


Fig. 5. "The Voice of Air."

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