Tiled Artworks Based on the Goldbach Conjecture

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Abstract

A simply, stated though still unproved, mathematical conjecture by Christian Goldbach is utilized to make two-dimensional artworks. Tile patterns with even numbers of tiles are divided into two sets. Each set consists of a prime number of tiles that reflects Goldbach's conjecture that any even number greater than two has at least one pair of primes that sum to that number.

The Artworks

I assembled the following groups of modular shapes for basic, sometimes tedious, designs to create, as it turn out, an extensive series of artworks. These arrangements are cartoons for the event of construction of aesthetically interesting artworks. The division of the picture plane in the shape of a rectangle or hexagon is an easy, if time consuming procedure. The method is much like a writer's use of language. Words are formed by the arrangement of the same 26 letters; however emotion and experience and intent are stated on a personal level. My contribution to contemporary art is to make the most of these images that carry the minimal usage of triangles and squares into a state of visual interest, something that compels the viewer to examine further or merely kick back and enjoy. My methods challenge the simplistic nature of these designs. By themselves the divisions that are chained together by connecting the sets of triangles that represent a prime number might be of little interest to many viewers. The important connection of shape, pattern, rhythm, texture, repetition, variation and color that results in the production of a compelling image is of interest. These artworks are handmade using a variety of materials that contribute surface qualities ranging from areas that are smooth to areas that are abrasive to the touch. How the designs were initiated is secondary. The artworks become complicated forms through the manipulation of traditional and nontraditional media.
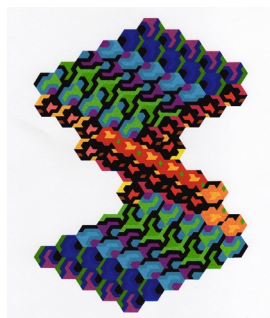

Figure 1. Hexagon Design
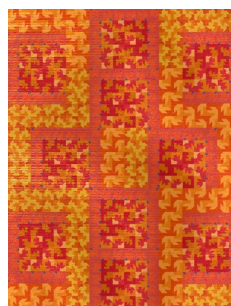Inkjet print, 10x8 inches

Figure 2. Goldbach Tiling
Ink jet print, 10x8 inches

Figure 3. Goldbach Tiling, lino-cut print, and collage on canvas, 48x48 inches
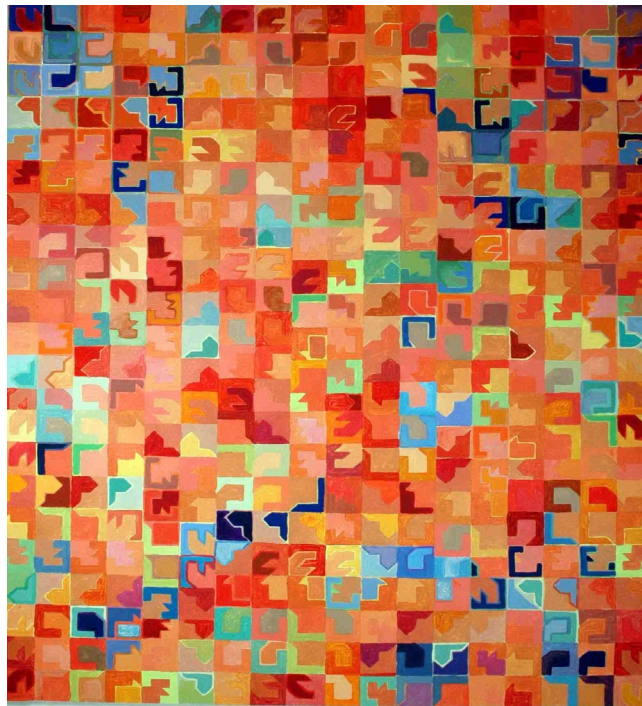

Figure 4. Goldbach Tiling, acrylic paint on canvas, 64x54 inches

The Tilings

The structured base developed by utilizing Christian Goldbach's (1690-1764) conjecture that any even number greater than two has at least one pair of primes that sum to that number brings forth the potential for hundreds of designs.

My extensive series of drawings, paintings, and assemblages based on the partitioning of a rectangle into an even number of triangles, a rectangle partitioned into an even number of squares and a hexagon partitioned into an even number of equilateral triangles is the subject of this writing. Upon completing the initial divisions, the triangles or squares corresponding to a pair of prime numbers are rearranged until a potentially satisfying aesthetic adjustment is produced. Color, texture and choice of material heighten the visual effect.

The even number thirty-two is convenient when working with a rectangle broken up using triangles. The near relationship of 19 and 13 to the Golden Ratio offers a pleasing design element. These designs have fallen into two categories.

The scattered arrangement allows for the distribution of the triangles corresponding to a pair of primes to be separated into several groups which offer several smaller shapes similar in color or texture (figure 5). This scatter arrangement when used as a repeated motif results in an interactive all-over pattern (figures 6 and 7). A rhythm is created through visual groupings and the viewer may easily pick out recurring images such as triangles, squares, trapezoids and undefined shapes created by the merging and separation of the basic triangles. The eye is allowed to search in and out and around the entire composition. Balance teases somewhere among the formal, the informal and radial. The interactive complexity provides a compositional unity with stability as well a movement that is fairly independent of enhancements such as color and texture.
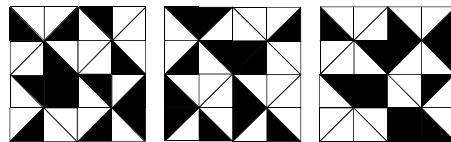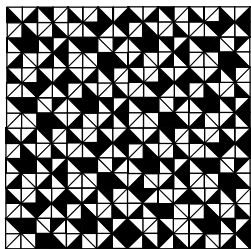

Figure 5. Scattered motif

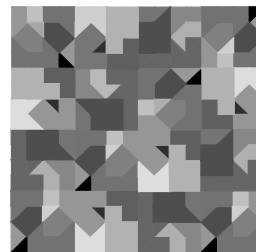**Figure 6.** Scattered arrangement, repeated motif

Figure 7. Scattered arrangement, repeated motif

Using the same three numbers, viz. 19+13=32, and a **tight arrangement** restricts each prime to one shape, two per rectangle (figure 8). The result is a grid that visually separates each grouping when multiples are utilized (figures 9 and 10). The rhythm is more along a staccato theme. Repetition is held together by the abutting and sharing of edges rather than the involuntary interlocking that becomes evident in the scattered arrangement.
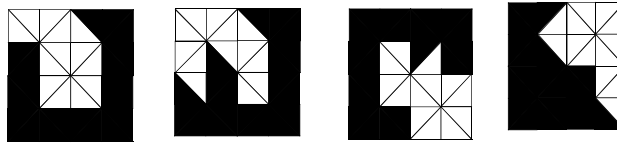
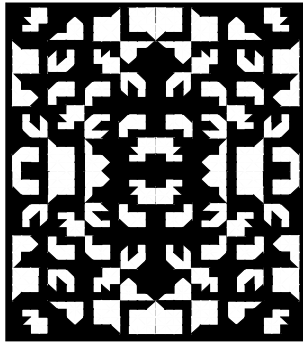**Figure 8.** Five tight arrangements

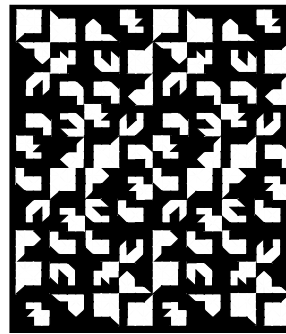**Figure 9.** Tight arrangement, repeated motif

Figure 10. Tight arrangement, repeated motif

The even number 42 is used for its aesthetic qualities, which are Spartan, when combined with theme and variation in the construction of paintings, drawings or assemblages using **the square motif** and the Goldbach conjecture. Pairs of primes include 23 and 19 (figure 11) or 31 and 11 (figure 12). These groupings require an intense approach with materials to make them interesting. Mirrors and the build-up of the surface give artworks the sparkle that's required.
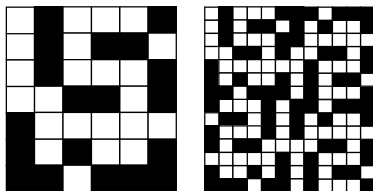

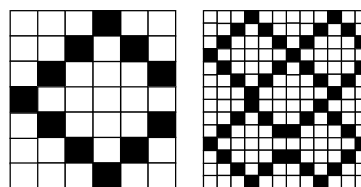**Figure 11.** Arrangement of squares, 23+19=42

Figure 12. Arrangement of squares 11+31=42

The hexagonal motif uses fifty-four equilateral triangles to offer further possibilities for design. Experimental pairs of primes include 17 and 37 as well as 23 and 31.
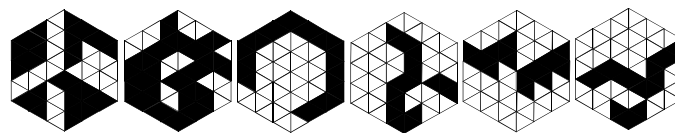

Figure 13.

Other even numbers have been used for creating patterns. Numbers in the hundreds and at times even in the thousands are more of challenge for creating an artwork. Many of these illustrations in their basic black-and-white form are depleted of the intellectual and emotional expression necessary to bring them to life. A closer consideration of my intent can be viewed by visiting my web site or better yet by visiting and seeing in person the completed works.