

The Influence and Use of Music and Mathematics in My Art

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Abstract

This paper presents a brief look at the influence and use of musical ideas in the evolution of my painting style and the subsequent invention/discovery of GridField Geometry.

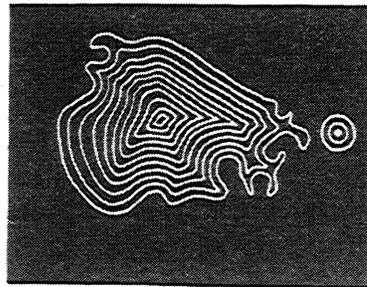
1. Introduction

Vassily Kandinski (1866-1944) developed nonobjective art circa 1910, and in his treatise *Concerning the Spiritual in Art*, published in 1912, urged that painting can approach the state of pure music; that is, that form, line, color, and texture (terms also common to music) can be used like sounds to evoke an emotional response without the help of subject matter. Since then painters have continued to try, in their own expressive way, to convert one form into the other. Before Kandinski, painters used these abstract elements in realistic paintings as a background to help express a musical idea or feeling to compliment the subject matter. These works usually contained musical instruments and/or dancers in their compositions. Painters today take advantage of either approach. My own work has been similarly influenced by the possibility of transposing a musical ideogram into a pictorial dimension.

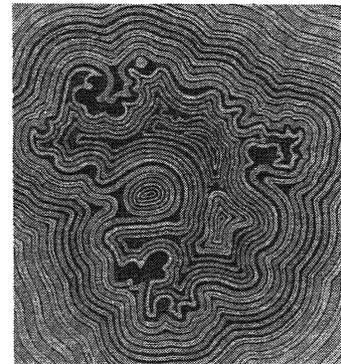
I started painting, as painters do, by drawing and studying from nature and the artists before me. Finding my own path necessitated a personal visual language, and in its evolution it became clear that music was going to be an integral part. The path I chose to explore was new to me, and I knew of few precedents to borrow from, so I began with the bare bones of knowledge and experience, using the painter's lexicon of form, line, color, and texture to build a personal language to express my feelings and thoughts. My art grew from very rudimentary beginnings to its present state of complexity and, in the process, acquired a well stocked visual dictionary of experience to call upon.

2. Simple Beginnings

My early paintings began as free flowing amoebic forms, where radiating bands of close valued, contrasting colors were used to induce an optical vibrancy and life to the painting as exemplified in the painting "Flea," Fig. 2.1. The radiating lines are evenly spaced giving the simplest of rhythmic patterns. Though this paper does not show color, it may be of interest for the reader to consider one color characteristic analogous to sound. If two contiguous colors have close or equal tonal qualities, the edge they form will appear to vibrate. Tone is the measure of the lightness or darkness of a color. To maximize this edge instability or vibration, the colors must be color opposites (color opposites of the primary colors red, blue, and yellow are respectively green, orange, and violet) of full intensity and equal



Painting: "Flea"
Fig. 2.1



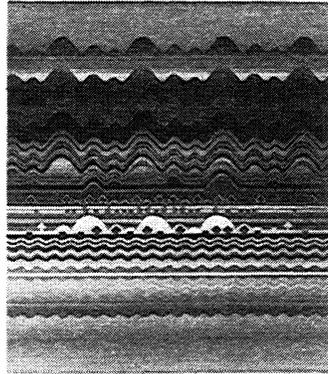
Painting: "July 4th"
Fig. 2.2

tone. Indeed, if this is done correctly, the black and white photo of "Flea" would have been a single grey tone -- the radiating bands of equal tone would have blended together in one solid grey. This was avoided in the photo with the use of a filter to darken one of the colors. On the other hand, if the extreme tones of black and white form the edge, the edge has maximum stability. I used the optical vibrational effect extensively in my early work to see how "loud" I could paint, much in the same manner as the Op artists of the 1960's. Later, this effect was refined to orchestrate the subtler qualities of a painting. The paintings during this early period advanced in their free flowing elasticity and their linear rhythms. The radiating color bands and lines began to vary more in thickness, giving an increasingly complex rhythmic pattern, or "pulse", as in "July 4th," Fig. 2.2.

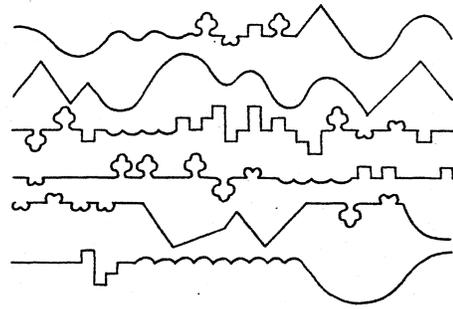
3. Landscape and Line

Perhaps because of my inherent love of the out-doors and landscape, and the feeling that the potential of the radiating imagery was limited, my style changed to an open ended, horizontally layered format, as exemplified in my painting "Landscape #13," Fig. 3.1. The lines were drawn to represent the basic landscape symbols of water, mountains, clouds, trees (vegetation), and architecture. The symbols were used like musical sounds or notes composed in some intuitive rhythmic pattern. They were sometimes oriented up or down for added visual and rhythmic interest, as seen in the

example drawing, Fig. 3.2. Indeed, the layered effect of these paintings has a visual similarity of an orchestral score with its horizontally layered note patterns. Sometimes the lines of symbolic notation are sandwiched between two flat regions of color or divide a single color in two parts. Sometimes the lines



Landscape #13
Fig. 3.1

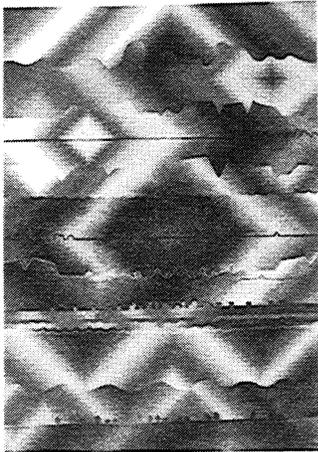


Symbolic Linear Landscape
Fig. 3.2

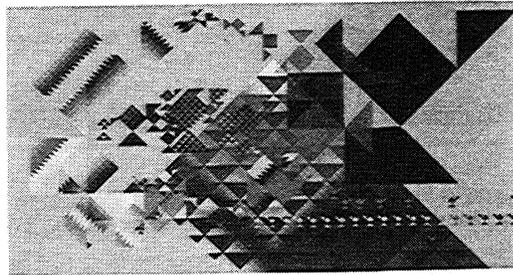
are formed by the edge of two contiguous colors. In this case, as explained above, an added vibrational quality of the edge was induced to play in concert with the other more or less stable edges in the composition. Also, the linear notation could be layered in any chosen order. For example, a natural layering sequence would be water, land, and sky, whereas I might layer it sky, land, and water.

4. Flat Space To Grid Space

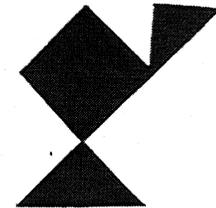
Later, the Cartesian grid was introduced as the foundation to my "visual music." This gave the opportunity to break up the flat, horizontal color spaces into diagonal rhythms of variegated colors and tones, as in "Landscape #43," Fig. 4.1. These diagonal rhythms became background "music" to the horizontal note patterns. The standard square grid format led to experimenting with a triangular grid system; an example of this is seen in "The Chicken Concerto," Fig. 4.2. This painting also exemplifies the introduction of the idea of a theme, or leitmotiv, a device common to music. The chicken theme, symbolized in Fig. 4.3, is used extensively throughout the painting in various positions, sizes, colors, and rhythmic situations much in the same manner as a composer states, manipulates, and recapitulates a theme in music.



Landscape #43
Fig. 4.1



Painting: "Chicken Concerto"
Fig. 4.2



Chicken Theme
Fig. 4.3

5. A New Geometry-- The GridField

I am not sure any artist, indeed, any human being, is entirely satisfied. There seems to be a need to keep searching, exploring, to broaden the language of one's art -- to increase the esthetic potential by finding more choices for expression. Though, at this point, I had enough tools and personal technique for a wide range of painting possibilities, new paths kept opening up to be explored. By some epiphany, I saw that one could go beyond the time honored straight line grid and coordinate system to a curvilinear grid and coordinate system. This was first approached by using the Cartesian grid, Fig. 5.1a, as the foundation, and plotting in a series of parallel curves, Fig. 5.1b, to replace one set of straight lines, Fig. 5.1c. Then using this set of wavy lines, called a wave field, to draw a second wave field as a function of, i.e., dependent on, the first wave field, Fig. 5.1d. This, in effect, replaces the underlying straight lines, as in Fig. 5.1c, to give the curvilinear grid and coordinate system shown in Fig. 5.1e. To distinguish this new grid from the Cartesian grid, and because of the crossing of the two fields to form a grid, the new space was called a GridField. The dynamics of this new geometry was far reaching when

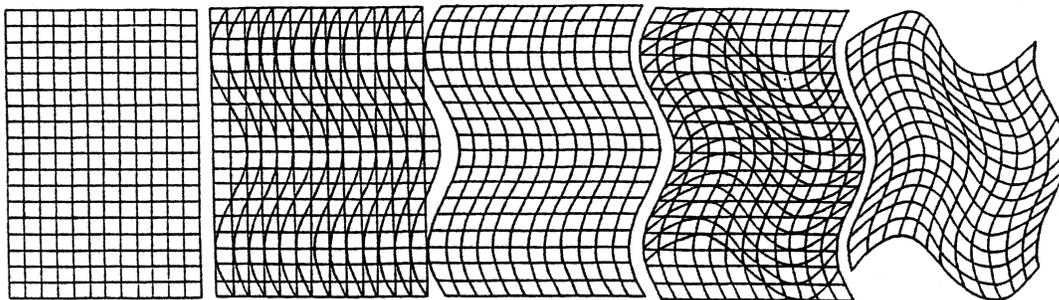


Fig. 5.1a

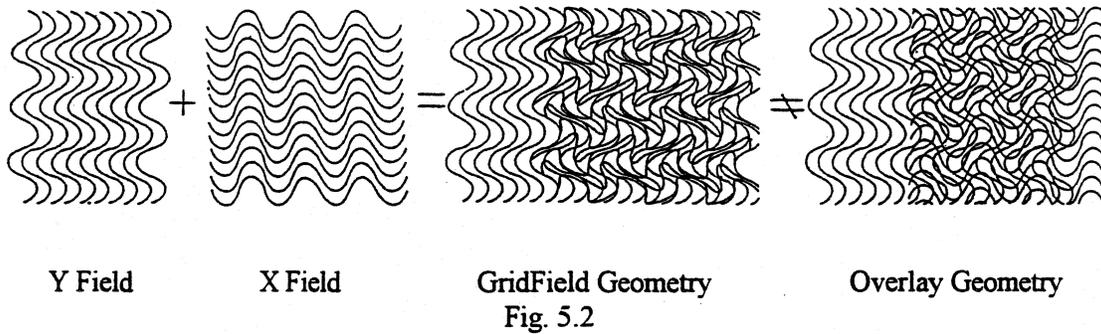
Fig. 5.1b

Fig. 5.1c
Fig. 5.1

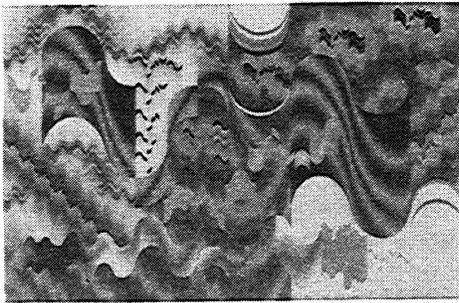
Fig. 5.1d

Fig. 5.1e

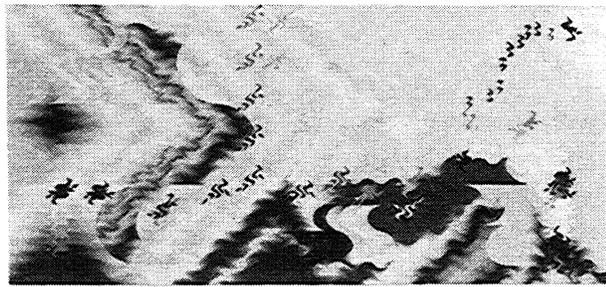
compared to the standard, static Cartesian grid. The infinite flexibility of the gridfield with its variables of wavelength and wave amplitude considerably increased the visual dynamics, i.e., the articulation, of the two dimensional space. It should be emphasized here that the GridField Geometry presented in this paper is **not** the simple overlay of two independent fields. Figure 5.2 demonstrates the difference. Here a gridfield is formed when an X field is placed in the Y field and the X field is changed. In other words, the X field is made to conform to the geometry of the Y field space. The same thing occurred in Fig. 5.1. The result of these two examples is called a **Common GridField**. An overlay situation is when an X field is placed on the Y field and neither field is changed.



Two paintings done with a common gridfield foundation are “Sun Song” and “Transcendent Figure,” shown in Figs. 5.3 and 5.4. One of the differences in these two paintings is that in “Sun Song,” the underlying Y coordinate field lines are straight, whereas the grid lines of both X and Y fields in “Transcendent Figure” are curvilinear.



“Sun Song”
Fig. 5.3



“Transcendent Figure”
Fig. 5.4

The main themes in both “Sun Song” and “Transcendent Figure,” are most clearly defined in their upper right hand corners. The strong theme in the lower left in “Transcendent Figure” is a combination of the right hand theme with its reflection. The left theme is gradually fragmented and transformed to the concluding right hand theme.

6. The Interphase GridField

At some point, realizing that a Cartesian grid/coordinate system is used as a bases to plot lines and curves, I asked why not do the same on a curvilinear grid/coordinate system? Hence, I plotted another field on the common gridfield, Fig. 6.1, which is Fig. 5.1e expanded, and created the full density (all fields shown) interphase gridfield, Fig. 6.2. Following a similar procedure as in Fig. 5.1, the Y field was deleted in Fig. 6.2 to give the interphase coordinate system of Fig. 6.3. The primary difference between a common gridfield and an interphase gridfield is that in a common gridfield, the two fields are oriented at 90^0 to one another, and cross each other, i.e., cross phase, as seen in Fig. 6.1. In an interphase situation, the two fields run parallel and interweave with one another, i.e., interphase, as in Fig. 6.3. An example of a painting configured in an interphase gridfield space is “Quantum Melody,” Fig. 6.4. In this example, I have an abstract theme described

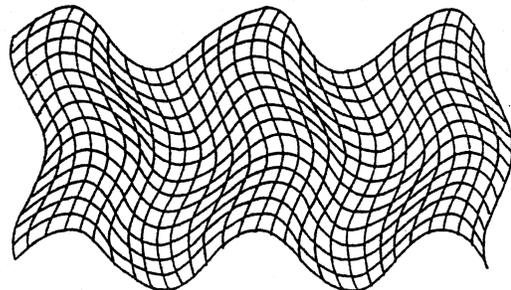
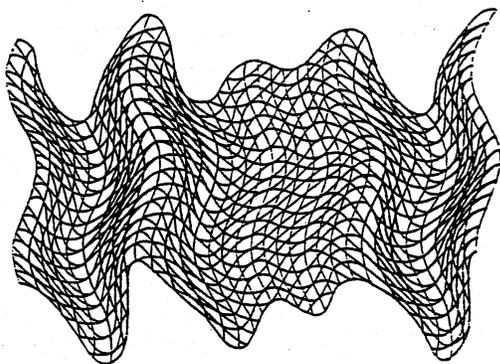
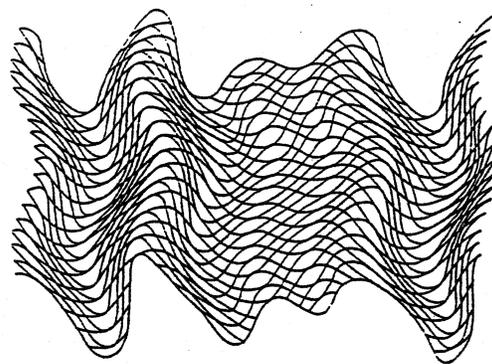


Fig. 6.1 Common GridField

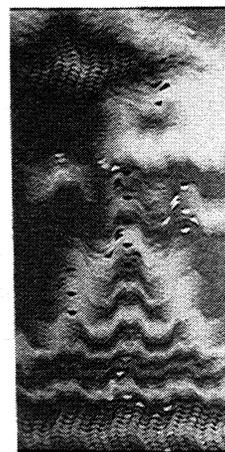


Full Density Interphase GridField
Fig. 6.2



Interphase GridField
Fig. 6.3

by a relationship of separate cells on the gridfield, whereas in the previous example, Fig. 5.4, a basic whole theme shape of combined cells was assumed. These could be described as note and shape themes. The shape theme is sometimes used more descriptively as a symbol or a recognizable, natural configuration as the bird-like figure in the upper right hand corner of "Transcendent Figure". The note theme is closer to pure abstraction -- a nondescript entity unto itself. Another example of giving an idea the graphic equivalent of music is seen in "The Chicken Concerto," Fig. 4.2. The title gives a clue to the chicken symbol; it also gives a clue to a musical intent in the use of the word concerto, though it does not follow the sonata-form common to the concerto. In this case, the chicken is considered the main theme and solo instrument played against a background of color and shape. Though it would be difficult to see a story in this painting, there are some recognizable events. For example, in the upper center section of the painting, there is a small version of the chicken theme "standing on a ledge". Reading to the right, the chicken appears to be doing a somersault, and in the process, growing larger, to end up as the largest chicken shape in the painting. A metaphor? Perhaps! The basic intention with the title, plus the incidents described was simply to give the work some humor. The paintings of Figs. 5.3 and 5.4 are more serious. The painting "Sun Song", Fig. 5.3, attempts to evoke the warmth and light of the sun in that it is painted in the "key" (to borrow a music term) of orange; in other words, the whole painting has a yellow-orange, sunshine glow. A musician might similarly choose a specific key, i.e., tonal relationship, to induce a mood or personal feeling, such as a sunny feeling, to a similar piece of music. The thematic material in "Sun Song" is purely abstract though used energetically, as is the rhythmic structure, to give a feel of heat -- of the tropics perhaps. The abstract theme/shape is structured by a specific six note musical theme I was thinking of at the time. "Transcendent Figure," Fig. 5.4, is what I call an abstract narrative; that is, a story told in purely abstract terms. This is a similar approach used in program-music, which is a class of instrumental compositions intended to represent distinct moods, or to depict actual scenes or events; sometimes called "descriptive music". In "Transcendent Figure" a form is "loudly" introduced, in strong tonal contrast, at the left. As it progresses to the right, it fragments and follows two paths, going through various transitions while traversing various color, tonal, and rhythmic environments, to "fly up" at the top right, and conclude as an elegant bird-like figure surrounded by a "peaceful" yellow glow. This is composed in a simple sonata form of an exposition of the theme/image with its development and final recapitulation. The viewer, of course, is left to read it according to his or her own personal life experiences. Indeed, the delights of music and abstract art are for the viewer to be more personally involved, and, the to discover and create thoughts that the artist perhaps did not consider.



"Quantum Melody"
Fig. 6.4

To further detail the visual/musical possibilities of GridField Geometry, consider Figs. 6.5, 6.6, 6.7, and 6.8. Fig.

6.5 is a 16 cell theme depicted in Cartesian grid space. Any image created in Cartesian space not only changes when it is transformed to a gridfield space, but will change shape according to the region of gridfield space it occupies. Fig. 6.6 shows the Fig. 6.5 theme, transformed in gridfield space, starting at the upper right and progressing diagonally downward through four spatial variations. The one above the fourth variation is a fragmented, note version of the main theme; the image to the right of this is the main theme split in two parts. The two themes to the immediate far right are the mirror reflection of each other. They look different because they occupy different spaces; in

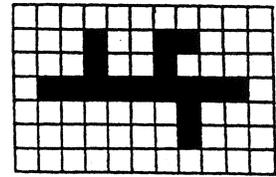
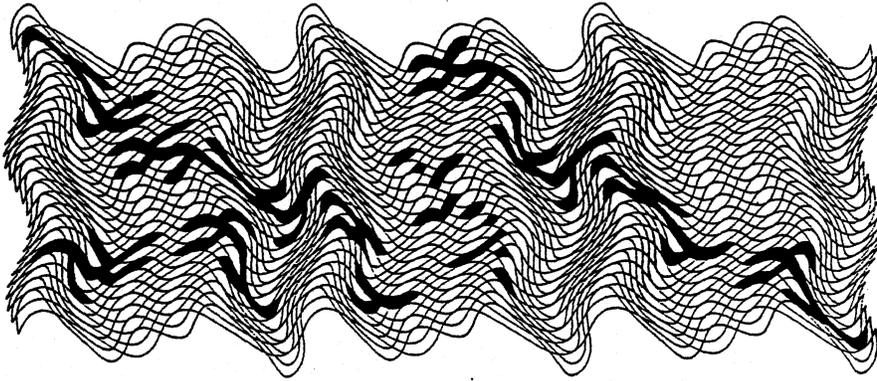
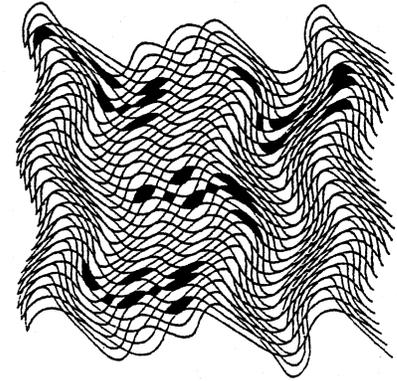


Fig. 6.5 Theme



Shape Theme Variations
Fig. 6.6



Note Theme Variations
Fig. 6.7

other words, their mirror symmetry is broken because of the geometry of the gridfield space. The diagonally “stretched” image, below, is two attached main themes. And the lower right image is geometrically the same initial theme, except it is rotated 180° -- it is rotationally symmetric. Fig. 6.7 shows four variations of a note type theme in four regions of the same gridfield space of Fig. 6.6. The idea of theme and variations is also common to musical composition; though, in music, the variations take place in time rather than space. Another example of theme and variations in art and mathematics is seen in fractal geometry. Here a primary shape is formed of smaller like shapes, which in turn are made of smaller like shapes, ad infinitum. The Fig. 6.8 simply shows some rhythmic wave variations in the same interphase gridfield geometry of the previous examples. One could also use the wave itself as a theme and variations by assuming a specific wave form or length to be the theme and varying its placement in the gridfield space. Fig.

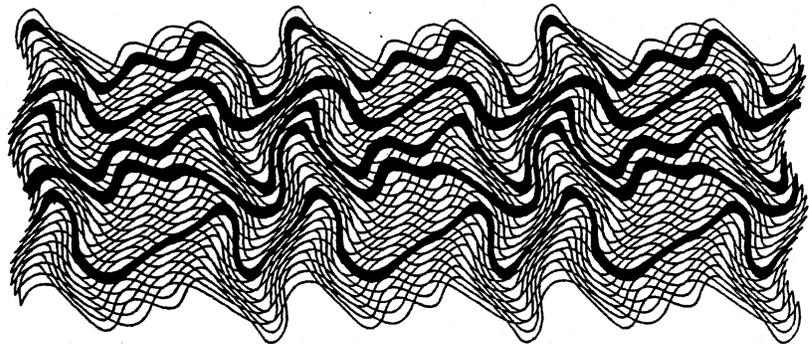


Fig. 6.8 Wave Rhythms

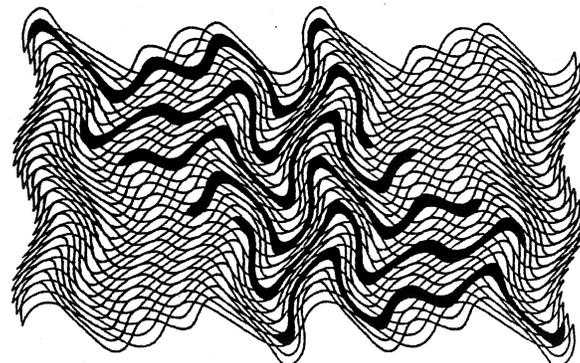


Fig. 6.9 Wave Theme and Variations

6.9 shows six variations of a continuous 25 cell wave theme. It should be stressed that these last gridfield

examples are drawn on just one of an infinite number of geometric configurations. For some other gridfield examples and rhythmic possibilities, refer to Appendix A.

7. Conclusion

My art has grown from very simple beginnings to a highly complex form of expression. Out of this experience and growth a geometry was born, which further increased my creative and esthetic possibilities. In retrospect, I am not sure such a geometry could have been discovered without the process of artistic exploration. I see no need for such a geometry in the context of the present fields of pure and practical mathematics, though I believe it holds many interesting challenges for mathematicians and computer programers. As a geometry of substance and practicality, it certainly has possibilities in the domains of art and design, and my personal feeling is that it also holds some possibilities in the physical sciences. The evolution of my art was a feedback process; that is, an art form drawing on my experience as an engineer/scientist to subsequently develop a geometry that in turn was recycled back and used in my art -- a marriage of experience and expression.

GridField Geometry demonstrates how **shapes** are changed when transposed to other geometries. This explores the worlds of visual experience. However, the musical context of this paper begs the question of what happens to **sound** if transposed to a gridfield environment? In other words, what would a song composed in our space, i.e., reality, sound like in a gridfield space? This is an interesting question, since sound is not a visual experience and not as directly transferable as visual shapes. This suggests another path of exploration, and might proceed by first codifying sound on a Cartesian grid, similar to a music score, as a symbolic function of sound and time. The Cartesian grid would most likely be chosen as the identifying grid of our space, because it is the most common way we interpret space. From here, it is a matter of transposing the codified sound composed in our space to other gridfield spaces and subsequently translating the transformed sound tracks back to our space. However, this is perhaps more an influence of art on music than music on art and the subject of another paper. Therefore, I will conclude by simply considering my paintings as a form of visual music -- tone poems that, like music, employ inherent mathematical and esthetic relationships to create a visual experience which calls for a response which is both intellectual and emotional.

Appendix A: A Selection of GridField Configurations

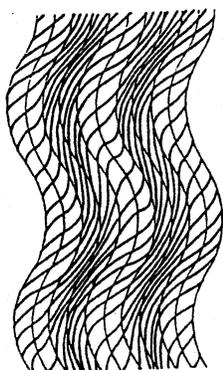


Fig. A1 CGF

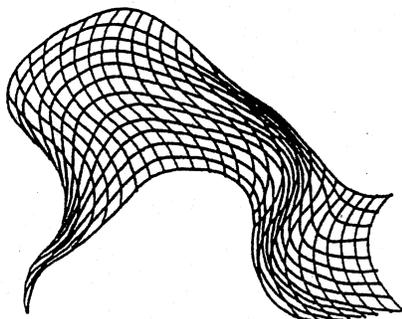


Fig. A2 CGF

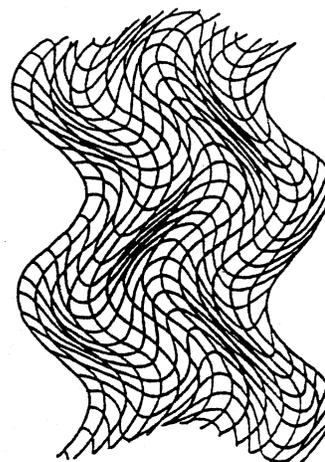


Fig. A3 CGF

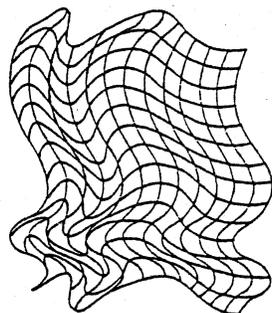


Fig. A4 CGF
Compound Wave Fields

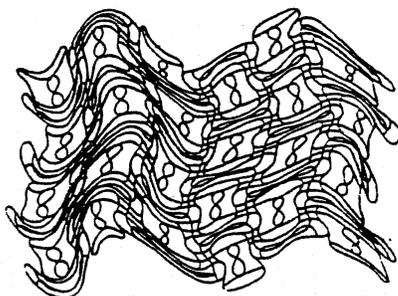


Fig. A5 IFG

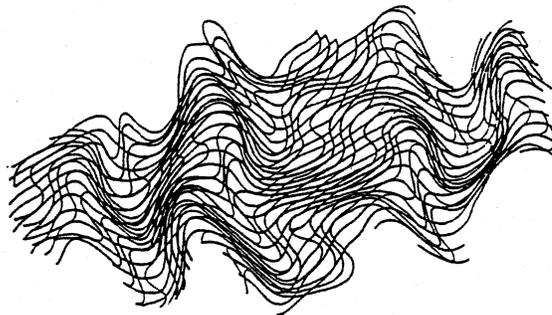


Fig. A6 IGF

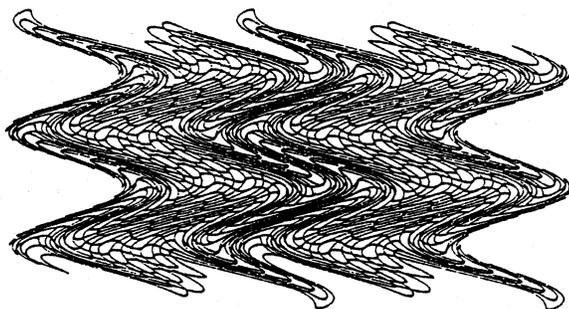


Fig. A7 IFG

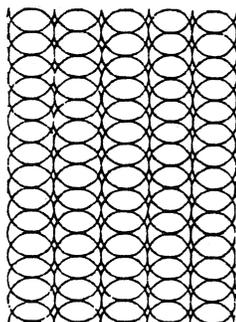


Fig. A8 IFG

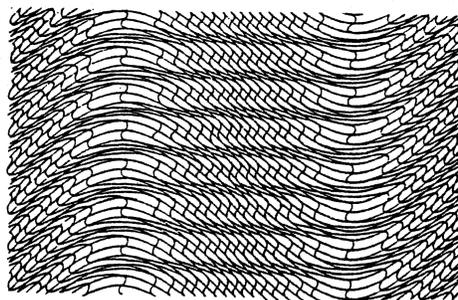


Fig. A9 IFG

Figures A1 through A4 are examples of a Common GridField (GFG). Fig. A4 further illustrates the interaction of two compound wave fields. A compound wave is the combination of two or more waves with different parameters.

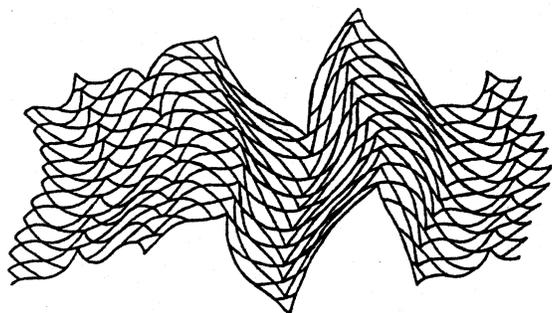


Fig. A10 IGF
2 Wave Shapes

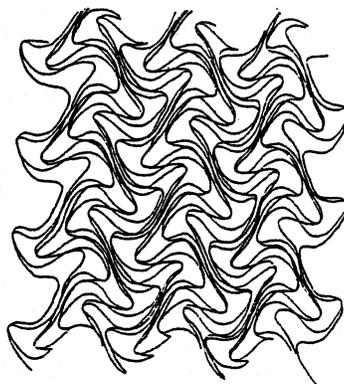
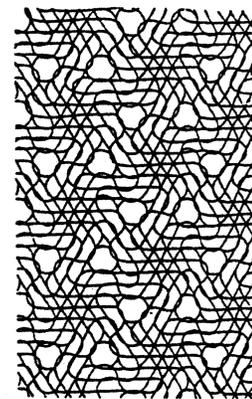


Fig. A11



IGF Fig. A12
3 Phase GF

Figures A5 through A11 are examples of an Interphase GridField (IFG). Fig. A10 illustrates the interaction of two different wave shapes, convex (sinusoidal), and concave. Fig. A12 is an example of a 3 Phase GridField Geometry; that is, the cross phasing, or interaction of three fields rather than the two crossing fields in the previous examples.

