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Virtual Movement Through Planar Geometry: Fundamental Concepts in Visual Art

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Abstract. In this paper I present the developments in my work using math and geometry as major elements to construct small maquette-sized pieces to large wall installations. I like to engage the viewer into my pieces for a certain amount of time in order to experience another dimension. The eye of the viewer is tricked with an impression of perpetual change and motion. And so the viewer sees more than what is actually received by the eye; he will find three-dimensional spaces within the two-dimensional surfaces. In this sense I offer the viewer a chance for virtual movement through planar geometry.

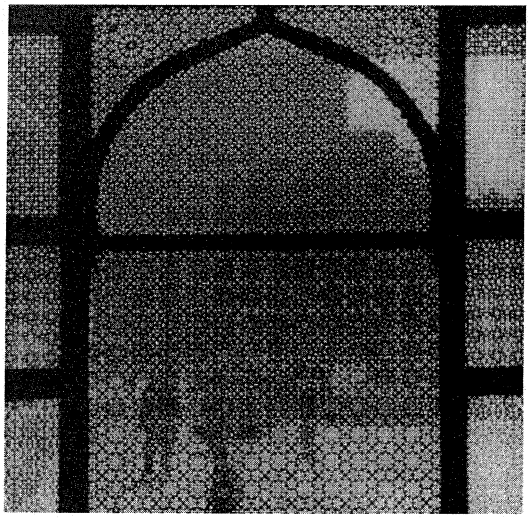

Figure 1: Detail of a window — *Fahtepur Sikri*, India

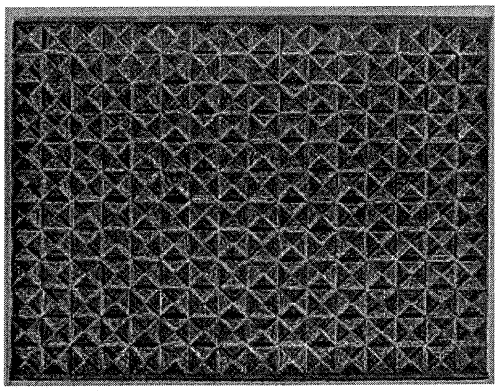

Figure 2: *"Composition I"* (1993)

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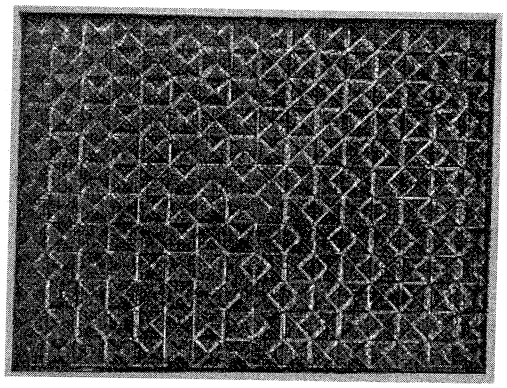


Figure 3: *"Composition II"* (1993)

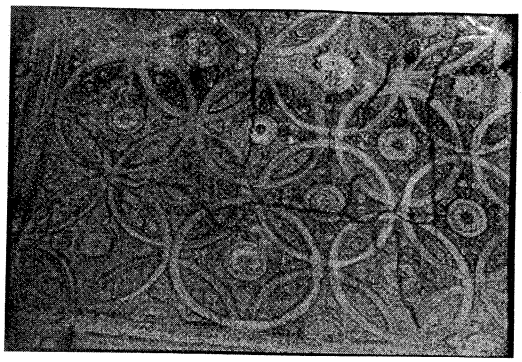


Figure 4: Detail of ceiling painting — *Kyauk-tawgyi* pagoda, Amarapura, Burma

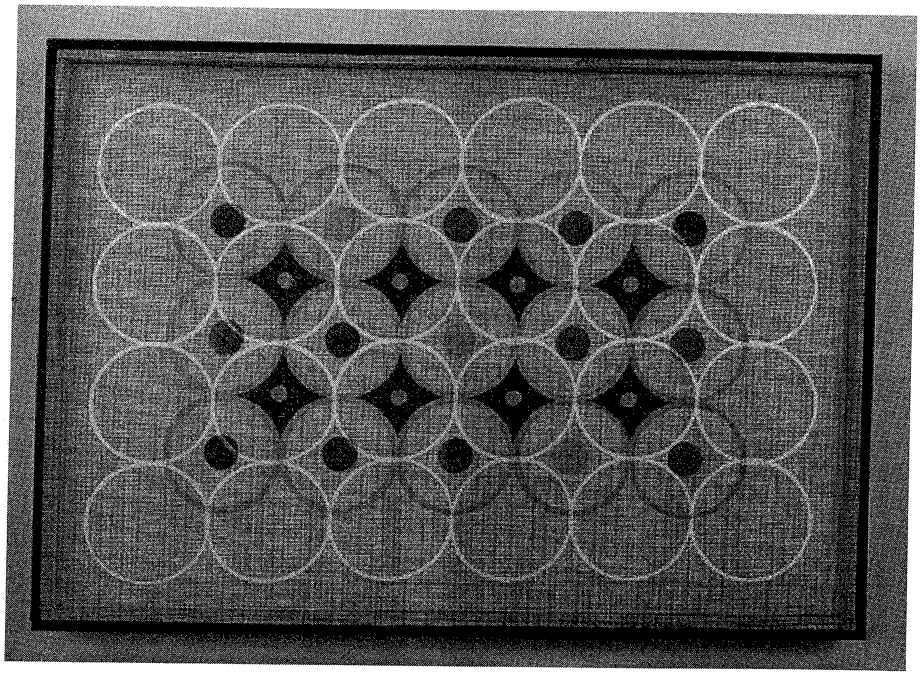


Figure 5: *"Circles on Circles"* (1993)

1 Introduction

The knowledge of geometry has been a fundamental basis of art forms throughout history. Whether Indian miniature painting or Native American folk art, ancient Egyptian architecture or Suprematist[1] painting, the application of geometry pervades and forms the visual world we move through. By looking at existing patterns in architecture, science, and nature, new formations can be discovered and applied by the contemporary artist. The freedom of scale

[1]Editor's note: an early 20th-century art movement in Russia producing abstract works featuring flat geometric forms.

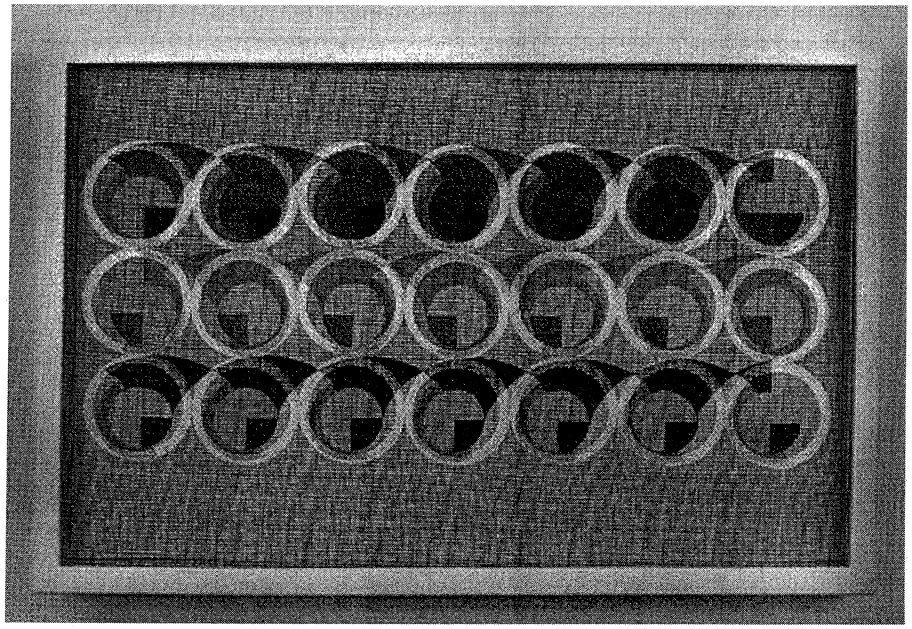


Figure 6: *"Left-Right-Left"* (1993)

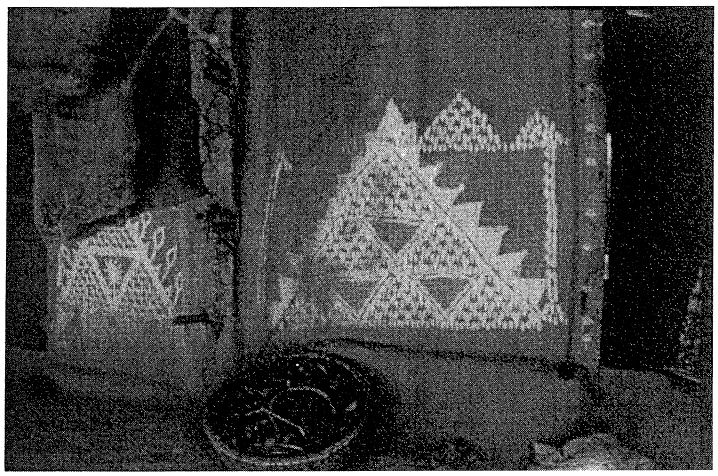


Figure 7: Finger-painting — Orissa, India

and combination of modern materials leads to a new order in form and space. Through a basic understanding of geometry complex ideas can surface and surprise the viewer.

My own work deals with hidden images: layers of planar surfaces visible from a certain angle which change according to distance and personal interaction. Three planar surfaces, consisting of canvas and screen, are parallax or completely unrelated in their geometrical design. The surfaces, as concrete as they are alone, together convey images with constantly changing focus and appearance. One knows what is present but captures, and then loses, the

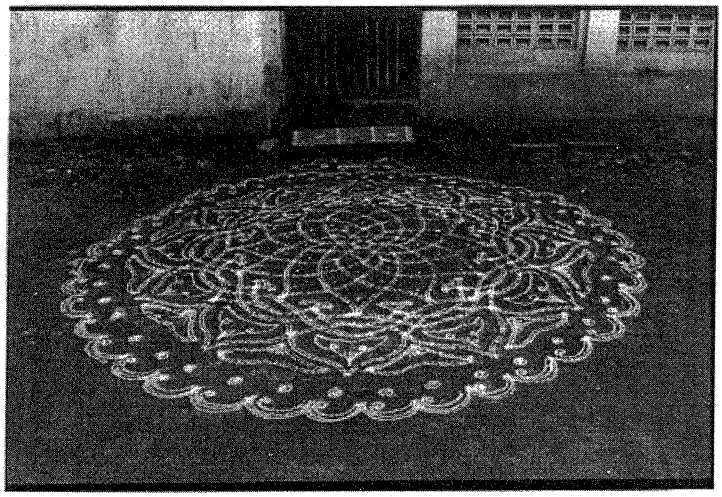


Figure 8: Circular *kolam* in the threshold of a home — Tamil Nadu, India

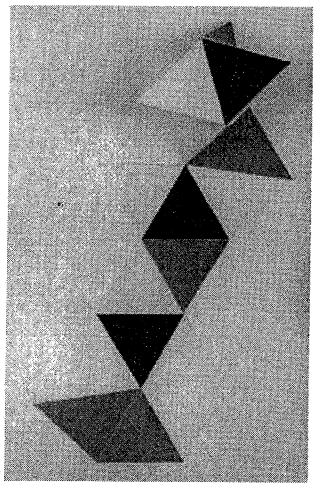


Figure 9: *"Hexagonal"* (1973)

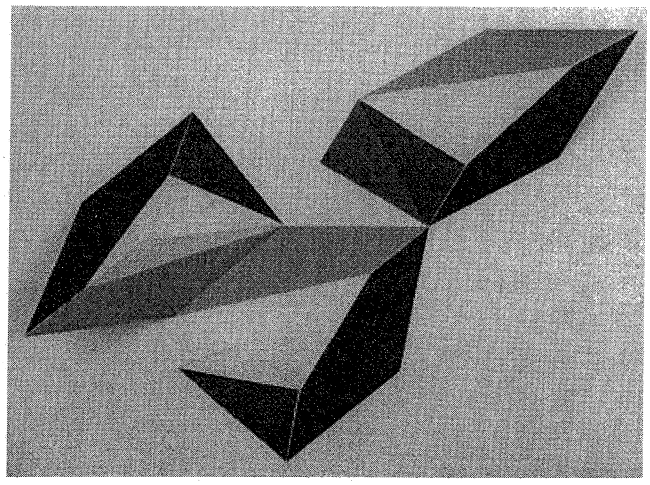


Figure 10: *"Olydos"* (1973)

optical image in an oscillating phenomenon. In this paper I will present the developments in my work using math and geometry as major elements to construct small maquette-sized pieces to large wall installations.

2 Journeys across art and architecture

Throughout my journeys I have come across art and architecture, textiles and materials, science and nature which have nourished my visual vocabulary. Through the understanding and knowledge of geometry we can remember and appreciate complicated structures and designs. By looking at existing patterns in art, science, and nature, new formations can still be discovered and applied by the contemporary artist.

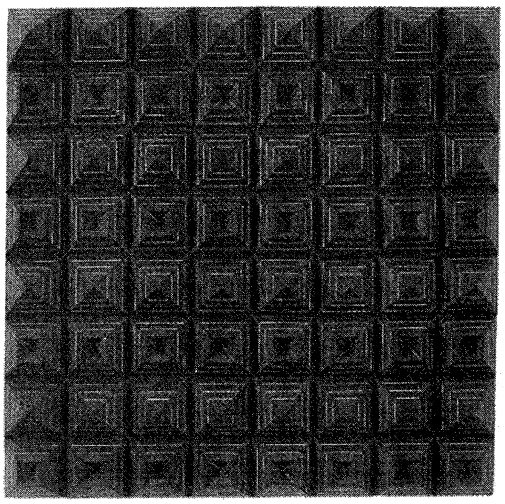


Figure 11: *"Wall Construction with Pyramids"* (1976)

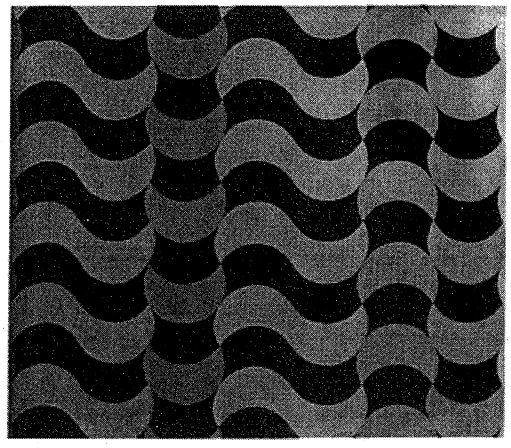
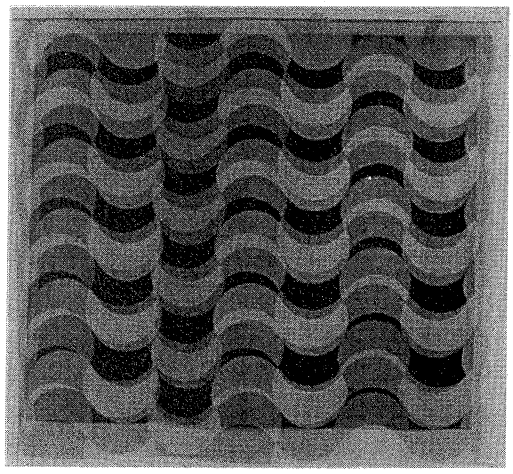
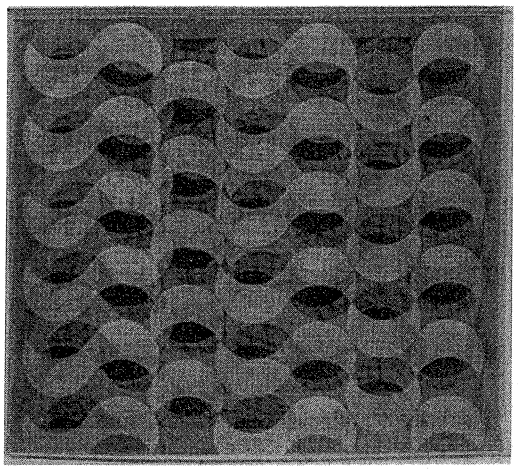


Figure 12: *"Seven Columns Interwoven"* (1993): first layer



a) first and second layers



b) all three layers

Figure 13: *"Seven Columns Interwoven"* (1993)

The exclusion of representational figures and forms in early Islamic architecture resulted in striking structures comprised of geometric forms visible in mosaic floors, wall motifs, and friezes. The windows of the Moghul Emperor Akbar's 16th Century Residence, *Fatehpur Sikri* near Agra, India present a Seurat-like image through geometric open patterns (Fig. 1). These structures inspired my prints, *"Composition I and II"* (Figs. 2 and 3), where triangles etched onto a plate were printed twice, reversed, and then combined to create a similar effect. Another series of ideas departed from the simple rotating square motif on the facade of the *Dome of the Rock* in Jerusalem, Israel and resulted in a 24 square on 24 square wall installation and the piece *"Set and Reset"*, a two-layered interacting drawing.

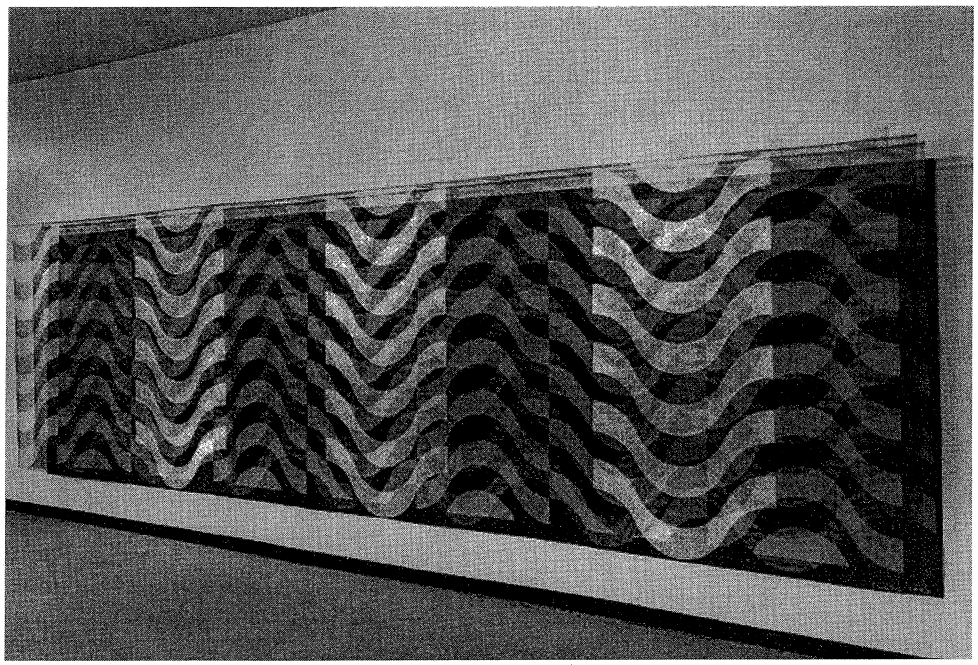


Figure 14: *"Interrupted Möbius"* (1993): side view

Views through an iron fence of overlapping circles and the ceiling painting of the *Kyauk-tawgyi* pagoda in Burma (Fig. 4) influenced the works *"Circles on Circles"* (Fig. 5) and *"Homage to Amarapura"*. These circular concepts further developed into a two surface gouache drawing *"Left-Right-Left"* (Fig. 6) and *"Homage to E.R."*, a wall installation of three surfaces interacting. In 1992 I constructed *"Horizontal Undulations"* for an exhibition in Jerusalem, Israel. During my visit to Burma in 1995, I saw the *Hsinbyume* pagoda in Mingun, constructed in 1838, with its seven layers of wavy terraces.

Geometry is embedded in the art and architecture that surround us but also appears ephemerally in the rituals and practices of daily life. A lace-like finger-painting made with rice flour depicting triangles within triangles decorates the mud wall of a tribal village in Orissa, India (Fig. 7). In Tamil Nadu we find a circular *kolam*[2] in the threshold of a home (Fig. 8). In Vietnam an arrangement of assorted coconut shells in the middle of the street caught my attention, as did the arrangement of money-ornaments at a monastery in Mt. Popa, Burma.

We constantly interact with geometric forms as we see and recreate them in our various alphabets and numeric systems on our daily use of reading and writing. Media and techniques can vary to create the finished form. The letters of a sign advertising Coca Cola were "written" with bottle caps, whereas the lettering I saw on the floor of a Burmese temple is carefully constructed with a compass.

[2]Editor's note: The word *kolam* is of Tamil origin and means 'costume', 'impersonation', or 'guise'.

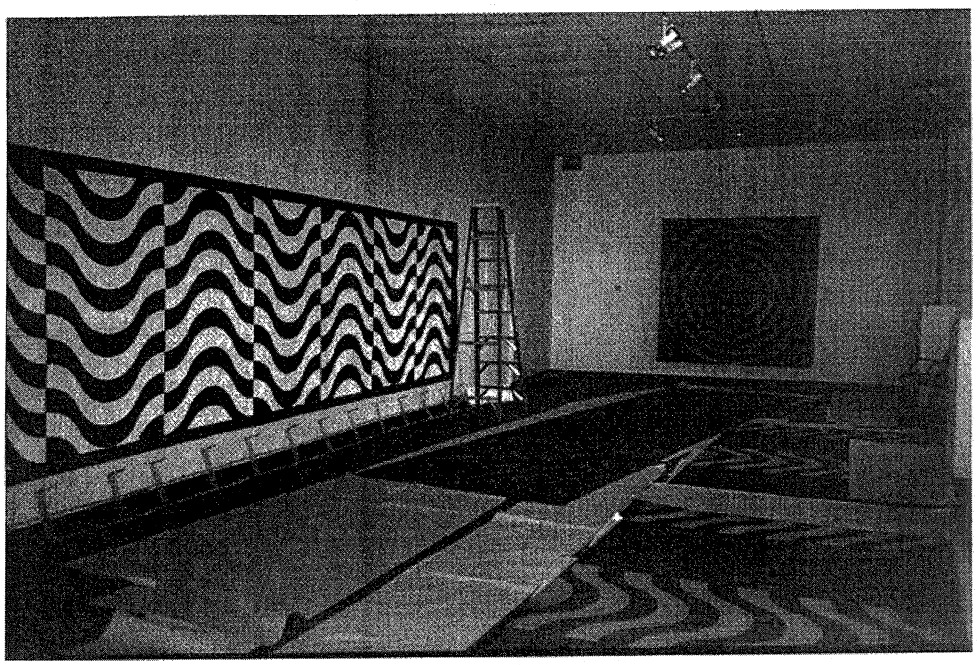


Figure 15: *"Interrupted Möbius"* (1993): installation view, first layer

3 Developments in my work

For more than a quarter of a century I have adopted and applied the fundamental elements of two and three-dimensional geometry to my art. I use geometry freely in my work, moving in and out of two or three-dimensional constructed images. I repeat a certain composition or movement on a surface, then interrupt, reverse and repeat, or only repeat part of the movement on a different surface. Through the method of printmaking I could easily edition a formation and then combine a two-dimensional ground plan with one or several three-dimensional forms as seen in two pieces I made in 1973. *"Hexagonal"* (Fig. 9) consists of two identical formations: one unfolded and one folded adjacent to the ground plan. *"Olydos"* (Fig. 10) consists of three identical formations, the center piece is unfolded adjacent to the left and right formations, which are folded. Thereafter pieces became more complex. I used up to 64 prints within one construction, as seen in *"Wall Construction with Pyramids"* (Fig. 11). When using two different modulars I could create a variation of pieces while using the same plates over and over again. I toyed with this concept for a number of years. Since I was printing on paper the scale and durability of these three-dimensional prints was limited, as was the size of a Lucite box which was created for protection.

Buddhist philosophy suggests that *"Space is the fundamental element of our cosmos. Its nature is emptiness and because it is empty it can contain and embrace everything[...] space is the precondition of all that exists"* [1]. My space is the wall or canvas: from there I depart and work my way into the cosmos. The geometrical properties of the given space determine the position of size, shape, and movement. My consciousness and awareness will then dictate the design and its relative size in relationship to human scale.

Within this space I have experimented since 1987 with two or three separate planar surfaces. Two of the surfaces are transparent, so they can interact with the third underlying

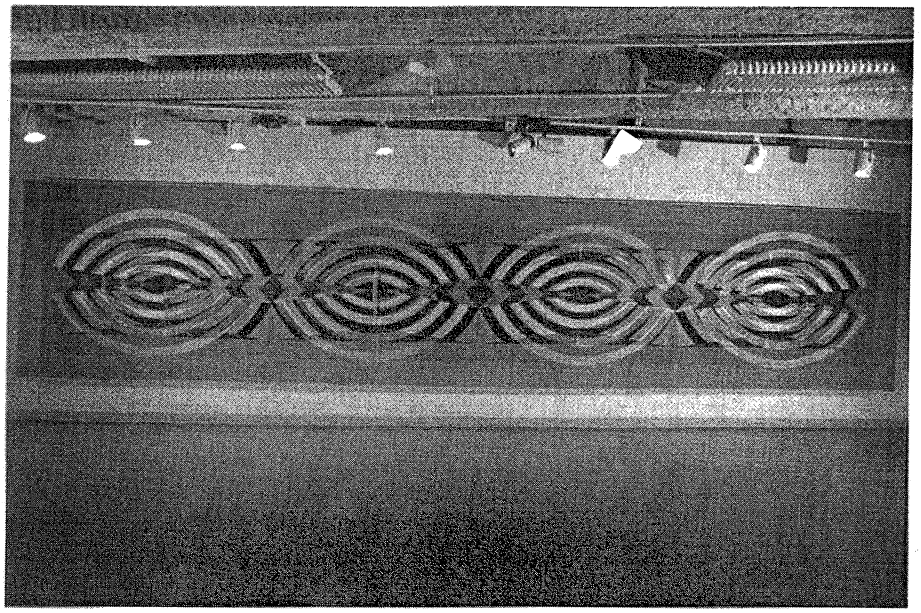


Figure 16: *"Four Parallax Ellipses"* (1989): installation view

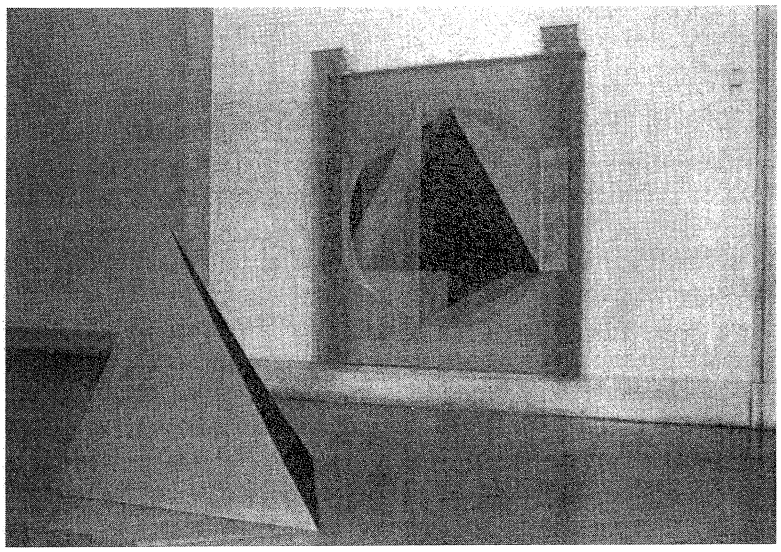


Figure 17: *"A Screen Play"* (1989)

layer. The distance between these surfaces changes according the scale of each piece. The painted construct then can only be viewed from a certain distance and angle. The surfaces, as concrete as they are alone, together convey images with constantly changing focus an appearance. The viewer becomes kinetic while the image and its formations remain still. One knows what is physically present but captures, and loses the optical image in an oscillating phenomenon. The eye of the viewer is tricked with an impression of perpetual change and

motion sometimes difficult to look at, but is forced to engage with the piece for a certain amount of time in order to experience another dimension.

"Seven Interwoven Columns" is shown here in three stages. Stage one (Fig. 12): a pattern with columns or half circles turning or alternating is created on the underlying layer of canvas. Stage two (Fig. 13a): A screen layer of half circles is added, slightly offset to the first layer. Stage three (Fig. 13b): a third layer of half circles is reversed, completing the circles and giving a spherical illusion.

In 1993, *"Interrupted Möbius"* (Figs. 14 and 15), a three-layered 6 feet high and 24 feet wide piece which protrudes one foot into space was created for the Berkshire Museum in Pittsfield, Massachusetts. The undulating horizontal lines are equally spaced and repeated on each surface; together they visually tip and create a three-dimensional effect.

For more than a century, scientists have been reminding us that the retina gives off luminous sensations of its own, and when the eye is provoked by certain combinations of form or color we might see what is not there. In my recent work I deal with the optical mixture of form and color. Physically form and color in a piece do not change. Yet the eye will find three-dimensional spaces within the two-dimensional surfaces. And so the viewer sees more than what is actually received by the eye.

I do not intentionally create an optical illusion or make use of the moiré phenomenon (which is commonly known to occur when two repetitive figures are overlapping at an angle of less than 45 degrees). The result of my pieces might be viewed as such a phenomenon, but I am still surprised when a piece is completed and such a three-dimensional illusion does occur. For example, a piece created in 1989, *"Four Parallax Ellipses"* (Fig. 16), measures 28 feet wide and 6 feet high. Due to the large size of this piece, I could not hang it fully in my studio and was able to view it in its entirety only when it was installed in a museum exhibition. The ellipses on both sides of the piece turned into circles and at a distance of about 20 feet, these illusionary circles began to curve towards the viewer.

I like to engage the viewer into my pieces, I like the idea of thinking of the eyeball as a "scanning device", the retina as a "selective light detector", the brain as an "interconnected digital computer" [2]. Through a basic understanding of geometry complex ideas can surface and surprise the viewer.

In 1991, I installed a piece entitled *"A Screen Play"* (Fig. 17) at the American Academy of Arts and Letters in New York which consisted of a wall painting with the image of triangles forming a pyramid within a circle, a second layer showing a slightly shifted triangle which interacts with the first layer, and a few feet in front of this a free-standing tetrahedron with the same proportions as in the wall painting, its front surface parallel to the wall installation and parallax to the center of the other triangle. I recently discovered a paradigm for this piece in Cracow, where, with the absence of blackboards, a university wall was used in the 14th century to illustrate principles of geometry.

4 Conclusion

Every step and discovery in my work is important: one piece will nourish the next one or retrieve from a previous work. Outside influences only interact when a new concept and idea is already formed. I see what I want to see; when the eye and mind are ready to store more information I digest and recreate. I enjoy the physical involvement in constructing and installing my pieces through which I offer the viewer a chance for virtual movement through planar geometry.

References

[1] K. CRITCHLOW: *Order in Space.* Viking Press, New York 1965.

[2] G. OSTER: *Optical Art.* Applied Optics **4**, No. 11, p. 1361 (1965).

Photo credit: David LEE, East Chatham, New York.

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