Spira Mirabilis

Kim D. Ray
Portland State University

THESIS APPROVAL

The abstract and thesis of Kim D. Ray for the Master of Fine Arts in Art: Painting/Sculpture were presented May 28, 1998 and accepted by the thesis committee and the department.

COMMITTEE APPROVALS: [redacted]

Susan J. Harlan, Chair

[redacted]

Melvin Katz, Advisor

[redacted]

Michihiro Kosuge

[redacted]

Mark Trowbridge

[redacted]

Marvin H. Beeson
Representative of the Office of Graduate Studies

DEPARTMENT APPROVAL: [redacted]

Mary A. Constans, Chair
Department of Art

ABSTRACT

An abstract of the thesis of Kim D. Ray for the Master of Fine Arts in Art: Painting/Sculpture presented May 28, 1998.

Title: *Spira Mirabilis*

My graduate work, culminating in *Spira Mirabilis*, my final thesis project, has been about a search for simplicity. What I have discovered along the way is complexity. In searching for a fundamental principle that generates a complex form, I discovered an apparently simple form that is, rather, a consequence of complex relationships. By creating a work that is grounded on a fundamental, universal principle, I hoped to evoke a subliminal or other-than-conscious response that would effect a transformation in the viewer. Ultimately, I found my own transformation through the creative process, and acquired a new viewpoint through a minimal expression of form.

My thesis exhibition, *Spira Mirabilis*, (installed at the Autzen Gallery, Portland State University, May 13-29, 1998) comprises fifty ropes, some black and some white, stretching vertically from the ceiling and fixed at the floor. The sequence of ropes reiterate a figure, formed by lines drawn on the floor, that is modeled after natural growth phenomena. Three spiral lines, one curving clockwise and two counterclockwise, emanate from a single point in the center of the room and intersect at two points related to body centers. Six knots in the ropes, three black and three white, denote those points of a vertical progression that both corresponds to human proportion and visually explains how the two progressions (black and white) are physically and conceptually interrelated.

There is a tranquillity about *Spira Mirabilis*, a contemplative peace. The figure does not set up a barrier, nor does it coerce motion. It is rather like a permeable membrane. The rhythm of lines and curves guides one around and through, without enclosing the space. *Spira Mirabilis* exists in the moment, and allows us to embrace that moment.

SPIRA MIRABILIS

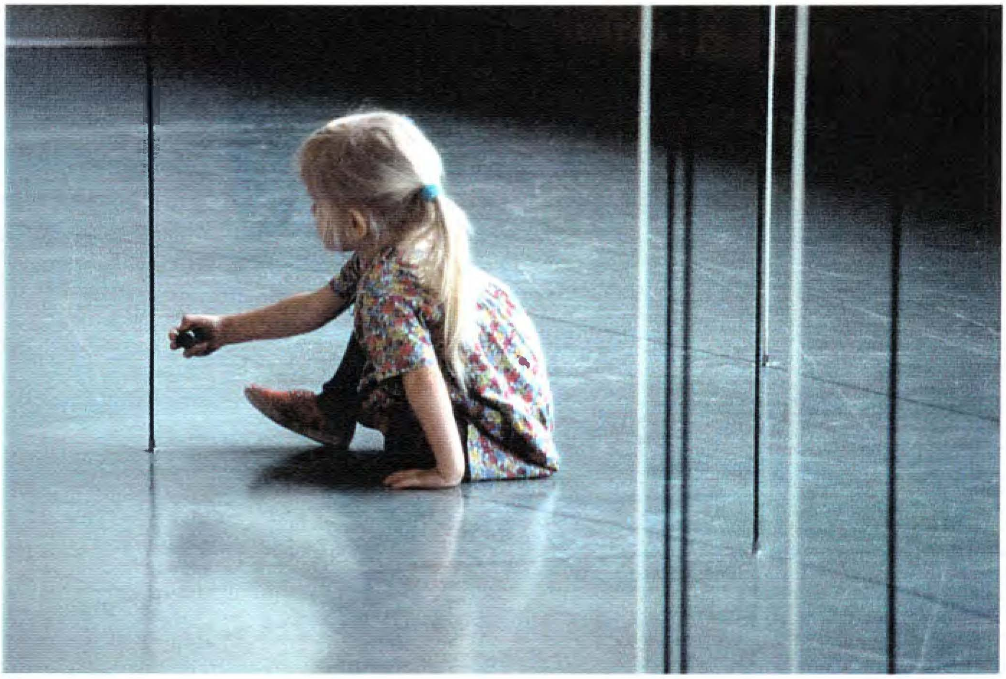
by

KIM D. RAY

A thesis submitted in partial fulfillment of the
requirements for the degree of

MASTER OF FINE ARTS
in
ART: PAINTING/SCULPTURE

Portland State University
1998



for Isabel

Acknowledgments

I would like to thank my committee members Marv Beeson, Mary Constans, Susan Harlan, Mel Katz, Michi Kosuge, and Mark Trowbridge for their confidence in and advocacy of my efforts throughout my tenure as a graduate student. I would especially like to thank Mel Katz, not only for his weekly probing observations and questions these past two years, but also for indirectly expanding my visual acuity and vocabulary during my formative years as an artist, through his integral role in the Portland Center for the Visual Arts, 1972-1987.

I am grateful to Chuck Cooper, Sally Finch, Angela Goldsmith, Jane Kristof and Daniel Pirofsky for their generous 12th-hour support; and to my student cohorts Thomas Botkin, Mylan Rakich, Adam Rupniewski, and Chizu Suenaga for enriching my graduate school experience.

I would also like to thank my friends whose talents and imaginations I have tapped over the years, as I have for this project: Michael Bowley, ex-officio committee member, and technical, logistical and conceptual consultant; Peggy Biskar, photography; John Cooper, technical and installation; Nancy Johnson, graphic design; and Sabrina Ullmann, my friend and advisor since 1972. Their invaluable generosity and support is unwavering.

Finally, I could not have completed this course of study without the encouragement, perseverance and ongoing support of Peter Dammann, and the inspiration of my child, Isabel Dora Ray Dammann.

Contents

List of Illustrations

It is too clear and
so it is hard to see.
A man once searched for fire with a lighted lantern.
Had he known what fire was,
He could have cooked his rice much sooner.

-Zen Buddhist story

Introduction

My graduate work, culminating in *Spira Mirabilis*, my final thesis project, has been about a search for simplicity. What I have discovered along the way is complexity. In searching for a fundamental principle that generates a complex form, I discovered an apparently simple form that is, rather, a consequence of complex relationships. My exploration became a spiral dance between content and context, between “reductionist” and “emergent” theories of nature,[1] the journey within engendering a journey without.

By creating a work that is grounded on a fundamental, universal principle, I hoped to evoke a subliminal or an other-than-conscious response that would effect a transformation in the viewer. Ultimately, I found my own transformation as a consequence of the creative process, and acquired a new viewpoint through a minimal expression of form.

My path over the last two years began with a two-dimensional exploration of figures based on my body proportions and generated by my reach. At the same time I was exploring dynamic spatial relationships, initially through creating a spatial illusion, which then expanded into the surrounding physical space. Over the course of my graduate work, the two-dimensional form metamorphosed, eventually into an idea for a wall as pure object, a large-scale structure that would both divide space and compel movement through space. Finally, however, I arrived at a dynamic stillness in form that neither forces nor restricts motion, but rather embraces the moment. An idealized form had evolved to find expression through simple line, without illusion. Ultimately, the idea was liberated from object as the supporting walls fell away, and *Spira Mirabilis* simply became what it is.

---

[1]Cohen, *The Collapse of Chaos,* 1994, page 397.

Search for a Fundamental

I commenced my graduate studies with an exploration of golden proportional relationships based on the scale of my body. By incorporating this universal principle I intended to infuse my work with a fundamental power.

Golden proportion has been an ongoing interest of mine, inspiring much of my undergraduate work as well as my installations at the Nine Gallery in Portland, Oregon. This mathematical concept is an ancient idea used throughout history in architectural form to create and express harmony. The golden proportion is inherent in the 4500-year-old Great Pyramid of Egypt and in Greek temples such as the Parthenon. Ideas relative to the golden proportion can be found in the writings of the Greek philosopher Protagoras (fifth Century BC), who expressed that "man is the measure of all things," and in the works of the Roman architect Vitruvius (second century BC), who recommended that the Greek model be used for harmoniously proportioned buildings. The works of both authors were later rediscovered and elaborated upon by Renaissance thinkers.

The Italian Renaissance scholar Fra Luca Pacioli wrote about geometric harmony in his 1494 treatise *Summa de Arithmetica*, and Pacioli's student Leonardo da Vinci subsequently drew his own version of Vitruvian man based on this notion of geometric harmony. The Venetian painter Jacopo de Barberi introduced northerner Albrecht Dürer to the geometrical construction of human figures, but refused to disclose his methods. Dürer then "set to work on his own and read Vitruvius," thus embarking on an exhaustive study of human proportion that would continue to occupy the artist for the next twenty years of his life, and eventually be published in many translations and editions after his death.[2]

---

[2]Panofsky, *The Life and Art of Albrect Dürer*, 1955, page 261.

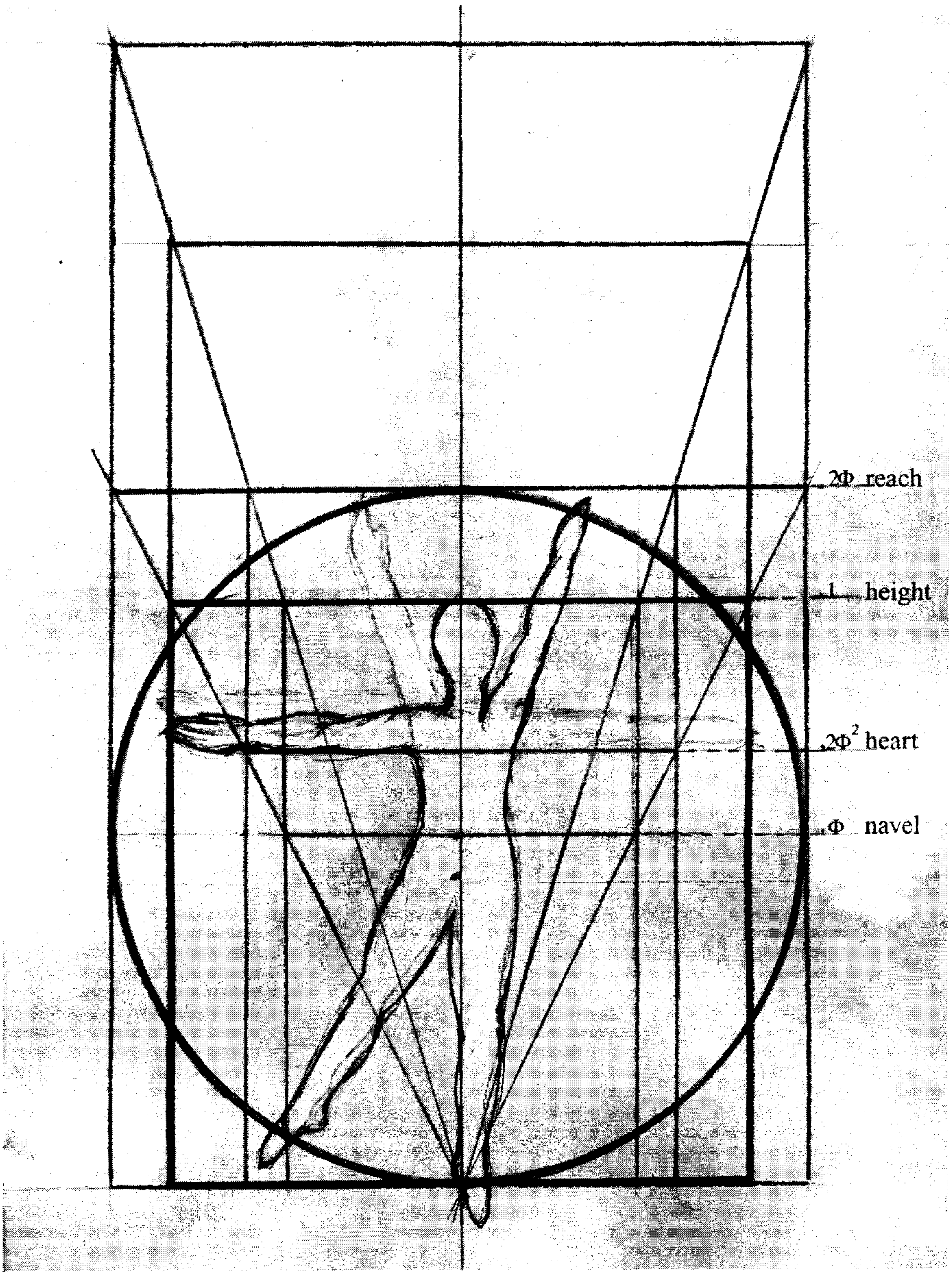


Fig. 1 "Vitruvian" model

One of the central elements of golden geometry is ϕ *(phi).* Referred to as the "golden number," "divine seed," *aurea sectio,* and "golden ratio," ϕ is innate in the human body. One's height, which equals one's arm spread, multiplied by ϕ, yields the height of one's navel (the "ϕ division"), and this in turn is half of one's vertical arm reach. Thus, height and arm spread establish dimensions of the square, and vertical reach determines the diameter of the circle centered on the navel of Vitruvian man (fig. 1). Just as π and $\sqrt{2}$ are the functional numbers of a circle and square respectively, ϕ is the functional number of the golden section, or golden rectangle. These are all irrational numbers (also called transcendental numbers); they are non-repeating decimals of infinite length. The key to understanding the interrelationship of the square and circle in Vitruvian man, ϕ is the proportional relationship between the two sides of a golden section. And, approximated by the number 0.618, ϕ is exactly expressed by the ratio $\frac{\sqrt{5}-1}{2}$.

Search for Scale

In the autumn of my first year of graduate study, I painted color fields on golden rectangles which I juxtaposed with large graphite drawings. The scale of the canvases and paper that I used was based on my vertical reach, while the drawn figures were based on my arm spread, or height. Two separate number sequences were generated: 30", 50", 80" (my reach) and 130"; and 3', 5' (my height), 8' and 13'. These may be recognized as whole Fibonacci numbers from the sequence 1, 1, 2, 3, 5, 8, 13, 21, etc. The sum of any two consecutive numbers, or terms, will yield the next term in the sequence, and the ratio of consecutive terms approaches the value of ϕ. The sequence generated by my height seems conceptually more fundamental (one's height is considered a unity, and is assigned the numerical value of one), but produces golden rectangles that are on more of an architectural scale than those generated by the sequence based on my reach (5'-by-8' compared to 50"-by-80"). The golden rectangles based on my reach, although physically on a more intimate scale, are not large enough to accommodate a motion that includes my arm spread. I invested in a roll of 80"-wide paper so that I could explore the relationship between these two inherent number systems along with related spatial concerns.

In December, I began work on a large, 80"-by-130" drawing which both physically and illusionistically extended beyond the plane of the wall (fig. 2). The drawing consisted of two sections: on the left, an 80" square reflects the history of an exploration of reach, and on the right a 50"-by-80" golden section covered by red-painted chainlink fencing material. The grid of the chainlink anchors the surface both visually and physically, and enhances the spatial illusion created by the drawing. The spiral arc integrates the two sections of the drawing, and when installed, it extended out onto the floor to inscribe a 130" square, which further enhanced the play between physical space and spatial illusion.

The following spring, I constructed a 54" section of wall, attached with hinges to an existing wall in my studio initially so that I could swing it out of the way (fig. 3). This made it possible to position the wall at any angle over an 180° arc to construct a drawing based on my reach across the corner, rather than being restricted to 90°. At an acute angle, the physical space in front of the wall enhances any spatial illusion created on the wall's surface. Construction lines on the floor marked various positions of the wall over a 180° arc. Thus, the piece expanded physically into the space in front of the wall, into the area behind the hinged section, and finally incorporated the storage space and sink closet behind the wall. My drawing had dynamically metamorphosed: from two-dimensional illusion, to object, to site-specific installation.

I wanted then to explore forms generated by my personal reach and motion in a curvilinear space. The next step, it seemed, was to build a curved wall. As with the hinged wall in my studio, I addressed the interior of the curve, the shape of which I imagined as essentially circular and one sided, that is, concave. Questions came to mind about the

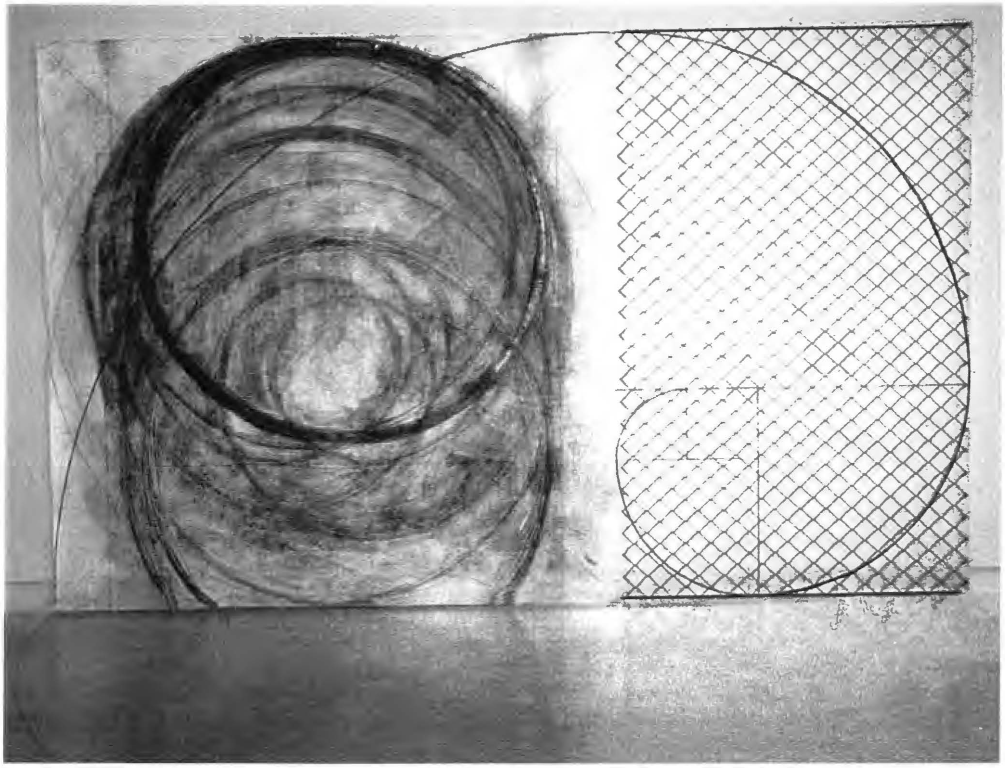


Fig. 2 Drawing, graphite on paper with chainlink fencing, 80" x 130"

Fig. 3 Drawing, graphite on paper with hinged wall, 80" x 100" (paper) negative space embraced by this curve: What is the overall character of this space? What diameter is the curve so that the enclosed space is small enough to record body motion yet not feel claustrophobic? Is there an opening or is it completely enclosed? How can I induce motion within the space, and into this space? How long and tall is the supporting wall; does the wall become another object?

Search for Form

A summer studying in Italy provided a hiatus from an insular focus on my studio walls. However, the questions from my studio traveled with me to Rome, where ruins of ancient walls are massive and ubiquitous. The Aurelian wall, hastily built in the third century AD to surround the city of Rome and keep out invading armies, is now a monument surrounded by the city. A barrier for 1600 years, the wall was finally breached during the Unification of Italy in 1870, and now serves as an historical blueprint for the city. Rome's neighborhood history is encrusted on the wall and partially entombed by it, and while the distinction is still apparent in its structure, the flow of urban life seems not to differentiate between the inside and outside. In the evenings, residents walk their dogs along the wall and hundreds of cats, Rome's ancient citizens, stand sentinel as the city, in a cloud of exhaust, bustles around and through, perforating this great wall.

Several neighborhoods in Rome are also caretakers of sections of the Republican wall, built in 378 BC. Massive and crumbling, these ancient ruins are minimally shielded from acid rain by corrugated sheet-metal placed overhead. The sidewalks hug these chunks of wall which protrude from alleys, sideyards, backyards, and basements of neighborhood shops and houses. No apparent distinction remains between the inside and outside of this wall, embraced on all sides by the city.

Outside Rome, at Hadrian's Villa, stands the 200-meter-long Ambulatory Wall, built early in the second century AD. A columnar shape imbedded in each end of this wall has convinced archaeologists that the wall originally functioned as the core of a colonnaded and covered walkway. One Roman mile, or seven laps around this structure, was believed the amount of exercise necessary to aid digestion following a meal. The Apsidal Hall's close proximity to this Ambulatory Wall led Pirro Ligorio, a 16th century archaeologist, to identify the building as a meeting place of stoic philosophers, whom he believed to have begun their discourse in the adjacent meeting hall then continued it while putting in their laps around the wall. The Ambulatory Wall defines an exterior space; we can only be outside this wall, not inside.

Rome seduced me with her walls, and altered the character of my project along the way. The solid nature of my wall project had been reinforced, but its scale had changed dramatically. From the 8- to 10-foot-high curved wall I had imagined enclosing a small, circular space in my studio, the project had expanded into a large-scale installed structure, dividing and activating Portland State's Autzen Gallery. Besides more area, the gallery also presented other features—doors at either end of the space, a wall of windows—that might engage a long-wall structure. I began to imagine a wall based on a logarithmic spiral or, perhaps, two nested spirals that describe a continuous figure possessing both an inside and an outside. I hoped also to make visible a vertical progression inherent in three-dimensional spiral growth. The height of the wall might begin at the ceiling by one door, and proceed in decreasing logarithmic steps to a central vortex at my mid-body height, where the form would transition from convex to concave and thereafter sweep up in logarithmic progression to the door opposite.

The form of my piece continued to develop in discourse with ideas for materials. The question of materials brought into question the very nature of a wall. What is a wall? What are its implications, and are these altered by the choice of materials used in its construction? The Berlin Wall, surrounded by mine fields and topped with barbed wire, kept East Germans in for nearly half a century. The Aurelian Wall—solid, massive and opaque—

kept marauders out for over one thousand years. Originally barriers, have these walls transformed into memorial objects, like Washington D.C.'s Vietnam Memorial, arguably a barrier wall itself?

Does a wall enclose space, divide it, or both? A solid, opaque form dividing space can be perceived as a barrier, even if it can also be circumnavigated as is inherent in the function of the Ambulatory Wall. Richard Serra's ill-fated *Tilted Arc* for example, a freestanding steel wall intended to dynamically divide an urban plaza, was perceived by the public as such a formidable barrier they demanded it be removed (Federal Building Plaza, New York, 1981-1989). Serra's trio of *Torqued Ellipses* (Dia Center, New York, 1997-98), however, both enclose and divide space, creating circumnavigable barriers that further establish a dialog among the three forms. At the University of California San Diego campus, one walks freely underneath Robert Irwin's *Two Running Violet Forms* that, made with coated, chainlink fence, carve an elevated, linear path through a eucalyptus grove and create an amorphous, aerial barrier. Dan Graham's translucent, circular enclosures at the Dia Center in New York, and at the Museum of Modern Art in San Francisco, compress sound and create a sensation of motion that borders on vertigo.

Search for Materials

The form of *Spira Mirabilis* began to emerge from a succession of volleys between ideas about structure, and considerations of building materials. Driven by cost, time constraints and the construction limitations imposed by the gallery space, the concept for the wall's fabric underwent a clumsy metamorphosis. Starting from a solid, framed object covered with plaster or sheet rock, the concept progressed to chainlink fencing, with the possibility of threading through the mesh various opaque materials. I also considered other materials for the wall such as paper, fabric, wire, steel and rope.

The possibility of using linear materials—such as in the rope drawings of Patrick Ireland, or as in the geometric figures of stretched yarn by Fred Sandback—seemed too insubstantial to support the sense of wall I had in mind. And the role of illusion was brought into question when considering materials such as those used by James Turrell and Dan Flavin to create enigmatic and surreal walls of light, or by Irwin to create a magic, translucent wall with scrim fabric and colored lights. One's spatial sensors are challenged when confronting these illusions made from color and light. Was this what I wanted my wall to do? Was there an inherent incongruity in using illusion to create a solid wall? Could my idea of wall incorporate subtle color shifts and spatial illusion and still stand firm? Did I want to create spatial illusion, or slice real space?

The ongoing quest for building materials paralleled the struggle for finding the right structure and shape of the form. Different materials would play off and activate the space in different ways. Originally, I conceived a long convex spiral, curving counterclockwise away from the gallery entrance to a point in the northeast area of the room, with a second spiral nesting within it and directing movement toward the emergency exit. A clockwise spiral, I realized, would shift this open area of congregation within the gallery from the back door to the front doors. This reversal would be problematic, however, in that it would require that the exhibition be entered through the emergency exit.

Search for Structure

The internal structure generating the spiral form evolved parallel to my search for materials. At the outset, the spiral was formed from whole-number approximations of golden proportions based on the Fibonacci series. Two nested spirals, with the same angle of rotation, would create a vortex at the point of juncture where the convex curve reverses and becomes concave. I was interested in discovering the shape of an object formed by two spirals converging in a vortex. I hoped to capture that quality embodied by the columnar ends of the Ambulatory Wall that compels movement around it, or that possessed by the alarmingly acute angle formed by I.M. Pei's East Wing of the National Gallery, which has been blackened by the touch of many a passerby.

The shape of this juncture became irrelevant, however, when I began to work with a figure generated by a pure (rather than approximate) logarithmic system, since in an ideal system, the point of origin has no dimension. This is the *spira mirabilis*, the marvelous spiral, the logarithmic spiral in which a line (or curve) progresses in infinitesimal steps toward zero, and outward to infinity. Jacob Bernoulli, the 16th century mathematician who discovered the logarithmic spiral, felt it such a fitting symbol for his life's work that he had it inscribed on his tombstone beneath the words *eadem mutata resurgo* (it will rise up again and again in likewise fashion).

The logarithmic spiral is an equiangular spiral (having the same divergent angle, with the spiral line crossing each radius at the same angle) distinguished by a geometric radial growth and an arithmetic rotational growth (meaning it has the same angle of rotation between radii). The golden ratio ϕ is the common multiplier in the geometric radial growth of the logarithmic spiral. That is, consecutive radii, spaced according to a constant rotational angle, are in golden proportional relationship to each other as determined by ϕ. Any geometric numerical progression can generate a logarithmic spiral when superimposed on an equiangular system of radii. The variable that controls the shape or speed of the curve is the rotational angle between radii. A smaller divergent angle (close to 0°) generates a flatter curve than does a larger angle (closer to 90°). The line and the circle then are the functional limits of a logarithmic spiral: a divergent angle of zero produces a line, and a divergent angle of 90° produces a circle.

The logarithmic spiral is abundant in the natural world. The chambered nautilus is a familiar example of this special kind of growth. Other marine gastropods such as the abalone and the Atlantic sundial exhibit exclusively clockwise logarithmic growth, whereas the nautilus grows symmetrically. The logarithmic spiral is innate in the teaching *mudra* (hand gesture) of Buddha: with the point of origin at the pressure point (*ho-ku*) between the thumb and index finger, one can trace a spiral around the curve formed by the thumb and continued by the index finger as it opens to join the second finger.

A single logarithmic spiral is an apparently uncomplicated system, and should engender clear and simple results. Nested spirals with different angles of rotation, however, produce a complicated figure—although their moments of origin may be simultaneous, they will cross over and over again at regular intervals as each curve crawls through space at a rate different from its partner. In order to avoid this complication of shape, I began using two curves which emanate from the same point and share a common angle of rotation. I experimented with nested curves that were identical in shape except that the ratio of their radial to vertical lengths were in inverse relationship to each other. At this time, I still imagined my wall taking on a more or less solid, opaque form. But I had not found an appropriate, workable material. I was frustrated, and bogged down by the limitations imposed by various materials and the gallery space itself. My inherently elegant system had not given rise to any clarity of structure or form.

Search for a System

Part of my solution was lying right in front of me, in the trail of leftovers from my process: lists of number sequences and piles of photocopied figure variations were covering my work table alongside my calculator, compass and protractor. I realized then that the system giving rise to the internal structure of the form was primal, and that by focusing on the system, I might discover a workable form. Essentially linear, an ideal system has no dimension. Thus, the solid walls of my concept began to crumble and fall away, opening the way to an expression of form using linear materials such as rope, wire, or steel rod—all of which I had originally discarded as too insubstantial. The opaque form became transparent, and the questions about installation were reduced to mechanics. Stretching wire was problematic since drilling into the concrete gallery floor was not permitted. Steel rod and rope are inherently different: steel rod suggest a form that is architectural or sculptural, whereas rope is more common and plastic. I ultimately chose the latter, which prompted further questions. What sort of rope would present an essentially clean, straight line, and be substantial enough to hold form in the Autzen Gallery, without overly asserting its character, either in texture or weight? Hemp, cotton or nylon; woven or three-strand? And what about color: should it be natural, black, white or painted?

At this time, I discarded the notion of using two nested spirals in favor of creating a simpler figure out of opposing spirals. This brought up more questions. Why two spirals instead of one? And why opposing spirals? This point of intersection could mark either my height or my reach, depending on which of these numbers is chosen to generate the structural system for the figure. It seemed then that I would either have to finally choose between these two, or incorporate a third spiral so that I could have two points of intersection—thereby denoting both number systems. Conceptually, the system based on my height was more appealing, but I couldn't find an aesthetic fit for the room. And a symmetrical spiral system seemed simpler, but most marine animals exhibit a single, unidirectional spiral, not two—and certainly not in opposition. With merely two months remaining before my exhibition, many questions remained unanswered. By shifting from the marine animal model to a botanical one, I came closer to finding a solution.

A pattern formed by opposing logarithmic spirals is apparent in plant growth. Daisies, sunflowers and pine cones all exhibit dueling sets of spirals, as do the growth tips of such plants as the foxglove (fig. 4). Comparison of the number of clockwise to counterclockwise spirals in each plant always yields consecutive Fibonacci numbers. For example, the numbers in the foxglove are 2 and 3; in a pine cone 5 and 8, 8 and 13, or 13 and 21; in a daisy 21 and 34; and in a sunflower 34 and 55, or 55 and 89.

Botanical studies have historically focused on spiral pattern as a formative growth principle. Recent studies by two physicists, Stéphane Douady and Yves Couder, however, have revealed that apparent patterns in plant growth are a consequence of an underlying structure based on growth dynamics.[3] New primordia (rudimentary growth nodules) in plants arise singly around the circumference of a central apex and space themselves as far from pre-existing primordia as possible. A rotational angle close to 137.5° between successive primordia establishes the apparent patterns in combination with growth dynamics, and ensures the most efficient packing of seeds in plants such as the sunflower. Referred to as the golden angle, 137.5° happens to be a function of the golden ratio ϕ and is derived exactly by the equation 360°-(360°x ϕ).

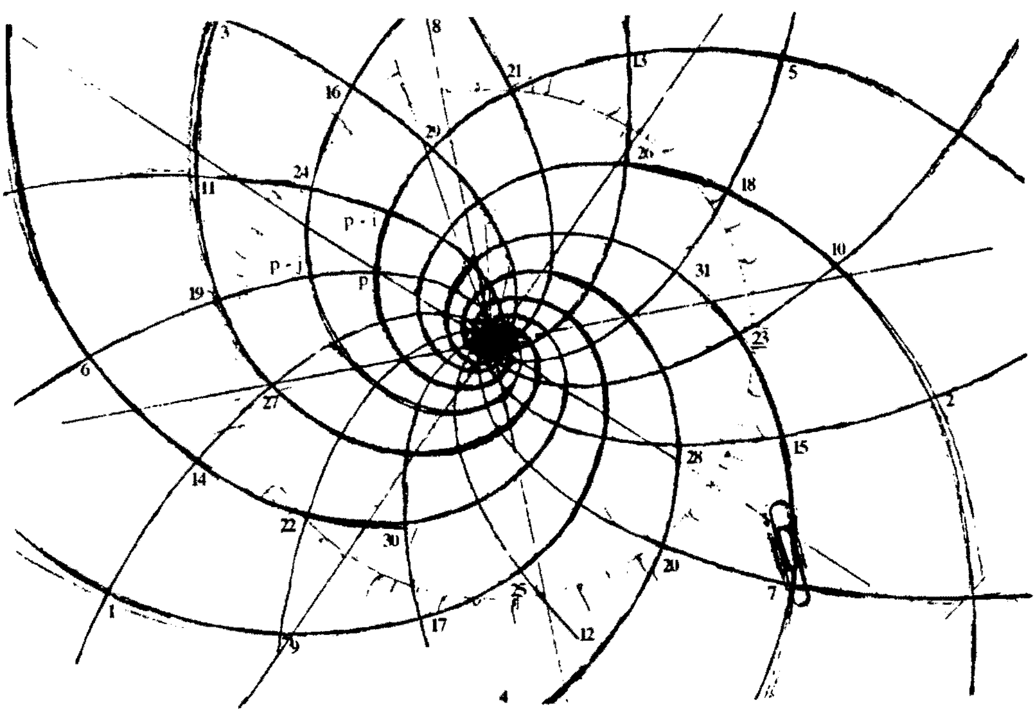


Fig. 4 Model for a natural growth system[4]

[3]Douady, "Phyllotaxis as a Physical Self-Organized Growth Process," *Physical Review Letters,* 1992.
[4]Model for a natural growth system. Older primordia (*p*) migrate away from the apex region or growth center, as new primordia appear over a rotation of 137.5°. To assign chronological sequencing to primordia, subtract *i* (the number of clockwise spirals) or *j* (the number of counterclockwise spirals) from a value *p* along any spiral. In this model, $i = 8$ and $j = 13$. The distance between any point *p* and *p-i* is equal to the distance between the same point *p* and *p-j*.

The penultimate figure plan, which I used for my exhibition announcement, developed from this new information (fig. 5). Dividing 360° by the consecutive Fibonacci numbers eight and 13 results in rotational angles of 45° and 27.5° for the two asymmetrical curves. The relationship of vertical to radial distance for each point in the sequence was simplified to that of a square; they would be equal. This produced a lyrical figure that would fit easily into the space upon installation, in spite of the many structural limitations imposed by complex ceiling features.

But something was still missing. Questions concerning the interrelationship of the two distinct number systems remained. And this figure did not meet all the criteria of a dynamic natural growth system. For most efficient packing in a natural growth system, for instance, the seeds are oriented along a shallow curve rather than along radians as mine would prove to be. By altering the rotational angle of the 27.5° curve first to 17.5°, and finally to 15°, while maintaining the number of spirals over 360° at 13 (instead of changing to 21 since 360°/21=17.5°), all of the pieces finally fell into place (fig. 6). The unique relationship between the three logarithmic spirals forming the ultimate installation figure was derivative of a natural growth system such as a pine cone. Thus, the relative distance between intersecting points of the two number series, generated by my height and reach could be found, not arbitrarily, but exactly.

And lastly, the common point of origin for the three spirals shifted from the arbitrarily specific golden section division point of the room to a more straightforward central location, in keeping with a natural plant growth system. Changing the position of the figure within the gallery insured that installation of the ropes would be more complicated, given the superstructure of the ceiling. And the site-specific aspect of the piece, which was secondary to its development, would become intrinsic to how it was read.

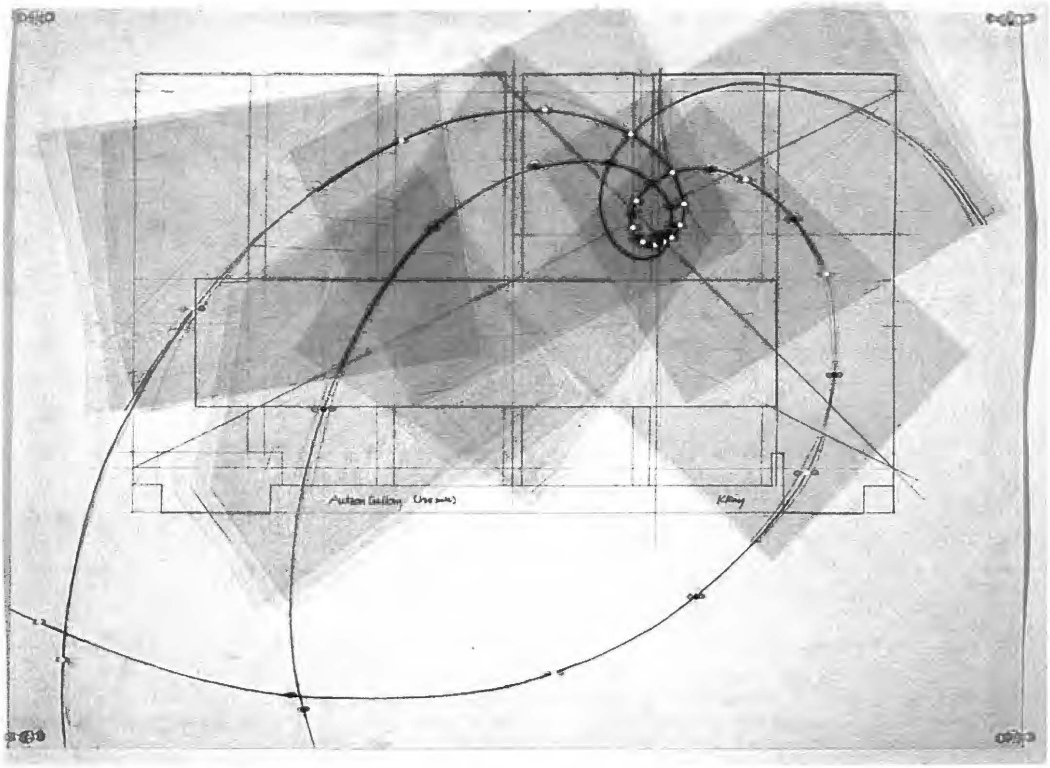


Fig. 5 Floor Plan (a)

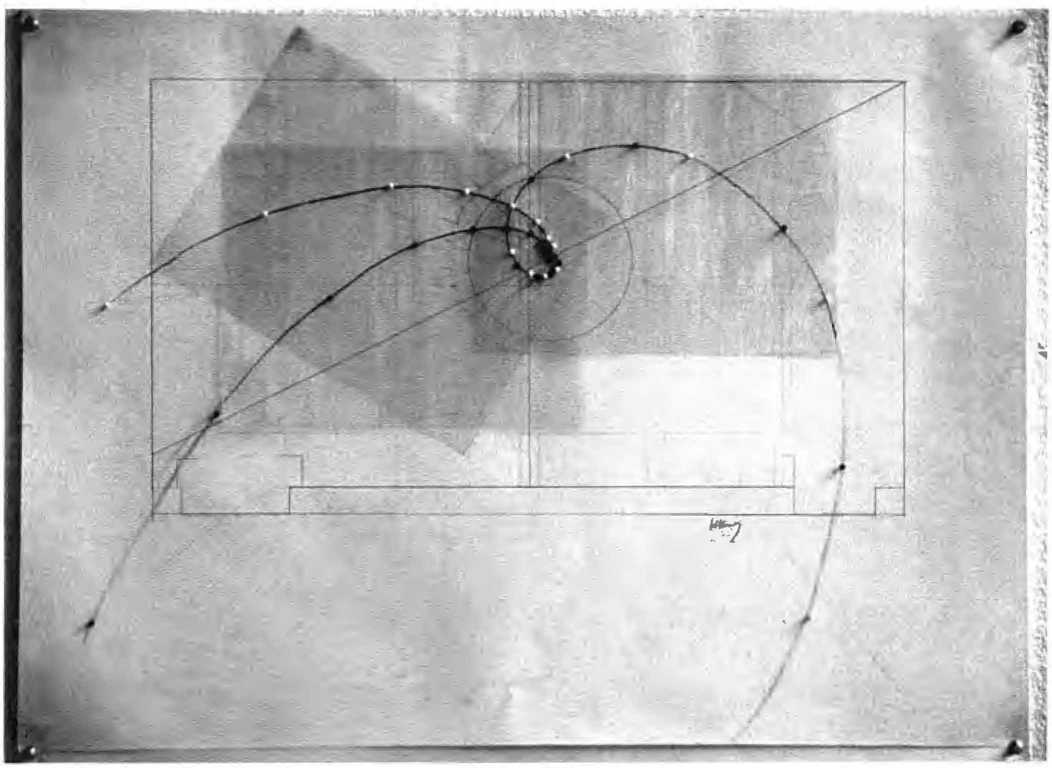


Fig. 6 Floor Plan (b)

Conclusion

My thesis exhibition, *Spira Mirabilis*, (Autzen Gallery, Portland State University, May 13-29, 1998) comprises fifty ropes; some black and some white, all one-quarter-inch in diameter, stretching vertically from the 17-foot ceiling, and fixed in a T-nut at the floor (frontispiece, figs. 7-14). A bank of windows, which begins four feet off the ground, constitutes one long wall of the 25-foot-by-48-foot gallery. A double-door entrance and an emergency exit are on the west and east ends of the long, facing wall. The sequence of ropes reiterate a figure formed by three intersecting spirals, lines drawn with graphite pencil on the floor and which appear to emanate from a single point in the center of the room.

Two of the spirals curve counterclockwise toward the double doors and are identical in shape, while the third curves clockwise in a more tightly wound spiral toward the exit. The ropes are sparse at the periphery of the room, and more densely spaced toward the center. They are fixed at specific points that establish the radial progression inherent in the growth system on which the figure is based.

A diagonal line runs corner-to-corner through the center point of the figure, and the central area is enclosed by a circle with a radius equal to my height (or unity). Six knots in the ropes, three black and three white, denote those points of a vertical progression that both correspond to human proportion and illuminate how the two progressions (black and white) are physically and conceptually interrelated (figs. 9, 10).

The twin spirals are generated on a rotational angle of 15° but with two different (but related) sets of radii which correspond to the two progressions: the primary system (height-based) is laid with black rope and the secondary system with white (figs. 7, 8). Although the radial growth of the third spiral is based on the same two numerical progressions, the rotational growth occurs over 45° instead of 15°. That is, both sets of radii map onto the third spiral which is generated by a rotation of 45° between radii (of either the black or white systems separately) and thus constructs a tighter curve (figs. 11, 12).

The complex ceiling structure (fig. 13), which I perceived throughout the development of the piece as a limitation of the space, became integral in how the final form took shape, and ultimately effected a site-specific reading which I had not previously imagined. Responding to the discourse overhead, visitors marveled at how well the installation fit into the architecture of the gallery.

Aesthetic, conceptual, and philosophical questions about the implied vertical progression lingered: to knot or not to knot? Should the entire vertical progression have been installed, either with knots or some other material? Should there be any knots at all? Are they excessive in number? This feature continued to evolve over the duration of the exhibition. I reduced the total number of knots from ten to six, when I realized that six was the maximum number required to establish a relationship between body harmonies and the three curves. And lastly, I installed the entire vertical progression for the final day of the exhibition. Simply tagging the ropes with (black or white) cable ties both established a visual context for the knots, and softened the vertical thrust by pulling the focus back down toward the central apex (fig. 14).

Spira Mirabilis is contemplative, peaceful, tranquil. It asserts its form without being imperious. It is symmetrical in its asymmetry, intensely vertical but not oppressively so. The spiral figure does not set up a barrier, nor does it coerce motion. It is rather like a permeable membrane: the rhythm of lines and curves guides one around and through, without enclosing space. Many visitors come to rest momentarily by the windows where the space is compressed into an ambulatory corridor. One visitor said that they felt as though they were being lifted up. Another said that being in the room was reminiscent of a Zen garden. As a way station on the journey toward enlightenment, *Spira Mirabilis* embraces the moment: it simply is.

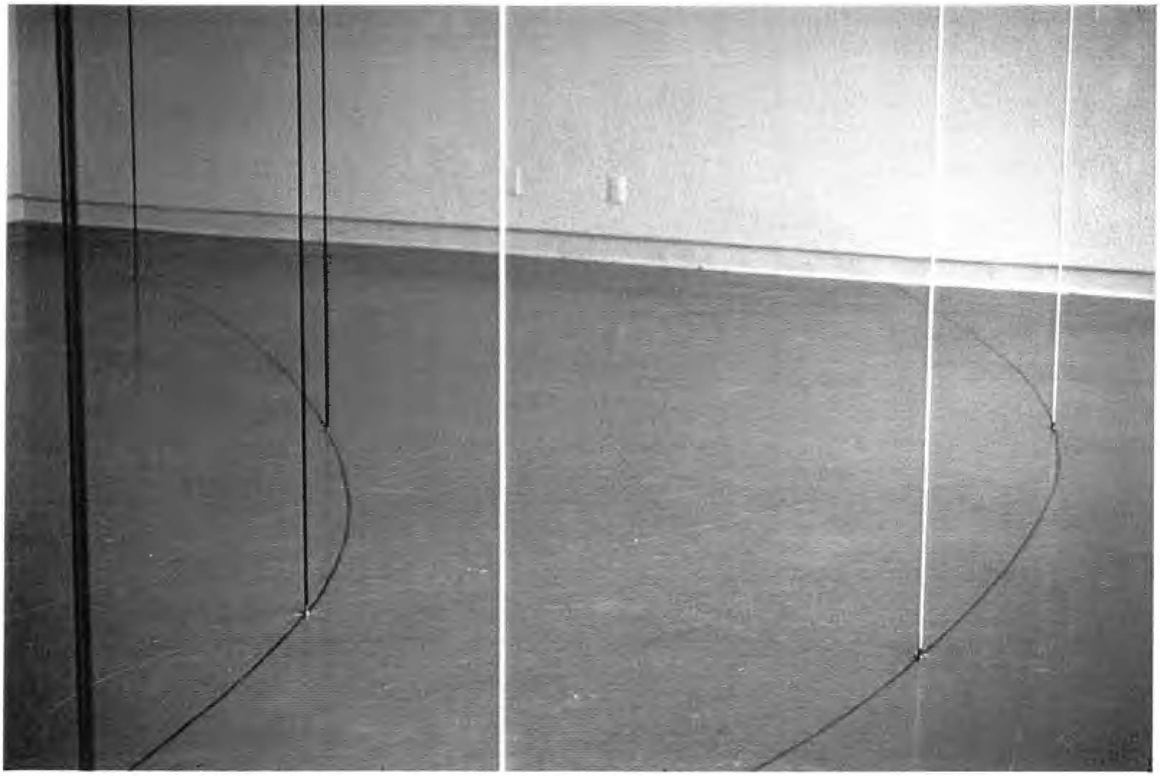


Fig. 7 *Spira Mirabilis,* west view, 15° spirals

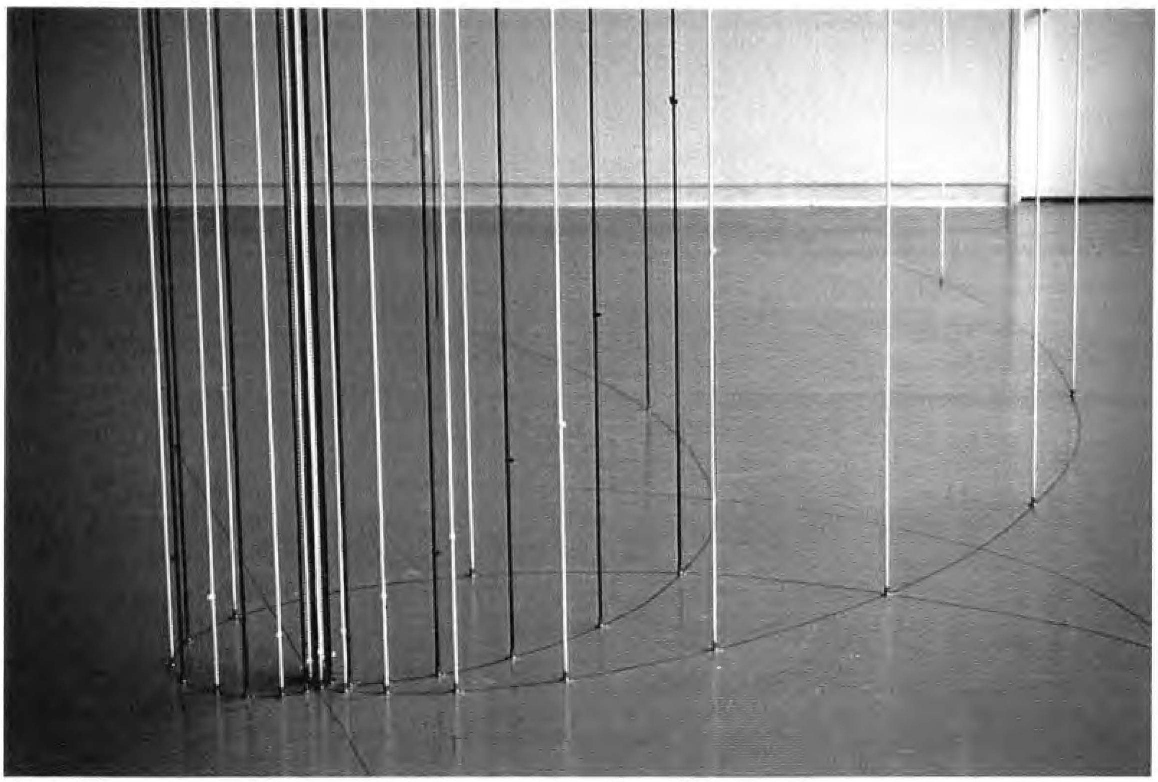
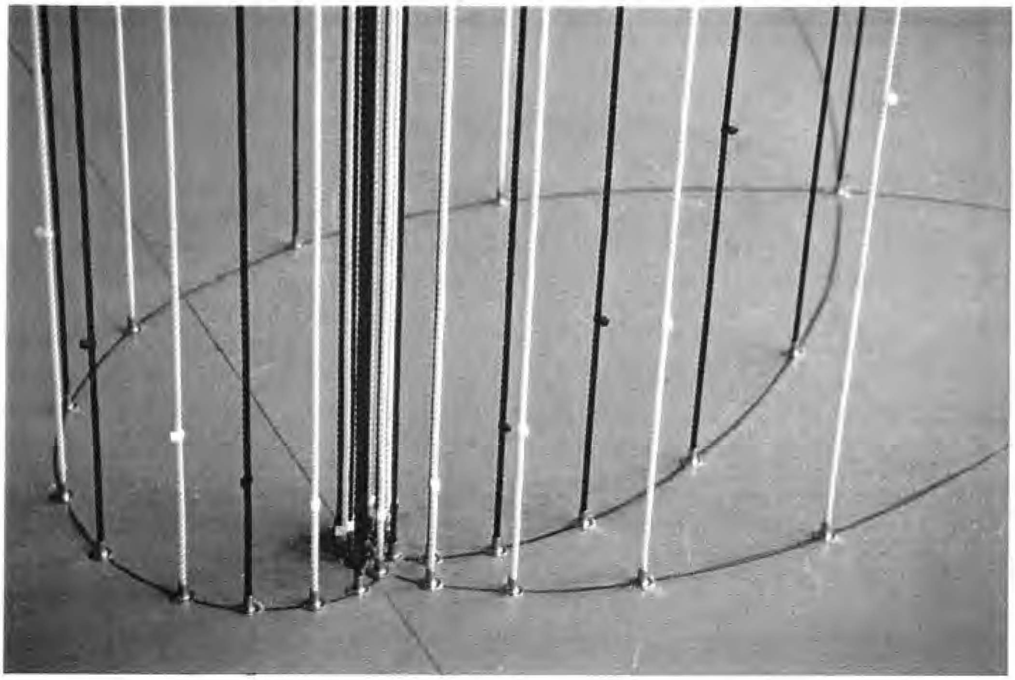


Fig. 8 *Spira Mirabilis,* west view



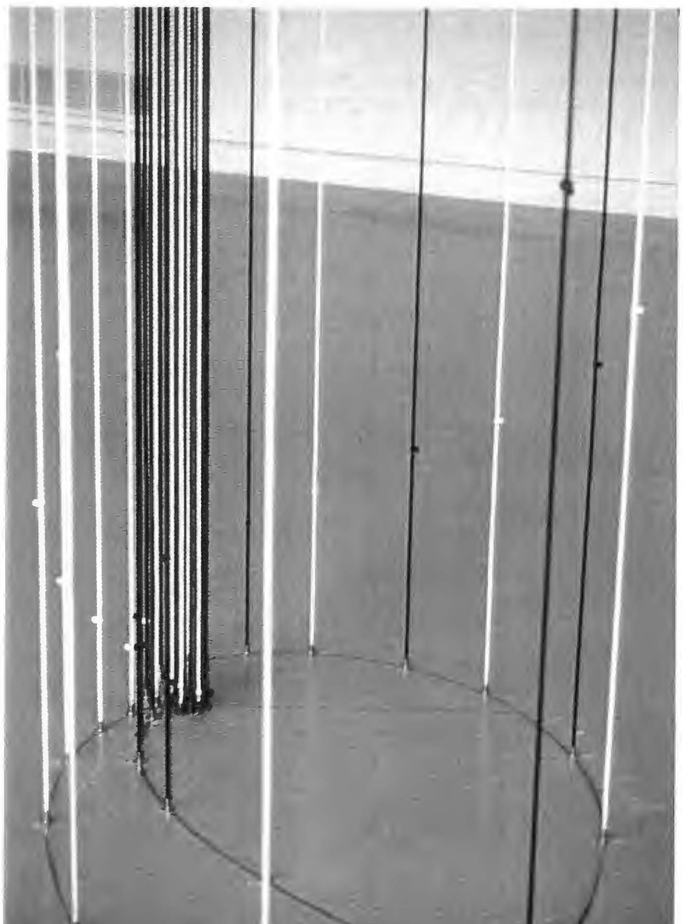
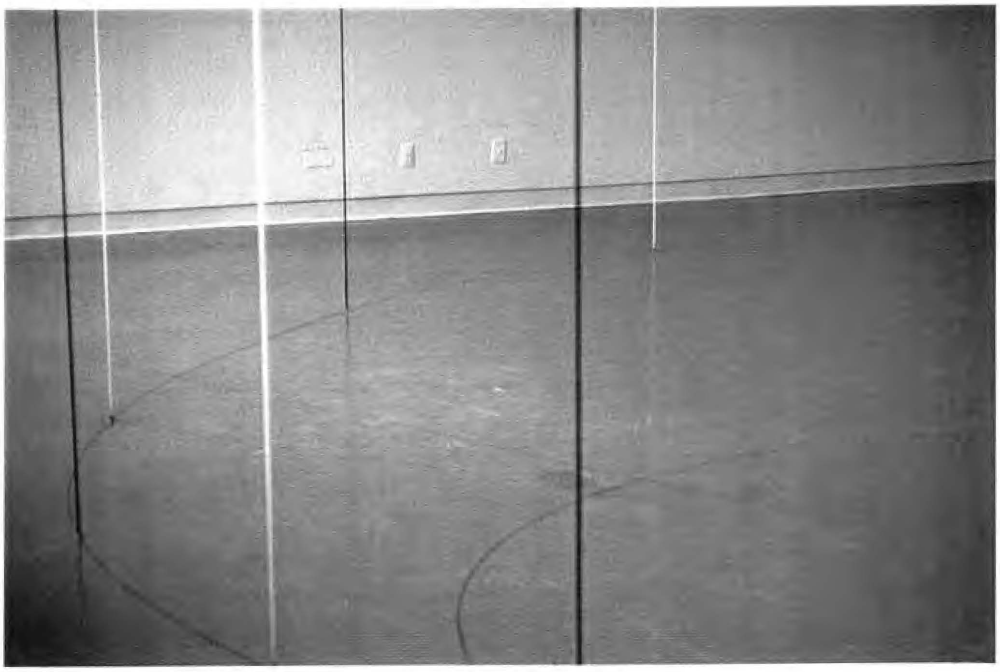


Fig. 9 *Spira Mirabilis*, detail of center

Fig. 10 *Spira Mirabilis*, south view



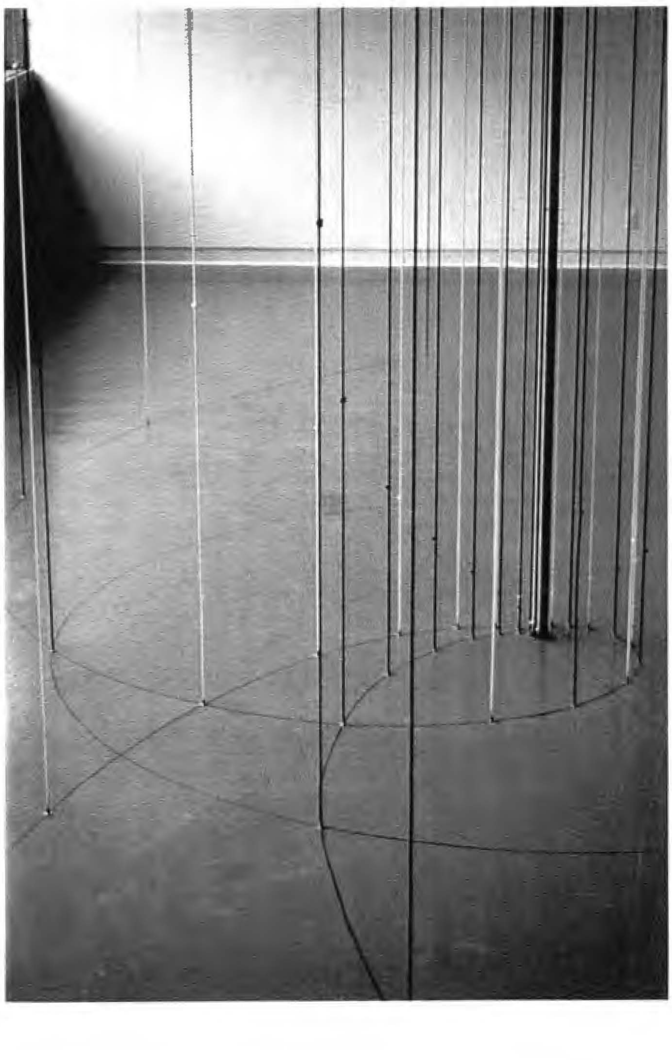
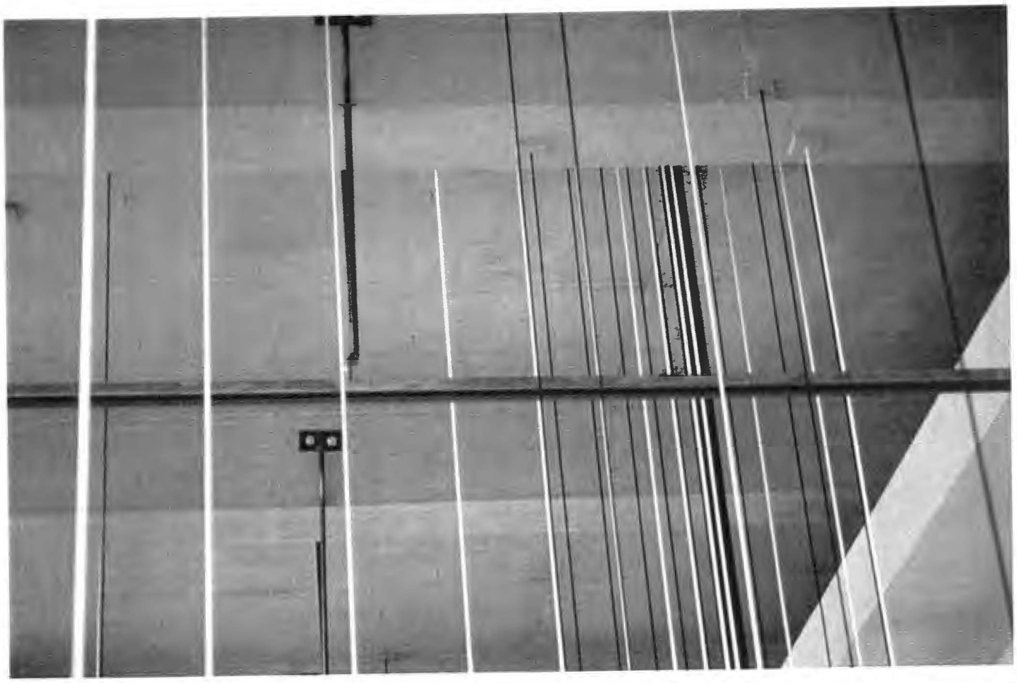


Fig. 11 *Spira Mirabilis,* east view, 45° spiral

Fig. 12 *Spira Mirabilis,* east view (a)



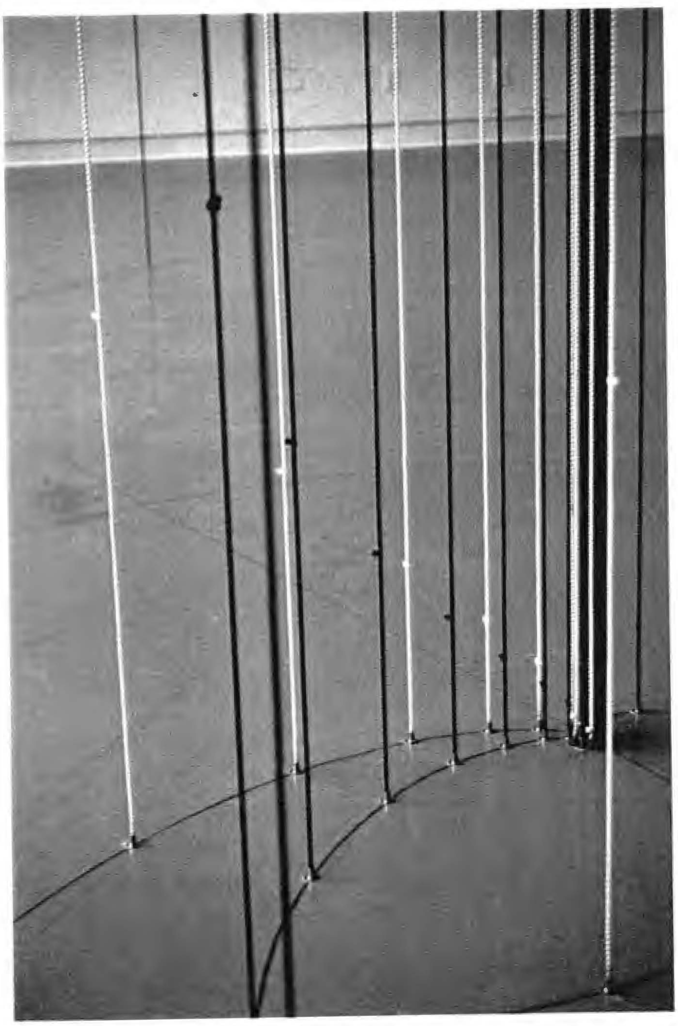


Fig. 13 *Spira Mirabilis*, central ceiling view

Fig. 14 *Spira Mirabilis*, east view (b)

Bibliography

Alberti, Leon Battista, *On Painting*, trans. John R. Spencer, Yale University Press, 1956.

Ashton, Dore, *Twentieth-Century Artists on Art,* Pantheon Books, New York, 1985.

Cohen, Jack, and Ian Stewart, *The Collapse of Chaos: Discovering Simplicity in a Complex World*, New York, Viking Press, 1994.

Doczi, György, *The Power of Limits: Proportional Harmonies in Nature, Art and Architecture*, Shambala Publications, 1981.

Douady, Stéphane, and Yves Couder, "Phyllotaxis as a Physical Self-Organized Growth Process," *Physical Review Letters*, vol. 68, 1992, page 2098-2101.

Dürer, Albrecht, *The Writings of Albrecht Dürer*, trans. and edited by William Martin Conway, Philosophical Library, 1958.

Grant, Michael, *The Ancient Mediterranean*, Charles Scribner's Sons, 1969.

Guedj, Denis, *Numbers: The Universal Language*, Harry N. Abrams, 1997.

Lawlor, Robert, *Sacred Geometry: Philosophy and Practice*, Thames and Hudson, 1992.

Le Corbusier, *Towards a New Architecture,* Dover Publications, New York, 1986.

MacDonald, William Lloyd, and John A. Pinto, *Hadrian's Villa and Its Legacy*, Yale University Press, 1995.

McKay, Alexander, *Vitruvius, Architect and Engineer: Buildings and Building Techniques in Augustan Rome*, Bristol Classic Press, 1985.

Newman, James R., *The World of Mathematics, Volume One,* Simon and Schuster, 1956.

Panofsky, Erwin, *The Life and Art of Albrecht Dürer*, Princeton University Press, 1955.

Purce, Jill, *The Mystic Spiral,* Thames and Hudson, New York, 1974.

Stewart, Ian, *Nature's Numbers: The Unreal Reality of Mathematics*, BasicBooks, 1995.

Strauss, Walter L., *The Complete Drawings of Albrecht Dürer, Volume 5—Human Proportions*, Abaris Books, New York, 1974.

Suzuki, Shunryu, *Zen Mind, Beginner's Mind,* Weatherhill, New York, 1970.

Taylor, Harold, *Art and the Intellect*, Museum of Modern Art, New York, 1960.

Vitruvius, *The Ten Books on Architecture*, trans. by Morris Hicky Morgan, Dover, 1960.

Waldrop, M. Mitchell, *Complexity: The Emerging Science at the Edge of Chaos*, Simon and Schuster, 1992.