

Hyperseeing

The Newsletter of the International Society
of the Arts, Mathematics, and Architecture.

www.isama.org

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**Keizo Ushio, Möbius in Space, 1990, African black granite,
h 2 x w 2 x d 1 m, Mihama Fukui, Japan. 1990.**

Möbius in Space is a granite Möbius band that has been divided down the center and remains in one piece. The drilled central space has a half-twist since the band has a half-twist. Hence the drilled space is a Möbius space. Thus the form-space sculpture is a Möbius band enclosing a Möbius space.

September 2006

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Introduction to ISAMA and Hyperseeing

Nat Friedman

History

The unity of art, mathematics, and architecture is ancient and can be seen in a seashell. A seashell is an abode that is also an ingenious spiral form-space sculpture. Seashells also display a variety of beautiful two-dimensional designs on curved surfaces. Thus the unity of art, mathematics, and architecture was already genetically encoded in these early life forms. The modern architect Frank Lloyd Wright applied the seashell spiral form when designing the Guggenheim Art Museum in New York City.

During the Renaissance there was no separation between art, mathematics, and architecture. This relationship also resulted in a mutual enrichment of these fields. The development of this relationship in the present influenced the founding of ISAMA in 1998, which was also motivated by an annual series of conferences at the University at Albany-SUNY, 1992-1997, and the University of California, Berkeley, 1998, co-organized with Carlo Sequin. Relatively recent examples of the interrelationship between art, mathematics, and architecture are discussed in the following paragraphs.

The Visual Mind, edited by Michele Emmer and published by M.I.T. Press, 1993, is an excellent book containing articles relating art and mathematics. The Visual Mind 2 was published by M.I.T. Press in 2005. Emmer's title is succinct since I believe that it is the visual mind that unifies art, architecture, and mathematics. In many ways, mathematics is based on visual thinking, just as art and architecture are. Moreover, mathematical forms may also be viewed as sculptures, as in the photographs of Hiroshi Sugimoto in the article *Reimagined Math* (New York Times Magazine, December 5, 2004). In his series of photographs "Mathematical Forms" he directs sensitive lighting on white plaster geometric models to enhance these forms and obtain beautiful images.

Mathematical concepts can also be seen to generate modern art forms as in the works of Max Bill, Agnes Denes, Maurice Escher, Naum Gabo, Sol Lewitt, Charles Perry, Dorthea Rockburne, and Arthur Silverman. Furthermore, the recent *Torqued Ellipses* and *Torqued Spirals* by Richard Serra are leading edge steel sculptures based on the mathematical idea of forming a volume by rotating an elliptical cross-section. Serra has also created form-space sculptures that combine surfaces with spherical curvature and surfaces with hyperbolic curvature. There is a monumental permanent exhibit, *The Matter of Time*, consisting of eight of these Serra sculptures at the Guggenheim Art Museum in Bilbao, Spain designed by Frank Gehry. Anish Kapoor has recently created monumental surfaces based on topological transformations such as *Taratantara* and *Marsyas*. Thus major contemporary art has been generated from mathematical concepts.

Present contemporary architecture may also be described as functional sculpture as in the works of Santiago Calatrava, Sir Norman Foster, Frank Gehry, Zaha Hadid, and Rem Koolhaas. In particular, Calatrava has combined kinetic sculpture and architecture in his addition to the Milwaukee Art Museum. Foster has designed beautiful curved wall buildings such as Swiss Re in London. A Gehry masterpiece is the Guggenheim Art Museum in Bilbao, Spain. Hadid and Koolhaas have introduced radical new geometric ideas in their architectural concepts. Thus contemporary architecture is influenced by sculptural concepts as well as new geometries.

Purpose

The main purpose of ISAMA is to further interdisciplinary education relating the arts, mathematics, and architecture. In particular, we are interested in developing visual literacy in mathematics with applications to the arts and architecture. We wish to help students learn to see the way a mathematician sees, the way an artist sees, and the way an architect sees. A mathematician sees relationships between curves, surfaces, volumes, and numbers. A painter sees relationships between shapes, colors, and light. A sculptor sees relationships between form, space, and light. An architect also sees relationships between form, space, and light with an emphasis on space and light. We are also concerned with seeing relationships between the arts, mathematics, and architecture. Thus it is all about seeing relationships.

Hyperseeing

Interdisciplinary education is concerned with seeing from multiple viewpoints in a very general sense, which we will refer to as *hyperseeing*. Hyperseeing is a more complete way of seeing. Several examples of hyperseeing will now be discussed in order to emphasize the generality of this concept.

A sculpture is defined as an object placed in a certain position relative to a horizontal plane, which may be the ground or a base. First, one may hypersee a sculpture by walking around it in order to see it from different viewpoints. Sometimes an interesting view of a sculpture is from above, as in the case of Richard Serra's torqued ellipses and torqued spirals. A top view is possible if one can look down on the sculpture from a balcony. If the sculpture is outdoors, then natural light also effects the perception of the sculpture so the time of viewing is also significant. Thus to hypersee an outdoor sculpture, it has to be seen at different times as well as from different viewpoints.

Second, one may hypersee an object by placing it in multiple positions, such as horizontal or vertical, thereby obtaining multiple sculptures. Sculptures consisting of the same object in different positions are said to be *congruent*. For certain objects, congruent sculptures can appear quite different. That is, one may not recognize that each sculpture is the same object in a different position. A *hypersculpture* is a set of congruent sculptures. Thus a hypersculpture is a more complete presentation of the sculptural possibilities of an object. For examples of hypersculptures, see *Attitudes* by Arthur Silverman, <http://math.albany.edu/math/pers/artmath/art/vm5-hhsc/> and *Rashomon* by Charles Ginnever, <http://math.albany.edu/math/pers/artmath/art/vm7-hhkms/> These two articles were originally published in Bridges Proceedings and also appear at Vismath, www.mi.sanu.ac.yu/vismath/

There is also Richard Serra's hypersculpture $4 \times 5 \times 6$ at Colby College in Waterville, Maine, www.colby.edu/academics_cs/museum_of_art/collections/serra/ This hypersculpture consists of three congruent sculptures where the common object is a forged rectangular steel block of dimensions 4 ft by 5 ft by 6 ft.

One may hypersee a ballet from the main floor or the balcony. From the main floor one can see the dancers in striking split-second poses, which can be seen as split-second figurative sculptures. Photographs can record these sculptures, as in Paul Kolnik's photographs of the New York City ballet, see www.paulkolnik.com . Thus through the medium of photography, one can also see dance from the viewpoint of figurative sculpture. From the balcony, one can see the interesting geometry of the choreography as in the case of George Balanchine's ballets. Thus one can also see dance from the viewpoint of dynamic geometry.

The choreographer Merce Cunningham creates modern dances for a circular stage where the audience sits 360 degrees around and there is no stage front. Thus the dance appears

differently depending on where the viewer is sitting. A viewer would have to see the dance repeated from different seating locations to gain a more complete appreciation of the dance, which would be hyperseeing the dance.

In mathematics, one can study a subject such as knots from the different viewpoints of algebra, geometry, and combinatorics. One can also see knots as curved woven patterns as in the case of Celtic knots. Knots are three-dimensional curves in space and can also be viewed as forms for sculptures. This is the case in works by José de Rivera, John Robinson and Wendy Taylor. Thus one can hypersee knots from mathematical viewpoints as well as artistic viewpoints.

Hyperseeing architectural works requires viewing them from interior viewpoints as well as exterior viewpoints. This can be a profound experience in relating architectural form and space. For example, this is the case in hyperseeing the buildings in Santiago Calatrava's City of Arts and Sciences in Valencia, Spain. Another memorable experience is hyperseeing the Swiss Re building in London designed by Sir Norman Foster. These buildings are truly examples of sculptural architecture.

Certain geometric sculpture can be seen as abstract architecture. For example, there are the monumental concrete works of the Basque sculptor Eduardo Chillida that enclose space such as *Homage to the Horizon* in Gijon, Spain and *Homage to Tolerance* in Sevilla, Spain. Hyperseeing architectural sculpture also requires viewing from exterior and interior viewpoints.

News.

Bridges 2006

The conference Bridges 2006 was held in London, August 4-9, 2006, and was a total success. Once again Reza Sarhangi, John Sharp and the editorial staff produced a substantial Proceedings. John Sharp, Phillip Kent and the organizational staff in London produced an exciting program. There were excellent talks and a variety of interesting excursions. Rob Fathauer mounted an excellent exhibit. Anne Burns produced a beautiful website for the exhibit at <http://myweb.cwpost.liu.edu/aburns/bridges06/bridges06.html> If you were not able to attend, I suggest you peruse the Bridges website, as well as the websites of the speakers, which are rich in images and information. For a review of Bridges London, see www.plus.maths.org/latestnews/may-aug06/bridges/index.html

We look forward to Bridges 2007, which will be held in San Sebastian, Spain (see announcements).

International Congress of Mathematics (ICM), Madrid

The ICM was held in Madrid, August 22- 30, 2006. Our favorite Japanese sculptor Keizo Ushio carved a divided granite torus at the conference. This sculpture is similar to the

sculpture Keizo carved at ISAMA 99 in San Sebastian, Spain. Keizo's website is www2.memenet.or.jp/~keizo/

Javier Barrallo has organized a virtual art exhibit for ICM, which can be seen at www.divulgamat.net/weborriak/Exposiciones/ArteMate/Perry/artemate.asp There are a large number of interesting art works at this website. In particular, there are works by artists who have spoken at ISAMA conferences such as Doug Peden, Charles Perry, and Keizo Ushio.

Journal of Mathematics and the Arts

Due to the energy of Gary Greenfield, the art-math tribe now has the Journal of Mathematics and the Arts (JMA). Gary Greenfield is the editor and JMA will be published by Taylor and Francis of England. JMA is a peer - reviewed journal that focuses on connections between mathematics and the arts. For information, see www.tandf.co.uk/journals/titles/17513472.asp

Conference Announcements.

Joint Meeting of the MAA and AMS in New Orleans

The annual joint meeting of the MAA and AMS will be held in New Orleans January 4-8, 2007. Fortunately, New Orleans is the home of the sculptor Arthur Silverman whose work is based on the tetrahedral form. Arthur has spoken at several of the Art-Mathematics conferences in Albany, Berkeley, and San Sebastian. Here is the announcement concerning Arthur's talk and studio visit.

Arthur Silverman: Tetrahedral Variations.

Arthur Silverman graduated from Tulane Medical School in 1947 and pursued a highly successful career as a surgeon in New Orleans. He retired from his medical practice while in his fifties in order to concentrate on an earlier passion for sculpture. He was attracted to geometric sculpture and became infatuated with the tetrahedron. He has produced more than 300 sculptures based on the tetrahedron, predominately in stainless steel or aluminum (see www.artsilverman.com). His signature work is a pair of tetrahedrons, each 10 ft by 60 ft in front of the Energy Center in downtown New Orleans. There are twenty of his sculptures in public buildings and outdoor areas in New Orleans. A map showing locations of the sculptures will be available at the Art Exhibit. Arthur Silverman will be giving a talk Tetrahedral Variations on Saturday at 6 pm at the Marriott. A studio visit is also being planned for Sunday at 6 pm. If you plan to visit the studio, please contact Nat Friedman: artmath@math.albany.edu

Mathematics and Culture

Mathematics and Culture-Convegno “ Mathematica and Cultura 2007”, Venice, Italy, March, 2007, organized by Michelle Emmer. Information will appear at www.mat.uniroma1.it/venezia2007.

Bridges 07

Bridges 07 will be held at the University of the Basque Country in San Sebastian, Spain July 24-27, 2007. Javier Barrallo will be the main organizer in San Sebastian. Javier has already organized two wonderful conferences in San Sebastian. Namely Mathematics and Design in 1998 and ISAMA 99 in 1999. San Sebastian is a beautiful city on the northern coast of Spain in the Basque country. Dorm rooms with private bath will be available at a very reasonable cost that includes breakfast. There will be an excursion to Bilbao to see the Guggenheim Art Museum, as well as an excursion to Zabalaga, the sculpture park of Eduardo Chillida, outside San Sebastian. This conference will differ from the 1998 and 1999 conferences in that you will NOT have your own bottle of wine at lunch. Thus the afternoon sessions are expected to be better attended!! Alas, some conferees will no doubt end up asleep on the beach. Watch the Bridges website for information.

Nexus V11, 2008

Nexus V11: Relationships between Architecture and Mathematics is organized by Kim Williams and will be held in June, 2008. For information, see www.nexusjournal.com

Exhibits.

Richard Serra. There is an exhibit of sculptures by Richard Serra at the Gagosian Gallery in Chelsea at 555 West 24th St, NYC, until September 23. In particular, there is a hypersculpture Equal Weights and Measures consisting of six congruent sculptures, where the common object is a forged steel rectangular block of dimensions 4'3" x 5'3" x 6'3". See www.gagosian.com/current/exhibitions/&gid=2

Omi Sculpture Park. Omi Sculpture Park is an outdoor sculpture exhibit. It is located near Ghent, NY and information is at www.artomi.org. Presently there are several geometric sculptures by Charles Ginnever including a hypersculpture *Transitions for Thelonius Monk* consisting of three congruent sculptures. Images are on the preceding website under Past Exhibitions. There are also impressive geometric sculptures by Bernard Venet and Tony Milkowski.

Illinois Institute of Technology, Chicago. ISAMA member Richard Krawczyk is the Gallery Director of the Kemper Room Art Gallery, Paul V. Galvin Library. Amy Lee Segami will exhibit paintings, September 21-November 4. There will also be a group exhibit of architecturally inspired furniture in the Paul V. Galvin Library titled Form Follows Form, September 21- October 28. Further information is at art@iit.edu

Communications.

This section is for short communications such as recommendations for artist's websites, links to articles, queries, answers, etc.

Artists websites.

Eva Hild. Eva Hild is a Swedish ceramic sculptor who works in porcelain. Part of her work consists of sculptural forms that are very reminiscent of minimal surfaces, although her motivation was really personal experiences. See www.2hild.com/eva_eng_ceramics.htm

Greg Johns. Greg Johns is an Australian sculptor who has produced significant geometric and figurative sculpture. His geometric sculpture concentrates on open and closed curved forms including knots. See www.gregjohnssculpture.com

Books.

The sixth Nexus conference took place in Genoa, Italy in June. The book *Nexus VI: Architecture and Mathematics* is now available from Kim Williams Books at www.kimwilliamsbooks.com

The Proceedings of Bridges 2006 discussed above is available from Rob Fathauer at www.mathartfun.com

As the Eye Moves, photos by David Finn, text by Donald Hall, comments by Henry Moore, Abrams, 1973. This book is a photographic study of the Henry Moore three-piece reclining figure *Bridge Prop*. The range of photos is a lesson in hyperseeing a single sculpture. Finn is a master photographer of sculpture. In particular, one learns to appreciate detail images as well as overall images. The book may be seen in libraries and copies are available at www.amazon.com

Resources.

See Kim Williams website www.kimwilliamsbooks.com for previous Nexus publications on architecture and mathematics.

See Rob Fathauer's website www.mathartfun.com for art-math products including past issues of Bridges Proceedings.

The electronic journal Vismath, edited by Slavik Jablan, is a rich source of interesting articles, exhibits, and information. See www.mi.sanu.ac.yu/vismath/

We remind readers that the Directory at www.isama.org is also a rich source of links to a variety of works.

