HYPERSEEING

Newsletter of the International Society of the Arts Mathematics and Architecture

www.isama.org

Arthur Silverman, Twin Tetrahedra, 1986,
Stainless steel, 60 x 10 ft each, Energy Center, New Orleans.

Hyperseeing

October, 2006

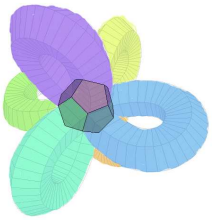
Previews

Previews are short 1-3 page articles that may be ideas for longer articles.

TOPOLOGICAL SCULPTING: *PLATONIC HANDLES*

Ergun Akleman

I created the structure shown in Figure 1 to demonstrate the power of multi-segment curved handles [1] by connecting neighboring faces of a dodecahedron with handles. I later used the same structure as an intermediate shape to create more complicated high genus sculptures. These were recently exhibited in both Siggraph and Bridges art shows.



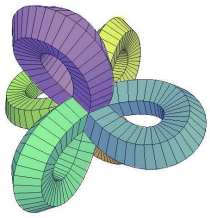
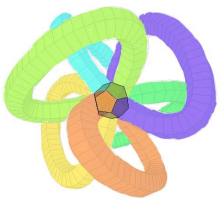


Figure 1. *The dodecahedral handle structure that I constructed by connecting neighboring faces of a dodecahedron with handles.*



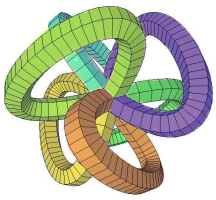


Figure 2*. Hernan Molina's dodecahedral handles sculpture constructed by connecting non-neighboring faces of a dodecahedron with handles.*

I quickly realized that it is possible to create similar intermediate structures by connecting neighboring faces of any platonic solid such as tetrahedron, octahedron or cube. I show these structures in my computer aided sculpting courses as examples of intermediate structures to create more complicated high genus sculptures.

One of greatest joys in teaching is that a student gets a surprising result every once in a while. This fall semester I had such an experience during the early days of a computer aided sculpting course. Hernan Molina, an Architecture master student, showed me a very interesting high genus sculpture. I initially thought that he used a completely different approach than mine. He said that he, in fact, used a similar approach by first creating an intermediate structure that is constructed by connecting faces of a dodecahedron with handles. I asked to see the intermediate structure. What I saw was a structure that looks significantly different than mine (see Figure 2). It turned out that Hernan has connected non-neighboring faces without allowing any self-intersection of handles.

Hernan's discovery motivated me to closely investigate these intermediate structures. I first realized that there was a need for an identifying name for these structures. I call them Platonic handles as the most appropriate name. As the name implies, a dodecahedral

handle is an intermediate structure created from a dodecahedron or a cubical handle is an an intermediate structure created from a cube by connecting the faces with handles.

I quickly discovered that mine and Hernan's dodecahedral handles are the only symmetric ones that can be created from a dodecahedron. I also found that there exist three different octahedral handles. It is easy to prove that there is only one tetrahedral handle. There exist two types of cubical handles. I have not enumerated all possible cases for icosahedral handles yet. It is also possible to create non-symmetric platonic handles. To analyze the similarities and differences between the two structures, I use Schegel diagrams (see Figure 4).

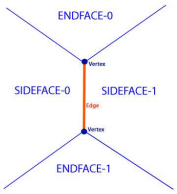


Figure 3. *An edge that connects two 3-valent vertices.*

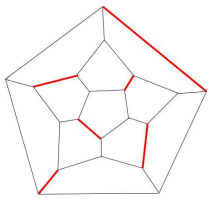
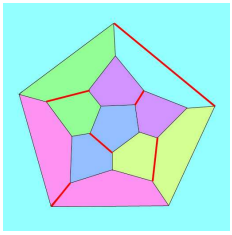


Figure 4. *Edge selection shown on Schegel diagram of a dodecahedron.*



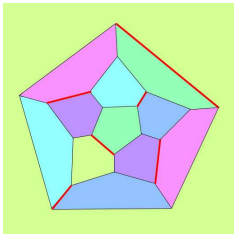


Figure 5. *The faces to be connected with the same colors on Schegel diagram for my and Hernan's construction.*

Here, I will briefly discuss dodecahedral handles. Since all vertices are valent-3 for dodecahedrons, each edge of a dodecahedron will have four surrounding faces that can be classified as two side-faces and two end-faces as illustrated in Figure 3. It is interesting to note that my construction connects two side-faces of a given edge and Hernan's construction connects two end-faces of an edge. So, the problem of selecting the faces to be connected reduces to a problem selecting a set of edges.

There is a unique solution to this selection problem. The solution set is shown in Figure 4 as orange edges. It is also possible to develop a simple procedure to select this set of edges. The following procedure uniquely defines the set of six edges based on the selection of the first edge.

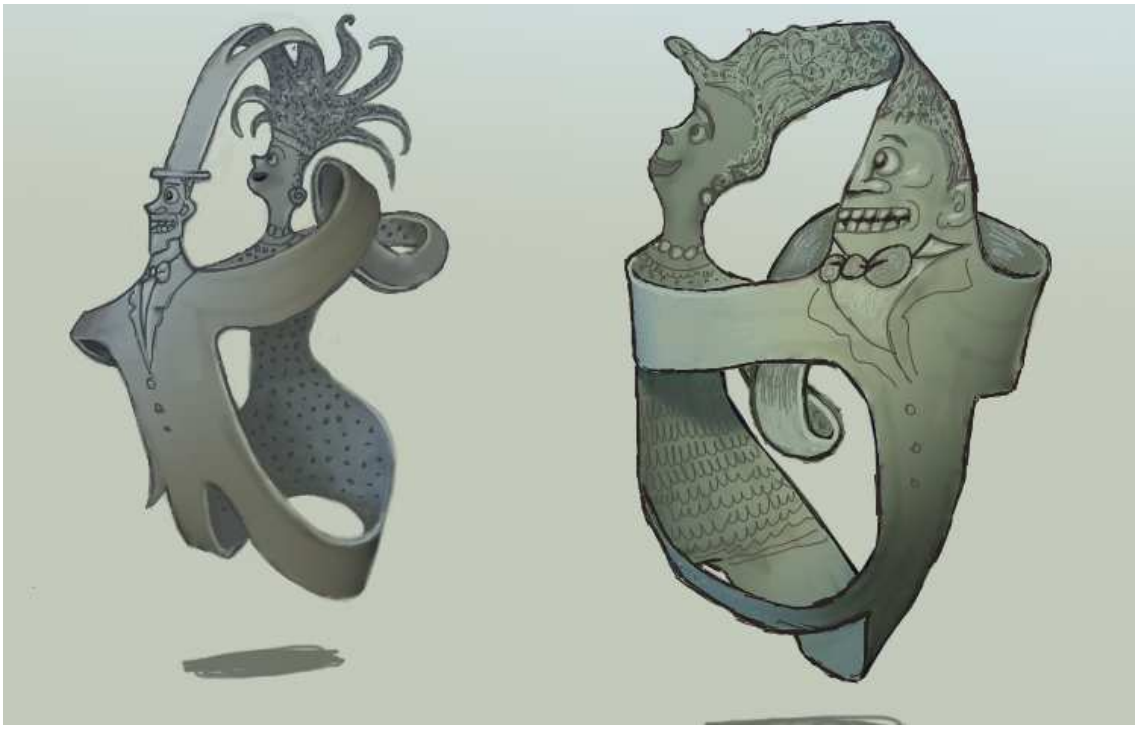
1. Select one edge.
2. Go to the end-faces of the selected edge.
3. Walk counter clockwise and select the third edge in each face.
4. Go to 2 until 6 edges are selected.

After the selection, as shown in Figure 5, if one connect two side-faces for each selected edge with an handle, my dodecahedral structure is obtained. On the other hand , If two end-faces are connected with an handle, one can obtain Hernan's structure. If you want to construct platonic handles, download Topological Mesh Modeling software, *TopMod*. from my website [2]. Try to create all possible platonic handles. For further clues check out the second project of my computer aided sculpting course at the course website [3].

References

1. V. Srinivasan, E. Akleman and J. Chen, "Interactive Construction of Multi-Segment Curved Handles", *Proc, Pacific Graphics 2002*, pp. 429-435, 2002.
2. http://www-viz.tamu.edu/faculty/ergun/research/topology/download.html
3. http://www-viz.tamu.edu/courses/viza657/06fall/projects/pr02.php

Cartoons



News.

International Congress of Mathematics (ICM), Madrid. Keizo Ushio.

Keizo Ushio was commissioned to carve a sculpture this past August at ICM-Madrid. Grupo Santander sponsored the commission. Keizo carved a divided torus in granite. The completed sculpture is shown below. First Keizo had to carve a torus out of a granite block. Then he had to drill through the torus along a circular cross-sectional diameter line. This diameter line rotated 360° as the cross section chosen for drilling moved 360° around the torus. The drilled lines are close enough together to allow the torus to be separated into two halves, which are then positioned as shown. For additional photos, see Keizo's website keizo@memenet.or.jp

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Keizo Ushio, Oushi Zokei ICM Madrid 2006,
Indian black granite, 171h x 140w x 140 d cm.

Keizo in cap at front and friends.

Higher Dimensions Symposium

Beth Whiteley attended the symposium described below and contributed the following summary.

Notes of Higher Dimensions Symposium

Elizabeth Whiteley

The Misher Symposium, titled, "In the Eye's Mind: Visions of Higher Dimensions in Art, Math, and Science", was held on October 16 at the University of the Sciences in Philadelphia. There were six speakers:

Linda Dalrymple Henderson, University of Texas at Austin, presented various approaches of artists toward the fourth dimension in the 20th century. Her definitive text, *The Fourth Dimension and Non-Euclidian Geometry in Modern Art*, is being expanded and re-published in 2008.

Thomas Banchoff, Brown University, concentrated on Salvador Dali. Dali aspired to merge art and science and religion with his use of hypercubes, stereoscopic films, references to catastrophy theory, etc. in his artworks. For more information, see http://www.dalidimension.com.

Peter Rose, University of the Arts, Philadelphia. His short films are devoted to alternative models of meta-dimensional thinking. For examples of his work with

diachronic motion, bending time and space, spatializing time, etc. you can view some of his films at http://www.peterrosepicture.com.

Tony Robbin, studio artist, New York, illustrated his talk about how to draw projective pictures of spacetime, quantum spacetime, and Lorenz transformations with present and past uses of the slicing model. His latest book, *Shadows of Reality: the Fourth Dimension in Relativity, Cubism, and Modern Thought*, was published in May of 2006.

J. Scott Carter, U. of South Alabama, titled his talk "Beyond the Fourth Dimension: Visualizing Information in the N-Cube with the Aid of Computer Software". He used Mathematica 5.0.

Satyan Devadoss, Williams College, emphasized the possibilities for collaboration between artists and mathematicians in the areas of tiling and symmetry, surfaces, polyhedra, and other mathematical ideas which can be conveyed through visualization.

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**

Announcements

ISAMA'07, Texas A&M University, May 18-21, 2007.

Thank you much to Ergun Akleman for arranging for Texas A&M University, College Station, Texas to host ISAMA'07 at the College of Architecture, May 18-21. There will be a Proceedings with an electronic submission process and an exhibit. There is a hotel on campus, as well as dorm facilities. There is also an airport in College Station serviced by several airlines. Relevant information will be on the website **http://archone.tamu.edu/isama07/**

For four days Texas A&M will be Texas Arts and Mathematics!!

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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 (see cover page). 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

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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 Donostia

Mucho congratulations to Reza for the **tenth** annual Bridges Conference, Bridges Donostia, to be held at the University of the Basque Country in San Sebastian, Spain, July 24-27, 2007. Donostia is the Basque name for San Sebastian. 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

Traveling Exhibit

There is a traveling exhibition organized by Claude Bruter, which is described by him in the following article. I found his use of English rather poetical and tried not to modify his text very much.

An Exhibition of Mathematical Art

Claude P. Bruter
bruter@univ-paris12.fr

A work of art is initially a representation. It carries the mark of who has built it. It has a significance.

As a representation, a work of art can simply reveal a share of the intrinsic architecture of the universe. This revelation surprises and delights. It to some extent makes vibrate, as by resonance, the sensitive cords of the human being which, as a fragile and temporary result of the deployment of this universe, contains some of its fundamental elements, at least in its constitution. It attaches the being with the totality of nature, immerses it in this kind of ocean, which is protective and comforting. The work of art is equipped with an emotional capacity.

Mathematics as a whole is a representation of structural and constitutive data of our universe. It has, in an intrinsic way, the properties of a work of art. Initially drawing from the concrete world what it intends to represent, it forges a symbolic system, which it develops in an apparently autonomous way, whose handling requires the acquisition of an increasingly complex and thorough technicality. Thus developing in an increasingly rich universe but detached also more and more of the immediate materiality, it becomes less and less accessible to the greatest number, which do not practice it. It has the appearance of a monster, cold and disconcerting by its high technicality.

However, it is possible to incarnate this universe symbolic system with the play of colors and matter to generate artistic forms that cause surprise, attract the glance, and arouse curiosity.

It is in this preoccupation with communication, exchange of ideas, and enrichment, which led me to a project where art would reveal parts of the mathematical world, and introduce mathematical ideas in a deferent, delicate, and subtle way. This led to the present exhibit that can be seen at http://hermay.org/ARPAM/palaiseau/index.html created by the painter Jean Constant. All the principal fields of geometry are represented: differential geometry with Patrice Jeener, François Apèry, Jean Constant, and John Sullivan; differential topology with the last three and Thomas Banchoff; dynamic topology with Michael Field; hyperbolic geometry with Irene Rousseau and David Wright; tessellations and polyhedrons with David Austin, Bill Casselman and George Binder; fractal geometry with Jean Francis Colonna and Nat Friedman. In addition there are the spheres of Dick Termes and graphics of Bahman Kalantari.

This is a traveling exhibition which was first shown at the Library of the Poincaré Institute, Jan 24- June 30,05. It has since traveled to the Ecole Polytechnique, July 5-Sept 18, 05; IFUM Bonneuil, Jan 4-16, 06; 7th Salon des Jeux Mathématiques in Paris, May 25-27, 06; and the Media Library of Palaiseau, June 3- Sept 16, 06. It has been at the Lycée Alphonse Daudet in Nîmes, Oct 7-14,06, IREM and Dept. de Mathematiques,University of Montpellier, Oct 17-24, 06; and will be at Institut Français de Thessaloniki, Greece, Nov 6-25, 06.

C.Bruter, Paris.

I'm sure all the contributing artists join me in thanking Claude Bruter for all of the work he has done in making this exhibition so successful.

Two Americans in Paris: Kenneth Snelson and George Rickey

"Two Americans in Paris" is a sculpture exhibition showing the work of the eminent sculptors Kenneth Snelson and George Rickey. The exhibition is at the Gardens of the Palais Royal in Paris, October 24- December 15, 2006. Kenneth Snelson (1927-) is the inventor of tensegrity and his informative website is www.kennethsnelson.net/ George Rickey (1907-2002) is considered the leading modern kinetic sculptor. For you old-timers, you may recall that Kenneth Snelson spoke at our first conference AM92 in Albany. George Rickey lived in Chatham, NY near Albany and we also showed a video of his work at AM92. Several participants at various AM conferences were fortunate in being able to visit George Rickey's studio. In particular, after AM97 Benigna Chilla, who was very close to George Rickey, arranged for Brent Collins, Carlo Sequin, and Nat Friedman to have wine and cheese at George's home and then we all went out for dinner. It was a most memorable evening. Two photos by Carlo Sequin are shown below.

George Rickey, Benigna Chilla, Nat Friedman, Studio, Chatham, NY, 1997.

Brent Collins and George Rickey, Restaurant, New Lebanon, NY, 1997.

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 Bernar 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.

Artist. Terry Karpowicz

Terry Karpowicz is a Chicago-based sculptor whose work is inspired by geometry. He frequently combines wood and stone incorporating fractal pieces of granite. Last year he had a large retrospective at the Illinois Institute of Technology, curated by Robert Krawczyk. His website is www.karpowiczstudios.com

Books

Art for a House of Mathematics by Anna Campbell Bliss.

Anna has attended many of our conferences. She is an architect in Salt Lake City, Utah. This book documents a large installation by Anna in the Cowles Mathematics Building at the University of Utah in Salt Lake City. The installation is multi media and covers three floors. It is a very impressive installation that combines many aspects of mathematics with art and architecture. This beautiful book is distributed by the American Mathematics Society, www.ams.org/bookstore.

Resources

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

[2] See Robert Fathauer's website www.mathartfun.com for art-math products including previous issues of Bridges.

[3] 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/

[4] The Directory at www.isama.org is a rich source of links to a variety of works.

For inclusion in Hyperseeing, members of ISAMA are invited to email material for the categories outlined in the contents above to Nat Friedman at
artmath@math.albany.edu