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dialog

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FOR THE MULTIDISCIPLINARY STUDY OF IMAGINATION
AT THE NEW YORK PSYCHOANALYTIC INSTITUTE

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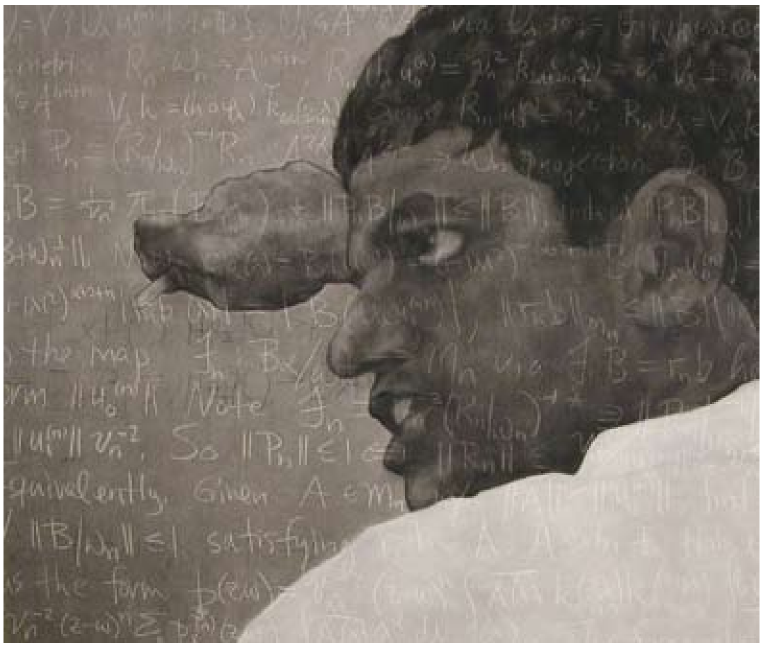
Beauty Bare
by Eva Brann



Math Head 8, *Sarah Ferguson*

The title comes from a sonnet by Edna St. Vincent Millay: "Euclid alone has looked on Beauty bare." It's not the greatest line of poetry, and if you visualize its image with a hint of malice, you have to smirk. Still, it's suggestive of some really good questions.

"Beauty bare." That surely does not mean beauty nude, but rather beauty denuded, stripped of something that veils it. The poet is suggesting that when you look at Euclidean objects, like circles, triangles, and rectangles, you see something revealed that incarnate shapes don't show, and that can move you as physical beauty might. What about a simple shape–devoid of body, of color, of the delights of irregularity–might get to you? With what organ do you see what Euclid saw? Through the eyes in your head, or with the eye of the mind, or on the immaterial tablets of your imagination?

Is Euclidean bareness rightly called abstract? Once, when I was going through Euclid's *Elements* with a class of freshmen at my college, I brought in a Mondrian painting, the one called *Tableau I*, a rectangular canvas subdivided by straight, thick black lines that are anything but "breadthless lengths" (Euclid's definition of a geometric line), and pleasing rectangular partitions filled in with primary colors. The class knew that such painting was called "abstract." What, we asked ourselves, were we to think of this esthetically vivid abstraction, almost riotously sensuous compared to the Euclidean diagrams we were studying, representing his "geometric algebra" of rectangles di-

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Mathematics at Philoctetes

In May of 2008, Harvard Mathematics Professor Barry Mazur partnered with Eva Brann to present *Imagination and Mathematics: The Geometry of Thought*, offering Philoctetes audiences a glimpse into how math exercises the imagination when used in everyday life. Following on the success of this discussion, Mazur proposed a series of events to continue exploring the intersection of mathematics and multidisciplinary thought.

Thanks to a generous grant from the John Templeton Foundation, whose mission is to support scientific endeavors that explore "big questions" about the nature of the universe and the human spirit, the Philoctetes Center organized a series that included two roundtables–*Mathematics and Religion* on October 17, accompanied by Loren Graham's presentation, *Naming God, Naming Infinity: Religious Mysticism and Mathematical Creativity*, and *Mathematics and Beauty* on November 14. The exhibition *The Aesthetics of Math*, curated by Hallie Cohen, served as a visual accompaniment to the series.

The Templeton grant further enabled the Center to commission four articles from roundtable participants that expand on themes explored during the events. These articles are featured in this special issue of *Dialog*.

Eva Brann (*Mathematics and Beauty*) teaches at St. John's College in Annapolis, Maryland. Her recent books include *The Ways of Naysaying*; *What, Then, Is Time?*; *The World of the Imagination: Sum and Substance*; and *The Past-Present*, a volume of essays.

Loren Graham (*Mathematics and Religion)* is Professor of the History of Science Emeritus at the Massachusetts Institute of Technology, and author, most recently, of *Naming Infinity: A True Story of Religious Mysticism and Mathematical Creativity.*

Edward Nelson (*Mathematics and Religion)* is Professor of Mathematics at Princeton University, and author of *Quantum Fluctuations, Predicative Arithmetic*, among other books.

Rebecca Newberger Goldstein (*Mathematics and Religion)* is a novelist and philosopher. She is the author, most recently, of *Betraying Spinoza: The Renegade Jew Who Gave Us Modernity*, and the upcoming *Thirty-Six Arguments for the Existence of God: A Work of Fiction*.

In this Issue

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Beauty Bare

Continued from front page

vided and composed to embody such equations or identities as $ax - x^2 = b^2$ or $(a - b)^2 = a^2 + b^2 - 2ab$? What *is* the difference between a pleasing picture of rectangles and an ingenious proof that uses them?

The pleasure and profit of a roundtable on "Mathematics and Beauty" is that the most naïve and the most sophisticated questions can be entertained together by experienced practitioners and engaged amateurs. Amateurs experience perplexities that professionals may have leaped over too quickly; professionals offer approaches, insights, and illustrations that a non-mathematician could never summon. In such a conversation, problems may not be solved definitively, but possibilities are stirred up endlessly.

Here are a slew of questions that we might bring to the table. What—and try to be as precise as possible—did your moment of seeing "Beauty bare" feel like? Is there a difference between the esthetics of beautiful sensory things and that of sense-pure mathematical objects? Are the criteria for beauty in mathematics articulable, and do mathematicians tend to agree on the beauty of a piece of mathematics? Should we call the *object* beautiful and the *proof* elegant? (Does beauty attach more to stabilities of insight, and elegance to motions of thinking?) Are mathematical objects *made*, like artifacts, so that their beauty must meet criteria of construction invented by knowledgeable critics, or are they *given* by a sort of intellectual nature, so that the finder might be as surprised by a novel, unexpected beauty, as is an explorer who comes on a hidden enchanted valley? Is there beauty in all branches of mathematics—can symbolic abstractions like algebraic equations or tables be beautiful? What esthetic significance do you see in the fact that so much of mathematics appears as equations? Is there a sort of esthetic satisfaction in the balance that an equation maintains about its fulcrum, i.e., the equal sign? Are all mathematical structures visualizable to a practitioner who has lived long enough with them? Are there plain or even ugly mathematical objects, or is there not one that someone doesn't love? Is truth beauty and beauty truth in mathematics, or are there things in the mathematical world that can be shown to exist and even to be useful, but that are repulsive? What is the meaning of the word "powerful" when mathematicians use it, and can a procedure be powerful but unbeautiful?

The pleasure and profit of a roundtable on "Mathematics and Beauty" is that the most naïve and the most sophisticated questions can be entertained together by experienced practitioners and engaged amateurs.

To return to Euclid, are those objects he deals with, the simplest and most elementary structures, more or less beautiful because we can easily imagine them and often see them embodied in the world around us, especially the man-made world of four-square structures and wheeled traffic?

Finally, are there mathematical figures that take the crown of beauty? It used to be thought that the circle was the perfection of beauty. That is why Ptolemy put up with the complexities of epicycles that produced absurd-looking real orbits, and why Kepler was reluctant to accept his own greatest discovery, the elliptical orbits of the planets. What makes a circle beautiful? Circles of all sizes look exactly the same, yet they have very different curvatures, in that they are like the tones that compose the rising scales on a keyboard. Each tone has just the same quality as the one an octave above, but the pitch is totally different. Yet no one thinks that the consonance of the octave is particularly beautiful; it's too much of a unity for that.

Furthermore, the circle's circumference defines a center that can be found in various ways. If the circle is set spinning, it stays stock-still, and if it is set rolling it describes a straight line, which is why you can get a chariot body on the axle between two wheels and step in. It's useful, but who thinks it's particularly beautiful? The fact that any one circle is self-congruent—any segment of the circumference can be slid onto another—could be regarded as boring rather than beautiful.

But the circle does show an unequivocally pleasing aspect when embodied in a roundtable; it brings about what might be called the Arthurian effect. King Arthur seated his chivalrous knights about a roundtable because he wanted to function as a first among equals, rather than as the head of the table. Roundtables give everyone an equal chance to talk about a topic—in this case, the elementary question of the beautiful. *E.B.*

Completed Infinity and Religion
by Edward Nelson

Edward Nelson

Mathematics and religion—strange bedfellows indeed! But perhaps if one goes deeply enough into any subject, one encounters religion. I want to focus on one question, regarded from three points of view. The question is this: does there exist a completed infinity consisting of all numbers 0, 1, 2, 3, ...?

First consider the question from the perspective of monotheistic faith. As I understand it, such faith regards everything in creation as contingent; God is not bound by necessity. Are we to believe that the truths of number theory, such as Fermat's last theorem (for n greater than 2 there is no solution in positive numbers of x to the n plus y to the n equals z to the n), could have been different had God chosen to make them so? The 19th century mathematician Leopold Kronecker famously said, "God created the integers; all else is the work of Man." It is hard to imagine this act of creation. To quote from my book *Predicative Arithmetic*, "Nowhere in the book of Genesis do we find the passage: And God said let there be numbers, and there were numbers; odd and even created he them, and he said unto them, be fruitful and multiply; and he commanded them to keep the laws of induction." But if the numbers were not created, do they exist in their infinite magnitude by necessity? The point I am trying to make is that there appears to be a problem for anyone who subscribes to monotheistic faith and also subscribes to faith in the existence of a completed infinity of all numbers.

The belief that all is number, that the universe is permeated by the music of the spheres, is a beautiful religious belief. And Pythagoreanism is the most harmless of all religions. But I have not been converted.

I was greatly intrigued by Max Tegmark's presentation during the *Mathematics and Religion* roundtable at the Philoctetes Center. He is an exponent of pure Pythagoreanism: all is number. To maintain that there is no basic difference between existence in physical reality and existence as mathematical possibility is a challenging and thought-provoking position. I hope Max will not be offended if I confess to difficulty in imagining what a creature somewhere in the multiverse with aleph 17 toes would look like. (Aleph 17 is one of Georg Cantor's infinite cardinals.) Historically, the Pythagorean Society was a religious group, and it also created mathematics as a deductive discipline—mathematics as mathematicians understand mathematics. So although the topic of mathematics and religion may seem strange to us, mathematics has a religious origin.

I would guess that this is an accident of our planet and that when we encounter some intelligent extraterrestrials, they will not have any pure mathematics—just a very advanced Babylonian mathematics tied to the everyday world. Incidentally, the Pythagorean Society is often called the Pythagorean Brotherhood, but one of the few things we know about them with some degree of confidence is that women were members with equal status. The belief that all is number, that the universe is permeated by the music of the spheres, is a beautiful religious belief. And Pythagoreanism is the most harmless of all religions. But I have not been converted.

If we reject the notion that the completed infinity of numbers was divinely created, and if we reject the notion that this completed infinity exists uncreated and by necessity, as it was in the beginning, is now, and ever shall be, what is left that we can accept? Just this: that the notion is a human fabrication. The idea of a completed infinity is an abstract notion, but it is a terrible reality that abstract notions have concrete consequences. The example of the abstract notion of the Aryan race suffices to make the point.

The notion of truth in mathematics, however, is a matter of dispute among mathematicians; truth in mathematics is an abstract notion.

Mathematical activity is a concrete human activity. Mathematicians prove theorems and the community of mathematicians agrees, after sufficient study, as to whether or not the proof is correct. It is just a matter of checking. This is an astounding consensus covering the globe and millennia of work. No other field of human endeavor matches this. The chief concern of mathematicians in practice is proof—correct deductions from axioms (thanks to Pythagoras!). The notion of truth in mathematics, however, is a matter of dispute among mathematicians; truth in mathematics is an abstract notion. Andrew Wiles proved Fermat's last theorem, and those competent to judge agree that the proof is a correct deduction from the axioms. The theorem has some concrete content—no one will ever find n, x, y, and z that falsify the theorem. This is due to the fact that the theorem has a simple logical structure. It is of the form: for all numbers, something concrete holds.

But consider a more complicated assertion of the form: for all numbers, there exists a number such that something concrete holds. An example is the twin primes conjecture: for all numbers n there exists a number p with p greater than n, such that both p and p + 2 are primes. This is an open problem. The notion of truth for this problem is entirely abstract—it involves a hypothetical and impossible search through all numbers. What mathematicians hope for is that someone will find a proof (a concrete object) either of the conjecture or of its negation. And this leads to the final thing I want to say.

The question as to whether number theory (Peano Arithmetic) is consistent or not is a question similar to Fermat's last theorem. If number theory is inconsistent, there is a concrete proof of a contradiction from the axioms. I am working on showing that this is indeed the case. The almost universally held belief that this is impossible is based on the abstract notion of truth in number theory, a belief in the existence of the set of all numbers as a completed infinity. *E.N.*

Mathematics as Theology
by Rebecca Newberger Goldstein

My most recent book, to be published in January 2010, is called *36 Arguments for the Existence of God: A Work of Fiction*. The sub-title, meant to be a joke, also happens to be true. The book is a novel. But it also has an appendix that is not meant as fiction, though it is ostensibly written by the novel's main character, Cass Seltzer. A psychologist of religion, Cass has recently become an intellectual celebrity following the success of his own book, entitled *The Varieties of Religious Illusion*. Cass does not think much of any of the arguments for God's existence, but he does nevertheless have some sympathy for the religious impulse, especially when it expresses a sense of amazement at the improbability of existence, his own and the world's. This sympathy earns him the sobriquet "the atheist with a soul."

In his appendix, Cass formulates arguments for the existence of God–all the arguments he can think of, some of which are sufficiently well-known to have acquired names, such as "The Cosmological Argument," "The Ontological Argument," and "The Argument from Design." Others Cass has to christen himself; for example, "The Argument from The Improbable Self," "The Argument from The Intolerability of Insignificance," "The Argument from The Unreasonableness of Reason." Two of the arguments in the appendix attempt to deduce God's existence from mathematics, which is not to say that these are mathematical arguments.* Rather, they argue that there is a certain mystery to mathematics, and that this mystery can best be resolved by positing God's existence as an explanation.

The fundamental question in the philosophy of mathematics is this: how can mathematics be true but not empirical?

The first of the arguments focuses on the non-empirical nature of mathematical knowledge as the mysterious element. Mathematics is derived through pure reason–what the philosophers call a priori reason–which means that it cannot be refuted by any empirical observations.** The fundamental question in the philosophy of mathematics is this: how can mathematics be true but not empirical? Is it because mathematics describes some trans-empirical reality–as mathematical realists (often called "Platonists") believe? Or is it rather that mathematics has no descriptive content at all and is a purely formal game consisting of stipulated rules and their consequences, as formalists believe? This mystery forms the basis of what Cass calls "The Argument from Mathematical Reality":

1. Mathematical truths are necessarily true. (There is no possible world in which, say, 2 plus 2 does not equal 4, or in which the square root of 2 can be expressed as the ratio of two whole numbers.)

2. The truths that describe our physical world, no matter how fundamental, are empirical, requiring observational evidence. (So, for example, we await some empirical means to test string theory, in order to find out whether we live in a world of eleven dimensions.)

3. Truths that require empirical evidence are not necessary truths. (We require empirical evidence because there are possible worlds in which these are not truths, and so we have to test that ours is not such a world.)

4. The truths of our physical world are not necessary truths (from 2 and 3).

5. The truths of our physical world cannot explain mathematical truths (from 1 and 4).

Max Tegmark

6. Mathematical truths exist on a different plane of existence from physical truths (from 5).

7. Only something which itself exists on a different plane of existence from the physical can explain mathematical truths (from 6).

8. Only God can explain mathematical truths (from 7).

9. God exists.

Since Cass Seltzer doesn't believe that any of the arguments for God's existence are sound, his aim, after formulating an argument, is to lay bare its weakest links. Here, very briefly, is what he says of "The Argument from Mathematical Reality":

Flaw 1: The inference of 5, from 1 and 4, does not take into account the formalist response to the non-empirical nature of mathematics.

Flaw 2: Even if one Platonistically accepts the derivation of 5 and then 6, there is something fishy about proceeding onward to 7, with its presumption that something *outside* of mathematical reality must explain the existence of mathematical reality. Lurking within 7 is the hidden premise that mathematical truths must be explained by reference to non-mathematical truths. But why? If God can be self-explanatory, as this argument presumes, why then can't mathematical reality be self-explanatory–especially since the truths of mathematics are, as this argument asserts, necessarily true?

Flaw 3: Mathematical reality–if indeed it exists–is, admittedly, mysterious. But invoking God does not dispel this puzzlement; it is an instance of "The Fallacy of Using One Mystery to Bury Another." The mystery of God's existence is often used, by those who assert ▶▶

*In E. T. Bell's *Men of Mathematics*, a story is told of an encounter between the great Swiss mathematician Leonhard Euler and the French encyclopaedist, Denis Diderot, in which Euler advanced a pseudo algebraic proof of the existence of God in order to embarrass the atheist Diderot. "Sir, (a+b^n)/n = x; hence God exists, answer please!" The story, although awfully good, appears to be apocryphal. See Dirk J. Struik's *A Concise History of Mathematics*, Third Revised Edition, Dover, 1967, in which he asserts that the "story seems to have been made up by the English mathematician De Morgan (1806-1871)." P. 129.

**The question of which mathematics can be applied to our physical world is an empirical question. So, for example, after non-Euclidean geometry was developed in the nineteenth century by, among others, Karl Friedrich Gauss, the question arose whether our physical space was Euclidean or non-Euclidean, a question for physicists, not mathematicians.

it, as an explanatory sink hole.

The other argument that makes reference to mathematics focuses on the mystery of infinity. Cass calls it "The Argument from Human Knowledge of Infinity":

1. We are finite, and everything with which we come into physical contact is finite.

2. We have a knowledge of the infinite, demonstrably so in mathematics.

3. We could not have derived this knowledge of the infinite from the finite, from anything that we are and come in contact with (from 1).

4. Only something itself infinite could have implanted knowledge of the infinite in us (from 2 and 3).

5. God would want us to have a knowledge of the infinite, both for the cognitive pleasure it affords us and because it allows us to come to know him, who is himself infinite.

6. God is the only entity that is both infinite and that could have an intention of implanting the knowledge of the infinite within us (from 4 and 5).

7. God exists.

Flaw: There are certain computational procedures governed by what logicians call recursive rules. A recursive rule is one that refers to itself, and hence can be applied to its own output ad infinitum. For example, we can define a natural number recursively: 1 is a natural number, and if you add 1 to a natural number, the result is a natural number. One can, in principle, apply this rule an indefinite number of times and thereby generate an infinite series of natural numbers. Recursive rules allow a finite system (a set of rules, a computer, a brain) to draw conclusions about infinity.

The fundamental nature of mathematics is sufficiently mysterious that mathematicians, though agreeing on what has been mathematically proved, disagree on what the results of those proofs amount to. Mathematical truth, and our knowledge of it, presents genuine philosophical questions, as profoundly baffling as any good philosophical problems are. But do these mathematics-generated philosophical questions have anything to do with God? I can't help agreeing with my own fictional character that theology based on mathematics amounts, in the end, to a kind of fiction. *R.N.G.*

Brian Greene

The Power of Names by Loren Graham

Loren Graham

A common concept in history is that knowing the name of something or someone gives one power over that thing or person. This concept occurs in many different forms, in numerous cultures–in ancient and primitive tribes, as well as in Islamic, Jewish, Egyptian, Vedic, Hindu, and Christian traditions. The strength of this belief varies, and there are certainly exceptions to it. Nonetheless, the persistence and historical continuity of the linking of naming and power are unmistakable. Some scholars find it embedded in the first verses of Genesis, probably written over three thousand years ago; others believe it to be an intrinsic characteristic of classical Greek religion; still others find it a central feature in magic and folklore; and modern feminists often see it as the reason that a woman in marriage is traditionally asked to take the name of her new husband. In all these cases, naming something or someone is seen as the exertion of dominion over that thing or person. Several twentieth-century mathematicians gave naming a peculiar twist that reflected their deep religious mysticism and influenced their creativity.

The great Russian-French mathematician Alexander Grothendieck put a heavy emphasis on naming as a way to gain cognitive power over objects even before they have been understood.

In Genesis we hear in the first verses that "God said 'Let there be Light' and there was light." Think about that statement logically. God named the thing before he created it; the naming seems a necessary first step toward creation. Then, according to Genesis, God gave Man the right to name all the animals, and, at the same time, the right of dominion over them. Here again the act of naming carries with it a sense of power, of hegemony. The Egyptian god Ptah allegedly had the power to create anything he could name. The ancient Egyptians similarly believed that one gained power over a god if one knew his name. According to the Jewish religion, the name of God was so holy that it was not to be said out loud. A likely reason for this prohibition was that naming God might be seen as an attempt to assert dominion over him, to duplicate illegitimately a power that God uniquely possessed.

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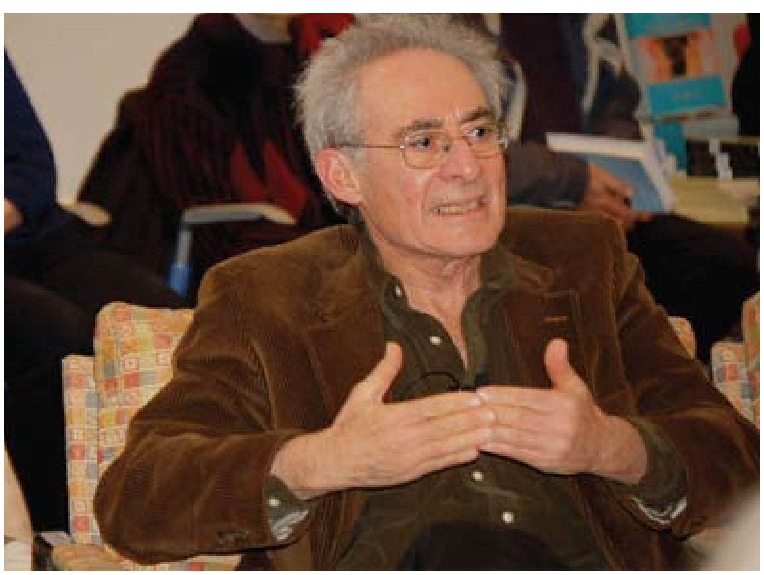
The Power of Names *Continued from page 5*

A specific use of naming to bring religious power is that of "The Jesus Prayer." The practice of this prayer dates back to at least the fifth century, when certain Christian "desert fathers" in Egypt and the Middle East promoted the view that the ceaseless repetition of the names "Jesus" and "God" brings the worshipper not only to a state of religious ecstasy, but also to profound insight on the world. These "hesychasts" took a different position from that of many Jews, who considered the name of God to be too holy or powerful to be enunciated. The desert fathers agreed that the names of God and his son are powerful, but they believed they could transfer some of that power back on themselves, thereby gaining knowledge of the world. The practice of the Jesus Prayer has continued down to the present day, but after the split between the eastern and western forms of Catholicism, it was much stronger in Orthodoxy, especially Russian Orthodoxy, than it was in the Roman Catholic Church. Several of the most important Russian mathematicians of the twentieth century were practitioners of the Jesus Prayer, and maintained that it has relevance to mathematics.

Mathematicians often observe that, on the basis of intuition, they sometimes develop concepts that are at first ineffable and resist definition. These concepts must be named before they can be brought under control and properly enter the mathematical world.

In modern mathematics, the naming theme emerges in different ways. The great Russian-French mathematician Alexander Grothendieck–still alive but no longer active as a mathematician–put a heavy emphasis on naming as a way to gain cognitive power over objects even before they have been understood. One observer of his work wrote, "Grothendieck had a flair for choosing striking, evocative names for new concepts; indeed, he saw the act of naming mathematical objects as an integral part of their discovery, as a way to grasp them even before they have been entirely understood." Mathematicians often observe that, on the basis of intuition, they sometimes develop concepts that are at first ineffable and resist definition. These concepts must be named before they can be brought under control and properly enter the mathematical world. Naming can be the path toward that control.



Barry Mazur

Elaine Scarry

In the late 19th and early 20th centuries, this topic became critical when mathematicians developed whole classes of "mathematical objects" of which no one had earlier conceived. Being totally unknown, they arrived unnamed. There was even serious doubt that they truly "existed." Maybe they did not deserve names.

Georg Cantor initiated this discussion when he promoted the view that there is more than one type of infinity. Until his time, most mathematicians and philosophers had accepted Aristotle's view that infinity is a potentiality, a single abstraction, and not an actuality. Cantor radically broke with the Aristotelian tradition by suggesting that infinity is an actuality, not a potentiality, and that it can exist in multiple forms. His first distinction was between countable and uncountable infinities. An example of the first is all the integers; an example of the second is the points on a line segment. But are these two infinities of the same type if one is countable and the other is not? Not at all, said Cantor. So if these infinities are different should they be given different names? Cantor's answer was in the affirmative, and he began the process of naming different infinities by different "Aleph numbers." Now the door was open to the creation, and the naming, of a whole gamut of infinities–an infinity of infinities, in fact. A new world of transfinite numbers was being created.

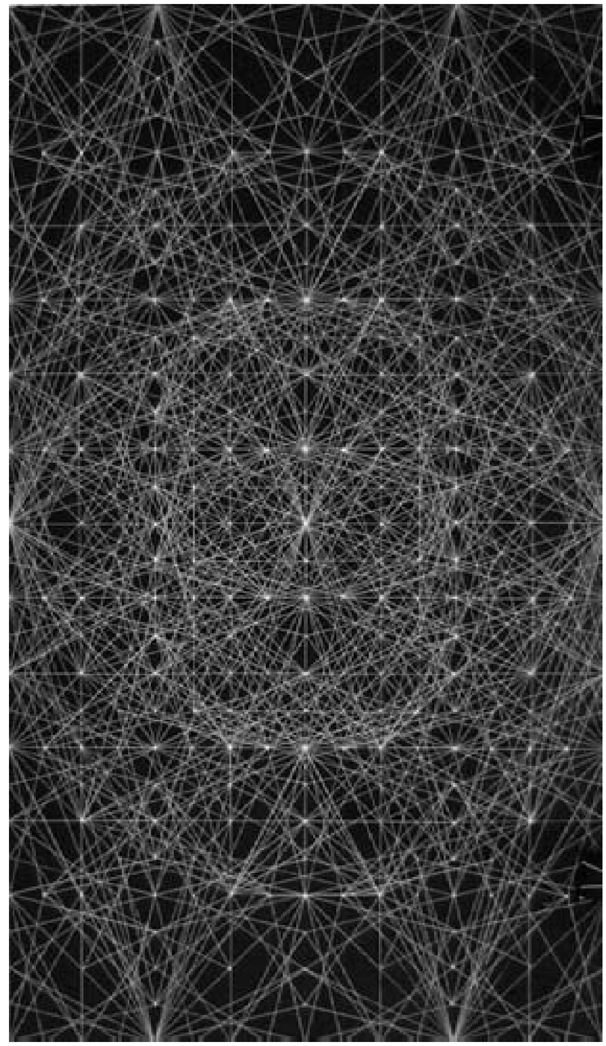
Particularly valuable work in this new field of set theory was done by Russian mathematicians, especially Dmitri Egorov and Nikolai Luzin. Both of them were under the heavy influence of a religious sect of the Russian Orthodox Church called Name Worshippers, whose members put a heavy emphasis on the power of naming. Intellectually and religiously, Egorov and Luzin were descendants of the desert fathers of the fifth century, who had such a strong influence in the Russian Orthodox Church. Egorov and Luzin believed that if they named God, they assured his existence, and similarly they thought that by naming the new sets, they could make them real. God could not be defined, but he could be named. The new sets also resisted definition, but they too could be named. The Russians returned to Moscow and created one of the most powerful mathematical schools of the twentieth century. The story of what they did, and how religious thought motivated them, is told in the recent book *Naming Infinity: A True Story of Religious Mysticism and Mathematical Creativity*, written by Jean-Michel Kantor and me. *L.G.*

The Aesthetics of Math

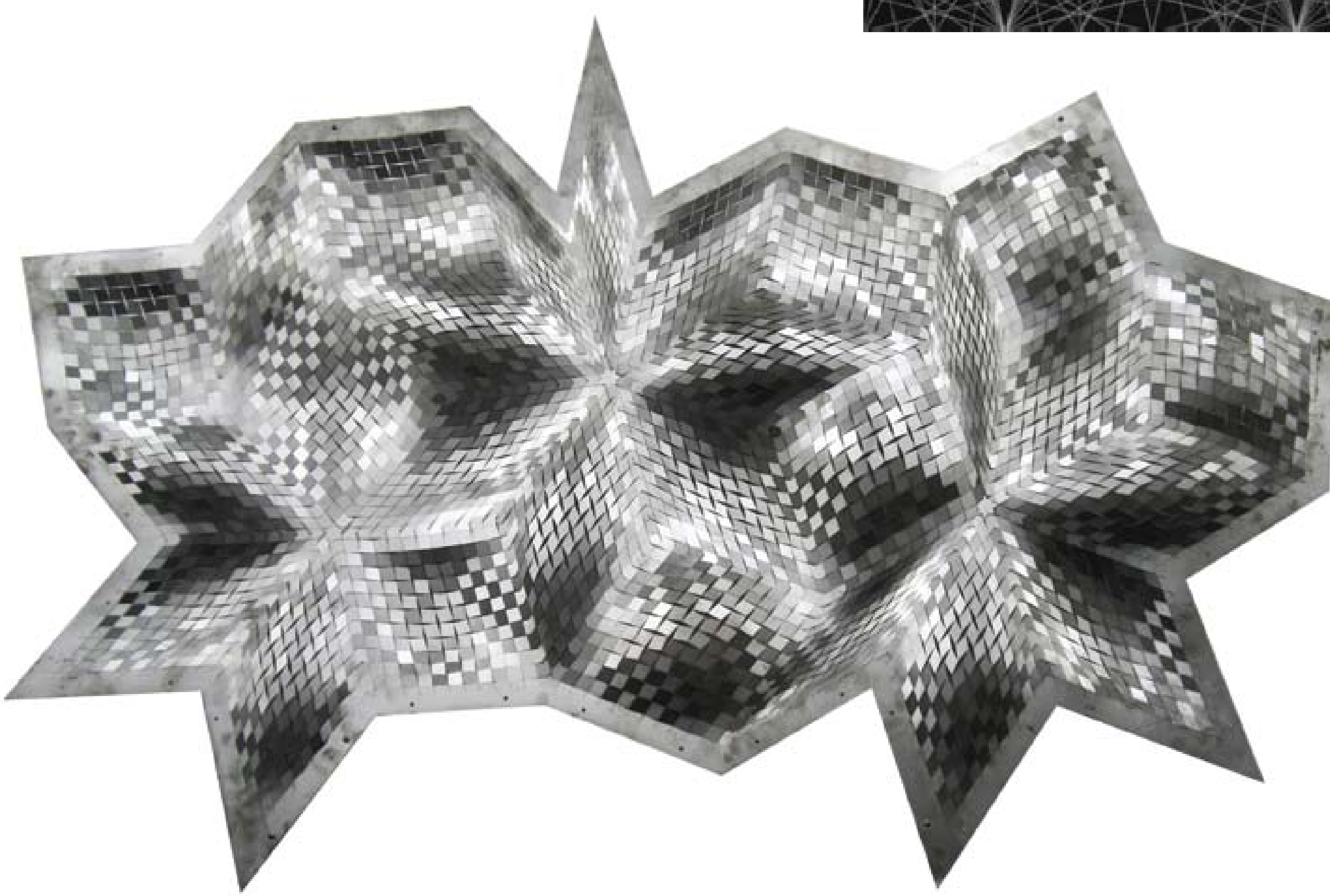
Mathematics has been used for millennia as a tool for organizing and explaining finite reality while simultaneously touching the infinite. Visual art draws on the language of images to convey both order and chaos in the tangible and ephemeral worlds. The Aesthetics of Math, the first exhibition of the 2009-10 Philoctetes season, explored the intersection between these two ways of understanding beauty, complexity, and the sublime.

For Devin Powers, pattern and symmetry encompass intimations of a higher reason. Joan Waltemath uses irrational numbers to unlock the aesthetic impact of her work, aiming at a heightened awareness of how art is apprehended. Sarah Ferguson shrouds her images in mathematical figures, creating a screen that is both porous and impenetrable, while Haresh Lalvani addresses the concept of infinity through the morphological permutations mapped in his metal sculptures.

This exhibition, curated by Marymount Manhattan College Associate Professor of Art Hallie Cohen, was organized as part of a series on mathematics made possible by a generous grant from the John Templeton Foundation. Events in this series include Naming God, Naming Infinity, Mathematics and Religion and Mathematics and Beauty.



Manifest, *Devin Powers*



Zig-Zag XURF, *Haresh Lalvani*

December Events

Time

Roundtable

Saturday, December 5, 2:30pm

Participants: Olga Ast, George Musser, Mark Norell, Michael Shara, Peter Whitely

Madmen, Exiles, and Savage Detectives: Latin American Poetry from Arenas to Bolaño

Poetry Reading & Discussion

Tuesday, December 8, 7:00pm

Participants: Laura Healy, Jaime Manrique

Love and Pleasure in the Age of Electricity

Roundtable

Saturday, December 12, 2:30pm

Participants: Elizabeth Auchincloss, Anne Cattaneo, Rachel Maines

Aging and Creativity

Roundtable

Saturday, December 19, 2:30pm

Participants: Patricia Bloom, Carmen De Lavallade, Elinor Fuchs, Gordon Rogoff

The Panelists

In addition to the contributors to this publication, the Philoctetes Center was pleased to welcome the following panelists for its two roundtables on mathematics:

Dominic Balestra (*Mathematics and Religion*) is Professor, former Chair of the Philosophy Department, and former Dean of the Arts and Sciences Faculty at Fordham University. He is the author of *Ways to World Meaning*.

Brian Greene (*Mathematics and Beauty*) is co-director of Columbia University's Institute for Strings, Cosmology, and Astroparticle Phyics (ISCAP). His first book, *The Elegant Universe*, was a finalist for the Pulitzer Prize in General Nonfiction and his most recent book, *The Fabric of the Cosmos*, was on the New York Times best-seller list.

Mario Livio (*Mathematics and Beauty*) is a senior astrophysicist and Head of the Office of Public Outreach at the Space Telescope Science Institute (STScI). He is the author of *The Golden Ratio* and *Is God A Mathematician?*

Barry Mazur (*Mathematics and Beauty*) is Gerhard Gade University Professor at Harvard, where he teaches in the Mathematics department. He is the author of *Imagining Numbers (Particularly the Square Root of Minus Fifteen)*, and has been elected a member of both the National Academy of Sciences and the American Philosophical Society.

Elaine Scarry (*Mathematics and Beauty*) is the Walter M. Cabot Professor of Aesthetics and the General Theory of Value at Harvard University, where she teaches in the English department. She is the author of *The Body in Pain, On Beauty and Being Just, Dreaming by the Book*, and *Resisting Representation*.

Max Tegmark (*Mathematics and Religion*) is an Associate Professor of Physics at MIT, having previously taught at the University of Pennsylvania and served as a Hubble Fellow. His work with the SDSS collaboration on galaxy clustering shared the first prize in *Science* magazine's "Breakthrough of the Year: 2003."

A Note from Co-Director Francis Levy

Philoctetes is grateful to The John Templeton Foundation for funding our enormously successful *Mathematics and Imagination* series. One of the things that Philoctetes does, in addition to its avowed mission of narrowing the gap between the cultures of science and art, is provide a forum for subjects that explore the breadth of human imagination. Audience appeal has become synonymous with commercialization—the lowest common denominator, to use a mathematical concept—but Philoctetes consistently tests the parameters of what can be defined as appealing. For these events, our discussion space was fully packed, with overflow seating in the downstairs auditorium where we screen simulcasts. Audiences were eager to hear panelists like Columbia astrophysicist Brian Greene discuss mathematics and beauty with renowned Harvard Aesthetics Professor Elaine Scarry.

Over the years, Philoctetes has consistently defied expectations about what captures the interest of human beings. One might not think that a discussion entitled *Exploring Beethoven's Sound World: Historically Informed Practice and the Seventh Symphony*, featuring violinist Stephanie Chase and conductor Thomas Crawford, would attract a large following. And yet the audience at this event was sizeable and enthusiastic. Is the roundtable *Evolution of God(s)*, which brought together a panel including Elaine Pagels of Princeton and author Robert Wright, a subject of appeal in a world dominated by mass culture? The house was packed, with people lined up out the door for the post-discussion Q and A.

Mathematics and Beauty, the final event in this recent series, epitomized everything that Philoctetes aspires to accomplish. Not surprisingly, the discussion about the intersection of math and beauty found its way to the subject of music. Music, like math, creates an independent universe whose rules and laws have a seemingly miraculous relationship to physical reality. Each gives birth to something that takes place on a spiritual level, but that also has a necessary connection with the concrete world. The day after the *Mathematics and Beauty* roundtable, Sean Wilentz came from Princeton to discuss *The Inventions of Bob Dylan* with the British critic Christopher Ricks. Curiously, the subject turned to math, as the two Dylanophiles tried to grasp the enormity of that artist's accomplishments. In one weekend we traveled seamlessly from Euclid to folk rock, hitting on an apparently unending series of relationships in subjects that might seem to elude comparison.

Beauty in art might classically be defined as that which is edifying and true. I would add joy to that definition. Philoctetes is *homo ludens intellectualis*—intellectual man at play. Please consider making a gift to help the Center continue bringing you these and other events in 2010. Contributions can be made by check or on our website (www.philoctetes.org). *F.L.*