# Creativity in mathematics

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"Mathematics links Art and Science in one great enterprise, the human attempt to make sense of the universe." So writes Abel Prizewinner and Fields Medalist Sir Michael F. Atiyah in the January 2010 *Notices of the American Mathematical Society*. The theme of the issue is creativity in mathematics.

Mathematicians have always felt a strong creative aspect in their subject, but only in recent years has the flowering of connections between mathematics and the arts made this aspect apparent to the general public. The collection of three articles in the Notices, together with Atiyah's short introductory piece, explore some of the various ways in which art and beauty appear in mathematics.

## Mathematics and Mime

In "Envisioning the Invisible", Tim Chartier describes how the performing arts can be used to capture mathematical concepts in a visceral way that audiences can really connect with. Chartier is a mathematician and also a mime; he trained with the legendary Marcel Marceau. In one of Chartier's mime sketches, he gets the audience to visualize the one-dimensional number line as a rope of infinite length. The sketch begins with the lone mime walking toward the audience and suddenly stumbling. Peering down, he sees an (invisible) object on the floor and proceeds to slowly pick it up. Examining it, he discovers a rope of infinite length in both directions. He then engages in a tug-of-war with the rope and eventually cuts it into two, prompting the audience to ponder questions about the nature of infinity. In addition to describing

several such mime pieces he performs (some of them together with his wife, who is also a trained mime), Chartier discusses the work of other mathematicians who work in such performing arts as dance, theater, juggling, and magic.

## Mathematics and Music

The strong affinity between mathematics and music is the subject of "Music: Broken Symmetry, Geometry, and Complexity", by Gary W. Don, Karyn K. Muir, Gordon B. Volk, and James S. Walker. Among the questions explored in the article are: Does Louis Armstrong's voice sound like his trumpet? What do Ludwig van Beethoven, Benny Goodman, and Jimi Hendrix have in common? How does the brain sometimes fool us when we listen to music, and how have composers used such illusions? Is it possible to objectively describe the connection between pitch and rhythm in melodies? Is it possible to objectively describe the complexity of musical rhythm? How can math help create new music?

## Mathematics and Visual Art

In "The Life and Survival of Mathematical Ideas", Michael F. Barnsley discusses how a specific mathematical topic, that of iterated function systems, can be viewed as a "creative system": The forms emerging from this system are fractals. His article is illustrated with many arresting computer-generated pictures that are true works of art, including some he has sold in art shows. Barnsley explains his notion of a "creative system", which is a system that possesses a core stable form (DNA), a fertile environment, a determination to survive, and random stimuli. "The mind of a mathematician", he argues, "provides a locus for creative systems, a place where mathematical structures live and evolve." He makes a parallel between biological forms, such as plants, and

mathematical forms. An example of mathematical forms are the geometric building blocks of points, lines, and planes; their "DNA" consists of the equations that describe points, lines, and planes. The forms evolve and adapt as they are passed on through generations of mathematicians' minds.

By serendipity, the article on music by Don et al employs some of Barnsely's work on fractal images to produce new music. Using Barnsley's Iterated Function Systems formulas, the authors created fractal images of a fern and of Sierpinski's triangle and used these images to create notes for musical compositions---so the "scores" were computer images rather than the usual musical scores. This connection between the two articles shows how the power of abstraction in mathematics makes it a fertile source for artistic expression.

More information: www.ams.org/

Source: American Mathematical Society