



# Devlin's Angle



SUNDAY, JANUARY 1, 2012

## Patterns? What patterns?

In the early 1990s I deliberately set out to help create a meme: mathematics is the science of patterns. My inspiration was an article written by Lynn Arthur Steen, published in *SCIENCE* Vol. 240 No. 4852, 29 April 1988, pp. 611-616. Steen's piece was a high-level overview of mathematics as practiced by late twentieth century pure mathematicians, titled simply "The Science of Patterns." In 1994, I published a full color book in W. H. Freeman's prestigious Scientific American Library series with the title [Mathematics: The Science of Patterns](#).

Both Steen and I were motivated by a desire to see major improvements in mathematics education, and (a closely related issue) an improved image and understanding of mathematics in American society. (This was long before the stakes were raised by the GOP declaring war on science.) But neither of us claimed originality to the view of mathematics captured by that catchy phrase. Back in 1940, the accomplished English mathematician G. H. Hardy wrote, in his book *A Mathematicians Apology*:

The mathematician's patterns, like the painter's or the poet's, must be beautiful, the ideas, like the colours or the words, must fit together in a harmonious way. Beauty is the first test; there is no permanent place in the world for ugly mathematics. ... It may be very hard to define mathematical beauty, but that is just as true of beauty of any kind – we may not know quite what we mean by a beautiful poem, but that does not prevent us from recognizing one when we read it.

The beauty to which Hardy was referring is, for the most part, a highly abstract, inner beauty, a beauty of abstract form and logical structure, a beauty that can be observed, and appreciated, only by those sufficiently well trained in the discipline. It is a beauty "cold and austere," according to Bertrand Russell, the famous English mathematician and philosopher, who wrote, in his 1918 book *Mysticism and Logic*:

Mathematics, rightly viewed, possesses not only truth, but supreme beauty – a beauty cold and austere, like that of sculpture, without appeal to any part of our weaker nature, without the gorgeous trappings of painting or music, yet sublimely pure, and capable of a stern perfection such as only the greatest art can show.

But I digress – as I often do when I reflect on the natural beauty of mathematics, a beauty more fundamental than that of the best poetry or art, the latter capturing the beauty in life and the human cognitive system's response to its existence and environment, mathematics providing a glimpse of the even deeper beauty of the universe itself, the very substrate on which we and everything we know exist.

The one obvious drawback with the "science of patterns" meme is, and always was, that it does not stand up to reflection. Not because it misses the target. Rather, it is, like many memes, altogether too general. It only captures mathematics for someone who already knows what mathematics is; it does not serve as an explanatory definition. "What kinds of pattern?" is the obvious initial response from someone not

### DEVLIN'S ANGLE



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His most recent books are *Mathematics Education for a New Era: Video Games as a Medium for Learning* (AK Peters/CRC Press), *The Man of Numbers: Fibonacci's Arithmetic Revolution* (Walker & Co), and an e-book short *Leonardo and Steve: The Young Genius Who Beat Apple to Market by 800 Years*.

Contact.

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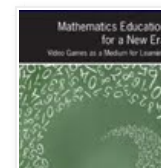
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well versed in mathematics who meets our meme for the first time. Practically any science (including the life, human, and social sciences) can be described as “the science of patterns of type X” for a suitable X.

Of course, both Steen and I had the answer at the ready. His entire SCIENCE article was devoted to providing examples of the kinds of pattern whose scientific study constitutes mathematics, as was my considerably longer book. Our hope was that that catchy phrase would provoke curiosity to read our explanations and learn what it was we were trying to convey.

If I were asked to provide a “dictionary definition” of mathematics as it is practiced today, I would come up with something along the following lines.

Mathematics is:

- The systematic study of number, shape, form, structure, relations, motion and change, and other concepts, represented by precisely defined abstractions; and
- the development and application of procedures for reasoning with those concepts; and
- the use of rigorous logical argument to determine truth on the basis of accepted assumptions (axioms); and
- the application of that methodology to the real world.

More accurate than our meme to be sure; but nothing like as catchy. And decidedly not destined to become a meme.

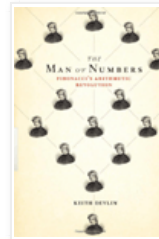
Still, accuracy aside, thinking of mathematics in terms of patterns is far more reflective of the bulk of contemporary mathematics than is the computational-centric view of the subject that still seems the dominant one in society at large. It also leads naturally to comparisons with other “pattern-delineated” human activities. Music for example.

With its high degree of abstraction and its formal, symbolic language, music has long been one of my favorite examples when trying to explain mathematics – and its attraction – to non-mathematicians. Yet like all good comparisons, music and mathematics serve to illuminate each other by their differences as much as their similarities.

The similarities and the differences between mathematics and music motivated me to collaborate with a choral group ([Zambra](#)) a few years ago. The idea was that we should work together to find musical interpretations of some of my favorite mathematical equations. The result was a stage show called Harmonius Equations. We started with – no prizes for guessing the right answer here – Euler's Identity. Here is the result:



Mathematics Education for a New Era: Video Games as a Medium for Learning



The Man of Numbers: Fibonacci's Arithmetic Revolution



Leonardo and Steve: The Young Genius Who Beat Apple to Market by 800 Years

- [@coolmathteacher](#) I guess that was your first question, so you have one left. :) [about 8 hours ago](#)
- Tomorrow morning (Wednesday) I head to Boston for the big annual math bash #JMM2012. [about 8 hours ago](#)
- New Devlin's Angle posted at MAA: <http://t.co/jpwUvhaC> Mathematics, patterns, and music. [about 8 hours ago](#)
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Next month I'll take a look at the rest of that collaboration.

Posted by Mathematical Association of America at 12:00 AM



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