



Math Digest

Summaries of Media Coverage of Math

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(Photo by Ed Burtynsky.)

This Month's Math Digest Summaries: *Posted here March 2011*

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- ["A new dimension for mathematics--the Periodic Table of shapes," *Gizmag*, 16 February 2011](#)
- ["Maths mavens cut to the core," *The Age*, February 14, 2011](#)
- ["Uncovering treasures of the past," *KNDU/KNDU TV*, 13 February 2011](#)
- ["Much Ado About Zero," *North Coast Journal*, 10 February 2011](#)
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Blogs. Brie Finegold summarizes two mathematics blogs this month: *The Unapologetic Mathematician* and *Fano Varieties and Extremal Laurent Polynomials*.

[*The Unapologetic Mathematician*](#) . John Armstrong's self-described "blath", *The Unapologetic Mathematician: Mathematics for the Interested Outsider*, is a great place to read almost-daily installments on higher level mathematics. After many months of posts on representation theory and symmetric groups, recent entries focus on differential topology by introducing manifolds. Interested graduate students or anyone with some basic point set topology knowledge can appreciate posts concerning different types of manifolds, their dimensions, and other basic properties. Although the sentiment of the subtitle (that laymen can follow the main lines of exposition) is overly optimistic, the continuity from post to post sets this blog apart. In addition, internal links to previous posts make unfamiliar terms easy to look up. Dr. Armstrong started his blog in 2007 after earning his Ph.D. from Yale studying category theory. He now earns his living by programming and has begun a new blog, *The Unapologetic Programmer--Adventures of a Former Mathematician*.

[*Fano Varieties and Extremal Laurent Polynomials: A collaborative research blog*](#) . Beautiful pictures and animations reminiscent of flowers or folding cloth grace recent posts of this blog, in which most entries take the form of a technical conversation between specialists Tom Coates, Alessio Corti, Sergei Galkin, Vasily Golyshev, and Al Kasprzyk. In their post on February 9th, the collaborators take a break from the language of research and describe the images of surfaces within a three dimensional Fano variety as being analogous to the MRI images made to help map the brain.

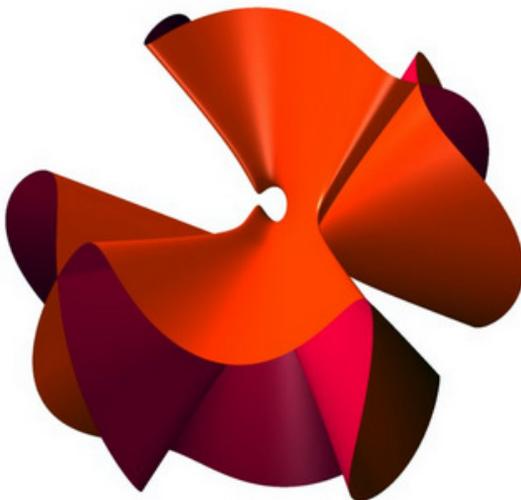
Because the main purpose of the blog is to enable researchers peppered across the globe to collaborate, exclusivity is to be expected. Nonetheless, readers who peruse other parts of the blog will appreciate titles of posts, such as "Things are not as straightforward as they seem", that give some insight into the trials and victories of mathematical research. And by playing the short animations, we may all appreciate at least some of the fruits of these mathematical labors.

Tom Coates's research is also covered in "Atoms Ripple in the Periodic Table of Shapes," by Jacob Aron (*New Scientist*, 16 February 2011). Here Coates couches the research in terms that a layperson might appreciate by describing part of the groups research project as an effort to create a "periodic table" of shapes. See more in this month's Math Digest: ["A new dimension for mathematics--the Periodic Table of shapes."](#)

--- Brie Finegold

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["A new dimension for mathematics--the Periodic Table of shapes."](#) by Gizmag Team. *Gizmag*, 16 February 2011.



The periodic table of elements may soon be joined by a periodic table of varieties, although it's more likely to sit in volumes on your bookshelf than on a poster on your wall. This article--appearing on the science and tech news website *Gizmag*--reports on the initiation of a three-year project, headed by algebraic geometers Tom Coates and Alessio Corti (both of Imperial College London), to classify the basic building blocks of three-, four-, and five-dimensional shapes. A modeling program developed by Coates will isolate shapes which are indivisible in some algebro-geometric sense. The researchers—Corti, Coates, Vasily Golyshev (IITP, Moscow), Al Kasprzyk (Imperial College London), Sergey Galkin (IPMU, Tokyo), and the Magma team (the Computational Algebra Group, University of Sydney, Australia)--then hope to understand the properties of these shape "atoms" from the algebraic equations defining them, and ultimately to understand how their properties affect those of shapes "built" from them. "We want to build a theory of chemistry for shapes," the article quotes Dr. Coates as saying. The image is a slice of a Fano variety, an example of a shape building block. (The slices inherit the curvature of the varieties.) The researchers hope their theory will ultimately help scientists

in fields as diverse as computer vision, theoretical physics, and robotics. More images, animations, and mathematics can be found on [the pair's blog](#).

Image: Slice of the Fano variety V_6 , by Andrew MacPherson and the FanoSearch team.

--- Ben Polletta

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["Maths mavens cut to the core,"](#) by Elisabeth Tarica. *The Age*, 14 February 2011.



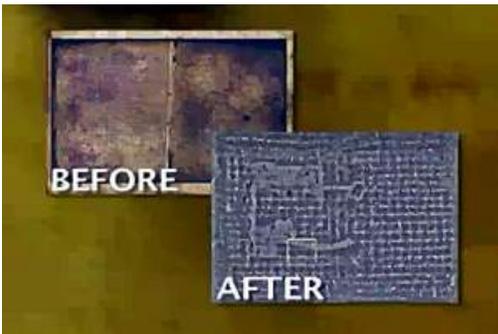
It was mathematicians to the rescue at an annual Maths-in-Industry Study Group, as reported in the Melbourne (Australia) daily *The Age*. Businesses from Australia and New Zealand paid \$7000 AUD a head to have a group of 80 leading mathematicians from the public and private sectors bring a fresh perspective to some of their pressing--and costly--problems. Past problems include: How many apples can be packed in a box? Why are train carriages in the Adelaide Hills squeaky? How can washing machines be kept from shaking during the spin cycle? This year, mathematicians sought ways to monitor water quality and secure wind farm power systems. Hosted by the Royal Melbourne Institute of Technology, the annual

event has brought mathematics to bear on 88 diverse conundrums since it was begun in 1993. The results are rewarding both for mathematicians, who appreciate the intellectual challenge, and for the participating companies, who one participating statistician estimates save millions of dollars through the Study Group. As the article quotes Connal Holmes of NZ Steel, "We find some quite innovative solutions coming through this group... these guys are not necessarily experts in our field but they come up with some amazing ideas from left field. We have some incredible solutions which literally we will be putting into practice next week."

--- Ben Polletta

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["Uncovering treasures of the past,"](#) Discoveries & Breakthroughs Inside Science. *KNDO/KNDU TV*, 13 February 2011.



A series of 90-second video spots, called *Discoveries & Breakthroughs Inside Science*, airs on local television stations around the country. These news segments are produced by the American Institute of Physics and supported by a group of scientific and engineering professional societies, including the AMS. The goal of this series is to promote awareness of and appreciation for the impact of recent advances in math, science, and engineering. In this episode, Dr. Uwe Bergmann, a physicist at SLAC National Accelerator Laboratory, describes how he used the Stanford Synchrotron Radiation Lightsource to x-ray the pages of an over 700-year-old prayerbook...and discovered the writings of Archimedes. In particular, researchers discovered a new word that

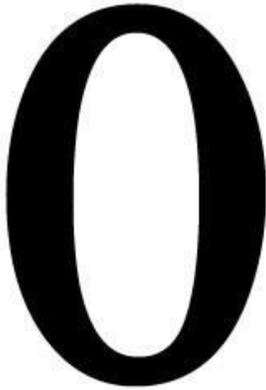
"changes completely Archimedes's interpretation of the concept of infinity." These very powerful x-rays have also been used to provide new information about a 150 million year-old fossil, "considered one of the most important transitional fossils between dinosaurs and birds," Uwe notes. Similar techniques are being used elsewhere to uncover a painting hidden below a Van Gough painting and a musical score, composed by Luigi Cherubini, which was previously covered by carbon black ink. [Watch the video](#) .

See [more math-related stories in this series](#).

--- Claudia Clark

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["Much Ado About Zero,"](#) by Barry Evans. *North Coast Journal*, 10 February 2011.



Looking for a few fast facts about the concept of "zero" and its origins? This short article has them, starting with the pre-zero days of Greece and Rome. As the author notes, the zero--now a unique and basic part of mathematical learning--was only recognized as a "number" like all the others in the past several hundred years. The Babylonian "zero" was simply a gap in the writing on a tablet, and the Incan "zero" was an un-knotted segment within a sequence of knots on a string used to represent numbers. The first documented use of a symbol to represent zero is at an Indian temple built in 876 CE, and the word "zero" has its origins in Italian and Arabic.

--- Lisa DeKeukelaere

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["Making Stuff: Smarter."](#) hosted by David Pogue, *NOVA, PBS.org*, 9 February 2011.



In this episode of *Making Stuff: Smarter*, Nova's David Pogue visits mathematician David Smith at Duke University in search of an invisibility cloak. In collaboration with another mathematician, Sir John Pendry, David has developed a circular plastic encasing with tiny copper rings that effectively lets light-waves pass around the circle, making what ever is within invisible. Currently the main drawback of this invisibility cloak is that it only works for wavelengths in the microwave region and not light-waves visible to the human eye.

Photograph of FR4 cloak (by David Schurig). Read more and see additional images on the [Novel Electromagnetic Media](#), the research group of David R. Smith at Duke University.

--- Baldur Hedinnsson

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["Sizing Up Crowds Pushes Limits of Technology."](#) by Carl Bialik, *Wall Street Journal*, 5 February 2011.



Estimating the number of people in a large crowd, such as a street protest, is harder than one might think. Due to Hosni Mubarak stepping down as president of Egypt after massive protests in Tahrir Square, the *Wall Street Journal* reports on the methods that journalists use to estimate crowd sizes. Even though the aerial photographs and satellite images have increased in quality, current methods used to determine the size of a large crowd are often no better than educated guesses and estimates can vary widely. Mathematicians and computer scientists are currently working on better techniques to estimate crowd sizes in accurate and unbiased



manner.

--- *Baldur Hedinnsson*

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"The house that math built," by Katie Daubs. *The Toronto Star*, 4 February 2011.



Canadian mathematics professor James Stewart lives in "one of North America's most important private houses," according to the director of the Museum of Modern Art in New York City. Stewart's five-story "Infinity House," which is perched on the edge of a ravine in Toronto and is estimated to have cost \$30 million, contains a 150-seat performance space and is a sought-after benefit locale for community interests. The secret to his success? Calculus textbooks. Ninety percent of Canadian university students and seventy percent of American university students learn from Stewart's chapters, and royalties earned on his book since it became a bestseller in 1992 have enabled Stewart to live his architectural dreams (although the author's conjecture about the value of the house is wildly overestimated). He began writing the text in the 1980's at the urging of his students, and it took him seven years to complete it. Read more about the house in a 2009 article in *Focus*, ["James](#)

[Stewart and the House That Math Built."](#) (Photo by Ed Burtynsky.)

--- *Lisa DeKeukelaere*

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Articles on a resolved a conjecture in enumerative combinatorics:

* ["Un théorème pour des empilements de cubes \(A theorem for stacking of cubes\)"](#) by Maurice Mashaal. *Pour la Science*, 2 February 2011;

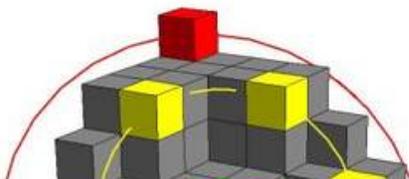
* "Spitzenforschung in IT (Top research in IT)," [Chefinfo](#) , February 2011;

* ["295 kilometer lange formel liefert Beweis \(295 kilometer formula delivers proof\),"](#) *OÖNachrichten*, 29 January 2011;

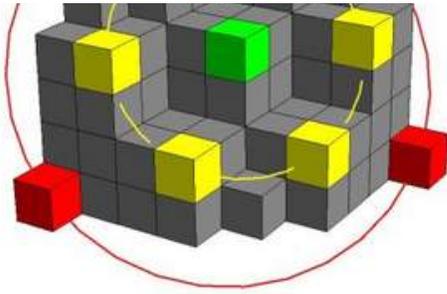
* ["Mathe-Vermutung bewiesen---Hilfsformel eine Million A4-Seiten lang \(Math conjecture proved---auxiliary formula runs one million A4 pages\)."](#) by Austrian Press Agency. *Der Standard*, 25 January 2011;

* "Linzer Forschern gelang mit Computer Beweis (Linz researchers reach with computer proof)," [Neues Volksblatt](#) , 25 January 2011;

* ["Ein Beweis, für den der Computer ein paar Monate braucht \(A proof that took the computer a couple of months\)."](#) *Die Presse*, 25 January 2011



These articles report on a recent result of three mathematicians, who have resolved a conjecture in enumerative combinatorics that remained open for nearly 30 years. The conjecture was proposed independently by George Andrews (who served as [AMS President 2009-2010](#)) and David Robbins (after whom the [AMS Robbins Prize](#) is named). A team of three mathematicians---Christoph



Koutschan, Manuel Kauers, and Doron Zeilberger---solved the problem and have described their proof in an [announcement](#) in the *Proceedings of the National Academy of Sciences*. The conjecture concerns plane partitions, which are arrays of numbers with weakly decreasing entries. Plane partitions can be represented by cubical diagrams like the one shown in the accompanying picture. Kauers et al considered a special type of plane partition, called a "totally symmetric plane partition" (TSPP). A plane partition is a TSPP if its cubical diagram looks the same when it is rotated so as to exchange the coordinate axes. An "orbit" in a TSPP is a set of cubes that remains unchanged under such a rotation. The

accompanying picture is an example of a TSPP, and the red cubes form an example of an orbit. What Koutschan, Kauers, and Zeilberger proved is that it is possible to write down an explicit formula that counts the orbits for totally symmetric plane partitions. Although related results had been obtained by others, no one had fully solved the problem until now. Another reason this result is especially noteworthy is that it used computers in a crucial way. As the *PNAS* article states, "the computations we performed went far beyond what has been thought to be possible with currently known algebraic algorithms, software packages, and computer hardware." [Image: A totally symmetric plane partition. Picture courtesy of Christoph Koutschan.]

--- Allyn Jackson

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"ESP Paper Rekindles Discussion About Statistics," by Greg Miller. [Science](#) , 21 January 2011, page 272.

In this article, Greg Miller describes how the upcoming appearance of a paper on extra sensory perception (ESP) in the *Journal of Personality and Social Psychology* has "sparked a lively discussion on blogs and in the mainstream media," and "rekindled a long-running debate about whether the statistical tools commonly used in psychology--and most other areas of science--too often lead researchers astray." By applying standard statistical methods like the t-test to the results of several experiments, the paper's author, Daryl Bem, a social psychologist and professor emeritus at Cornell University, "found statistically significant evidence suggesting his subjects had unconscious knowledge of future events." But other statisticians, including University of Washington, Seattle statistician Adrian Raftery, argue that there are problems with such standard statistical methods. "Scientists generally want to know...the probability that a given hypothesis is true, given the data they've observed. But that's not what a p-value tells them," Miller writes. Instead, Raftery and others argue for an approach based on Bayesian statistics, a more "intuitive" approach "designed to determine the probability that a hypothesis is true given the data a researcher has observed." Miller goes on to describe this approach, as well as some of the analyses that have already been undertaken of Bem's data, in the remainder of this article.

--- Claudia Clark

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