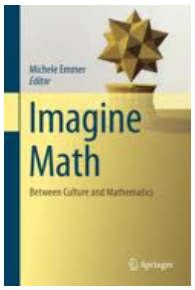
Imagine Math, between culture and mathematics *Michelle Emmer (ed.)* Springer Verlag, 2012 (vii+289 p.), hard cover, ISBN 978-88-470-2426-7, €64.15





Michele Emmer

This is another book, edited by Michele Emmer that has all the characteristics of the books appearing in the *Mathematics and Culture* series[1]. Also here there is a plethora of subjects written by different authors ranging from mathematicians to musicians and all kinds in between. Style and subjects of the contributions vary with the authors. They all link up with mathematics on one hand and on the other with history, different kinds of art (music, literature, architecture, film,...), science, medicine, economics etc. Let me illustrate this with a number of examples.

A first chapter is a tribute to *Benoît Mandelbrot* with many quotes linking fractals with art. The next is about the restoration of the *Teatro Le Fenice* in Venice (destroyed by fire in 1996 - what's in a name) and the use of computer models. This brings us to an homage to *Andrea Pozzo*, a Baroque artist famous for his use of geometry and perspective in his frescos. Near the end of the book there is another homage to *Lucia Pacioli* who was also a pioneer in the use of perspective. The *trompe l'oeil* paintings on walls creating the illusion of a long gallery, or the painting on dome ceilings or paintings creating the illusion of a dome require great skill and mathematical exactness. You may also notice how an artist struggles with composition and perspective. While composition is all about ratios for example in the frame of a painting, this may contradict the laws of perspective, so that sometimes the result is a mixture of both.



Pozzo's brilliant trompe-l'oeil dome at Sant'Ignazio (1685)



From left to right: Hypatia of Alexandia, Emily du Châtelet, Maria Gaetana Agnesi, Sophie Germaine, Mary Fairfax Sommerville, Sonya Kovalevsky, and Emmy Noether.

There are several contributions devoted to women in mathematics. Hypatia lived in Alexandria in the 4th century and was the first known woman to contribute to mathematics. She was brutally murdered for some obscure reasons, probably religious or political. There have been many other women in the course of history that contributed to the progress of mathematics. Emily du Châtelet (°1706, Paris) was a lover of Voltaire and translated Newton's work[2]. Maria Gaetana Agnesi (°1718, Milan) is known for the 'witch of Agnesi', a plane curve that she studied. She called it *verseria* (turning curve) but it was misunderstood as *avversiera* (wife of the devil). Hence the weird translation. Sophie Germaine (°1776, Paris), being a women she was denied admission to the *École Polytechnique*, but she studied mathematics on her own. She made for example a substantial contribution towards the solution of *Fermat's last theorem*. She was on the same level as Cauchy, Ampère, Navier, Poisson and Fourier, and considered to be the founder of mathematical physics, but probably less known just because she was a woman. In fact the official refused to

[1] See reviews in this Newsletter issue 50 (November 2004) and 56 (January 2006).

[2] See review of Voltaire's riddle in this Newsletter issue 85 (December 2011).

write 'mathematician' on her death certificate and wrote 'property owner' instead. Mary Fairfax Sommerville (°1780, Jedburgh, Scotland) solved a problem about Diophantine equations and wrote several books about celestial mechanics, physical geography, and chemistry. She died at the age of 92. Sonya Kovalevsky (°1850, Moscow) writer of fiction and non-fiction, and Emmy Noether (°1882, Erlangen) founder of modern algebra, are probably more familiar names. Some thoughts about the current situation of women in mathematics are added.

In the collection of papers under the title 'mathematics and art' authors consider different aspects like the use of geometrical curves (spiral, helicoids) and surfaces (hyperboliods) in architecture or the role of mathematics in art throughout the past and how these mathematical rules also appear in nature. Also literature can be analyzed using mathematical structures and statistical analysis, but conversely, a set of generating rules may also construct an artificial language. An analysis is given of the 'inescapable labyrinth' that *Jorge Luis Borges* created with mathematical precision in his story 'The library of Babel'.



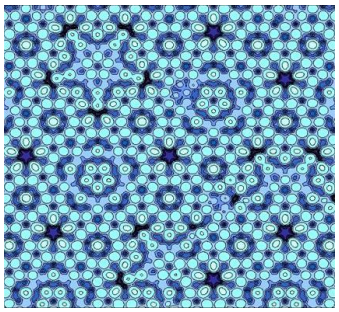
Spiral Minaret in
Samarra Iraq 847 to 851



Cathedral of Brasília
by Oscar Niemeyer (1958)



US Seal



quasi crystal



Plimpton 322 tablet

Under the part 'applications' we find essays about Lorentz knots, the statistics of words, leading numbers, games, aperiodic tilings (birth of quasi crystals). A brief numerologic analysis of the US Seal shows that the number 13 (there were originally 13 states) is omnipresent. *E Pluribus Unum* has 13 letters, there are 13 stars and 13 bumps in the circle above, the olive branch has 13 leaves and there are 13 arrows on the other side and 13 stripes in the shield. A contribution about a numerical model used for connecting artificial parts to the aorta falls under 'medical application'. Other links are found between differential equations and origami. The folding of the paper is considered to be a continuous map $f : \mathbb{R}^2 \to \mathbb{R}^3$, which can be analyzed by mathematical tools. A study of the number system of Mesopotamia is of historical nature. It is argued that the Mesopotamian period of about 3000 years is too long to consider the Babylonian mathematical system (tablet Pimpleton 233) as the sole representative of that period. Furthermore, there is not only a stage play about Hypatia (*Hypatia's Dream* by Massimo Vicenzi, 2009), but there are also films about or inspired by mathematics (like *Le Ruban de Moebius* by Edouard Blondeau[3]). It is also interesting to see how in the course of history the casting of characters playing the role of a mathematician in a movie has evolved (from Brigitte Bardot to Angelina Jolie). A final chapter is about the graphical representation of hidden rules that are used in music: visual art produced from music.

The book is about mathematics, but the formulas are only sporadically used. Theorems and proofs are fully absent. The texts are often written by non-mathematicians. Hence it is easily accessible for anyone having a general interested in mathematics and the interaction with many other aspects of science, society, and knowledge which are not the obvious engineering applications. The nice thing about it is that the interaction often goes both ways. Adhemar Bultheel

[3]Short film: 9'29 (2011). A French spoken version can be found on Youtube.