

Bridges Coimbra

Mathematics, Music, Art, Architecture, Culture

Conference Proceedings



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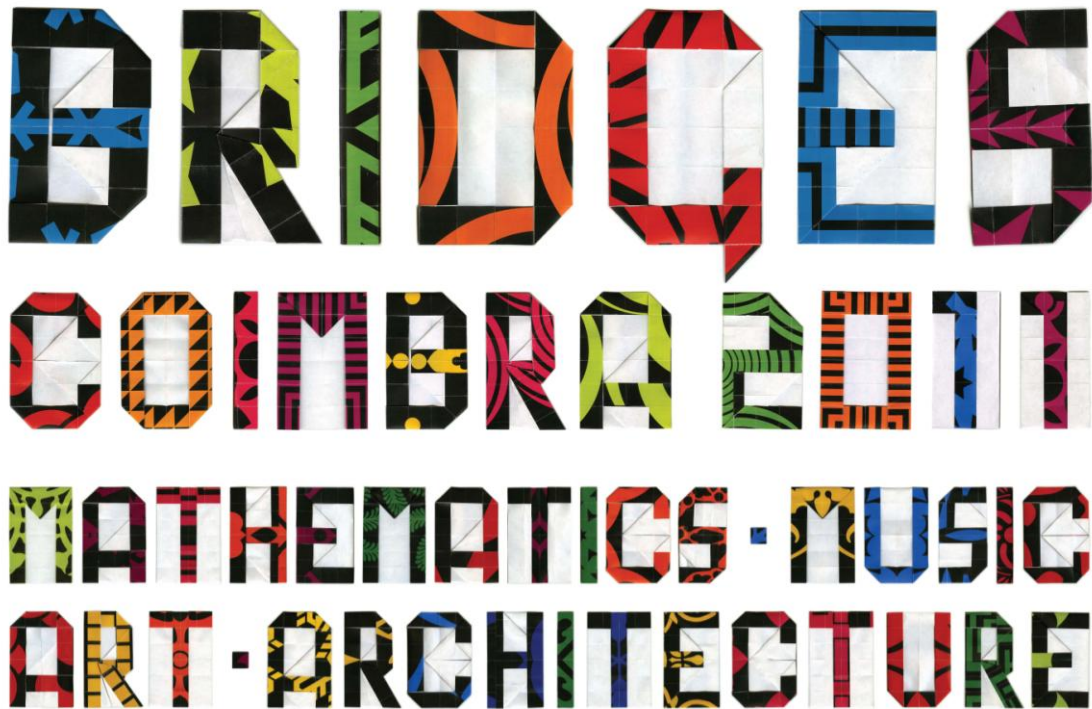


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Preface

In 2011, the Bridges Conference is being held at the University of Coimbra, Portugal, July 27–31. The University of Coimbra was established in 1290 as the first university in Portugal, and the first Portuguese language university in the world!

Coimbra has a rich history. It contains important archeological remains of structures dating from the time when it was a Roman town called Aeminium, such as its well preserved aqueduct and cryptoporticus, as well as from the period when it served as the capital of Portugal (from 1139 to about 1260). In the Late Middle Ages, declining as the political centre of the Kingdom of Portugal, Coimbra began to evolve into a major cultural centre with the foundation of the University of Coimbra in 1290. Today the university with its long history and monumental buildings attracts many visitors from around the world and is also an important tourist attraction.

After the much larger metropolitan areas of Lisbon and Porto, Coimbra is the most important urban focal point of the central part of the country. It is situated on the Rio Mondego, the longest river located exclusively in Portugal. The river flowing through the city provides a scenic setting for the town centre that invites everybody for walks along its river banks and across its four bridges. It is a lovely setting for our Bridges conference!

Since last year the conference has grown again and is setting new records. We received more paper and workshop submissions than ever before, presenting intriguing ideas in mathematics, in the arts, and in several other cultural domains that can benefit from a description or analysis using mathematical notations and techniques. This year the keynote paper is coauthored by Fields medalist William P. Thurston. Another plenary paper will be presented by Paulus Gerdes, the president of ISGEM, the International Study Group on Ethnomathematics.

The formal talks are complemented by a wide variety of hands-on workshops, a juried art exhibition and several evening programs devoted to music, theater performances, and movies with an art-math theme, and special day programs devoted to poetry and family art-math activities. There is also a day-long excursion to various museums and cultural sites.

The workshops provide hands-on extensions of many lectures, where a smaller group of participants can immerse themselves more fully in a specific topic—often focused on the teaching of some mathematical skills to students of all ages. As in many previous years, Mara Alagic and Paul Gailiunas have taken charge of this important part of the conference. But this year we had more workshop submissions than ever, and there will be a complete track paralleling all the sessions of regular and short papers.

The local organizers also planned a Portuguese Math/Art Day, which features invited talks by Manuel Arala Chaves (Associação Atractor—www.atractor.pt), Paulus Gerdes (Maputo, Mozambique) and João Paulo Xavier (University of Porto), complemented by workshops on the symmetry of plane patterns, on Roman architecture in Portugal, and on Lunda Art, inspired by Sona Geometry from Angola. A special 3D projection show with some of the nice stereoscopic materials produced by Associação Atractor has been produced for this occasion.

An exhibition of mathematical art has been an annual feature of Bridges since 2001, and it has grown steadily over the years under the dedicated leadership of Robert Fathauer. This year, work was submitted by more than 70 artists from 20 countries. Diverse artistic media are represented, including wood, metal, and stone

sculpture, beadwork, and fabric, in addition to a variety of two-dimensional media. Mathematical ideas at play in the art exhibition encompass tilings, fractals, polyhedra, hyperbolic geometry, anamorphosis, knots, topology, and magic squares. Anne Burns, Ana Isabel Cardoso, and Nat Friedman joined Robert Fathauer on the jury. The exhibition website was created by Nathan Selikoff, and Nathan and Robert also edited the catalog for the exhibition.

The Bridges conference always had a Music Night. This year Dmitri Tymoczko is again organizing this popular event. Coimbra's professional orchestra, the Orquestra Clássica do Centro, has graciously agreed to play a concert featuring new and old works, including a mathematically inspired composition by Giovanni Albini, and new works by Dmitri Tymoczko and Vi Hart.

Over the years we have experimented with many different formats for Theater Night. This year the event is orchestrated by Steve Abbott; it is focused on a single dramatic piece: *The Physicists*, by Friedrich Dürrenmatt, performed in the form of a staged reading by conference participants. The play takes place in a home for the mentally ill, which counts Isaac Newton and Albert Einstein among its patients. Although the moral responsibility of scientists is the dominant theme of this tragic comedy, topology also plays an interesting role, as the central character is another scientist, named Mobius, who is taking refuge in the sanatorium and negotiates the politics of the madhouse.

Last year we inaugurated a new conference event: The Bridges Math Art Short Movie Festival. A rapidly growing number of artists and educators are using movies, videos, and animations for applications spanning education, industry, and the arts. Since one of the objectives of the Bridges organization is to introduce participants to innovative and integrative techniques, we will continue the venue launched last year, and we will screen many short movies with an art-math topic.

The importance of Family Day is growing yet further this year. Kristóf Fenyvesi, our coordinator of community events, has been working together with Ana Maria de Almeida and Maria Emília Bigotte to create a fun-filled day for families, offering on-site immersion into the world of mathematics and arts. Conference participants, including educators, workshop holders, and animators, as well as various local artists, have collaborated to prepare a variety of interesting community activities, ranging from presentations and interactive demonstrations to games, workshops, and a mathematical flea market.

Poetry Day is a new addition this year to the Bridges Conference. This event, coordinated by Sarah Glaz, University of Connecticut mathematician and poet, is a reading of poems with strong links to mathematics. The invited readers are a diverse group of poets whose specialties include mathematics, philosophy, history, teaching, translating and conducting scholarly work on the connections between mathematics and poetry. Reading their own poems are Emily Grosholz, JoAnne Growney, Amy Uyematsu and Sarah Glaz. Saeed Ghahramani will read modern Iranian poems in translation. Coimbra University mathematician and translator, Francisco Craveiro, will be joined by the other poets for a bilingual reading of mathematical poems he translated into Portuguese. Francisco will read the Portuguese translations, while the other poets will read the English originals. The event will end with an "open microphone" period in which Bridges participants can share their own mathematical poems with the audience.

Such a rich and varied event cannot be put together by just a few official chair persons; it takes the full energy of many dedicated individuals who have been laboring for several months and in a few instances for a couple of years to put this year's conference together. In addition to the organizers of the many events mentioned above that make up the wonderful mosaic that forms a Bridges conference, we would also like to express our special thanks to our team in Coimbra: Penousal Machado in the Department of Computer

Science, Ana Almeida in the Department of Mathematics, and Amílcar Cardoso, the President of the Centre for Informatics and Systems at the University of Coimbra, Portugal, as well as the many local organizations and individuals who have helped to make this conference a reality, in particular:

- University of Coimbra, particularly to João Gabriel Silva, the Rector and José António Bandeirinha, former Culture Pro-Rector;
- City of Coimbra, particularly to Maria José Azevedo, Vice-Mayor;
- Machado de Castro Museum and its Director, Ana Alcoforado;
- Science Museum, particularly Paulo Gama Mota, Director, and Carlota Simões, Vice-Director;
- Turismo de Coimbra, particularly to Luís Alcoforado, the President;
- Instituto Superior de Engenharia de Coimbra;
- Math Department of the University of Coimbra;
- Centre for Mathematics of the University of Coimbra;
- Centre for Informatics and Systems of the University of Coimbra;
- Orquestra Clássica do Centro, particularly Artur Pinho, Conductor, and all his team;
- Grupo de Etnografia e Folclore da Academia de Coimbra (GEFAC);
- Design Atelier FBA., particularly André Ferrão.

Last, but not least, we would like to thank all the Bridges conference attendees, who often come from rather far-away places. It is really your active participation and enthusiasm that makes this conference such an exciting event.

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