

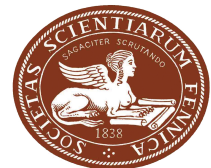
BRIDGES AALTO 2022

MATHEMATICS / ART / MUSIC / ARCHITECTURE / CULTURE

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Preface

Welcome to the 25th annual Bridges Conference! This year we will finally gather face to face in Helsinki, the sustainable capital of Finland and a vibrant seaside city of beautiful islands and great green urban areas. Helsinki marches to a wonderful and unique beat of its own with dynamic food, design, architecture – and sauna! – scenes. The conference, in collaboration with Aalto University, University of Helsinki, and University of the Arts Helsinki, will take place at the Otaniemi campus of Aalto University in Espoo, Finland. The Otaniemi campus, a crown jewel of Finnish architecture, is nine kilometers from the center of Helsinki. The main venue for the lectures and the Exhibition of Mathematical Art will be the Undergraduate Centre, while the public lectures will take place at the University of Helsinki. Family Day will be held at the National Museum of Finland, the premier institution for Finnish cultural history.

Aalto University is a Finnish multidisciplinary university founded in 2010 by merging the Helsinki School of Economics, the University of Art and Design Helsinki, and the Helsinki University of Technology. The university shapes a sustainable future by making research breakthroughs in and across our disciplines, sparking the game changers of tomorrow and creating novel solutions to major global challenges. With nearly half of its academic faculty from outside Finland, Aalto is a highly international community with strong academic standing. Aalto is particularly important for engineering in Finland since it educates more than 40 percent of the country's engineering graduates. The cornerstones of research touch four fundamental competence areas: ICT and digitalization, materials and sustainable use of natural resources, global business dynamics, and arts and design. Aalto University also focuses on three integrative, multidisciplinary themes: advanced energy solutions, health and well-being, and human-centered living environments. Aalto ranks 30th out of the world's young universities according to the 2022 Times Higher Education Young University Rankings, and 9th according to QS. Aalto University continues to excel in art and design, ranking 6th in the world in 2022. In the Times Higher Education Impact Ranking 2022, Aalto ranks 54th globally for responsible consumption and production. Our community is made up of 12,000 students, 400 professors and close to 4,000 other faculty and staff working on our dynamic campus in Espoo.

Since 2018, the academic minor Aalto Math&Arts (matharts.aalto.fi) has had three transdisciplinary courses integrating mathematics with visual arts, design and architecture: Shapes in Action, Crystal Flowers in Halls of Mirrors: Mathematics meets Art and Architecture, and Spatial Structures. These courses have already attracted a broad range of students from freshmen to PhD students coming from all schools of Aalto. The minor culminates in a biennial student exhibition that has taken place at Aalto, as well as Heureka, the Finnish Science Centre in 2017, and at Tapiola Cultural Centre in 2019. In November 2019, the Aalto Math&Arts exhibition was showcased in the Future Lab exhibition week in the West Bund Art Centre in Shanghai, China. Some of the pieces from these exhibitions will be showcased during the Bridges Conference.

Other Math&Arts activities include public events under Mathematics and Arts Colloquia, school visits, retraining school teachers under the LUMATIKKA project funded by the Finnish Ministry of Education, participating FinnCERES project funded by the Finnish Academy of Sciences, and a joint Fold Co-Innovation project funded by Business Finland with VTT and eight Finnish industrial partners. Activities focusing towards schools are run in collaboration with Aalto Junior.

We are grateful for contributions to the Bridges 2022 conference from Aalto University, University of Helsinki and University of the Arts Helsinki. The local organizing committee was broadly represented by experts from mathematics and arts bringing versatile insight to the arrangements. We are thankful to Anna Valtonen, the Vice President of Art and Creative Practices at Aalto University; Jouko Lampinen, the Dean of the School of Science; and Nuutti Hyvönen, the Head of the Department of Mathematics and Systems Analysis, for making the conference possible at Aalto. For financial support outside Aalto we are grateful to the Finnish Cultural Foundation; the Magnus Ehrnrooth Foundation; the Federation of Finnish Learned Societies; the Mathematics Fund of the Finnish Academy of Science and Letters; Jan Vapaavuori, the former Mayor of Helsinki; Juhana Vartiainen, current Mayor of Helsinki; Tuula Antola, the former Director of Economic Development of Espoo and currently Joint Authority Director at Omnia; Mari Paavilainen, Event Coordinator of Espoo; and Tuomas Hytönen, the Head of the Mathematics and Statistics Department of the University of Helsinki.

Hanna Korhonen and her team at the National Museum of Finland had a great impact on the planning and implementation of Family Day. The promotional video was edited by Taneli Luotoniemi. Petteri Mäkinie and Taneli also designed the postcards and posters. For administrative support we are indebted to Johanna Glader, Paula Hämäläinen, Laura Karvonen, Karola Salminen, Maisa Rein, and David Radnell. Interior designer Markus Holste curated the Math&Arts exhibition and arranged the Bridges Exhibition of Mathematical Art, together with Taneli Luotoniemi. Valuable help was provided by students Balázs Nagyvárad, Waltteri Keus, Joel Hakavuori, Matti Rehell, and Samuel Toivonen.

We are very thankful for the hard work and endurance of the host committee, chaired by Kirsi Peltonen. The committee drafted and continually refined the original plans for the 2020 Bridges conference in Helsinki, which was postponed twice due to the COVID pandemic.

This year's Bridges Program Chair is David Reimann. He coordinated an international program committee of over 60 experts, who provided extensive peer reviews and editorial comments on submissions. David also served as chair of the regular papers track, while Doug Norton chaired the short papers track, and Eve Torrence chaired the workshop papers track. Great thanks go to the program committee whose work enriches the field and makes the conference and proceedings possible. Special thanks to Art Exhibition chairs Robert Fathauer and Bruce Torrence, Poetry Reading chair Sarah Glaz, Short Film Festival chair Bianca Violet, and Family Day chair Kristóf Fenyvesi. Thank you to Dan Bach for designing the cover art and to Conan Chadbourne for preparing the Art Exhibition catalog. Thanks to Craig S. Kaplan for production of this Proceedings and the Bridges Archive.

The 2022 Bridges proceedings includes 34 regular papers, 51 short papers, and 6 workshop papers. Once again, we are fortunate to have papers covering a wide range of topics. The papers showcase new ideas in fashion, music, dance, poetry, literature, visual art (both 2D artwork and 3D sculptures), and crafts such as beadwork, weaving, and origami. We see connections to an equally wide range of mathematical ideas including topology, symmetry, tilings, knot theory, polyhedra, optimization, and more. Readers are sure to find them engaging and captivating. The enormous range of creativity and breadth of ideas in the Bridges community continues to be astounding. This complicates the task of serving on the Program Committee. We are grateful for the meticulous service of those members who graciously assist their colleagues in polishing their written work.

An exhibition of mathematical art has been an annual feature of Bridges since 2001. Bridges has always interpreted mathematical art broadly, to include all artifacts that express mathematical themes visually. In addition to objects whose primary function is to serve as an artwork, this year's exhibition also showcases other mathematically inspired creations, such as puzzles, prototypes, textiles, and architectural renderings. A wide variety of artistic media are represented, including 2D and 3D digital prints, drawing, painting, beadwork, weaving, ceramics, woodwork, metalwork, quilting, and paper cutting and folding. Artists drew inspiration from the mathematics of fractals, polyhedra, non-Euclidean and higher dimensional geometry, tiling, knot theory, number theory, and more. Robert Fathauer and Bruce Torrence served as co-curators of the exhibition. The jury considering the artworks consisted of Robert Fathauer, Taneli Luotoniemi, Kate McCallum, and Bruce Torrence. The art submission website was created and administered by Nathan Selikoff.

This year we were able to offer two travel scholarships and ten registrations for students who are presenting their work. We are very grateful to the Bridges community for donations supporting the Reza Sarhangi Travel Scholarship and Memorial Lecture Fund, which makes this program possible. This is a testament to the enduring legacy and generous spirit of Bridges founder Reza Sarhangi for creating an atmosphere of goodwill, sharing, and working together to further the study of mathematics and art.

We welcome you to join us in our celebration of mathematics and the arts, whether in person in Finland, through the pages of our printed publications, or in our online archive that covers a quarter-century of magnificent work from conferences past. Bridges serves as a beacon for all those fascinated by the connections between mathematics and the arts. With your support, it will continue to light the way for many years to come.

The Bridges Organization Board of Directors and Bridges 2022 Chairs
www.bridgesmathart.org

