Co-funded by the Erasmus+ Programme of the European Union

STEAMTeach

STEAM Education for Teaching Professionalism

Education, Games and Creativities

Dr. Kristóf Fenyvesi

University of Jyväskylä

Finnish Institute for Educational Research

Innovative Learning Environments Research Group

STEAMTeach

STEAM Education for Teaching Professionalism

Innovative Learning Environments

Finnish Institute For Educational Research

JYVÄSKYLÄN YLIOPISTO
UNIVERSITY OF JYVÄSKYLÄ

ILE is a research and education group that focuses on the advancement of children's and young people's 21st Century Skills. The field includes especially user-driven design and study of learning technologies and spaces for enhancement of learning and wellbeing, analyses of innovative teaching and learning practices, technology-enhanced learning, and evaluation and comparison of ICT use in education. When applicable, the research can also be directed to other phases of human life for the study of citizen's knowledge society capabilities.

Team members

Marja Kankaanranta Kati Clements Kristof Fenyvesi Tiina Mäkelä Piet Sikström

Saana Mehtälä Mikko Muilu Mimmu Alanko Matias Mäki-Kuutti Takumi Yada

Co-funded by the Erasmus+ Programme of the European Union

UPGRADE
Upgrading pre- and in-service teachers' digital skills with online STEAM hands-on training modules

free3D
A FRAMEWORK FOR EFFICIENT AND ENGAGING HYBRID EDUCATION IN LOWER-SECONDARY SCHOOLS

JYULearn

"Co-designing learning environments with teachers and learners"

Ministry of Education and Culture

"Assessment of transversal skills in formal and informal learning environments"

kaks.fi
KUNNALLISALAN KEHITTÄMISSÄÄTIÖ

Digiloping Teachers:
Digital competences development and mentoring for teachers

https://www.jyu.fi/it/en/research/research-areas/cognitive-science-and-educational-technology/ile

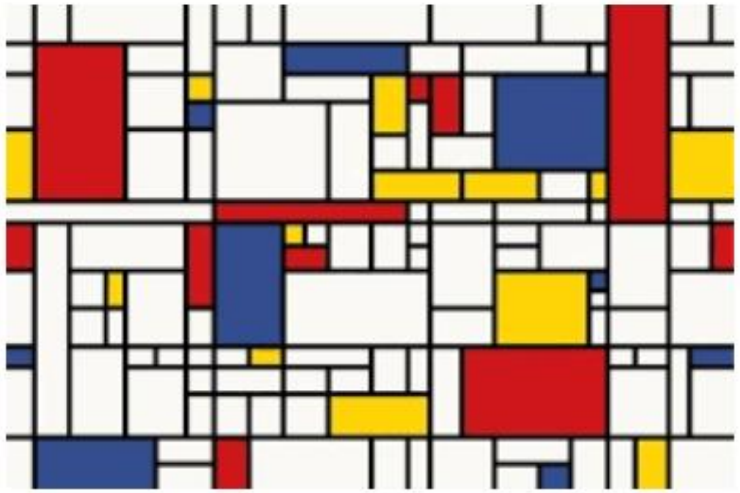
STEAM:

integration between subjects of Science, Technology, Engineering, Arts and Mathematics

Mondrian Art Puzzles

STEAMTeach
STEAM Education for Teaching Professionalism

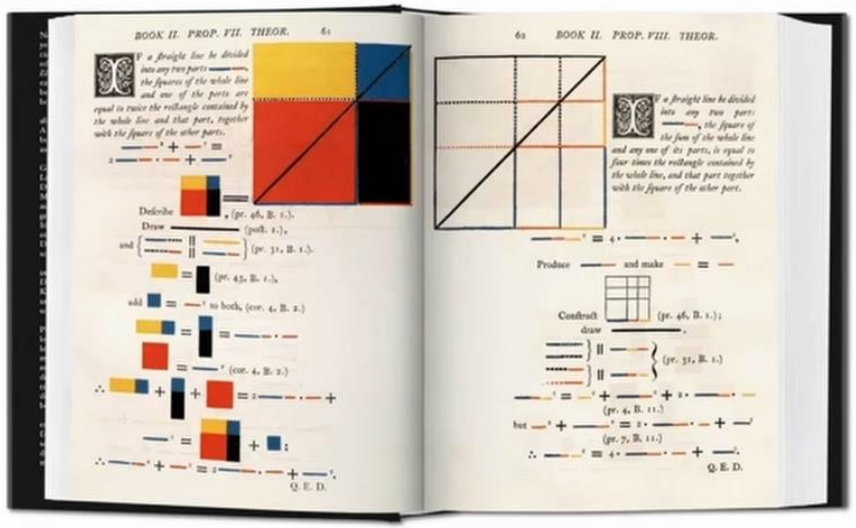
Piet Mondrian was a Dutch painter who is now considered one of the great artists of the 20th century [1]. Among his other works, some of Mondrian's art had a unique, geometric style that (no surprise) attracted the eyes and minds of mathematicians. His art looked a little something like this:



From the clashing of two worlds, math and art, the "Mondrian art puzzle" was born: a fun, creative, and colorful math activity built for almost any age!

Art & Mathematics

Merging art with mathematics was a natural process
for Piet Mondrian to visualize the essential, pure beauty and balance.



Oliver Byrne's 1847 edition of Euclid's Elements

Mondrian: Composition with Red Blue and Yellow

Art & Mathematics

Mondrian's artistic evolution from figural painting to geometrical imagery was a spiritual journey and an intellectual effort. The goal was to discover the structure beneath the surface and to highlight the profoundly significant.

Evolution

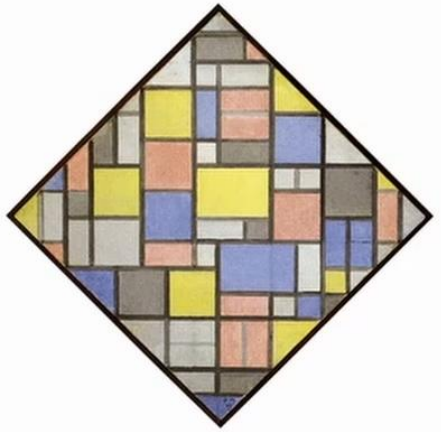
The Large Nude

Pier and Ocean

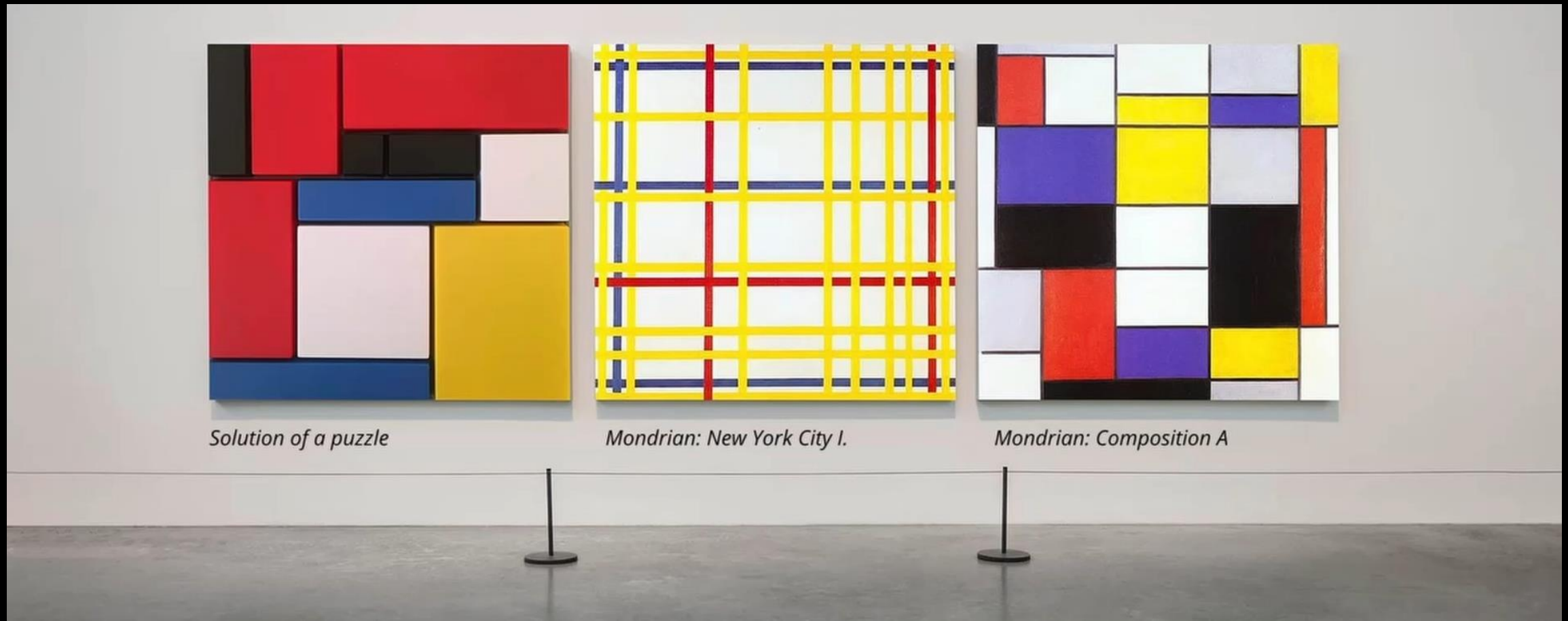
Art & Mathematics

Mondrian's systematically implemented grids and the "primary colors" - red, blue, yellow, and white - express the "universal forces" of his vision of art and reality.

Composition 1916



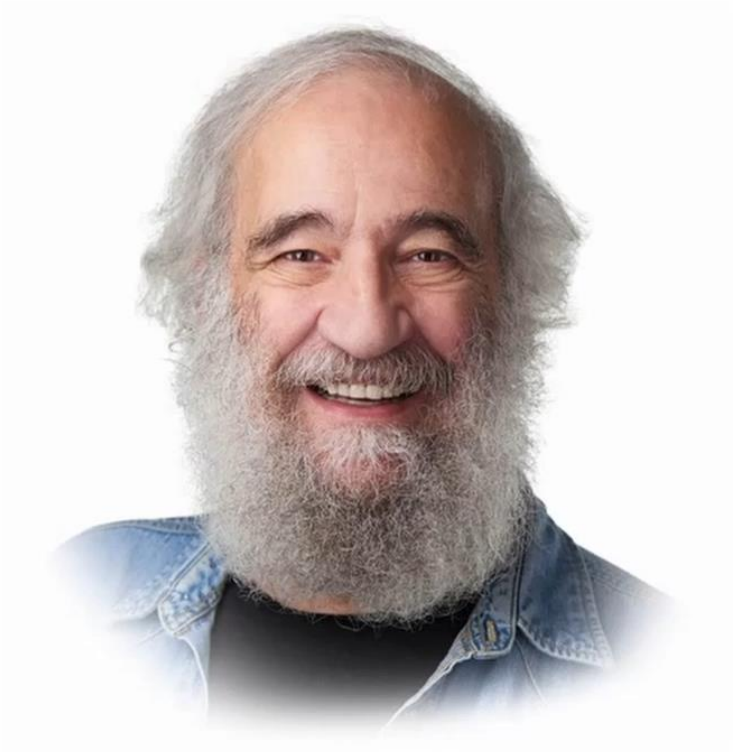
Composition with Grid 6


Solution of a puzzle
Mondrian: New York City I.
Mondrian: Composition A

How it started?

The original idea of Mondrian Blocks is created by **Prof. Dr. Laszlo Mero**.

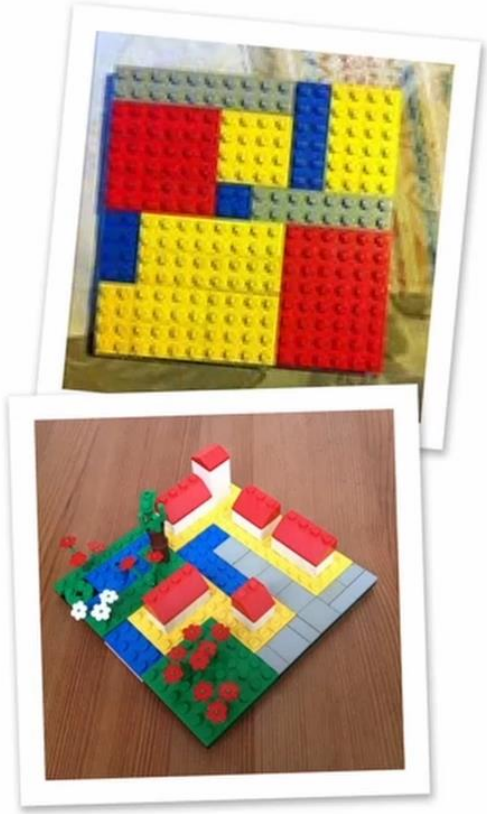
He is a Professor of Math,
a Professor of Psychology,
a research psychologist,
and popular science author.



How it started?

The idea came up when an escape room needed a puzzle.

The first prototype is made of Lego blocks.



How it started?

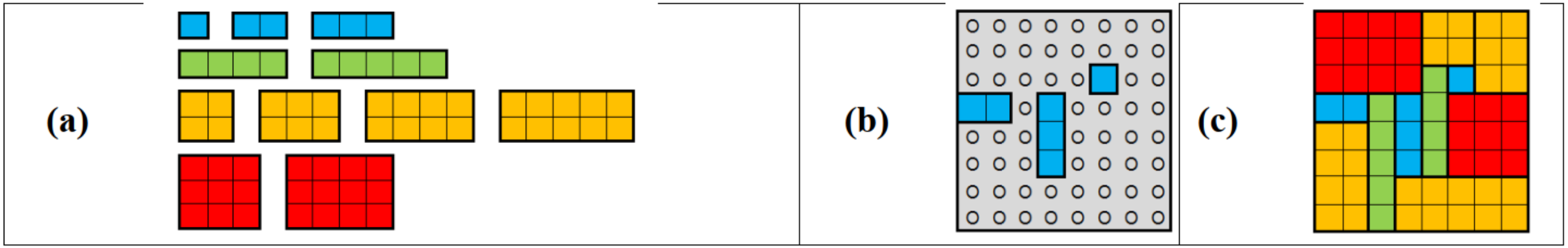
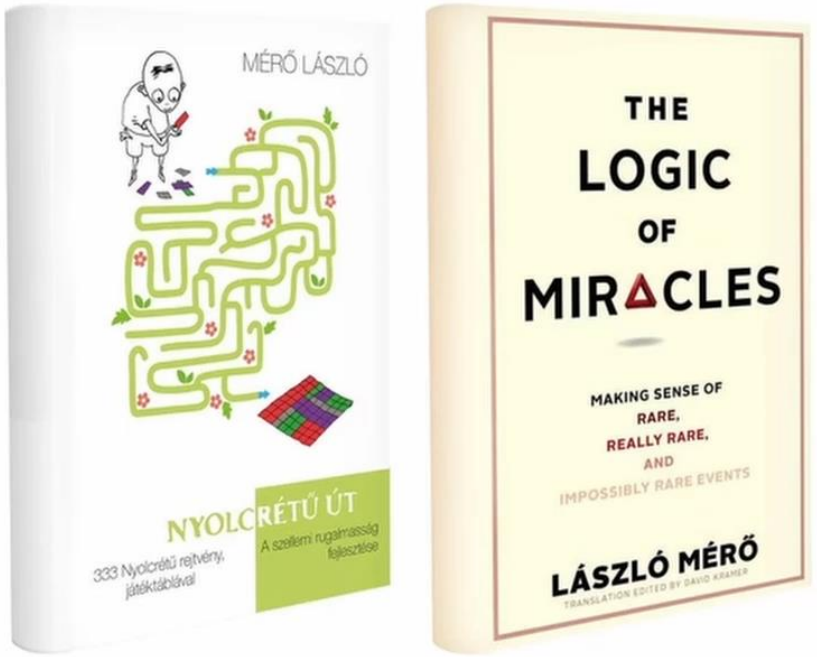


Figure 1a, b, c: *Mérő's idea came up when he was requested to create a logic puzzle for an escape room. (a) The origin of the idea is the recognition: the sum of the squares is exactly 64, which can be fitted in a 8x8 square. (b) A puzzle: the blue modules cannot be moved and all the rest of the modules need to be fitted on the board without gaps and overlapping. (c) A solution. Conclusion: there are a surprisingly large number of puzzles possible.*

How it started?

At first the game became an appendix of a book.

The Eightfold path: Developing intellectual flexibility.



The result of the development

Imre Kökényesi

Product developer
and game designer

Best Education & Games
2020 Buyer's Choice Award

The result of the development

Four editions, each with 88 different challenges inside.

MSA MUSEUM STORE ASSOCIATION

Best Education & Games

2020 Buyer's Choice Award

Mondrian Blocks' connection to cognitive skills.

The following cognitive skills are help to improve the ability of learning math:

Instinct knowledge of numbers, dimensions, areas

Flexible thinking, changing the point of view

Reasoning

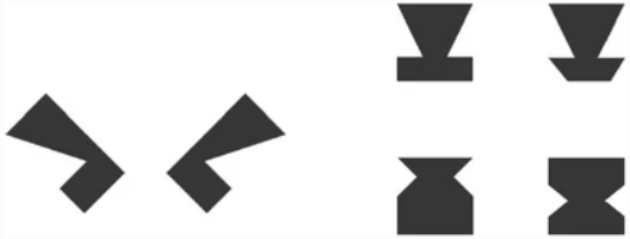
Critical thinking

Perceptual organization

Working memory

Processing speed

From: The role of 2D and 3D mental rotation in mathematics for young children: what is it? Why does it matter? And what can we do about it?

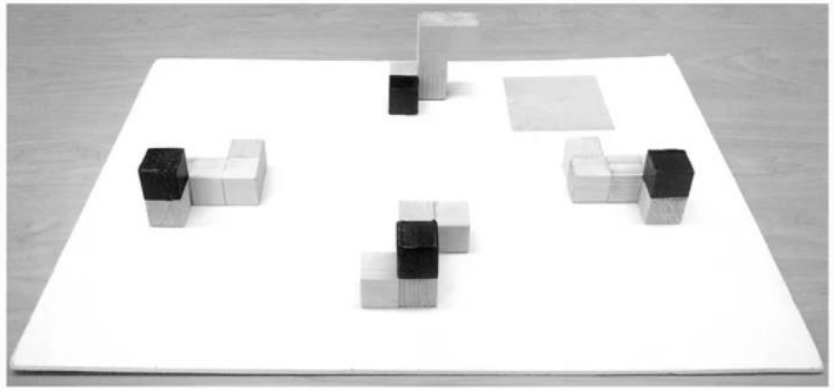


When we mentally rotate the *two shapes on the left* so that they are joined at a centre *y* axis, which figure do they make (of the *four on the right*)? (From Levine CMTT, et al., 1999); see also the classic test of Shepard & Metzler, 1971

From: The role of 2D and 3D mental rotation in mathematics for young children: what is it? Why does it matter? And what can we do about it?

When asking children to think about the area of these two squares, students describe mentally rotating the left square to match the square on the right as a proof that the area of the two squares are the same

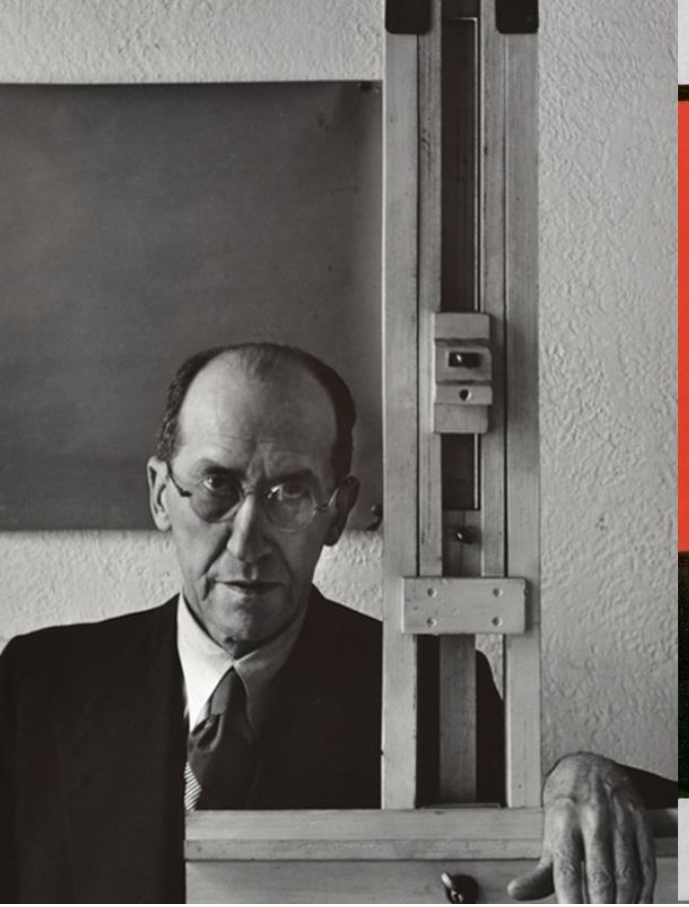
From: The role of 2D and 3D mental rotation in mathematics for young children: what is it? Why does it matter? And what can we do about it?

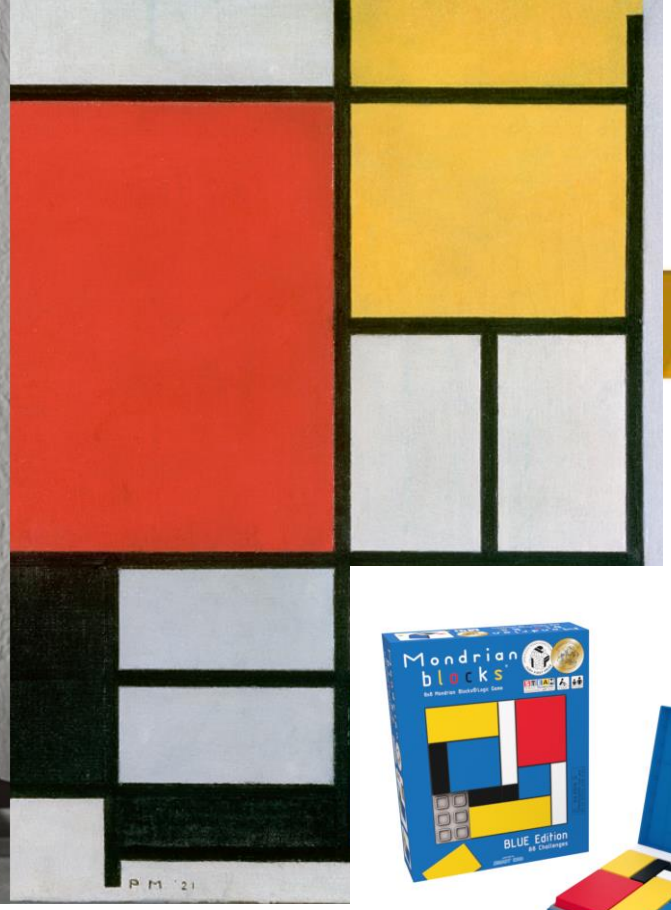


In this 3D mental rotation blocks task (3DMRBT: Hawes, LeFevre, Chang & Bruce, 2014), the participant must identify which of the three figures at the front exactly matches with the figure at the back once rotated

„The ability to mentally rotate objects in space has been singled out by cognitive scientists as a central metric of spatial reasoning (see Jansen, Schmelter, Quaiser-Pohl, Neuburger, & Heil, 2013; Shepard & Metzler, 1971 for example). However, this is a particularly undeveloped area of current mathematics curricula…"

Bruce, C.D., Hawes, Z. The role of 2D and 3D mental rotation in mathematics for young children: what is it? Why does it matter? And what can we do about it?. *ZDM Mathematics Education* **47,** 331–343 (2015). https://doi.org/10.1007/s11858-014-0637-4





MO MATH
NATIONAL MUSEUM OF MATHEMATICS

EXPERIENCE WORKSHOP
www.experienceworkshop.org

Visit | Events | Exhibits | Donate | Shop

Mondrian 150!
Mondrian Day at MoMath

Saturday, February 19
10:00 am – 5:00 pm ET (New York)

MO MATH
NATIONAL MUSEUM OF MATHEMATICS

Visit | Events | Exhibits | Donate | Shop

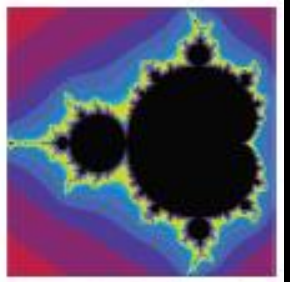
Friday, February 18 at 6:30 pm ET (New York)

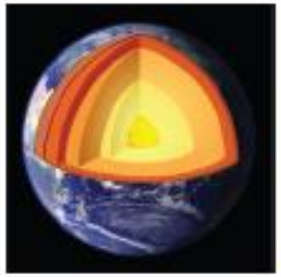
TWO SIGMA FAMILY FRIDAYS MOMATH

Cognitive Games

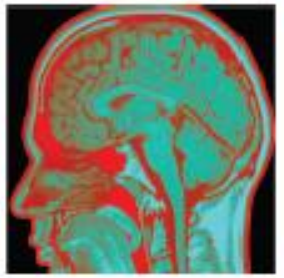
Sunday, February 20
10:00 am – 5:00 pm ET (New York)

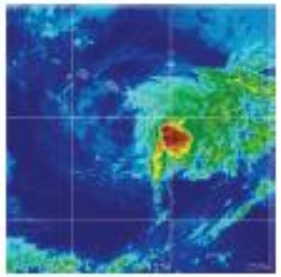
INTERNATIONAL DAY OF MATHEMATICS
MARCH 14





MATHEMATICS IS EVERYWHERE





Kristóf Fenyvesi and Tuuli Lähdesmäki (Editors)

Aesthetics of Interdisciplinarity: Art and Mathematics

This anthology fosters an interdisciplinary dialogue between the mathematical and artistic approaches in the field where mathematical and artistic thinking and practice merge. The articles included highlight the most significant current ideas and phenomena, providing a multifaceted and extensive snapshot of the field and indicating how interdisciplinary approaches are applied in the research of various cultural and artistic phenomena. The discussions are related, for example, to the fields of aesthetics, anthropology, art history, art theory, artistic practice, cultural studies, ethno-mathematics, geometry, mathematics, new physics, philosophy, physics, study of visual illusions, and symmetry studies. Further, the book introduces a new concept: the interdisciplinary aesthetics of mathematical art, which the editors use to explain the manifold nature of the aesthetic principles intertwined in these discussions.

ISBN 978-3-319-57257-4

▶ birkhauser-science.com

Kristóf Fenyvesi and Tuuli Lähdesmäki (Ed.)

Aesthetics of Interdisciplinarity: Art and Mathematics

Kristóf Fenyvesi
Tuuli Lähdesmäki
Editors

Aesthetics of Interdisciplinarity: Art and Mathematics

Birkhäuser

THE FRONTIERS COLLECTION

Wuppuluri · Wu (Eds.)

ON ART AND SCIENCE

Shyam Wuppuluri
Dali Wu (Eds.)

ON ART AND SCIENCE

Tango of an Eternally Inseparable Duo

With an Afterword by Sir Martin Rees

Springer

EXPERIENCE WORKSHOP

www.experienceworkshop.org

Mathematics and Art Connections Expressed in Artworks by South African Students

Kristóf Fenyvesi (Researcher of STEAM Education, University of Jyväskylä, kristof.fenyvesi@jyu.fi)

Christopher Brownell (Associate Professor, Mathematics and STEM Education, Program Director, Mathematics Education, Fresno Pacific University, USA, chris.brownell@fresno.edu)

Pamela Burnard (Professor of Arts, Creativities and Educations, University of Cambridge, pab61@cam.ac.uk)

Pallawi Sinha (Postdoctoral Research Associate, University of Cambridge, ps527@cam.ac.uk)

Werner Olivier (Professor of Mathematics, Nelson Mandela University, werner.olivier2@mandela.ac.za)

Catherina Steyn (Researcher of Mathematics Education, Nelson Mandela University, Catherina.Steyn@mandela.ac.za)

Zsolt Lavicza (Professor of STEM Education Research Methods, Johannes Kepler University, Linz, lavicza@gmail.com)

CRITICAL ISSUES IN THE FUTURE OF LEARNING AND TEACHING

Why Science and Art Creativities Matter

(Re-)Configuring STEAM for Future-Making Education

Pamela Burnard and
Laura Colucci-Gray (Eds.)

Chapter 8 Reconfiguring STEAM through Material Enactments of Mathematics and Arts

A Diffractive Reading of Young People's Intradisciplinary Math-Artworks

Authors: Pamela Burnard, Pallawi Sinha, Carine Steyn, Kristóf Fenyvesi, Christopher Brownell, Olivier Werner, and Zsolt Lavicza

Pages: 171–199

BRILL | SENSE

NELSON MANDELA UNIVERSITY

Change the world

Govan Mbeki Mathematics Development Centre

EXPERIENCE WORKSHOP

www.experienceworkshop.org

Wuppuluri · Wu (Eds.)

ON ART AND SCIENCE

OPEN DESIGN AFRIKA

HOME FESTIVAL PROJECTS ABOUT NEWS UNESCO DESIGN CITIES CONTACT

EDUCATION, COMMUNITY, DESIGN-LED INNOVATION

BUILDING THRIVING FUTURES THROUGH CREATIVITY

Why Science and Art Creativities Matter

(Re-)Configuring STEAM for Future-Making Education

Pamela Burnard and Laura Colucci-Gray (Eds.)

Shyam Wuppuluri

Dali Wu (Eds.)

ON ART AND SCIENCE

Tango of an

Springer

PLAYFUL LEARNING
in Early Childhood Education in Finland

This book is intended for all persons working with children aged 0–7 years who do the vital work, for instance, in Early Childhood Education and Care (ECEC) centres, kindergartens, nurseries and schools in all parts of the world. This book is also an excellent tool for training ECEC teachers.

The book contains over 100 practical and playful activities for children under seven years of age. It will give you concrete examples and ideas for how to implement activities with children in order for them to learn through play. The chapters of the book are based on the Finnish pedagogical practices, scientific research, and development projects of ECEC and is also based on the Finnish National Core Curriculum for ECEC.

We writers hope this book will inspire you in your work with children and promote their lifelong learning. We hope the children will receive beneficial learning experiences through the playful activities we've described – and that you, the reader, will experience happiness working and playing with the children.

PLAYFUL LEARNING in Early Childhood Education in Finland *elevates the pedagogical significance of play in learning, as well as children's holistic growth and well-being. This book encourages versatile and functional working methods that promote children's creativity, interaction and participation. Our main task is to help you provide good childhood experiences and consequently a promising future for all children.*

Pia Kola-Torvinen, Counsellor of Education, Finnish National Agency for Education

PLAYFUL LEARNING in Early Childhood Education in Finland *is a book that gets right to activities that are useful for children. Behind the planned playful activities are education professionals who have proved the effectiveness of these activities based on specific theories and research. The book is useful in daycare centres and is needed in teacher education. It can also be an excellent guide for parents in home education. The book guides children to participate and experience joy together. The book itself plays a valuable part in developing children's culture.*

Ulla Härkönen, professor emerita at the University of Eastern Finland

Finland International Education

1AC5
ISBN 978-951-1-43042-1
otava.fi

PLAYFUL LEARNING in Early Childhood Education in Finland

OTAVA

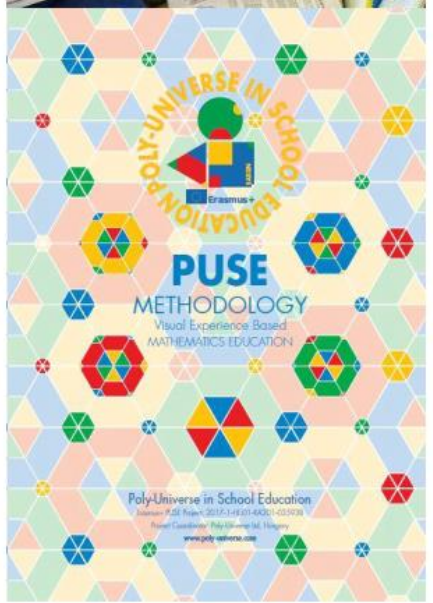
PLAYFUL LEARNING
in Early Childhood Education in Finland

Integrating pedagogical activity and care through play with language, art, mathematics and motor skills

Pirkko Karvonen
Tuulikki Ukkonen-Mikkola
Kristof Fenyvesi
Milla Salonen
Päivi Erkkilä
Elina Laine
Susan Hellden-Paavola
Laura Taittonen

Finland International Education

WORKSHOP 1: SHAPES AND COLORS



The Polyuniverse offers a new perspective for mathematics and art education. Mind-bending combinations made of 24 pieces each of the 3 basic shapes: the triangle, the circle and the square.

WORKSHOP 2: STRUCTURE

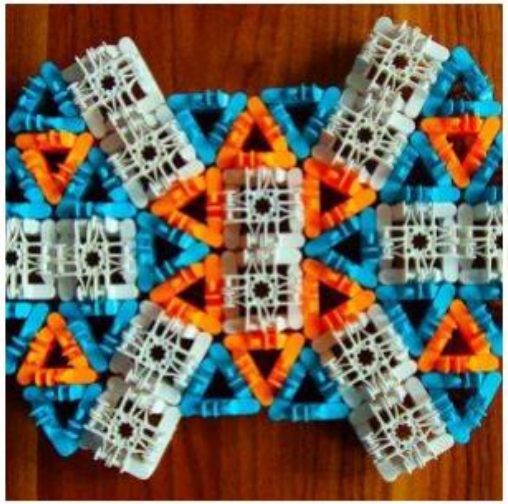
Make a geometrical magic carpet, tapestry or decoration inspired by various patterns, including visual illusions! Determine the colours, think about the pattern, count, and create.

WORKSHOP 3: LOGIC

MONDRIAN BLOCKS are offering cognitive challenges at the conjunction of art and mathematics. Let the flow take your mind to the next level!

METHER-BORGSTRÖM'S STEAM PLAY DAY

WORKSHOP 4: LINKS & FLEXIBILITY



Called the "next level LEGO" by the New York Magazine, LUX is a revolution in construction. Modeled after nature at the molecular level, LUX connects through linking, instead of sticking or stacking, and therefore gives the immediate experience of the world of kinematics. Now this wonderful moving aspect of our universe can be accessed in playing and learning experience!

WORKSHOP 5: MODULARITY

The Design Award Winner Logifaces is the ANALOGUE GAME FOR DIGITAL MINDS. LOGIFACES lets you train your mind, boost your creativity and challenge yourself and your friends.

THANK YOU FOR YOUR ATTENTION!

Contact: kristof.fenyvesi@jyu.fi